Milena (Olena)

User documentation 1.0a Id

Generated by Doxygen 1.5.6

Fri May 7 19:43:40 2010

Contents

Chapter 1

Documentation of milena

1.1 Introduction

This is the documentation of Milena.

1.2 Overview of Milena.

- mln
- mln::accu
- mln::algebra
- mln::arith
- mln::binarization
- mln::border
- mln::canvas
- mln::convert
- mln::data
- mln::debug
- mln::display
- mln::draw
- mln::estim
- mln::extension
- mln::fun
- mln::geom
- mln::graph
- mln::histo

- mln::io
- mln::labeling
- mln::data
- mln::linear
- mln::literal
- mln::logical
- mln::make
- mln::math
- mln::metal
- mln::morpho
- mln::norm
- mln::opt
- mln::pw
- mln::registration
- mln::set
- mln::tag
- mln::test
- mln::topo
- mln::trace
- mln::trait
- mln::transform
- mln::util
- mln::value
- mln::win

1.3 Copyright and License.

Chapter 2

Quick Reference Guide

- Installation
- Foreword
- Site
- Site set
- Image
- Structural elements: Window and neighborhood
- Sites, psites and dpoints
- Iterators
- Memory management
- Basic routines
- Input / Output
- Graphs and images
- Useful global variables
- Useful macros
- Common Compilation Errors

- Installation
- Foreword
- Site
- Site set
- Image
- Structural elements: Window and neighborhood
- Sites, psites and dpoints
- Iterators
- Memory management
- Basic routines
- Input / Output
- Graphs and images
- Useful global variables
- Useful macros
- Common Compilation Errors

2.1 Installation

2.2 Requirements

2.2.1 To compile the user examples

2.2.2 To compile the documentation (Optional)

2.2.3 To develop in Olena

2.3 Getting Olena

2.4 Building Olena

2.5 Foreword

2.6 Generality

2.7 Directory hierarchy

2.8 Writing and compiling a program with Olena

2.9 Site

2.10 Site set

Iterators

2.11 Basic interface

2.12 Optional interface

```
  box2d b(2,3);

  // The bbox can be retrived in constant time.
  std::cout << b.bbox() << std::endl;

  // nsites can be retrieved in constant time.
  std::cout << "nsites = " << b.nsites() << std::endl;
```

```
[(0,0)..(1,2)]
nsites = 6
```

```
  p_array<point2d> arr;
  arr.insert(point2d(1,0));
```

```
  arr.insert(point2d(1,1));

  // The bbox is computed thanks to bbox() algorithm.
  box2d box = geom::bbox(arr);
  std::cout << box << std::endl;

  // p_array provides nsites(),
  // it can be retrieved in constant time.
  std::cout << "nsites = " << arr.nsites() << std::endl;
```

```
[(1,0)..(1,1)]
nsites = 2
```

2.13 Image

2.14 Definition

2.15 Possible image types

2.16 Possible value types

2.17 Domain

```
  // Define a box2d from (-2,-3) to (3,5).
  box2d b = make::box2d(-2,-3, 3,5);
  // Initialize an image with b as domain.
  image2d<int> ima(b);

  std::cout << "b = " << b << std::endl;
  std::cout << "domain = " << ima.domain() << std::endl;
```

```
b = [(-2,-3)..(3,5)]
domain = [(-2,-3)..(3,5)]
```

```
  // Create an image on a 2D box
  // with 10 columns and 10 rows.
  image2d<bool> ima(make::box2d(10, 10));

  mln_site_(image2d<bool>) p1(20, 20);
  mln_site_(image2d<bool>) p2(3, 3);

  std::cout << "has(p1)? "
            << (ima.has(p1) ? "true" : "false")
            << std::endl;

  std::cout << "has(p2)? "
            << (ima.has(p2) ? "true" : "false")
            << std::endl;
```

```
has(p1)? false
has(p2)? true
```

```
  point2d p(9,9);

  // At (9, 9), both values change.
  ima1(p) = 'M';
```

```
  ima2(p) = 'W';

  bool b = (ima1(p) == ima2(p));
  std::cout << (b ? "True" : "False") << std::endl;
```

```
False
```

2.18 Border and extension

2.18.1 Image border

```
  bool vals[3][3] = { { 0, 1, 1 },
                      { 1, 0, 0 },
                      { 1, 1, 0 } };

  image2d<bool> ima_def = make::image(vals);
  border::fill(ima_def, false);
  debug::println_with_border(ima_def);

  std::cout << "===========" << std::endl << std::endl;

  border::thickness = 0;
  image2d<bool> ima_bt0 = make::image(vals);
  debug::println_with_border(ima_bt0);
```

```
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - | | - - -
- - - | - - - - -
- - - | | - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -

===========

- | |
| - -
| | -
```

2.18.2 Generality on image extension

imamorphed

2.18.3 Different extensions

```
  image2d<rgb8> lena;
  io::ppm::load(lena, MLN_IMG_DIR "/small.ppm");
  box2d bbox_enlarged = lena.domain();
  bbox_enlarged.enlarge(border::thickness);
  mln_VAR(ima_roi, lena | fun::p2b::big_chess<box2d>(lena.domain(), 10));
```

2.18.3.1 Extension with a value

```
  mln_VAR(ext_with_val, extended_to(extend(ima_roi, literal::blue), bbox_enlarged));
```

2.18.3.2 Extension with a function

```
namespace mln
{

  struct my_ext : public Function_v2v<my_ext>
  {

    typedef value::rgb8 result;

    value::rgb8 operator()(const point2d& p) const
    {
      if ((p.row() + p.col()) % 20)
        return literal::black;
      return literal::white;
    }

  };

} // end of namespace mln
```

```
  mln_VAR(ext_with_fun, extended_to(extend(ima_roi, my_ext()), bbox_enlarged));
```

2.18.3.3 Extension with an image

```
  mln_VAR(ext_with_ima, extend(ima_roi, lena));
```

```
  // Default border size is set to 0.

  // Image defined on a box2d from
  // (0, 0) to (2, 2)
  image2d<int> ima1(2, 3);

  std::cout << "ima1.has(0, 0) : "
            << ima1.has(point2d(0, 0)) << std::endl;

  std::cout << "ima1.has(-3, 0) : "
            << ima1.has(point2d(-3, 0)) << std::endl;

  std::cout << "ima1.has(2, 5) : "
            << ima1.has(point2d(2, 5)) << std::endl;

  std::cout << "=========" << std::endl;

  // Set default border size to 0.
  border::thickness = 0;

  // Image defined on a box2d from
  // (0, 0) to (2, 2)
  image2d<int> ima2(2, 3);

  std::cout << "ima2.has(0, 0) : "
            << ima2.has(point2d(0, 0)) << std::endl;

  std::cout << "ima2.has(-3, 0) : "
            << ima2.has(point2d(-3, 0)) << std::endl;

  std::cout << "ima2.has(2, 5) : "
            << ima2.has(point2d(2, 5)) << std::endl;
```

```
ima1.has(0, 0) : 1
ima1.has(-3, 0) : 1
ima1.has(2, 5) : 1
=========
```

```
ima2.has(0, 0) : 1
ima2.has(-3, 0) : 0
ima2.has(2, 5) : 0
```

```
border::thickness = 30;

// Declare the image to be rotated.
image2d<value::rgb8> ima1_(220, 220);
data::fill(ima1_, literal::cyan);
border::fill(ima1_, literal::yellow);
// Set an infinite extension.
mln_VAR(ima1, extend(ima1_, pw::cst(literal::yellow)));

// Declare the output image.
image2d<value::rgb8> ima2(220, 220);
data::fill(ima2, literal::cyan);
border::fill(ima2, literal::yellow);

box2d extended_domain= ima1.domain();
extended_domain.enlarge(border::thickness);

// Draw the domain bounding box
draw::box(ima1, geom::bbox(ima1_), literal::red);
// Save the image, including its border.
doc::ppmsave(ima1 | extended_domain, "ima2d-rot");

// Define and apply a point-wise rotation
fun::x2x::rotation<2,float> rot1(0.5, literal::zero);
image2d<value::rgb8>::fwd_piter p(ima1.domain());
for_all(p)
{
  algebra::vec<2,float> pv = p.to_site().to_vec();
  algebra::vec<2,float> v = rot1.inv()(pv);
  ima2(p) = ima1(v);
}

draw::box(ima2, ima2.bbox(), literal::red);
doc::ppmsave(extended_to(ima2, extended_domain), "ima2d-rot");
```

```
my_routine(ima | ima.domain());
```

2.19 Interface

2.20 Load and save images

```
image2d<bool> ima;
io::pbm::load(ima, MLN_DOC_DIR "/img/small.pbm");
```

```
io::pbm::save(ima, MLN_DOC_DIR "/figures/ima_save.pbm");
```

2.21 Create an image

```
// Build an empty image;
image2d<value::int_u8> img1a;

// Build an image with 2 rows
// and 3 columns sites
image2d<value::int_u8> img1b(box2d(2, 3));
image2d<value::int_u8> img1c(2, 3);
```

```
bool vals[6][5] = {
    {0, 1, 1, 0, 0},
    {0, 1, 1, 0, 0},
    {0, 0, 0, 0, 0},
    {1, 1, 0, 1, 0},
    {1, 0, 1, 1, 1},
    {1, 0, 0, 0, 0}
};
image2d<bool> ima = make::image(vals);


image2d<value::int_u8> img2a(2, 3);
image2d<value::int_u8> img2b;

initialize(img2b, img2a);
data::fill(img2b, img2a);
```

Fill

2.22 Access and modify values

```
box2d b(2,3);
image2d<value::int_u8> ima(b);

// On image2d, Site <=> point2d
point2d p(1, 2);

// Associate '9' as value for the site/point2d (1,2).
// The value is returned by reference and can be changed.
opt::at(ima, 1,2) = 9;
std::cout << "opt::at(ima, 1,2) = " << opt::at(ima, 1,2)
          << std::endl;
std::cout << "ima(p) = " << ima(p) << std::endl;

std::cout << "---" << std::endl;


// Associate '2' as value for the site/point2d (1,2).
// The value is returned by reference
// and can be changed as well.
ima(p) = 2;
std::cout << "opt::at(ima, 1,2) = " << opt::at(ima, 1,2)
          << std::endl;
std::cout << "ima(p) = " << ima(p) << std::endl;
```

```
opt::at(ima, 1,2) = 9
ima(p) = 9
---
opt::at(ima, 1,2) = 2
ima(p) = 2
```

Iterators

2.23 Image size

```
image2d<int> ima(make::box2d(0,0, 10,12));

std::cout << "nrows = " << ima.nrows()
          << " - "
          << "ncols = " << ima.ncols()
          << std::endl;
```

```
nrows = 11 - ncols = 13
```

2.24 Structural elements: Window and neighborhood

2.25 Define an element

2.25.1 Window

2.25.2 Neighborhood

```
  label_8 nlabels;
  image2d<label_8> lbl = labeling::blobs(ima, c4(), nlabels);
```

2.25.3 Custom structural elements

```
  window2d win;
  win.insert(-1, -1);
  win.insert(-1,  0);
  win.insert(-1,  1);
```

```
o -
o X
o -
```

```
  bool b[9]     =   { 1, 0, 0,
                      1, 0, 0,
                      1, 0, 0 };

  bool b2[3][3] = { { 1, 0, 0 },
                    { 1, 0, 0 },
                    { 1, 0, 0 } };

  window2d win = convert::to<window2d>(b);
  window2d win2 = convert::to<window2d>(b2);
```

2.25.4 Conversion between Neighborhoods and Windows

2.26 Sites, psites and dpoints

2.27 Need for site

```
 c 0 1 2 3
r
  +-+-+-+-+
0 | |x| | |
  +-+-+-+-+
1 | | | | |
  +-+-+-+-+
```

2.28 Need for psite

```
unsigned my_values(const mln::point2d& p)
```

```
{
  if (p.row() == 0)
    return 8;
  return 9;
}
```

```
  p_array<point2d> arr;
  arr.append(point2d(3, 6));
  arr.append(point2d(3, 7));
  arr.append(point2d(3, 8));
  arr.append(point2d(4, 8));
  arr.append(point2d(4, 9));
```

```
  mln_VAR(ima, my_values | arr);
```

```
c   6 7 8 9
r
   +-+-+-+
3  | |x| |
   +-+-+-+-+
4      | | |
       +-+-+
```

```
arr[] = 0 1 2 3 4
       +-+-+-+-+-+
       | |x| | | |
       +-+-+-+-+-+
```

2.29 From psite to site

2.30 Dpoint

```
  dpoint2d dp(-1,0);
  point2d p(1,1);

  std::cout << p + dp << std::endl;
```

```
(0,1)
```

2.31 Iterators

```
  box2d b(3, 2);
  mln_piter_(box2d) p(b);

  for_all(p)
    std::cout << p; //prints every site coordinates.
```

```
(0,0)(0,1)(1,0)(1,1)(2,0)(2,1)
```

```
template <typename I>
void fill(I& ima, mln_value(I) v)
{
  mln_piter(I) p(ima.domain());
  for_all(p)
    ima(p) = v;
}
```

```
template <typename I, typename J>
void paste(const I& data, J& dest)
{
  mln_piter(I) p(data.domain());
  for_all(p)
  dest(p) = data(p);
}
```

Useful macros

2.32 Memory management

```
  image2d<int> ima1(box2d(2, 3));
  image2d<int> ima2;
  point2d p(1,2);

  ima2 = ima1; // ima1.id() == ima2.id()
  // and both point to the same memory area.

  ima2(p) = 2; // ima1 is modified as well.

  // prints "2 - 2"
  std::cout << ima2(p) << " - " << ima1(p) << std::endl;
  // prints "true"
  std::cout << (ima2.id_() == ima1.id_()) << std::endl;
```

```
  image2d<int> ima1(5, 5);
  image2d<int> ima3 = duplicate(ima1); // Makes a deep copy.

  point2d p(2, 2);
  ima3(p) = 3;

  std::cout << ima3(p) << " - " << ima1(p) << std::endl;
  std::cout << (ima3.id_() == ima1.id_()) << std::endl;
```

```
3 - 0
0
```

2.33 Basic routines

2.34 Fill

```
  image2d<char> imga(5, 5);
```

```
  data::fill(imga, 'a');
```

```
  data::fill((imga | box2d(1,2)).rw(), 'a');
```

2.35 Paste

```
  image2d<unsigned char> imgb(make::box2d(5,5, 7,8));
  // Initialize imga with the same domain as imgb.
  image2d<unsigned char> imga(imgb.domain());
```

```
// Initialize the image values.
data::fill(imgb, 'b');

// Paste the content of imgb in imga.
data::paste(imgb, imga);

debug::println(imga);
```

```
98 98 98 98
98 98 98 98
98 98 98 98
```

```
image2d<int> ima1(5, 5);
image2d<int> ima2(10, 10);

std::cout << "ima1.domain() = " << ima1.domain()
          << std::endl;
std::cout << "ima2.domain() = " << ima2.domain()
          << std::endl;
```

```
image2d<int> ima1(5, 5);
image2d<int> ima2(10, 10);

std::cout << "ima1.domain() = " << ima1.domain()
          << std::endl;
std::cout << "ima2.domain() = " << ima2.domain()
          << std::endl;
```

2.36 Blobs

```
bool vals[6][5] = {
    {0, 1, 1, 0, 0},
    {0, 1, 1, 0, 0},
    {0, 0, 0, 0, 0},
    {1, 1, 0, 1, 0},
    {1, 0, 1, 1, 1},
    {1, 0, 0, 0, 0}
};
image2d<bool> ima = make::image(vals);
```

```
label_8 nlabels;
image2d<label_8> lbl = labeling::blobs(ima, c4(), nlabels);
```

2.37 Logical not

```
bool vals[5][5] = {
  {1, 0, 1, 0, 0},
  {0, 1, 0, 1, 0},
  {1, 0, 1, 0, 0},
  {0, 1, 0, 1, 0},
  {0, 1, 0, 1, 0}
};
image2d<bool> ima = make::image(vals);
```

```
image2d<bool> ima_neg = logical::not_(ima);
```

```
logical::not_inplace(ima);
```

2.38 Compute

2.38.1 Accumulators

2.38.2 Example with labeling::compute()

```
  bool vals[6][5] = {
      {0, 1, 1, 0, 0},
      {0, 1, 1, 0, 0},
      {0, 0, 0, 0, 0},
      {1, 1, 0, 1, 0},
      {1, 0, 1, 1, 1},
      {1, 0, 0, 0, 0}
  };
  image2d<bool> ima = make::image(vals);
```

```
  label_8 nlabels;
  image2d<label_8> lbl = labeling::blobs(ima, c4(), nlabels);
```

```
  util::array<box2d> boxes =
      labeling::compute(accu::meta::shape::bbox(),
                        lbl,
                        nlabels);
```

```
  for (unsigned i = 1; i <= nlabels; ++i)
    std::cout << boxes[i] << std::endl;
```

```
[(0,1)..(1,2)]
[(3,0)..(5,1)]
[(3,2)..(4,4)]
```

```
  unsigned nsites = geom::nsites(ima);
```

2.39 Working with parts of an image

```
//function_p2b
bool my_function_p2b(mln::point2d p);

//function_p2v
//V is the value type used in the image.
template <typename V>
V my_function_p2v(mln::point2d p);
```

```
  bool vals[6][5] = {
      {0, 1, 1, 0, 0},
      {0, 1, 1, 0, 0},
      {0, 0, 0, 0, 0},
      {1, 1, 0, 1, 0},
      {1, 0, 1, 1, 1},
      {1, 0, 0, 0, 0}
  };
  image2d<bool> ima = make::image(vals);
```

2.39.1 Restrict an image with a site set

```
p_array<point2d> arr;

// We add two points in the array.
arr.append(point2d(0, 1));
arr.append(point2d(4, 0));

// We restrict the image to the sites
// contained in arr and fill these ones
// with 0.
// We must call "rw()" here.
data::fill((ima | arr).rw(), 0);

debug::println((ima | arr));

mln_VAR(ima2, ima | arr);
// We do not need to call "rw()" here.
data::fill(ima2, 0);


-



-

-



-
```

2.39.2 Restrict an image with a predicate

```
label_8 nlabels;
image2d<label_8> lbl = labeling::blobs(ima, c4(), nlabels);


mln_VAR(lbl_2, lbl | (pw::value(lbl) == pw::cst(2u)));


image2d<rgb8> ima2;
initialize(ima2, ima);
data::fill(ima2, literal::black);

data::fill((ima2 | lbl_2.domain()).rw(), literal::red);


label_8 nlabels;
image2d<label_8> lab = labeling::blobs(ima, c4(), nlabels);

image2d<rgb8> ima2;
initialize(ima2, ima);
data::fill(ima2, literal::black);

data::fill((ima2 | (pw::value(lab) == pw::cst(2u))).rw(), literal::red);
```

2.39.3 Restrict an image with a C function

```
bool row_oddity(mln::point2d p)
{
  return p.row() % 2;
}
```

```
  image2d<rgb8> ima2;
  initialize(ima2, ima);
  data::fill(ima2, literal::black);

  data::fill((ima2 | row_oddity).rw(), literal::red);
```

```
ima | sub_D
```

```
0 1 0
1 1 1
```

```
  mln_VAR(imab1, ima | (pw::value(ima) == pw::cst(1u)));
```

```
1
1 1 1
```

```
box2d b1(1,0, 1, 2);
mln_VAR(imac, imab1 | b1);

// Print:
// 1 1 1
debug::prinln(imac);

box2d b2(0,0, 1, 1);
// Will fail at runtime.
// ima.domain().has((0,0)) is false.
mln_VAR(imad, imab1 | b2);
debug::prinln(imad);
```

```
ima / sub_D
```

2.40 Input / Output

2.41 ImageMagick

2.42 GDCM

2.43 Graphs and images

2.44 Description

2.45 Example

```
     0 1 2 3 4
  .-----------
0 |  0       2
1 |    \   / |
2 |      1   |
3 |       \  |
4 |        3-4
```

```
  util::graph g;

  for (unsigned i = 0; i < 5; ++i)
    g.add_vertex(); // Add vertex 'i';
```

```
  g.add_edge(0, 1); // Associated to edge 0.
  g.add_edge(1, 2); // Associated to edge 1.
  g.add_edge(1, 3); // Associated to edge 2.
  g.add_edge(3, 4); // Associated to edge 3.
  g.add_edge(4, 2); // Associated to edge 4.
```

```
  typedef fun::i2v::array<point2d> F;
  F f(5); // We need to map 5 vertices.
  f(0) = point2d(0, 0);
  f(1) = point2d(2, 2);
  f(2) = point2d(0, 4);
  f(3) = point2d(4, 3);
  f(4) = point2d(4, 4);
```

```
  typedef p_vertices<util::graph, F> pv_t;
  pv_t pv(g, f);
```

```
template <typename S>
struct viota_t : public mln::Function_v2v< viota_t<S> >
{
  typedef unsigned result;

  viota_t(unsigned size)
  {
    v_.resize(size);
    for(unsigned i = 0; i < size; ++i)
      v_[i] = 10 + i;
  }

  unsigned
  operator()(const mln_psite(S)& p) const
  {
    return v_[p.v().id()];
  }

  protected:
    std::vector<result> v_;
};
```

```
  // Constructs an image
  viota_t<pv_t> viota(pv.nsites());
  mln_VAR(graph_vertices_ima, viota | pv);

  //Prints each vertex and its associated data.
  mln_piter_(graph_vertices_ima_t) p(graph_vertices_ima.domain());
  for_all(p)
    std::cout << "graph_vertices_ima(" << p << ") = "
              << graph_vertices_ima(p) << std::endl;
```

```
graph_vertices_ima((0,0)) = 10
graph_vertices_ima((2,2)) = 11
graph_vertices_ima((0,4)) = 12
graph_vertices_ima((4,3)) = 13
graph_vertices_ima((4,4)) = 14
```

```
  // Function which maps sites to data.
  viota_t viota(g.v_nmax());

  // Iterator on vertices.
  mln_vertex_iter_(util::graph) v(g);

  // Prints each vertex and its associated value.
  for_all(v)
    std::cout << v << " : " << viota(v) << std::endl;
```

```
0 : 10
1 : 11
2 : 12
3 : 13
4 : 14
```

```
    // Iterator on vertices.
    mln_vertex_iter_(util::graph) v(g);

    // Iterator on v's edges.
    mln_vertex_nbh_edge_iter_(util::graph) e(v);

    // Prints the graph
    // List all edges for each vertex.
    for_all(v)
    {
      std::cout << v << " : ";
      for_all(e)
        std::cout << e << " ";
      std::cout << std::endl;
    }
```

```
0 : (0,1)
1 : (0,1) (1,2) (1,3)
2 : (1,2) (2,4)
3 : (1,3) (3,4)
4 : (3,4) (2,4)
```

```
    // Iterator on edges.
    mln_edge_iter_(util::graph) e(g);

    // Iterator on edges adjacent to e.
    mln_edge_nbh_edge_iter_(util::graph) ne(e);

    // Prints the graph
    // List all adjacent edges for each edge.
    for_all(e)
    {
      std::cout << e << " : ";
      for_all(ne)
        std::cout << ne << " ";
      std::cout << std::endl;
    }
```

```
(0,1) : (1,2) (1,3)
(1,2) : (0,1) (1,3) (2,4)
(1,3) : (0,1) (1,2) (3,4)
(3,4) : (1,3) (2,4)
(2,4) : (1,2) (3,4)
```

```
    // Iterator on vertices.
    mln_vertex_iter_(util::graph) v(g);

    // Iterator on vertices adjacent to v.
    mln_vertex_nbh_vertex_iter_(util::graph) nv(v);

    // Prints the graph
    // List all adjacent edges for each edge.
    for_all(v)
    {
      std::cout << v << " : ";
      for_all(nv)
        std::cout << nv << " ";
      std::cout << std::endl;
    }
```

```
0 : 1
1 : 0 2 3
2 : 1 4
3 : 1 4
4 : 3 2
```

2.46 Useful global variables

2.47 Useful macros

2.48 Variable declaration macros

2.49 Iterator type macros

2.49.1 Default iterator types

2.49.2 Forward iterator types

2.49.3 Backward iterators

2.49.4 Graph iterators

2.50 Common Compilation Errors

2.51 Installation

2.52 Requirements

2.52.1 To compile the user examples

2.52.2 To compile the documentation (Optional)

2.52.3 To develop in Olena

2.53 Getting Olena

2.54 Building Olena

2.55 Foreword

2.56 Generality

2.57 Directory hierarchy

2.58 Writing and compiling a program with Olena

2.59 Site

2.60 Site set

Iterators

2.61 Basic interface

2.62 Optional interface

```
box2d b(2,3);

// The bbox can be retrived in constant time.
std::cout << b.bbox() << std::endl;

// nsites can be retrieved in constant time.
std::cout << "nsites = " << b.nsites() << std::endl;
```

```
[(0,0)..(1,2)]
nsites = 6
```

```
p_array<point2d> arr;
arr.insert(point2d(1,0));
arr.insert(point2d(1,1));

// The bbox is computed thanks to bbox() algorithm.
box2d box = geom::bbox(arr);
std::cout << box << std::endl;

// p_array provides nsites(),
// it can be retrieved in constant time.
std::cout << "nsites = " << arr.nsites() << std::endl;
```

```
[(1,0)..(1,1)]
nsites = 2
```

2.63 Image

2.64 Definition

2.65 Possible image types

2.66 Possible value types

2.67 Domain

```
// Define a box2d from (-2,-3) to (3,5).
box2d b = make::box2d(-2,-3, 3,5);
// Initialize an image with b as domain.
image2d<int> ima(b);

std::cout << "b = " << b << std::endl;
std::cout << "domain = " << ima.domain() << std::endl;
```

```
b = [(-2,-3)..(3,5)]
domain = [(-2,-3)..(3,5)]
```

```
// Create an image on a 2D box
// with 10 columns and 10 rows.
```

```
  image2d<bool> ima(make::box2d(10, 10));

  mln_site_(image2d<bool>) p1(20, 20);
  mln_site_(image2d<bool>) p2(3, 3);

  std::cout << "has(p1)? "
            << (ima.has(p1) ? "true" : "false")
            << std::endl;

  std::cout << "has(p2)? "
            << (ima.has(p2) ? "true" : "false")
            << std::endl;
```

```
has(p1)? false
has(p2)? true
```

```
  point2d p(9,9);

  // At (9, 9), both values change.
  ima1(p) = 'M';
  ima2(p) = 'W';

  bool b = (ima1(p) == ima2(p));
  std::cout << (b ? "True" : "False") << std::endl;
```

```
False
```

2.68 Border and extension

2.68.1 Image border

```
  bool vals[3][3] = { { 0, 1, 1 },
                      { 1, 0, 0 },
                      { 1, 1, 0 } };

  image2d<bool> ima_def = make::image(vals);
  border::fill(ima_def, false);
  debug::println_with_border(ima_def);

  std::cout << "===========" << std::endl << std::endl;

  border::thickness = 0;
  image2d<bool> ima_bt0 = make::image(vals);
  debug::println_with_border(ima_bt0);
```

```
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -
- - - - | | - - -
- - - | - - - - -
- - - | | - - - -
- - - - - - - - -
- - - - - - - - -
- - - - - - - - -

===========

- | |
| - -
| | -
```

2.68.2 Generality on image extension

imamorphed

2.68.3 Different extensions

```
  image2d<rgb8> lena;
  io::ppm::load(lena, MLN_IMG_DIR "/small.ppm");
  box2d bbox_enlarged = lena.domain();
  bbox_enlarged.enlarge(border::thickness);
  mln_VAR(ima_roi, lena | fun::p2b::big_chess<box2d>(lena.domain(), 10));
```

2.68.3.1 Extension with a value

```
  mln_VAR(ext_with_val, extended_to(extend(ima_roi, literal::blue), bbox_enlarged));
```

2.68.3.2 Extension with a function

```
namespace mln
{

  struct my_ext : public Function_v2v<my_ext>
  {

    typedef value::rgb8 result;

    value::rgb8 operator()(const point2d& p) const
    {
      if ((p.row() + p.col()) % 20)
        return literal::black;
      return literal::white;
    }

  };

} // end of namespace mln
```

```
  mln_VAR(ext_with_fun, extended_to(extend(ima_roi, my_ext()), bbox_enlarged));
```

2.68.3.3 Extension with an image

```
  mln_VAR(ext_with_ima, extend(ima_roi, lena));
```

```
  // Default border size is set to 0.

  // Image defined on a box2d from
  // (0, 0) to (2, 2)
  image2d<int> ima1(2, 3);

  std::cout << "ima1.has(0, 0) : "
            << ima1.has(point2d(0, 0)) << std::endl;

  std::cout << "ima1.has(-3, 0) : "
            << ima1.has(point2d(-3, 0)) << std::endl;

  std::cout << "ima1.has(2, 5) : "
            << ima1.has(point2d(2, 5)) << std::endl;

  std::cout << "=========" << std::endl;
```

```
// Set default border size to 0.
border::thickness = 0;

// Image defined on a box2d from
// (0, 0) to (2, 2)
image2d<int> ima2(2, 3);

std::cout << "ima2.has(0, 0) : "
          << ima2.has(point2d(0, 0)) << std::endl;

std::cout << "ima2.has(-3, 0) : "
          << ima2.has(point2d(-3, 0)) << std::endl;

std::cout << "ima2.has(2, 5) : "
          << ima2.has(point2d(2, 5)) << std::endl;
```

```
ima1.has(0, 0) : 1
ima1.has(-3, 0) : 1
ima1.has(2, 5) : 1
=========
ima2.has(0, 0) : 1
ima2.has(-3, 0) : 0
ima2.has(2, 5) : 0
```

```
border::thickness = 30;

// Declare the image to be rotated.
image2d<value::rgb8> ima1_(220, 220);
data::fill(ima1_, literal::cyan);
border::fill(ima1_, literal::yellow);
// Set an infinite extension.
mln_VAR(ima1, extend(ima1_, pw::cst(literal::yellow)));

// Declare the output image.
image2d<value::rgb8> ima2(220, 220);
data::fill(ima2, literal::cyan);
border::fill(ima2, literal::yellow);

box2d extended_domain= ima1.domain();
extended_domain.enlarge(border::thickness);

// Draw the domain bounding box
draw::box(ima1, geom::bbox(ima1_), literal::red);
// Save the image, including its border.
doc::ppmsave(ima1 | extended_domain, "ima2d-rot");

// Define and apply a point-wise rotation
fun::x2x::rotation<2,float> rot1(0.5, literal::zero);
image2d<value::rgb8>::fwd_piter p(ima1.domain());
for_all(p)
{
  algebra::vec<2,float> pv = p.to_site().to_vec();
  algebra::vec<2,float> v = rot1.inv()(pv);
  ima2(p) = ima1(v);
}

draw::box(ima2, ima2.bbox(), literal::red);
doc::ppmsave(extended_to(ima2, extended_domain), "ima2d-rot");
```

```
my_routine(ima | ima.domain());
```

2.69 Interface

2.70 Load and save images

```
image2d<bool> ima;
io::pbm::load(ima, MLN_DOC_DIR "/img/small.pbm");


io::pbm::save(ima, MLN_DOC_DIR "/figures/ima_save.pbm");
```

2.71 Create an image

```
// Build an empty image;
image2d<value::int_u8> img1a;

// Build an image with 2 rows
// and 3 columns sites
image2d<value::int_u8> img1b(box2d(2, 3));
image2d<value::int_u8> img1c(2, 3);


bool vals[6][5] = {
    {0, 1, 1, 0, 0},
    {0, 1, 1, 0, 0},
    {0, 0, 0, 0, 0},
    {1, 1, 0, 1, 0},
    {1, 0, 1, 1, 1},
    {1, 0, 0, 0, 0}
};
image2d<bool> ima = make::image(vals);


image2d<value::int_u8> img2a(2, 3);
image2d<value::int_u8> img2b;

initialize(img2b, img2a);
data::fill(img2b, img2a);
```

Fill

2.72 Access and modify values

```
box2d b(2,3);
image2d<value::int_u8> ima(b);

// On image2d, Site <=> point2d
point2d p(1, 2);

// Associate '9' as value for the site/point2d (1,2).
// The value is returned by reference and can be changed.
opt::at(ima, 1,2) = 9;
std::cout << "opt::at(ima, 1,2) = " << opt::at(ima, 1,2)
          << std::endl;
std::cout << "ima(p) = " << ima(p) << std::endl;

std::cout << "---" << std::endl;


// Associate '2' as value for the site/point2d (1,2).
// The value is returned by reference
```

```
// and can be changed as well.
ima(p) = 2;
std::cout << "opt::at(ima, 1,2) = " << opt::at(ima, 1,2)
          << std::endl;
std::cout << "ima(p) = " << ima(p) << std::endl;
```

```
opt::at(ima, 1,2) = 9
ima(p) = 9
---
opt::at(ima, 1,2) = 2
ima(p) = 2
```

Iterators

2.73 Image size

```
image2d<int> ima(make::box2d(0,0, 10,12));

std::cout << "nrows = " << ima.nrows()
          << " - "
          << "ncols = " << ima.ncols()
          << std::endl;
```

```
nrows = 11 - ncols = 13
```

2.74 Structural elements: Window and neighborhood

2.75 Define an element

2.75.1 Window

2.75.2 Neighborhood

```
label_8 nlabels;
image2d<label_8> lbl = labeling::blobs(ima, c4(), nlabels);
```

2.75.3 Custom structural elements

```
window2d win;
win.insert(-1, -1);
win.insert(-1,  0);
win.insert(-1,  1);
```

```
o -
o X
o -
```

```
bool b[9]     =   { 1, 0, 0,
                    1, 0, 0,
                    1, 0, 0 };

bool b2[3][3] = { { 1, 0, 0 },
                  { 1, 0, 0 },
                  { 1, 0, 0 } };
```

```
  window2d win = convert::to<window2d>(b);
  window2d win2 = convert::to<window2d>(b2);
```

2.75.4 Conversion between Neighborhoods and Windows

2.76 Sites, psites and dpoints

2.77 Need for site

```
 c 0 1 2 3
r
  +-+-+-+-+
0 | |x| | |
  +-+-+-+-+
1 | | | | |
  +-+-+-+-+
```

2.78 Need for psite

```
unsigned my_values(const mln::point2d& p)
{
  if (p.row() == 0)
    return 8;
  return 9;
}
```

```
  p_array<point2d> arr;
  arr.append(point2d(3, 6));
  arr.append(point2d(3, 7));
  arr.append(point2d(3, 8));
  arr.append(point2d(4, 8));
  arr.append(point2d(4, 9));
```

```
  mln_VAR(ima, my_values | arr);
```

```
c  6 7 8 9
r
   +-+-+-+
3  | |x| |
   +-+-+-+-+
4      | | |
       +-+-+
```

```
arr[] = 0 1 2 3 4
       +-+-+-+-+-+
       | |x| | | |
       +-+-+-+-+-+
```

2.79 From psite to site

2.80 Dpoint

```
  dpoint2d dp(-1,0);
```

```
  point2d p(1,1);

  std::cout << p + dp << std::endl;
```

```
(0,1)
```

2.81 Iterators

```
  box2d b(3, 2);
  mln_piter_(box2d) p(b);

  for_all(p)
    std::cout << p; //prints every site coordinates.
```

```
(0,0)(0,1)(1,0)(1,1)(2,0)(2,1)
```

```
template <typename I>
void fill(I& ima, mln_value(I) v)
{
  mln_piter(I) p(ima.domain());
  for_all(p)
    ima(p) = v;
}

template <typename I, typename J>
void paste(const I& data, J& dest)
{
  mln_piter(I) p(data.domain());
  for_all(p)
  dest(p) = data(p);
}
```

Useful macros

2.82 Memory management

```
  image2d<int> ima1(box2d(2, 3));
  image2d<int> ima2;
  point2d p(1,2);

  ima2 = ima1; // ima1.id() == ima2.id()
  // and both point to the same memory area.

  ima2(p) = 2; // ima1 is modified as well.

  // prints "2 - 2"
  std::cout << ima2(p) << " - " << ima1(p) << std::endl;
  // prints "true"
  std::cout << (ima2.id_() == ima1.id_()) << std::endl;

  image2d<int> ima1(5, 5);
  image2d<int> ima3 = duplicate(ima1); // Makes a deep copy.

  point2d p(2, 2);
  ima3(p) = 3;

  std::cout << ima3(p) << " - " << ima1(p) << std::endl;
  std::cout << (ima3.id_() == ima1.id_()) << std::endl;
```

```
3 - 0
0
```

2.83 Basic routines

2.84 Fill

```
image2d<char> imga(5, 5);

data::fill(imga, 'a');

data::fill((imga | box2d(1,2)).rw(), 'a');
```

2.85 Paste

```
image2d<unsigned char> imgb(make::box2d(5,5, 7,8));
// Initialize imga with the same domain as imgb.
image2d<unsigned char> imga(imgb.domain());

// Initialize the image values.
data::fill(imgb, 'b');

// Paste the content of imgb in imga.
data::paste(imgb, imga);

debug::println(imga);
```

```
98 98 98 98
98 98 98 98
98 98 98 98
```

```
image2d<int> ima1(5, 5);
image2d<int> ima2(10, 10);

std::cout << "ima1.domain() = " << ima1.domain()
          << std::endl;
std::cout << "ima2.domain() = " << ima2.domain()
          << std::endl;

image2d<int> ima1(5, 5);
image2d<int> ima2(10, 10);

std::cout << "ima1.domain() = " << ima1.domain()
          << std::endl;
std::cout << "ima2.domain() = " << ima2.domain()
          << std::endl;
```

2.86 Blobs

```
bool vals[6][5] = {
    {0, 1, 1, 0, 0},
    {0, 1, 1, 0, 0},
    {0, 0, 0, 0, 0},
    {1, 1, 0, 1, 0},
    {1, 0, 1, 1, 1},
    {1, 0, 0, 0, 0}
};
image2d<bool> ima = make::image(vals);

label_8 nlabels;
image2d<label_8> lbl = labeling::blobs(ima, c4(), nlabels);
```

2.87 Logical not

```
bool vals[5][5] = {
  {1, 0, 1, 0, 0},
  {0, 1, 0, 1, 0},
  {1, 0, 1, 0, 0},
  {0, 1, 0, 1, 0},
  {0, 1, 0, 1, 0}
};
image2d<bool> ima = make::image(vals);
```

```
image2d<bool> ima_neg = logical::not_(ima);
```

```
logical::not_inplace(ima);
```

2.88 Compute

2.88.1 Accumulators

2.88.2 Example with labeling::compute()

```
bool vals[6][5] = {
    {0, 1, 1, 0, 0},
    {0, 1, 1, 0, 0},
    {0, 0, 0, 0, 0},
    {1, 1, 0, 1, 0},
    {1, 0, 1, 1, 1},
    {1, 0, 0, 0, 0}
};
image2d<bool> ima = make::image(vals);
```

```
label_8 nlabels;
image2d<label_8> lbl = labeling::blobs(ima, c4(), nlabels);
```

```
util::array<box2d> boxes =
    labeling::compute(accu::meta::shape::bbox(),
                      lbl,
                      nlabels);
```

```
for (unsigned i = 1; i <= nlabels; ++i)
  std::cout << boxes[i] << std::endl;
```

```
[(0,1)..(1,2)]
[(3,0)..(5,1)]
[(3,2)..(4,4)]
```

```
unsigned nsites = geom::nsites(ima);
```

2.89 Working with parts of an image

```
//function_p2b
bool my_function_p2b(mln::point2d p);

//function_p2v
//V is the value type used in the image.
template <typename V>
V my_function_p2v(mln::point2d p);
```

```
  bool vals[6][5] = {
      {0, 1, 1, 0, 0},
      {0, 1, 1, 0, 0},
      {0, 0, 0, 0, 0},
      {1, 1, 0, 1, 0},
      {1, 0, 1, 1, 1},
      {1, 0, 0, 0, 0}
  };
  image2d<bool> ima = make::image(vals);
```

2.89.1 Restrict an image with a site set

```
  p_array<point2d> arr;

  // We add two points in the array.
  arr.append(point2d(0, 1));
  arr.append(point2d(4, 0));

  // We restrict the image to the sites
  // contained in arr and fill these ones
  // with 0.
  // We must call "rw()" here.
  data::fill((ima | arr).rw(), 0);

  debug::println((ima | arr));

  mln_VAR(ima2, ima | arr);
  // We do not need to call "rw()" here.
  data::fill(ima2, 0);
```

```
  -
```

```
-
```

```
  -
```

```
-
```

2.89.2 Restrict an image with a predicate

```
  label_8 nlabels;
  image2d<label_8> lbl = labeling::blobs(ima, c4(), nlabels);
```

```
  mln_VAR(lbl_2, lbl | (pw::value(lbl) == pw::cst(2u)));
```

```
  image2d<rgb8> ima2;
```

```
  initialize(ima2, ima);
  data::fill(ima2, literal::black);

  data::fill((ima2 | lbl_2.domain()).rw(), literal::red);
```

```
  label_8 nlabels;
  image2d<label_8> lab = labeling::blobs(ima, c4(), nlabels);

  image2d<rgb8> ima2;
  initialize(ima2, ima);
  data::fill(ima2, literal::black);

  data::fill((ima2 | (pw::value(lab) == pw::cst(2u))).rw(), literal::red);
```

2.89.3 Restrict an image with a C function

```
bool row_oddity(mln::point2d p)
{
  return p.row() % 2;
}
```

```
  image2d<rgb8> ima2;
  initialize(ima2, ima);
  data::fill(ima2, literal::black);

  data::fill((ima2 | row_oddity).rw(), literal::red);
```

```
ima | sub_D
```

```
0 1 0
1 1 1
```

```
  mln_VAR(imab1, ima | (pw::value(ima) == pw::cst(1u)));
```

```
1
1 1 1
```

```
box2d b1(1,0, 1, 2);
mln_VAR(imac, imab1 | b1);

// Print:
// 1 1 1
debug::prinln(imac);

box2d b2(0,0, 1, 1);
// Will fail at runtime.
// ima.domain().has((0,0)) is false.
mln_VAR(imad, imab1 | b2);
debug::prinln(imad);
```

```
ima / sub_D
```

2.90 Input / Output

2.91 ImageMagick

2.92 GDCM

2.93 Graphs and images

2.94 Description

2.95 Example

```
     0 1 2 3 4
   .-----------
 0 |  0       2
 1 |    \   / |
 2 |      1   |
 3 |       \  |
 4 |        3-4
```

```
  util::graph g;

  for (unsigned i = 0; i < 5; ++i)
    g.add_vertex(); // Add vertex 'i';


  g.add_edge(0, 1); // Associated to edge 0.
  g.add_edge(1, 2); // Associated to edge 1.
  g.add_edge(1, 3); // Associated to edge 2.
  g.add_edge(3, 4); // Associated to edge 3.
  g.add_edge(4, 2); // Associated to edge 4.


  typedef fun::i2v::array<point2d> F;
  F f(5); // We need to map 5 vertices.
  f(0) = point2d(0, 0);
  f(1) = point2d(2, 2);
  f(2) = point2d(0, 4);
  f(3) = point2d(4, 3);
  f(4) = point2d(4, 4);


  typedef p_vertices<util::graph, F> pv_t;
  pv_t pv(g, f);
```

```
template <typename S>
struct viota_t : public mln::Function_v2v< viota_t<S> >
{
  typedef unsigned result;

  viota_t(unsigned size)
  {
    v_.resize(size);
    for(unsigned i = 0; i < size; ++i)
      v_[i] = 10 + i;
  }

  unsigned
  operator()(const mln_psite(S)& p) const
```

```
  {
    return v_[p.v().id()];
  }

  protected:
    std::vector<result> v_;
};

  // Constructs an image
  viota_t<pv_t> viota(pv.nsites());
  mln_VAR(graph_vertices_ima, viota | pv);

  //Prints each vertex and its associated data.
  mln_piter_(graph_vertices_ima_t) p(graph_vertices_ima.domain());
  for_all(p)
    std::cout << "graph_vertices_ima(" << p << ") = "
              << graph_vertices_ima(p) << std::endl;
```

```
graph_vertices_ima((0,0)) = 10
graph_vertices_ima((2,2)) = 11
graph_vertices_ima((0,4)) = 12
graph_vertices_ima((4,3)) = 13
graph_vertices_ima((4,4)) = 14
```

```
  // Function which maps sites to data.
  viota_t viota(g.v_nmax());

  // Iterator on vertices.
  mln_vertex_iter_(util::graph) v(g);

  // Prints each vertex and its associated value.
  for_all(v)
    std::cout << v << " : " << viota(v) << std::endl;
```

```
0 : 10
1 : 11
2 : 12
3 : 13
4 : 14
```

```
    // Iterator on vertices.
    mln_vertex_iter_(util::graph) v(g);

    // Iterator on v's edges.
    mln_vertex_nbh_edge_iter_(util::graph) e(v);

    // Prints the graph
    // List all edges for each vertex.
    for_all(v)
    {
      std::cout << v << " : ";
      for_all(e)
        std::cout << e << " ";
      std::cout << std::endl;
    }
```

```
0 : (0,1)
1 : (0,1) (1,2) (1,3)
2 : (1,2) (2,4)
3 : (1,3) (3,4)
4 : (3,4) (2,4)
```

```
    // Iterator on edges.
```

```
mln_edge_iter_(util::graph) e(g);

// Iterator on edges adjacent to e.
mln_edge_nbh_edge_iter_(util::graph) ne(e);

// Prints the graph
// List all adjacent edges for each edge.
for_all(e)
{
  std::cout << e << " : ";
  for_all(ne)
    std::cout << ne << " ";
  std::cout << std::endl;
}
```

```
(0,1) : (1,2) (1,3)
(1,2) : (0,1) (1,3) (2,4)
(1,3) : (0,1) (1,2) (3,4)
(3,4) : (1,3) (2,4)
(2,4) : (1,2) (3,4)
```

```
// Iterator on vertices.
mln_vertex_iter_(util::graph) v(g);

// Iterator on vertices adjacent to v.
mln_vertex_nbh_vertex_iter_(util::graph) nv(v);

// Prints the graph
// List all adjacent edges for each edge.
for_all(v)
{
  std::cout << v << " : ";
  for_all(nv)
    std::cout << nv << " ";
  std::cout << std::endl;
}
```

```
0 : 1
1 : 0 2 3
2 : 1 4
3 : 1 4
4 : 3 2
```

2.96 Useful global variables

2.97 Useful macros

2.98 Variable declaration macros

2.99 Iterator type macros

2.99.1 Default iterator types

2.99.2 Forward iterator types

2.99.3 Backward iterators

2.99.4 Graph iterators

2.100 Common Compilation Errors

Chapter 3

Tutorial

- tuto1
- tuto2
- tuto3
- tuto4
- tuto5
- tuto6
- tuto7
- tuto8

Chapter 4

Module Index

4.1 Modules

Here is a list of all modules:

Chapter 5

Namespace Index

5.1 Namespace List

Here is a list of all documented namespaces with brief descriptions:

Chapter 6

Class Index

6.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 7

Class Index

7.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 8

Module Documentation

8.1 On site sets

Accumulators working on site sets.

Classes

- struct mln::accu::center< P, V >

  Mass center accumulator.

- struct mln::accu::math::count< T >

  Generic counter accumulator.

- struct mln::accu::shape::bbox< P >

  Generic bounding box accumulator class.

- class mln::accu::site_set::rectangularity< P >

  Compute the rectangularity of a site set.

8.1.1 Detailed Description

Accumulators working on site sets.

8.2 On images

Accumulators working on images.

Classes

- struct mln::accu::count_adjacent_vertices< F, S >

  Accumulator class counting the number of vertices adjacent to a set of mln::p_edges_psite (i.e., a set of edges).

- struct mln::accu::max_site< I >

  Define an accumulator that computes the first site with the maximum value in an image.

- struct mln::accu::shape::height< I >

  Height accumulator.

- struct mln::accu::shape::volume< I >

  Volume accumulator class.

8.2.1 Detailed Description

Accumulators working on images.

8.3 On values

Accumulators working on image values.

Classes

- struct mln::accu::convolve< T1, T2, R >

  Generic convolution accumulator class.

- struct mln::accu::count_labels< L >

  Count the number of different labels in an image.

- struct mln::accu::count_value< V >

  Count a given value.

- struct mln::accu::histo< V >

  Generic histogram class over a value set with type V.

- struct mln::accu::label_used< L >

  References all the labels used.

- struct mln::accu::logic::land

  "Logical-and" accumulator.

- struct mln::accu::logic::land_basic

  "Logical-and" accumulator.

- struct mln::accu::logic::lor

  "Logical-or" accumulator.

- struct mln::accu::logic::lor_basic

  "Logical-or" accumulator class.

- struct mln::accu::maj_h< T >

  Compute the majority value.

- struct mln::accu::math::inf< T >

  Generic inf accumulator class.

- struct mln::accu::math::sum< T, S >

  Generic sum accumulator class.

- struct mln::accu::math::sup< T >

  Generic sup accumulator class.

- struct mln::accu::rms< T, V >

  Generic root mean square accumulator class.

- struct mln::accu::stat::deviation< T, S, M >

Generic standard deviation accumulator class.

- struct mln::accu::stat::max< T >

  Generic max accumulator class.

- struct mln::accu::stat::max_h< V >

  Generic max function based on histogram over a value set with type V.

- struct mln::accu::stat::mean< T, S, M >

  Generic mean accumulator class.

- struct mln::accu::stat::median_alt< S >

  Generic median_alt function based on histogram over a value set with type S.

- struct mln::accu::stat::median_h< V >

  Generic median function based on histogram over a value set with type V.

- struct mln::accu::stat::min< T >

  Generic min accumulator class.

- struct mln::accu::stat::min_h< V >

  Generic min function based on histogram over a value set with type V.

- struct mln::accu::stat::min_max< V >

  Generic min and max accumulator class.

- struct mln::accu::stat::rank< T >

  Generic rank accumulator class.

- struct mln::accu::stat::rank< bool >

  rank accumulator class for Boolean.

- struct mln::accu::stat::rank_high_quant< T >

  Generic rank accumulator class.

- struct mln::accu::stat::var< T >

  Var accumulator class.

- struct mln::accu::stat::variance< T, S, R >

  Variance accumulator class.

8.3.1 Detailed Description

Accumulators working on image values.

8.4 Multiple accumulators

Set of special accumulators for computing several accumulators at the same time.

Classes

- struct mln::accu::pair< A1, A2, T >

  Generic pair of accumulators.

- struct mln::accu::tuple< A, n, >

  Generic tuple of accumulators.

8.4.1 Detailed Description

Set of special accumulators for computing several accumulators at the same time.

8.5 Graphes

All graphes implementations.

Classes

- class mln::util::graph

  Undirected graph.

- class mln::util::line_graph< G >

  Undirected line graph of a graph of type G.

8.5.1 Detailed Description

All graphes implementations.

8.6 Images

All the generic image types provided in Olena.

Modules

- Basic types

  Concrete images.

- Image morphers

  Morpher on both image values and domain.

- Values morphers

  Morpher on image values.

- Domain morphers

  Morpher on image domain.

- Identity morphers

  Morpher adding new functionnalities.

8.6.1 Detailed Description

All the generic image types provided in Olena.

8.7 Basic types

Concrete images.

Classes

- class mln::complex_image< D, G, V >

  Image based on a complex.

- class mln::edge_image< P, V, G >

  Image based on graph edges.

- struct mln::flat_image< T, S >

  Image with a single value.

- struct mln::image1d< T >

  Basic 1D image class.

- class mln::image2d< T >

  Basic 2D image class.

- struct mln::image2d_h< V >

  2d image based on an hexagonal mesh.

- struct mln::image3d< T >

  Basic 3D image class.

- class mln::pw::image< F, S >

  A generic point-wise image implementation.

- class mln::vertex_image< P, V, G >

  Image based on graph vertices.

8.7.1 Detailed Description

Concrete images.

8.8 Image morphers

Morpher on both image values and domain.

8.9 Values morphers

Morpher on image values.

Classes

- struct mln::fun_image< F, I >

  Image read through a function.

- class mln::thru_image< I, F >

  Morph image values through a function.

- class mln::thrubin_image< I1, I2, F >

  Morphes values from two images through a binary function.

- struct mln::violent_cast_image< T, I >

  Violently cast image values to a given type.

8.9.1 Detailed Description

Morpher on image values.

8.10 Domain morphers

Morpher on image domain.

Classes

- struct mln::extended< I >

    Makes an image become restricted by a point set.

- class mln::extension_fun< I, F >

    Extends the domain of an image with a function.

- class mln::extension_ima< I, J >

    Extends the domain of an image with an image.

- class mln::extension_val< I >

    Extends the domain of an image with a value.

- struct mln::hexa< I >

    hexagonal image class.

- struct mln::image_if< I, F >

    Image which domain is restricted by a function 'site -> Boolean'.

- struct mln::p2p_image< I, F >

    FIXME: Doc!

- struct mln::slice_image< I >

    2D image extracted from a slice of a 3D image.

- struct mln::sub_image< I, S >

    Image having its domain restricted by a site set.

- struct mln::sub_image_if< I, S >

    Image having its domain restricted by a site set and a function.

- struct mln::transformed_image< I, F >

    Image having its domain restricted by a site set.

- struct mln::unproject_image< I, D, F >

    Un-projects an image.

8.10.1 Detailed Description

Morpher on image domain.

8.11 Identity morphers

Morpher adding new functionnalities.

Classes

- struct mln::decorated_image< I, D >

  Image that can have additional features.

- class mln::labeled_image< I >

  Morpher providing an improved interface for labeled image.

- struct mln::lazy_image< I, F, B >

  Image values are computed on the fly.

- class mln::plain< I >

  Prevents an image from sharing its data.

- class mln::safe_image< I >

  Makes an image accessible at undefined location.

- struct mln::tr_image< S, I, T >

  Transform an image by a given transformation.

8.11.1 Detailed Description

Morpher adding new functionnalities.

8.12 Types

Milena Object types.

Modules

- Graphes

  All graphes implementations.

- Images

  All the generic image types provided in Olena.

- Neighborhoods

  All the predefined generic neighborhoods.

- Site sets

  All Site set types.

- Utilities

  Miscalleneous useful containers/structures.

- Windows

  All the predefined generic windows.

8.12.1 Detailed Description

Milena Object types.

8.13 Accumulators

All accumulator types.

Modules

- On site sets

    Accumulators working on site sets.

- On images

    Accumulators working on images.

- On values

    Accumulators working on image values.

- Multiple accumulators

    Set of special accumulators for computing several accumulators at the same time.

8.13.1 Detailed Description

All accumulator types.

8.14 Routines

All algorithms/routines provided in Milena.

8.15 Canvas

All canvas.

8.16 Functions

All predefined functions.

Namespaces

- namespace mln::fun::i2v

    Namespace of integer-to-value functions.

- namespace mln::fun::stat

    Namespace of statistical functions.

- namespace mln::fun::v2i

    Namespace of value-to-integer functions.

- namespace mln::fun::v2v

    Namespace of functions from value to value.

Modules

- v2w2v functions

    All bijective functions.

- v2w_w2v functions

    All bijective function.

- vv2b functions

    All functions mapping two values to a logical value.

Classes

- struct mln::Function< E >

    Base class for implementation of function-objects.

- struct mln::Function_v2b< E >

    Base class for implementation of function-objects from a value to a Boolean.

- struct mln::Function_v2v< E >

    Base class for implementation of function-objects from value to value.

- struct mln::Function_vv2b< E >

    Base class for implementation of function-objects from a couple of values to a Boolean.

- struct mln::Function_vv2v< E >

    Base class for implementation of function-objects from a couple of values to a value.

8.16.1 Detailed Description

All predefined functions.

8.17 Neighborhoods

All the predefined generic neighborhoods.

Modules

- 1D neighborhoods

    Predefined 1D neighborhoods.

- 2D neighborhoods

    Predefined 2D neighborhoods.

- 3D neighborhoods

    Predefined 3D neighborhoods.

8.17.1 Detailed Description

All the predefined generic neighborhoods.

8.18 1D neighborhoods

Predefined 1D neighborhoods.

Typedefs

- typedef neighb< window1d > mln::neighb1d

  Type alias for a neighborhood defined on the 1D square grid with integer coordinates.

Functions

- const neighb1d & mln::c2 ()

  2-connectivity neighborhood on the 1D grid.

8.18.1 Detailed Description

Predefined 1D neighborhoods.

8.18.2 Typedef Documentation

8.18.2.1 typedef neighb<window1d> mln::neighb1d

Type alias for a neighborhood defined on the 1D square grid with integer coordinates.

8.18.3 Function Documentation

8.18.3.1 const neighb1d & mln::c2 () `[inline]`

2-connectivity neighborhood on the 1D grid.

```
o x o
```

Returns:

A neighb1d.

Referenced by mln::geom::mesh_curvature().

8.19 2D neighborhoods

Predefined 2D neighborhoods.

Typedefs

- typedef neighb< window2d > mln::neighb2d
    Type alias for a neighborhood defined on the 2D square grid with integer coordinates.

Functions

- const neighb2d & mln::c2_col ()
    Vertical 2-connectivity neighborhood on the 2D grid.
- const neighb2d & mln::c2_row ()
    Horizontal 2-connectivity neighborhood on the 2D grid.
- const neighb2d & mln::c4 ()
    4-connectivity neighborhood on the 2D grid.
- const neighb2d & mln::c8 ()
    8-connectivity neighborhood on the 2D grid.

8.19.1 Detailed Description

Predefined 2D neighborhoods.

8.19.2 Typedef Documentation

8.19.2.1 typedef neighb<window2d> mln::neighb2d

Type alias for a neighborhood defined on the 2D square grid with integer coordinates.

8.19.3 Function Documentation

8.19.3.1 const neighb2d & mln::c2_col () [inline]

Vertical 2-connectivity neighborhood on the 2D grid.

```
- o -
- x -
- o -
```

Returns:

A neighb2d.

8.19.3.2 const neighb2d & mln::c2_row () [inline]

Horizontal 2-connectivity neighborhood on the 2D grid.

```
- - -
o x o
- - -
```

Returns:

A neighb2d.

8.19.3.3 const neighb2d & mln::c4 () [inline]

4-connectivity neighborhood on the 2D grid.

```
- o -
o x o
- o -
```

Returns:

A neighb2d.

8.19.3.4 const neighb2d & mln::c8 () [inline]

8-connectivity neighborhood on the 2D grid.

```
o o o
o x o
o o o
```

Returns:

A neighb2d.

8.20 3D neighborhoods

Predefined 3D neighborhoods.

Typedefs

- typedef neighb< window3d > mln::neighb3d

    Type alias for a neighborhood defined on the 3D square grid with integer coordinates.

Functions

- const neighb3d & mln::c18 ()

    18-connectivity neighborhood on the 3D grid.

- const neighb3d & mln::c26 ()

    26-connectivity neighborhood on the 3D grid.

- const neighb3d & mln::c4_3d ()

    4-connectivity neighborhood on the 3D grid.

- const neighb3d & mln::c6 ()

    6-connectivity neighborhood on the 3D grid.

- const neighb3d & mln::c8_3d ()

    8-connectivity neighborhood on the 3D grid.

8.20.1 Detailed Description

Predefined 3D neighborhoods.

8.20.2 Typedef Documentation

8.20.2.1 typedef neighb<window3d> mln::neighb3d

Type alias for a neighborhood defined on the 3D square grid with integer coordinates.

8.20.3 Function Documentation

8.20.3.1 const neighb3d & mln::c18 () [inline]

18-connectivity neighborhood on the 3D grid.

```
  . o .
 o o o
. o .
```

```
    o o o
  o x o
o o o

    . o .
  o o o
. o .
```

Returns:

A neighb3d.

References mln::c6(), mln::window< D >::insert(), and mln::win::sym().

Referenced by mln::c26().

8.20.3.2 const neighb3d & mln::c26 () [inline]

26-connectivity neighborhood on the 3D grid.

```
    o o o
  o o o
o o o

    o o o
  o x o
o o o

    o o o
  o o o
o o o
```

Returns:

A neighb3d.

References mln::c18(), mln::window< D >::insert(), and mln::win::sym().

8.20.3.3 const neighb3d & mln::c4_3d () [inline]

4-connectivity neighborhood on the 3D grid.

```
    . . .
  . . .
. . .

    . o .
  o x o
. o .

    . . .
  . . .
. . .
```

Returns:

A neighb3d.

References mln::window< D >::insert(), and mln::win::sym().

8.20.3.4 const neighb3d & mln::c6 () [inline]

6-connectivity neighborhood on the 3D grid.

```
    . . .
   . o .
  . . .

    . o .
   o x o
  . o .

    . . .
   . o .
  . . .
```

Returns:

A neighb3d.

References mln::window< D >::insert(), and mln::win::sym().

Referenced by mln::c18().

8.20.3.5 const neighb3d & mln::c8_3d () [inline]

8-connectivity neighborhood on the 3D grid.

```
    . . .
   . . .
  . . .

    o o o
   o x o
  o o o

    . . .
   . . .
  . . .
```

Returns:

A neighb3d.

8.21 Site sets

All Site set types.

Modules

- Basic types
  Basic site sets.
- Graph based
  Site sets based on a graph.
- Complex based
  Site sets based on a complexes.
- Sparse types
  Sparse site sets.
- Queue based
  Site sets based on a queue.

8.21.1 Detailed Description

All Site set types.

8.22 Basic types

Basic site sets.

Classes

- struct mln::box< P >

  Generic box class: site set containing points of a regular grid.

- class mln::p_line2d

  2D discrete line of points.

- class mln::p_mutable_array_of< S >

  p_mutable_array_of is a mutable array of site sets.

- class mln::p_run< P >

  Point set class in run.

8.22.1 Detailed Description

Basic site sets.

8.23 Graph based

Site sets based on a graph.

Classes

- class mln::p_edges< G, F >

  Site set mapping graph edges and image sites.

- struct mln::p_faces< N, D, P >

  A complex psite set based on a the N-faces of a complex of dimension D (a D-complex).

- class mln::p_vertices< G, F >

  Site set based mapping graph vertices to sites.

8.23.1 Detailed Description

Site sets based on a graph.

8.24 Complex based

Site sets based on a complexes.

Classes

- class mln::p_complex< D, G >

  A complex psite set based on the N-faces of a complex of dimension `D` *(a* `D-complex`*).*

8.24.1 Detailed Description

Site sets based on a complexes.

8.25 Sparse types

Sparse site sets.

Classes

- class mln::p_array< P >

  Multi-set of sites.

- class mln::p_centered< W >

  Site set corresponding to a window centered on a site.

- class mln::p_if< S, F >

  Site set restricted w.r.t.

- class mln::p_image< I >

  Site set based on an image of Booleans.

- class mln::p_set< P >

  Mathematical set of sites (based on util::set).

- class mln::p_transformed< S, F >

  Site set transformed through a function.

- class mln::p_vaccess< V, S >

  Site set in which sites are grouped by their associated value.

8.25.1 Detailed Description

Sparse site sets.

8.26 Queue based

Site sets based on a queue.

Classes

- class mln::p_key< K, P >

  Priority queue class.

- class mln::p_priority< P, Q >

  Priority queue.

- class mln::p_queue< P >

  Queue of sites (based on std::deque).

- class mln::p_queue_fast< P >

  Queue of sites class (based on p_array.

8.26.1 Detailed Description

Site sets based on a queue.

8.27 Utilities

Miscalleneous useful containers/structures.

Classes

- class mln::util::adjacency_matrix< V >

  A class of adjacency matrix.

- class mln::util::array< T >

  A dynamic array class.

- class mln::util::couple< T, U >

  Definition of a couple.

- struct mln::util::eat

  Eat structure.

- class mln::util::fibonacci_heap< P, T >

  Fibonacci heap.

- struct mln::util::ignore

  Ignore structure.

- struct mln::util::nil

  Nil structure.

- struct mln::util::ord_pair< T >

  Ordered pair structure s.a.

- class mln::util::set< T >

  An "efficient" mathematical set class.

- class mln::util::site_pair< P >

  A pair of sites.

- class mln::util::soft_heap< T, R >

  Soft heap.

- struct mln::util::tracked_ptr< T >

  Smart pointer for shared data with tracking.

- struct mln::util::yes

  Object that always says "yes".

8.27.1 Detailed Description

Miscalleneous useful containers/structures.

8.28 Windows

All the predefined generic windows.

Modules

- 1D windows
  Predefined 1D windows.
- 2D windows
  Predefined 2D windows.
- 3D windows
  Predefined 3D windows.
- N-D windows
  Predefined N-D windows.
- Multiple windows
  Generic multiple windows.

8.28.1 Detailed Description

All the predefined generic windows.

8.29 1D windows

Predefined 1D windows.

Typedefs

- typedef line< grid::tick, 0, def::coord > mln::win::segment1d

    Segment window defined on the 1D grid.

- typedef window< mln::dpoint1d > mln::window1d

    Type alias for a window with arbitrary shape, defined on the 1D square grid with integer coordinates.

8.29.1 Detailed Description

Predefined 1D windows.

8.29.2 Typedef Documentation

8.29.2.1 typedef line<grid::tick, 0, def::coord> mln::win::segment1d

Segment window defined on the 1D grid.

An segment1d is centered and symmetric; so its height (length) is odd.

For instance:

```
o x o
```

is defined with length = 3.

8.29.2.2 typedef window<mln::dpoint1d> mln::window1d

Type alias for a window with arbitrary shape, defined on the 1D square grid with integer coordinates.

8.30 2D windows

Predefined 2D windows.

Classes

- struct mln::win::backdiag2d

  Diagonal line window defined on the 2D square grid.

- struct mln::win::diag2d

  Diagonal line window defined on the 2D square grid.

- struct mln::win::octagon2d

  Octagon window defined on the 2D square grid.

- struct mln::win::rectangle2d

  Rectangular window defined on the 2D square grid.

Typedefs

- typedef ball< grid::square, def::coord > mln::win::disk2d

  2D disk window; precisely, ball-shaped window defined on the 2D square grid.

- typedef line< grid::square, 1, def::coord > mln::win::hline2d

  Horizontal line window defined on the 2D square grid.

- typedef line< grid::square, 0, def::coord > mln::win::vline2d

  Vertical line window defined on the 2D square grid.

- typedef window< mln::dpoint2d > mln::window2d

  Type alias for a window with arbitrary shape, defined on the 2D square grid with integer coordinates.

Functions

- const window2d & mln::win_c4p ()

  4-connectivity window on the 2D grid, including the center.

- const window2d & mln::win_c8p ()

  8-connectivity window on the 2D grid, including the center.

8.30.1 Detailed Description

Predefined 2D windows.

8.30.2 Typedef Documentation

8.30.2.1 typedef ball<grid::square, def::coord> mln::win::disk2d

2D disk window; precisely, ball-shaped window defined on the 2D square grid.

8.30.2.2 typedef line<grid::square, 1, def::coord> mln::win::hline2d

Horizontal line window defined on the 2D square grid.

An hline2d is centered and symmetric; so its height is 1 and its width (length) is odd.

For instance:

```
o o x o o
```

is defined with length = 5.

8.30.2.3 typedef line<grid::square, 0, def::coord> mln::win::vline2d

Vertical line window defined on the 2D square grid.

An vline2d is centered and symmetric; so its width is 1 and its height (length) is odd.

For instance:

```
o
x
o
```

is defined with length = 3.

8.30.2.4 typedef window<mln::dpoint2d> mln::window2d

Type alias for a window with arbitrary shape, defined on the 2D square grid with integer coordinates.

8.30.3 Function Documentation

8.30.3.1 const window2d & mln::win_c4p () `[inline]`

4-connectivity window on the 2D grid, including the center.

```
- o -
o x o
- o -
```

Returns:

A window2d.

References mln::window< D >::insert(), and mln::window< D >::size().

8.30.3.2 const window2d & mln::win_c8p () [inline]

8-connectivity window on the 2D grid, including the center.

```
o o o
o x o
o o o
```

Returns:

A window2d.

References mln::window< D >::insert(), and mln::window< D >::size().

8.31 3D windows

Predefined 3D windows.

Classes

- struct mln::win::cube3d

  Cube window defined on the 3D grid.

- struct mln::win::cuboid3d

  Cuboid defined on the 3-D square grid.

Typedefs

- typedef ball< grid::cube, def::coord > mln::win::sphere3d

  3D sphere window; precisely, ball-shaped window defined on the 3D cubic grid.

- typedef window< mln::dpoint3d > mln::window3d

  Type alias for a window with arbitrary shape, defined on the 3D square grid with integer coordinates.

Functions

- const window3d & mln::win_c4p_3d ()

  4-connectivity window on the 3D grid, including the center.

- const window3d & mln::win_c8p_3d ()

  8-connectivity window on the 3D grid, including the center.

8.31.1 Detailed Description

Predefined 3D windows.

8.31.2 Typedef Documentation

8.31.2.1 typedef ball<grid::cube, def::coord> mln::win::sphere3d

3D sphere window; precisely, ball-shaped window defined on the 3D cubic grid.

8.31.2.2 typedef window<mln::dpoint3d> mln::window3d

Type alias for a window with arbitrary shape, defined on the 3D square grid with integer coordinates.

8.31.3 Function Documentation

8.31.3.1 const window3d & mln::win_c4p_3d () [inline]

4-connectivity window on the 3D grid, including the center.

```
    - - -
   - - -
  - - -

    - o -
   o x o
  - o -

    - - -
   - - -
  - - -
```

Returns:

A window3d.

References mln::window< D >::insert(), and mln::window< D >::size().

8.31.3.2 const window3d & mln::win_c8p_3d () [inline]

8-connectivity window on the 3D grid, including the center.

```
    - - -
   - - -
  - - -

    o o o
   o x o
  o o o

    - - -
   - - -
  - - -
```

Returns:

A window3d.

References mln::window< D >::insert(), and mln::window< D >::size().

8.32 N-D windows

Predefined N-D windows.

Classes

- struct mln::win::ball< G, C >

  Generic ball window defined on a given grid.

- struct mln::win::line< M, i, C >

  Generic line window defined on a given grid in the given dimension.

8.32.1 Detailed Description

Predefined N-D windows.

8.33 Multiple windows

Generic multiple windows.

Classes

- class mln::win::multiple< W, F >

  Multiple window.

- class mln::win::multiple_size< n, W, F >

  Definition of a multiple-size window.

8.33.1 Detailed Description

Generic multiple windows.

8.34 v2w2v functions

All bijective functions.

8.35 v2w_w2v functions

All bijective function.

8.36 vv2b functions

All functions mapping two values to a logical value.

Chapter 9

Namespace Documentation

9.1 mln Namespace Reference

mln/convert/to_image.hh

Classes

- struct Accumulator

  Base class for implementation of accumulators.

- class bkd_pixter1d

  Backward pixel iterator on a 1-D image with border.

- class bkd_pixter2d

  Backward pixel iterator on a 2-D image with border.

- class bkd_pixter3d

  Backward pixel iterator on a 3-D image with border.

- struct box

  Generic box class: site set containing points of a regular grid.

- struct Box

  Base class for implementation classes of boxes.

- class box_runend_piter

  A generic backward iterator on points by lines.

- class box_runstart_piter

  A generic forward iterator on points by lines.

- struct Browsing

  Base class for implementation classes that are browsings.

- struct category< R(∗)(A) >

Category declaration for a unary C function.

- class complex_image

  Image based on a complex.

- class complex_neighborhood_bkd_piter

  Backward iterator on complex neighborhood.

- class complex_neighborhood_fwd_piter

  Forward iterator on complex neighborhood.

- class complex_psite

  Point site associated to a mln::p_complex.

- class complex_window_bkd_piter

  Backward iterator on complex window.

- class complex_window_fwd_piter

  Forward iterator on complex window.

- struct decorated_image

  Image that can have additional features.

- struct Delta_Point_Site

  FIXME: Doc!

- struct Delta_Point_Site< void >

  Delta point site category flag type.

- struct dpoint

  Generic delta-point class.

- struct Dpoint

  Base class for implementation of delta-point classes.

- class dpoints_bkd_pixter

  A generic backward iterator on the pixels of a dpoint-based window or neighborhood.

- class dpoints_fwd_pixter

  A generic forward iterator on the pixels of a dpoint-based window or neighborhood.

- class dpsites_bkd_piter

  A generic backward iterator on points of windows and of neighborhoods.

- class dpsites_fwd_piter

  A generic forward iterator on points of windows and of neighborhoods.

- struct Edge

  edge category flag type.

- class edge_image

  Image based on graph edges.

- struct extended

  Makes an image become restricted by a point set.

- class extension_fun

  Extends the domain of an image with a function.

- class extension_ima

  Extends the domain of an image with an image.

- class extension_val

  Extends the domain of an image with a value.

- class faces_psite

  Point site associated to a mln::p_faces.

- struct flat_image

  Image with a single value.

- struct fun_image

  Image read through a function.

- struct Function

  Base class for implementation of function-objects.

- struct Function< void >

  Function category flag type.

- struct Function_v2b

  Base class for implementation of function-objects from a value to a Boolean.

- struct Function_v2v

  Base class for implementation of function-objects from value to value.

- struct Function_vv2b

  Base class for implementation of function-objects from a couple of values to a Boolean.

- struct Function_vv2v

  Base class for implementation of function-objects from a couple of values to a value.

- class fwd_pixter1d

  Forward pixel iterator on a 1-D image with border.

- class fwd_pixter2d

  Forward pixel iterator on a 2-D image with border.

- class fwd_pixter3d

  Forward pixel iterator on a 3-D image with border.

- struct Gdpoint

  FIXME: Doc!

- struct Gdpoint< void >

  Delta point site category flag type.

- struct Generalized_Pixel

  Base class for implementation classes that are pixels or that have the behavior of pixels.

- struct Gpoint

  Base class for implementation of point classes.

- struct Graph

  Base class for implementation of graph classes.

- struct graph_elt_mixed_neighborhood

  Elementary neighborhood on graph class.

- class graph_elt_mixed_window

  Elementary window on graph class.

- struct graph_elt_neighborhood

  Elementary neighborhood on graph class.

- struct graph_elt_neighborhood_if

  Elementary neighborhood_if on graph class.

- class graph_elt_window

  Elementary window on graph class.

- class graph_elt_window_if

  Custom window on graph class.

- class graph_window_base
- class graph_window_if_piter

  Forward iterator on line graph window.

- class graph_window_piter

  Forward iterator on line graph window.

- struct hexa

  hexagonal image class.

- struct Image

  Base class for implementation of image classes.

- struct image1d

  Basic 1D image class.

- class image2d

  Basic 2D image class.

- struct image2d_h

  2d image based on an hexagonal mesh.

- struct image3d

  Basic 3D image class.

- struct image_if

  Image which domain is restricted by a function 'site -> Boolean'.

- struct interpolated

  Makes the underlying image being accessed with floating coordinates.

- struct Iterator

  Base class for implementation classes that are iterators.

- class labeled_image

  Morpher providing an improved interface for labeled image.

- class labeled_image_base

  Base class Morpher providing an improved interface for labeled image.

- struct lazy_image

  Image values are computed on the fly.

- struct Literal

  Base class for implementation classes of literals.

- struct Mesh

  Base class for implementation classes of meshes.

- struct Meta_Accumulator

  Base class for implementation of meta accumulators.

- struct Meta_Function

  Base class for implementation of meta functions.

- struct Meta_Function_v2v

  Base class for implementation of function-objects from value to value.

- struct Meta_Function_vv2v

  Base class for implementation of function-objects from value to value.

- class mixed_neighb

  Adapter class from window to neighborhood.

- class neighb

  Adapter class from window to neighborhood.

- struct Neighborhood

  Base class for implementation classes that are neighborhoods.

- struct Neighborhood< void >

  Neighborhood category flag type.

- struct Object

  Base class for almost every class defined in Milena.

- struct p2p_image

  FIXME: Doc!

- class p_array

  Multi-set of sites.

- class p_centered

  Site set corresponding to a window centered on a site.

- class p_complex

  A complex psite set based on the N-faces of a complex of dimension `D` *(a* `D-complex`*).*

- class p_edges

  Site set mapping graph edges and image sites.

- struct p_faces

  A complex psite set based on a the N-faces of a complex of dimension D (a D-complex).

- class p_graph_piter

  Generic iterator on point sites of a mln::S.

- class p_if

  Site set restricted w.r.t.

- class p_image

  Site set based on an image of Booleans.

- class p_indexed_bkd_piter

  Backward iterator on sites of an indexed site set.

- class p_indexed_fwd_piter

  Forward iterator on sites of an indexed site set.

- class p_indexed_psite

  Psite class for indexed site sets such as p_array.

- class p_key

  Priority queue class.

- class p_line2d

2D discrete line of points.

- class p_mutable_array_of

  p_mutable_array_of is a mutable array of site sets.

- class p_n_faces_bkd_piter

  Backward iterator on the n-faces sites of an mln::p_complex<D, P>.

- class p_n_faces_fwd_piter

  Forward iterator on the n-faces sites of an mln::p_complex<D, P>.

- class p_priority

  Priority queue.

- class p_queue

  Queue of sites (based on std::deque).

- class p_queue_fast

  Queue of sites class (based on p_array.

- class p_run

  Point set class in run.

- class p_set

  Mathematical set of sites (based on util::set).

- class p_set_of

  p_set_of is a set of site sets.

- class p_transformed

  Site set transformed through a function.

- struct p_transformed_piter

  Iterator on p_transformed<S,F>.

- class p_vaccess

  Site set in which sites are grouped by their associated value.

- class p_vertices

  Site set based mapping graph vertices to sites.

- struct pixel

  Generic pixel class.

- struct Pixel_Iterator

  Base class for the implementation of pixel iterator classes.

- class plain

  Prevents an image from sharing its data.

- struct point

  Generic point class.

- struct Point

  Base class for implementation of point classes.

- struct Point_Site

  Base class for implementation classes of the notion of "point site".

- struct Point_Site< void >

  Point site category flag type.

- struct Proxy

  Base class for implementation classes of the notion of "proxy".

- struct Proxy< void >

  Proxy category flag type.

- struct Pseudo_Site

  Base class for implementation classes of the notion of "pseudo site".

- struct Pseudo_Site< void >

  Pseudo_Site category flag type.

- struct Regular_Grid

  Base class for implementation classes of regular grids.

- class safe_image

  Makes an image accessible at undefined location.

- struct Site

  Base class for classes that are explicitly sites.

- struct Site< void >

  Site category flag type.

- struct Site_Iterator

  Base class for implementation of classes of iterator on points.

- struct Site_Proxy

  Base class for implementation classes of the notion of "site proxy".

- struct Site_Proxy< void >

  Site_Proxy category flag type.

- struct Site_Set

  Base class for implementation classes of site sets.

- struct Site_Set< void >

  Site_Set category flag type.

- struct slice_image

  2D image extracted from a slice of a 3D image.

- struct sub_image

  Image having its domain restricted by a site set.

- struct sub_image_if

  Image having its domain restricted by a site set and a function.

- class thru_image

  Morph image values through a function.

- class thrubin_image

  Morphes values from two images through a binary function.

- struct tr_image

  Transform an image by a given transformation.

- struct transformed_image

  Image having its domain restricted by a site set.

- struct unproject_image

  Un-projects an image.

- struct Value

  Base class for implementation classes of values.

- struct Value_Iterator

  Base class for implementation of classes of iterator on values.

- struct Value_Set

  Base class for implementation classes of sets of values.

- struct Vertex

  Vertex category flag type.

- class vertex_image

  Image based on graph vertices.

- struct violent_cast_image

  Violently cast image values to a given type.

- struct w_window

  Generic w_window class.

- struct Weighted_Window

  Base class for implementation classes that are weighted_windows.

- class window

Generic window class.

- struct Window

  Base class for implementation classes that are windows.

Namespaces

- namespace accu

  Namespace of accumulators.

- namespace algebra

  Namespace of algebraic structure.

- namespace arith

  Namespace of arithmetic.

- namespace binarization

  Namespace of "point-wise" expression tools.

- namespace border

  Namespace of routines related to image virtual (outer) border.

- namespace canvas

  Namespace of canvas.

- namespace convert

  Namespace of conversion routines.

- namespace data

  Namespace of image processing routines related to pixel data.

- namespace debug

  Namespace of routines that help to debug.

- namespace def

  Namespace for core definitions.

- namespace display

  Namespace of routines that help to display images.

- namespace doc

  The namespace mln::doc is only for documentation purpose.

- namespace draw

  Namespace of drawing routines.

- namespace estim

  Namespace of estimation materials.

- namespace extension

  Namespace of extension tools.

- namespace fun

  Namespace of functions.

- namespace geom

  Namespace of all things related to geometry.

- namespace graph

  Namespace of graph related routines.

- namespace grid

  Namespace of grids definitions.

- namespace histo

  Namespace of histograms.

- namespace impl

  Implementation namespace of mln namespace.

- namespace io

  Namespace of input/output handling.

- namespace labeling

  Namespace of labeling routines.

- namespace linear

  Namespace of linear image processing routines.

- namespace literal

  Namespace of literals.

- namespace logical

  Namespace of logic.

- namespace make

  Namespace of routines that help to make Milena's objects.

- namespace math

  Namespace of mathematical routines.

- namespace metal

  Namespace of meta-programming tools.

- namespace morpho

  Namespace of mathematical morphology routines.

- namespace norm

  Namespace of norms.

- namespace opt

  Namespace of optional routines.

- namespace pw

  Namespace of "point-wise" expression tools.

- namespace registration

  Namespace of "point-wise" expression tools.

- namespace select

  Select namespace (FIXME doc).

- namespace set

  Namespace of image processing routines related to pixel sets.

- namespace subsampling

  Namespace of "point-wise" expression tools.

- namespace tag

  Namespace of image processing routines related to tags.

- namespace test

  Namespace of image processing routines related to pixel tests.

- namespace topo

  Namespace of "point-wise" expression tools.

- namespace trace

  Namespace of routines related to the trace mechanism.

- namespace trait

  Namespace where traits are defined.

- namespace transform

  Namespace of transforms.

- namespace util

  Namespace of tools using for more complex algorithm.

- namespace value

  Namespace of materials related to pixel value types.

- namespace win

  Namespace of image processing routines related to win.

Typedefs

- typedef mln::complex_image< 1, mln::discrete_plane_1complex_geometry, bool > bin_1complex_image2d

  Type alias for a binary image based on a 1-complex, where 0-faces are located at discrete (integer) 2-dimensional points.

- typedef mln::complex_image< 2, mln::space_2complex_geometry, bool > bin_2complex_image3df

  Type alias for a binary image based on a 2-complex, where 0-faces are located at floating-point 3-dimensional points.

- typedef box< mln::point1d > box1d

  Type alias for a box defined on the 1D square grid with integer coordinates.

- typedef box< mln::point2d > box2d

  Type alias for a box defined on the 2D square grid with integer coordinates.

- typedef box< point2d_h > box2d_h

  FIXME.

- typedef box< point3d > box3d

  Type alias for a box defined on the 3D square grid with integer coordinates.

- typedef mln::geom::complex_geometry< 1, point2d > discrete_plane_1complex_geometry

  Type alias for the geometry of a 1-complex (e.g., a graph) located in a discrete 2-dimensional plane (with integer coordinates).

- typedef mln::geom::complex_geometry< 2, point2d > discrete_plane_2complex_geometry

  Type alias for the geometry of a 2-complex located in a discrete 2-dimensional plane (with integer coordinates).

- typedef dpoint< mln::grid::tick, def::coord > dpoint1d

  Type alias for a delta-point defined on the 1D square grid with integer coordinates.

- typedef dpoint< mln::grid::square, mln::def::coord > dpoint2d

  Type alias for a delta-point defined on the 2D square grid with integer coordinates.

- typedef dpoint< mln::grid::hexa, def::coord > dpoint2d_h

  Type alias for a delta-point defined on the 2D square grid with integer coordinates.

- typedef dpoint< mln::grid::cube, def::coord > dpoint3d

  Type alias for a delta-point defined on the 3D square grid with integer coordinates.

- typedef mln::complex_image< 2, mln::space_2complex_geometry, float > float_2complex_image3df

  Type alias for a floating-point image based on a 2-complex, where 0-faces are located at floating-point 3-dimensional points.

- typedef mln::complex_image< 1, mln::discrete_plane_1complex_geometry, mln::value::int_u8 > int_u8_1complex_image2d

Type alias for an 8-bit gray-level image based on a 1-complex, where 0-faces are located at discrete (integer) 2-dimensional points.

- typedef mln::complex_image< 2, mln::discrete_plane_2complex_geometry, mln::value::int_u8 > int_u8_2complex_image2d

  Type alias for an 8-bit gray-level image based on a 2-complex, where 0-faces are located at discrete (integer) 2-dimensional points.

- typedef mln::complex_image< 2, mln::space_2complex_geometry, mln::value::int_u8 > int_u8_-2complex_image3df

  Type alias for an 8-bit gray-level image based on a 2-complex, where 0-faces are located at floating-point 3-dimensional points.

- typedef neighb< window1d > neighb1d

  Type alias for a neighborhood defined on the 1D square grid with integer coordinates.

- typedef neighb< window2d > neighb2d

  Type alias for a neighborhood defined on the 2D square grid with integer coordinates.

- typedef neighb< window3d > neighb3d

  Type alias for a neighborhood defined on the 3D square grid with integer coordinates.

- typedef p_run< point2d > p_run2d

  Type alias for a run of 2d points.

- typedef p_set_of< p_run2d > p_runs2d

  Type alias for a set of runs of 2d points.

- typedef point< grid::tick, def::coordf > point1df

  Type alias for a point defined on the 1D ruler with floating-point coordinates.

- typedef point< mln::grid::square, mln::def::coordf > point2df

  Type alias for a point defined on the 2D square grid with floating-point coordinates.

- typedef point< grid::cube, def::coordf > point3df

  Type alias for a point defined on the 3D square grid with floating-point coordinates.

- typedef mln::complex_image< 2, mln::space_2complex_geometry, mln::value::rgb8 > rgb8_-2complex_image3df

  Type alias for a (3x8-bit) RGB image based on a 2-complex, where 0-faces are located at floating-point 3-dimensional points.

- typedef mln::geom::complex_geometry< 2, point3df > space_2complex_geometry

  Type alias for the geometry of a 2-complex located in a 3-dimensional space (with floating-point coordinates).

- typedef mln::complex_image< 2, mln::space_2complex_geometry, unsigned > unsigned_-2complex_image3df

  Type alias for a gray-level image based on a 2-complex, where 0-faces are located at floating-point 3-dimensional points.

- typedef algebra::vec< 2u, double > vec2d_d

  2D vector with double coordinates.

- typedef algebra::vec< 2u, float > vec2d_f

  2D vector with float coordinates.

- typedef algebra::vec< 3u, double > vec3d_d

  3D vector with double coordinates.

- typedef algebra::vec< 3u, float > vec3d_f

  3D vector with float coordinates.

- typedef w_window< dpoint1d, float > w_window1d_float

  Type alias for a w_window with arbitrary shape, defined on the 1D grid (with integer coordinates) and whose weights are floating values.

- typedef w_window< dpoint1d, int > w_window1d_int

  Type alias for a w_window with arbitrary shape, defined on the 1D grid (with integer coordinates) and whose weights are integers.

- typedef w_window< dpoint2d, float > w_window2d_float

  Type alias for a w_window with arbitrary shape, defined on the 2D square grid (with integer coordinates) and whose weights are floating values.

- typedef w_window< dpoint2d, int > w_window2d_int

  Type alias for a w_window with arbitrary shape, defined on the 2D square grid (with integer coordinates) and whose weights are integers.

- typedef w_window< dpoint3d, float > w_window3d_float

  Type alias for a w_window with arbitrary shape, defined on the 3D grid (with integer coordinates) and whose weights are floating values.

- typedef w_window< dpoint3d, int > w_window3d_int

  Type alias for a w_window with arbitrary shape, defined on the 3D grid (with integer coordinates) and whose weights are integers.

- typedef window< mln::dpoint1d > window1d

  Type alias for a window with arbitrary shape, defined on the 1D square grid with integer coordinates.

- typedef window< mln::dpoint2d > window2d

  Type alias for a window with arbitrary shape, defined on the 2D square grid with integer coordinates.

- typedef window< mln::dpoint3d > window3d

  Type alias for a window with arbitrary shape, defined on the 3D square grid with integer coordinates.

- typedef point< grid::tick, def::coord > point1d

  Type alias for a point defined on the 1D ruler with integer coordinates.

- typedef point< mln::grid::square, mln::def::coord > point2d

  Type alias for a point defined on the 2D square grid with integer coordinates.

- typedef point< grid::hexa, def::coord > point2d_h
  Type alias for a point defined on the 2D hexagonal grid with integer coordinates.
- typedef point< grid::cube, def::coord > point3d
  Type alias for a point defined on the 3D square grid with integer coordinates.

Functions

- template<typename I>
  I::psite a_point_of (const Image< I > &ima)
  Give a point of an image.
- template<typename I, typename F>
  p2p_image< const I, F > apply_p2p (const Image< I > &ima, const Function_v2v< F > &f)
  FIXME: Doc!
- template<typename I, typename F>
  p2p_image< I, F > apply_p2p (Image< I > &ima, const Function_v2v< F > &f)
  FIXME: Doc!
- const neighb3d & c18 ()
  18-connectivity neighborhood on the 3D grid.
- const neighb1d & c2 ()
  2-connectivity neighborhood on the 1D grid.
- const neighb3d & c26 ()
  26-connectivity neighborhood on the 3D grid.
- const neighb2d & c2_col ()
  Vertical 2-connectivity neighborhood on the 2D grid.
- const neighb2d & c2_row ()
  Horizontal 2-connectivity neighborhood on the 2D grid.
- const neighb2d & c4 ()
  4-connectivity neighborhood on the 2D grid.
- const neighb3d & c4_3d ()
  4-connectivity neighborhood on the 3D grid.
- const neighb3d & c6 ()
  6-connectivity neighborhood on the 3D grid.
- const neighb2d & c8 ()
  8-connectivity neighborhood on the 2D grid.
- const neighb3d & c8_3d ()

8-connectivity neighborhood on the 3D grid.

- template<typename T2, typename T1>
  fun::x2x::composed< T2, T1 > compose (T2 f, T1 g)

  Do a composition of two transformations.

- template<typename I>
  mln::trait::concrete< I >::ret duplicate (const Image< I > &model)

  Duplicate the image `model` *with the values of the image* `data`.

- template<typename I>
  extension_val< const I > extend (const Image< I > &ima, const typename I::value &val)

  Routines for domain extension with a value.

- template<typename I, typename J>
  extension_ima< const I, const J > extend (const Image< I > &ima, const Image< J > &ext)

  Routines for domain extension with an image.

- template<typename I, typename F>
  extension_fun< const I, F > extend (const Image< I > &ima, const Function_v2v< F > &fun)

  Routines for domain extension with a function.

- bool implies (bool lexpr, bool rexpr)

  Implication.

- template<typename I, typename J>
  void initialize (Image< I > &target, const Image< J > &model)
- template<typename I, typename N>
  bool is_simple_2d (const Image< I > &ima, const Neighborhood< N > &nbh, const typename I::psite &p)

  Test if a point is simple or not.

- template<typename P>
  box< P > larger_than (const box< P > a, const box< P > b)

  Return the minimum box including box `a` *and box* `b`.

- template<typename I, typename V, typename E>
  image2d< typename I::value > make_debug_graph_image (const I &input, const V &ima_v, const E &ima_e, const value::rgb8 &bg)

  Draw a graph.

- mln_gen_complex_neighborhood (complex_m_face_neighborhood, complex_m_face_window)

  Neighborhood centered on an n-face of complex returning the m-faces transitively adjacent to this center n-face.

- mln_gen_complex_neighborhood (complex_higher_dim_connected_n_face_neighborhood, complex_higher_dim_connected_n_face_window)

  Neighborhood centered on an n-face of complex returning the n-faces sharing an (n+1)-face with the center n-face.

- mln_gen_complex_neighborhood (complex_lower_dim_connected_n_face_neighborhood, complex_lower_dim_connected_n_face_window)

Neighborhood centered on an n-face of complex returning the n-faces sharing an (n-1)-face with the center n-face.

- mln_gen_complex_neighborhood (complex_lower_higher_neighborhood, complex_lower_higher_-window)

  Neighborhood centered on an n-face of complex returning its adjacent (n-1)-faces and (n+1)-faces.

- mln_gen_complex_neighborhood (complex_higher_neighborhood, complex_higher_window)

  Neighborhood centered on an n-face of complex returning its adjacent (n+1)-faces.

- mln_gen_complex_neighborhood (complex_lower_neighborhood, complex_lower_window)

  Neighborhood centered on an n-face of complex returning its adjacent (n-1)-faces.

- mln_gen_complex_window (complex_m_face_window, topo::adj_m_face_fwd_iter, topo::adj_m_-face_bkd_iter)

  Window centered on an n-face of complex returning the m-faces transitively adjacent to this center n-face.

- mln_gen_complex_window (complex_higher_dim_connected_n_face_window, topo::adj_higher_-dim_connected_n_face_fwd_iter, topo::adj_higher_dim_connected_n_face_bkd_iter)

  Window centered on an n-face of complex returning the n-faces sharing an (n+1)-face with the center n-face.

- mln_gen_complex_window (complex_lower_dim_connected_n_face_window, topo::adj_lower_-dim_connected_n_face_fwd_iter, topo::adj_lower_dim_connected_n_face_bkd_iter)

  Window centered on an n-face of complex returning the n-faces sharing an (n-1)-face with the center n-face.

- mln_gen_complex_window (complex_lower_higher_window, topo::adj_lower_higher_face_fwd_-iter, topo::adj_lower_higher_face_bkd_iter)

  Window centered on an n-face of complex returning its adjacent (n-1)-faces and (n+1)-faces.

- mln_gen_complex_window (complex_higher_window, topo::adj_higher_face_fwd_iter, topo::adj_-higher_face_bkd_iter)

  Window centered on an n-face of complex returning its adjacent (n+1)-faces.

- mln_gen_complex_window (complex_lower_window, topo::adj_lower_face_fwd_iter, topo::adj_-lower_face_bkd_iter)

  Window centered on an n-face of complex returning its adjacent (n-1)-faces.

- mln_gen_complex_window_p (complex_m_face_window_p, topo::adj_m_face_fwd_iter, topo::adj_m_face_bkd_iter)

  Window centered on an n-face of complex returning the m-faces transitively adjacent to this center n-face, as well as this center n-face.

- mln_gen_complex_window_p (complex_higher_dim_connected_n_face_window_p, topo::adj_-higher_dim_connected_n_face_fwd_iter, topo::adj_higher_dim_connected_n_face_bkd_iter)

  Window centered on an n-face of complex returning the n-faces sharing an (n+1)-face with the center n-face, as well as this center n-face.

- mln_gen_complex_window_p (complex_lower_dim_connected_n_face_window_p, topo::adj_-lower_dim_connected_n_face_fwd_iter, topo::adj_lower_dim_connected_n_face_bkd_iter)

  Window centered on an n-face of complex returning the n-faces sharing an (n-1)-face with the center n-face, as well as this center n-face.

- mln_gen_complex_window_p (complex_lower_higher_window_p, topo::adj_lower_higher_face_-fwd_iter, topo::adj_lower_higher_face_bkd_iter)

  Window centered on an n-face of complex returning its adjacent (n-1)-faces and (n+1)-faces as well as the center n-face.

- mln_gen_complex_window_p (complex_higher_window_p, topo::adj_higher_face_fwd_iter, topo::adj_higher_face_bkd_iter)

  Window centered on an n-face of complex returning its adjacent (n+1)-faces as well as the center n-face.

- mln_gen_complex_window_p (complex_lower_window_p, topo::adj_lower_face_fwd_iter, topo::adj_lower_face_bkd_iter)

  Window centered on an n-face of complex returning its adjacent (n-1)-faces as well as the center n-face.

- template<typename W1, typename W2>
  mln_regular (W1) operator-(const Window< W1 > &win1

  Set difference between a couple of windows `win1` *and* `win2`*.*

- template<typename O1, typename O2>
  mln_trait_op_geq (O1, O2) operator>

  General definition of the "greater than or equal to" operator.

- template<typename O1, typename O2>
  mln_trait_op_greater (O1, O2) operator>(const Object< O1 > &lhs

  General definition of the "greater than" operator.

- template<typename O1, typename O2>
  mln_trait_op_leq (O1, O2) operator<

  Default definition of the "less than or equal to" operator.

- template<typename O1, typename O2>
  mln_trait_op_neq (O1, O2) operator!

  General definition of the "not equal to" operator.

- template<typename P, typename S>
  P operator* (const Gpoint< P > &p, const value::scalar_< S > &s)

  Multiply a point `p` *by a scalar* `s`*.*

- template<typename S>
  S & operator++ (value::Scalar< S > &rhs)

  Pre-incrementation for any scalar type.

- template<typename N1, typename N2>
  neighb< typename N1::window::regular > operator- (const Neighborhood< N1 > &nbh1, const Neighborhood< N2 > &nbh2)

  Set difference between a couple of neighborhoods `nbh1` *and* `nbh2`*.*

- template<typename P, typename D>
  P operator- (const Gpoint< P > &p, const Gdpoint< D > &dp)

  Substract a delta-point `dp` *to a grid point* `p`*.*

- template<typename S>
  S & operator– (value::Scalar< S > &rhs)

  Pre-decrementation for any scalar type.

- template<typename L, typename R>
  bool operator< (const Image< L > &lhs, const Image< R > &rhs)

  Point-wise test if the pixel values of `lhs` *are point-wise less than the pixel values of* `rhs`.

- template<typename I, typename G, typename W>
  std::ostream & operator<< (std::ostream &ostr, const complex_window_bkd_piter< I, G, W > &p)

  Print an mln::complex_window_bkd_piter.

- template<typename I, typename G, typename W>
  std::ostream & operator<< (std::ostream &ostr, const complex_window_fwd_piter< I, G, W > &p)

  Print an mln::complex_window_fwd_piter.

- template<typename I, typename G, typename N>
  std::ostream & operator<< (std::ostream &ostr, const complex_neighborhood_bkd_piter< I, G, N > &p)

  Print an mln::complex_neighborhood_bkd_piter.

- template<typename I, typename G, typename N>
  std::ostream & operator<< (std::ostream &ostr, const complex_neighborhood_fwd_piter< I, G, N > &p)

  Print an mln::complex_neighborhood_fwd_piter.

- template<typename L, typename R>
  bool operator<= (const Image< L > &lhs, const Image< R > &rhs)

  Point-wise test if the pixel values of `lhs` *are point-wise less than or equal to the pixel values of* `rhs`.

- template<typename G, typename F>
  bool operator<= (const p_vertices< G, F > &lhs, const p_vertices< G, F > &rhs)

  Inclusion of a mln::p_vertices in another one.

- template<unsigned N, unsigned D, typename P>
  bool operator<= (const p_faces< N, D, P > &lhs, const p_faces< N, D, P > &rhs)

  Inclusion of a mln::p_faces in another one.

- template<typename G, typename F>
  bool operator<= (const p_edges< G, F > &lhs, const p_edges< G, F > &rhs)

  Inclusion of a mln::p_edges in another one.

- template<unsigned D, typename G>
  bool operator<= (const p_complex< D, G > &lhs, const p_complex< D, G > &rhs)

  Inclusion of a mln::p_complex in another one.

- template<typename L, typename R>
  bool operator== (const Image< L > &lhs, const Image< R > &rhs)

  Point-wise test if the pixel values of `lhs` *are equal to the pixel values of* `rhs`.

- template<typename G, typename F>
  bool operator== (const p_vertices< G, F > &lhs, const p_vertices< G, F > &rhs)

  Comparison between two mln::p_vertices's.

- template<unsigned N, unsigned D, typename P>
  bool operator== (const p_faces< N, D, P > &lhs, const p_faces< N, D, P > &rhs)

  Comparison between two mln::p_faces's.

- template<typename G, typename F>
  bool operator== (const p_edges< G, F > &lhs, const p_edges< G, F > &rhs)

  Comparison between two mln::p_edges's.

- template<unsigned D, typename G>
  bool operator== (const p_complex< D, G > &lhs, const p_complex< D, G > &rhs)

  Comparison between two mln::p_complex's.

- template<typename F, typename S>
  pw::image< F, S > operator| (const Function_v2v< F > &f, const Site_Set< S > &ps)

  Construct an image from a function and a site set.

- template<typename S, typename F>
  p_if< S, F > operator| (const Site_Set< S > &s, const Function_v2b< F > &f)

  Restrict a site set `s` *to points that verify* `f`.

- template<typename V, typename G, typename P>
  vertex_image< P, V, G > operator| (const fun::i2v::array< V > &vertex_values, const p_vertices< G, fun::i2v::array< P > > &pv)

  Construct a vertex image from a fun::i2v::array and a p_vertices.

- template<typename V, typename G, typename P>
  edge_image< P, V, G > operator| (const fun::i2v::array< V > &edge_values, const p_edges< G, fun::i2v::array< P > > &pe)

  Construct a edge image from a fun::i2v::array and a p_edges.

- template<typename I, typename F>
  image_if< const I, F > operator| (const Image< I > &ima, const Function_v2b< F > &f)

  ima | f creates an image_if with the image ima and the function f.

- template<typename I, typename F>
  image_if< I, F > operator| (Image< I > &ima, const Function_v2b< F > &f)

  ima | f creates an image_if with the image ima and the function f.

- template<typename I>
  const internal::primary_type< I >::ret & primary (const Image< I > &input)

  FIXME: Doc!

- template<typename S, typename F>
  p_transformed< S, F > ptransform (const Site_Set< S > &s, const Function_v2v< F > &f)

  Transform a site set `s` *through the function* `f`.

- const window2d & win_c4p ()

  4-connectivity window on the 2D grid, including the center.

- const window3d & win_c4p_3d ()

  4-connectivity window on the 3D grid, including the center.

- const window2d & win_c8p ()

  8-connectivity window on the 2D grid, including the center.

- const window3d & win_c8p_3d ()

  8-connectivity window on the 3D grid, including the center.

- template<typename T>
  mln_exact (T)∗exact(T ∗ptr)

  Exact cast routine for mln objects.

- template<unsigned D, typename G>
  bool operator!= (const complex_psite< D, G > &lhs, const complex_psite< D, G > &rhs)

  Is lhs *not equal to* rhs*?*

- template<unsigned D, typename G>
  bool operator< (const complex_psite< D, G > &lhs, const complex_psite< D, G > &rhs)

  Is lhs *"less" than* rhs*?*

- template<unsigned D, typename G>
  bool operator== (const complex_psite< D, G > &lhs, const complex_psite< D, G > &rhs)

  Comparison of two instances of mln::complex_psite.

- template<unsigned N, unsigned D, typename P>
  bool operator!= (const faces_psite< N, D, P > &lhs, const faces_psite< N, D, P > &rhs)

  Is lhs *equal to* rhs*?*

- template<unsigned N, unsigned D, typename P>
  bool operator< (const faces_psite< N, D, P > &lhs, const faces_psite< N, D, P > &rhs)

  Is lhs *"less" than* rhs*?*

- template<unsigned N, unsigned D, typename P>
  bool operator== (const faces_psite< N, D, P > &lhs, const faces_psite< N, D, P > &rhs)

  Comparison of two instances of mln::faces_psite.

Variables

- const dpoint1d before = dpoint1d(-1)

  Definition of a shortcut for delta point in 1d.

- const dpoint3d sagittal_dec = dpoint3d(0, 0, -1)

Definition of a shortcut for delta point in 3d.

- const dpoint2d up = dpoint2d(-1, 0)
  Definition of a shortcut for delta point in 2d.

9.1.1 Detailed Description

mln/convert/to_image.hh

This implementation is not an usual heap, it allows to set an error rate so that some nodes may be "corrupted".

Generic class for hierarchical queues.

The generic dual input tree algorithm for high quantized image.

The dual input tree algorithm specialized for low quantized image.

mln/linear/convolve_directional.hh

Read AVS header from a file.

Define a function which aborts a process in io module.

Forward declaration.

mln/core/def/all.hh

The namespace mln corresponds to the Milena (mini-Olena) project.

This accumulator uses an mln::util::pix (pixel) to update the reference level, area and volume information of the component.

The class mln/accu/volume is not a general-purpose accumulator; it is used to implement volume-based connected filters.

See also:

mln::morpho::closing::volume
mln::morpho::opening::volume

The functor should provide the following methods:

- template <typename g>=""> void init(const Graph<G>& g) Will be called at the beginning.
- bool to_be_treated(unsigned id) Return whether this vertex has already been marked or if it may be a a component representative.
- void new_component_from_vertex(unsigned id) will be called for the first vertex encountered for each component.
- void process_vertex(unsigned id) Will be called for each vertex queued.
- bool to_be_queued(unsigned id) Return whether this vertex has already been marked or if it can be added to the current component.

- void added_to_queue(unsigned id) Will be called for every vertex encountered in each component, except the first one.
- void next_component() Will be called after all vertices from a component have been treated.
- void final() Will be called at the end;

Conversions to mln::Image.

FIXME: Re-write this description.

The contents of mln mimics the contents of the olena project but in a simplified way. Some classes have the same name in both projects and roughly have the same behavior.

Warning:

The Milena project is independent from the Olena project; the user has to choose between both the project she wants to work with.

File that includes all core definitions.

The set of operators defined in this file is:

```
l += r  :  l = l + r, -> l&
l -= r  :  l = l - r, -> l&
l *= r  :  l = l * r, -> l&
l /= r  :  l = l / r, -> l&
l %= r  :  l = l % r, -> l&

+ r     :  -> r
- r     :  -> (0 - r)

l ++    :  t = l, ++l, -> t
l --    :  t = l, --l, -> t

++ r    :  r += 1, -> r&
-- r    :  r -= 1, -> r&

l != r  :  -> ! (l == r)

l >  r  :  -> (r < l)
l >= r  :  -> (r <= l)
l <= r  :  -> ! (r < l)   warning: re-define when partial ordering
```

As a consequence, the set of operators to be defined along with a client class is:

```
l + r
l - r
l * r
l / r

l == r

l < r
l <= r  in case of partial ordering
```

Convolution by a line-shaped (directional) kernel.

This implementation is based on P. Salembier algorithm using hierachical queues. This implies a low-quantized input image so that the number of queues is limited.

TODO: Think about how to extend f domain in a more generic way. The actual implementation doubles the size of the first dimension. It implies a boxed domain.

TODO: Use the less functor. The actual implementation is for max-tree.

TODO: During the canonization pass, we build the tree site set from the sorted site set of f, so that we compute twice f histogram (can be avoided).

This implementation is based on tarjan's union method, so that image quantization does not impact on the computation time.

TODO: Think about how to extend f domain in a more generic way. The actual implementation doubles the size of the first dimension. It implies a boxed domain.

TODO: Use the less functor. The actual implementation is for max-tree.

Hierarchical queues are often used with connected operators (P. Salemebier's max tree algorithm relies on these queues). To be efficient, the hiererachy is a static array and each are preallocated using an histogram.

FIXME: consider hqueues as a site set ?

A "corrupted node" means that its correct order is not totally preserved for performance reasons. Of course, it will have an impact on the returned values. As a result, be ware of not using this data structure if the element order is relevant for to you.

A corruption threshold can be passed to the constructor. This threshold means that if nodes have a rank higher than this threshold they can be "corrupted" and therefore their rank can be reduced. Tuning this threshold may have an impact on the structure entropy thus on the returned values order. It may also have an impact on the performance.

More implementation details are available in: "The soft heap: an approximate priority queue with optimal error rate", Bernard Chazelle, JACM, 2000.

URL: `http://www.cs.princeton.edu/~chazelle/pubs/sheap.pdf`

9.1.2 Typedef Documentation

9.1.2.1 typedef mln::complex_image<1, mln::discrete_plane_1complex_geometry, bool> mln::bin_1complex_image2d

Type alias for a binary image based on a 1-complex, where 0-faces are located at discrete (integer) 2-dimensional points.

9.1.2.2 typedef mln::complex_image<2, mln::space_2complex_geometry, bool> mln::bin_2complex_image3df

Type alias for a binary image based on a 2-complex, where 0-faces are located at floating-point 3-dimensional points.

9.1.2.3 typedef box<mln::point1d> mln::box1d

Type alias for a box defined on the 1D square grid with integer coordinates.

See also:

mln::win::rectangle1d.

9.1.2.4 typedef box<mln::point2d> mln::box2d

Type alias for a box defined on the 2D square grid with integer coordinates.

See also:

mln::win::rectangle2d.

9.1.2.5 typedef box<point2d_h> mln::box2d_h

FIXME.

9.1.2.6 typedef box<point3d> mln::box3d

Type alias for a box defined on the 3D square grid with integer coordinates.

See also:

mln::win::rectangle3d.

9.1.2.7 typedef mln::geom::complex_geometry<1, point2d> mln::discrete_plane_1complex_-geometry

Type alias for the geometry of a 1-complex (e.g., a graph) located in a discrete 2-dimensional plane (with integer coordinates).

9.1.2.8 typedef mln::geom::complex_geometry<2, point2d> mln::discrete_plane_2complex_-geometry

Type alias for the geometry of a 2-complex located in a discrete 2-dimensional plane (with integer coordinates).

9.1.2.9 typedef dpoint<mln::grid::tick, def::coord> mln::dpoint1d

Type alias for a delta-point defined on the 1D square grid with integer coordinates.

9.1.2.10 typedef dpoint<mln::grid::square, mln::def::coord> mln::dpoint2d

Type alias for a delta-point defined on the 2D square grid with integer coordinates.

9.1.2.11 typedef dpoint<mln::grid::hexa, def::coord> mln::dpoint2d_h

Type alias for a delta-point defined on the 2D square grid with integer coordinates.

9.1.2.12 typedef dpoint<mln::grid::cube, def::coord> mln::dpoint3d

Type alias for a delta-point defined on the 3D square grid with integer coordinates.

9.1.2.13 typedef mln::complex_image<2, mln::space_2complex_geometry, float> mln::float_2complex_image3df

Type alias for a floating-point image based on a 2-complex, where 0-faces are located at floating-point 3-dimensional points.

9.1.2.14 typedef mln::complex_image<1, mln::discrete_plane_1complex_geometry, mln::value::int_u8> mln::int_u8_1complex_image2d

Type alias for an 8-bit gray-level image based on a 1-complex, where 0-faces are located at discrete (integer) 2-dimensional points.

9.1.2.15 typedef mln::complex_image<2, mln::discrete_plane_2complex_geometry, mln::value::int_u8> mln::int_u8_2complex_image2d

Type alias for an 8-bit gray-level image based on a 2-complex, where 0-faces are located at discrete (integer) 2-dimensional points.

9.1.2.16 typedef mln::complex_image<2, mln::space_2complex_geometry, mln::value::int_u8> mln::int_u8_2complex_image3df

Type alias for an 8-bit gray-level image based on a 2-complex, where 0-faces are located at floating-point 3-dimensional points.

9.1.2.17 typedef p_run<point2d> mln::p_run2d

Type alias for a run of 2d points.

9.1.2.18 typedef p_set_of<p_run2d> mln::p_runs2d

Type alias for a set of runs of 2d points.

9.1.2.19 typedef point< grid::tick, def::coord > mln::point1d

Type alias for a point defined on the 1D ruler with integer coordinates.

9.1.2.20 typedef point<grid::tick, def::coordf> mln::point1df

Type alias for a point defined on the 1D ruler with floating-point coordinates.

9.1.2.21 typedef point< grid::square, def::coord > mln::point2d

Type alias for a point defined on the 2D square grid with integer coordinates.

9.1.2.22 typedef point< grid::hexa, def::coord > mln::point2d_h

Type alias for a point defined on the 2D hexagonal grid with integer coordinates.

9.1.2.23 typedef point<mln::grid::square, mln::def::coordf> mln::point2df

Type alias for a point defined on the 2D square grid with floating-point coordinates.

9.1.2.24 typedef point< grid::cube, def::coord > mln::point3d

Type alias for a point defined on the 3D square grid with integer coordinates.

9.1.2.25 typedef point<grid::cube, def::coordf> mln::point3df

Type alias for a point defined on the 3D square grid with floating-point coordinates.

9.1.2.26 typedef mln::complex_image<2, mln::space_2complex_geometry, mln::value::rgb8> mln::rgb8_2complex_image3df

Type alias for a (3x8-bit) RGB image based on a 2-complex, where 0-faces are located at floating-point 3-dimensional points.

9.1.2.27 typedef mln::geom::complex_geometry<2, point3df> mln::space_2complex_geometry

Type alias for the geometry of a 2-complex located in a 3-dimensional space (with floating-point coordinates).

9.1.2.28 typedef mln::complex_image<2, mln::space_2complex_geometry, unsigned> mln::unsigned_2complex_image3df

Type alias for a gray-level image based on a 2-complex, where 0-faces are located at floating-point 3-dimensional points.

9.1.2.29 typedef algebra::vec<2u,double> mln::vec2d_d

2D vector with double coordinates.

9.1.2.30 typedef algebra::vec<2u,float> mln::vec2d_f

2D vector with float coordinates.

9.1.2.31 typedef algebra::vec<3u,double> mln::vec3d_d

3D vector with double coordinates.

9.1.2.32 typedef algebra::vec<3u,float> mln::vec3d_f

3D vector with float coordinates.

9.1.2.33 typedef w_window<dpoint1d, float> mln::w_window1d_float

Type alias for a w_window with arbitrary shape, defined on the 1D grid (with integer coordinates) and whose weights are floating values.

9.1.2.34 typedef w_window<dpoint1d, int> mln::w_window1d_int

Type alias for a w_window with arbitrary shape, defined on the 1D grid (with integer coordinates) and whose weights are integers.

9.1.2.35 typedef w_window<dpoint2d, float> mln::w_window2d_float

Type alias for a w_window with arbitrary shape, defined on the 2D square grid (with integer coordinates) and whose weights are floating values.

9.1.2.36 typedef w_window<dpoint2d, int> mln::w_window2d_int

Type alias for a w_window with arbitrary shape, defined on the 2D square grid (with integer coordinates) and whose weights are integers.

9.1.2.37 typedef w_window<dpoint3d, float> mln::w_window3d_float

Type alias for a w_window with arbitrary shape, defined on the 3D grid (with integer coordinates) and whose weights are floating values.

9.1.2.38 typedef w_window<dpoint3d, int> mln::w_window3d_int

Type alias for a w_window with arbitrary shape, defined on the 3D grid (with integer coordinates) and whose weights are integers.

9.1.3 Function Documentation

9.1.3.1 template<typename I> I::psite mln::a_point_of (const Image< I > & *ima*) `[inline]`

Give a point of an image.

9.1.3.2 template<typename I, typename F> p2p_image< const I, F > mln::apply_p2p (const Image< I > & *ima*, const Function_v2v< F > & *f*) `[inline]`

FIXME: Doc!

9.1.3.3 template<typename I, typename F> p2p_image< I, F > mln::apply_p2p (Image< I > & *ima*, const Function_v2v< F > & *f*) `[inline]`

FIXME: Doc!

Referenced by mln::debug::slices_2d().

9.1.3.4 template<typename T2, typename T1> fun::x2x::composed< T2, T1 > mln::compose (T2 *f*, T1 *g*) [inline]

Do a composition of two transformations.

Parameters:

← ***f*** The second transformation.

← ***g*** The first transformation.

Returns:

The composed transformation fog.

Referenced by mln::geom::rotate().

9.1.3.5 template<typename I> mln::trait::concrete< I >::ret mln::duplicate (const Image< I > & *model*) [inline]

Duplicate the image `model` with the values of the image `data`.

Parameters:

← ***model*** The image to be duplicated.

Returns:

The duplicate.

Precondition:

model.is_valid

References mln::data::fill(), and initialize().

Referenced by mln::registration::icp(), mln::plain< I >::operator I(), mln::geom::impl::seeds2tiling(), mln::geom::impl::seeds2tiling_roundness(), and mln::labeling::superpose().

9.1.3.6 template<typename I> extension_val< const I > mln::extend (const Image< I > & *ima*, const typename I::value & *val*) [inline]

Routines for domain extension with a value.

9.1.3.7 template<typename I, typename J> extension_ima< const I, const J > mln::extend (const Image< I > & *ima*, const Image< J > & *ext*) [inline]

Routines for domain extension with an image.

9.1.3.8 template<typename I, typename F> extension_fun< const I, F > mln::extend (const Image< I > & *ima*, const Function_v2v< F > & *fun*) [inline]

Routines for domain extension with a function.

Referenced by mln::geom::rotate(), and mln::geom::translate().

9.1.3.9 bool mln::implies (bool *lexpr*, bool *rexpr*) [inline]

Implication.

Referenced by mln::p_line2d::is_valid().

9.1.3.10 template<typename I, typename J> void mln::initialize (Image< I > & *target*, const Image< J > & *model*) [inline]

Initialize the image `target` with data extracted from image `model`.

Parameters:

↔ ***target*** The image to be initialized.

← ***model*** The image to provide data for the initialization.

Precondition:

(not target.is_valid) and model.is_valid

Referenced by duplicate(), mln::labeling::fill_holes(), mln::morpho::tree::filter::filter(), mln::linear::gaussian(), mln::linear::gaussian_1st_derivative(), mln::linear::gaussian_2nd_derivative(), mln::morpho::impl::generic::hit_or_miss(), mln::graph::labeling(), mln::io::magick::load(), mln::io::dicom::load(), make_debug_graph_image(), mln::morpho::tree::filter::max(), mln::data::impl::generic::median(), mln::morpho::meyer_wst(), mln::morpho::tree::filter::min(), mln::arith::min(), mln::arith::minus(), mln::arith::plus(), mln::morpho::impl::generic::rank_-filter(), mln::arith::revert(), mln::geom::rotate(), mln::data::impl::stretch(), mln::morpho::watershed::topological(), and mln::data::impl::generic::transform().

9.1.3.11 template<typename I, typename N> bool mln::is_simple_2d (const Image< I > & *ima*, const Neighborhood< N > & *nbh*, const typename I::psite & *p*) [inline]

Test if a point is simple or not.

A point of an object is simple if in its c8 neiborhood, there is exactly one connected component of the object, and only one connected component of the background Examples : (| == object, - = background)

- - | | P | Here p is simple in the c4 and c8 case. | | |
- | - | P | Here p is never simple. | | |

9.1.3.12 template<typename P> box< P > mln::larger_than (const box< P > *a*, const box< P > *b*) [inline]

Return the minimum box including box `a` and box `b`.

References mln::box< P >::pmax(), and mln::box< P >::pmin().

9.1.3.13 template<typename I, typename V, typename E> image2d<typename I ::value> mln::make_debug_graph_image (const I & *input*, const V & *ima_v*, const E & *ima_e*, const value::rgb8 & *bg*) [inline]

Draw a graph.

References mln::box< P >::crop_wrt(), mln::image2d< T >::domain(), mln::debug::draw_graph(), mln::data::fill(), mln::literal::green, initialize(), and mln::convert::to().

9.1.3.14 template<typename T> mln::mln_exact (T) [inline]

Exact cast routine for mln objects.

This set of routines can be used to downcast an object towards its exact type. The only argument, respectively `ptr` or `ref`, should be an mln::Object.

`The` parameter E is the exact type of the object.

Returns:

The return follows the nature of the argument (either a pointer or a reference, const or not).

Referenced by mln::geom::rotate(), mln::Accumulator< E >::take_as_init(), mln::Accumulator< E >::take_n_times(), mln::convert::to(), and mln::geom::translate().

9.1.3.15 mln::mln_gen_complex_neighborhood (complex_m_face_neighborhood, complex_m_face_window)

Neighborhood centered on an n-face of complex returning the m-faces transitively adjacent to this center n-face.

9.1.3.16 mln::mln_gen_complex_neighborhood (complex_higher_dim_connected_n_face_neighborhood, complex_higher_dim_connected_n_face_window)

Neighborhood centered on an n-face of complex returning the n-faces sharing an (n+1)-face with the center n-face.

9.1.3.17 mln::mln_gen_complex_neighborhood (complex_lower_dim_connected_n_face_neighborhood, complex_lower_dim_connected_n_face_window)

Neighborhood centered on an n-face of complex returning the n-faces sharing an (n-1)-face with the center n-face.

9.1.3.18 mln::mln_gen_complex_neighborhood (complex_lower_higher_neighborhood, complex_lower_higher_window)

Neighborhood centered on an n-face of complex returning its adjacent (n-1)-faces and (n+1)-faces.

9.1.3.19 mln::mln_gen_complex_neighborhood (complex_higher_neighborhood, complex_higher_window)

Neighborhood centered on an n-face of complex returning its adjacent (n+1)-faces.

9.1.3.20 mln::mln_gen_complex_neighborhood (complex_lower_neighborhood, complex_lower_window)

Neighborhood centered on an n-face of complex returning its adjacent (n-1)-faces.

9.1.3.21 mln::mln_gen_complex_window (complex_m_face_window, topo::adj_m_face_fwd_iter, topo::adj_m_face_bkd_iter)

Window centered on an n-face of complex returning the m-faces transitively adjacent to this center n-face.

9.1.3.22 mln::mln_gen_complex_window (complex_higher_dim_connected_n_face_window, topo::adj_higher_dim_connected_n_face_fwd_iter, topo::adj_higher_dim_connected_n_face_bkd_iter)

Window centered on an n-face of complex returning the n-faces sharing an (n+1)-face with the center n-face.

9.1.3.23 mln::mln_gen_complex_window (complex_lower_dim_connected_n_face_window, topo::adj_lower_dim_connected_n_face_fwd_iter, topo::adj_lower_dim_connected_n_face_bkd_iter)

Window centered on an n-face of complex returning the n-faces sharing an (n-1)-face with the center n-face.

9.1.3.24 mln::mln_gen_complex_window (complex_lower_higher_window, topo::adj_lower_higher_face_fwd_iter, topo::adj_lower_higher_face_bkd_iter)

Window centered on an n-face of complex returning its adjacent (n-1)-faces and (n+1)-faces.

9.1.3.25 mln::mln_gen_complex_window (complex_higher_window, topo::adj_higher_face_fwd_iter, topo::adj_higher_face_bkd_iter)

Window centered on an n-face of complex returning its adjacent (n+1)-faces.

9.1.3.26 mln::mln_gen_complex_window (complex_lower_window, topo::adj_lower_face_fwd_iter, topo::adj_lower_face_bkd_iter)

Window centered on an n-face of complex returning its adjacent (n-1)-faces.

9.1.3.27 mln::mln_gen_complex_window_p (complex_m_face_window_p, topo::adj_m_face_fwd_iter, topo::adj_m_face_bkd_iter)

Window centered on an n-face of complex returning the m-faces transitively adjacent to this center n-face, as well as this center n-face.

9.1.3.28 mln::mln_gen_complex_window_p (complex_higher_dim_connected_n_face_window_p, topo::adj_higher_dim_connected_n_face_fwd_iter, topo::adj_higher_dim_connected_n_face_bkd_iter)

Window centered on an n-face of complex returning the n-faces sharing an (n+1)-face with the center n-face, as well as this center n-face.

9.1.3.29 mln::mln_gen_complex_window_p (complex_lower_dim_connected_-n_face_window_p, topo::adj_lower_dim_connected_n_face_fwd_iter, topo::adj_lower_dim_connected_n_face_bkd_iter)

Window centered on an n-face of complex returning the n-faces sharing an (n-1)-face with the center n-face, as well as this center n-face.

9.1.3.30 mln::mln_gen_complex_window_p (complex_lower_higher_window_p, topo::adj_lower_higher_face_fwd_iter, topo::adj_lower_higher_face_bkd_iter)

Window centered on an n-face of complex returning its adjacent (n-1)-faces and (n+1)-faces as well as the center n-face.

9.1.3.31 mln::mln_gen_complex_window_p (complex_higher_window_p, topo::adj_higher_face_fwd_iter, topo::adj_higher_face_bkd_iter)

Window centered on an n-face of complex returning its adjacent (n+1)-faces as well as the center n-face.

9.1.3.32 mln::mln_gen_complex_window_p (complex_lower_window_p, topo::adj_lower_face_fwd_iter, topo::adj_lower_face_bkd_iter)

Window centered on an n-face of complex returning its adjacent (n-1)-faces as well as the center n-face.

9.1.3.33 template<typename W1, typename W2> mln::mln_regular (W1) const `[inline]`

Set difference between a couple of windows `win1` and `win2`.

Inter a window `win` with a delta-point `dp`.

It just calls mln::win::diff.

9.1.3.34 template<typename O1, typename O2> mln::mln_trait_op_geq (O1, O2) `[inline]`

General definition of the "greater than or equal to" operator.

The "greater than or equal to" operator is here defined for every Milena objects. It relies on the definition of the "less than or equal to" operator. It returns "rhs <= lhs".

Warning:

> There shall not be any other definition of this operator in Milena when applying on a couple of mln::Object.

9.1.3.35 template<typename O1, typename O2> mln::mln_trait_op_greater (O1, O2) const `[inline]`

General definition of the "greater than" operator.

The "greater than" operator is here defined for every milena objects. It relies on the definition of the "less than" operator. It returns "rhs < lhs".

Warning:

There shall not be any other definition of this operator in Milena when applying on a couple of mln::Object.

9.1.3.36 template<typename O1, typename O2> mln::mln_trait_op_leq (O1, O2) [inline]

Default definition of the "less than or equal to" operator.

A default version of the "less than or equal to" operator is defined for every Milena objects. It relies on the definition of the "less than" operator. It returns "not (rhs < lhs)".

Warning:

In the case of partial ordering between objects, this operator has to be re-defined.

9.1.3.37 template<typename O1, typename O2> mln::mln_trait_op_neq (O1, O2) [inline]

Initial value:

```
(const Object<O1>& lhs, const Object<O2>& rhs)
  {
    return ! (exact(lhs) == exact(rhs));
  }

  template <typename O1, typename O2>
  inline
  mln_trait_op_greater(O1, O2)
    operator>(const Object<O1>& lhs, const Object<O2>& rhs)
  {
    return exact(rhs) < exact(lhs);
  }

  template <typename O1
```

General definition of the "not equal to" operator.

The "not equal to" operator is here defined for every milena objects. It relies on the definition of the "equal to" operator. It returns "not (lhs == rhs)".

Warning:

There shall not be any other definition of this operator in Milena when applying on a couple of mln::Object.

9.1.3.38 template<unsigned D, typename G> bool mln::operator!= (const complex_psite< D, G > & *lhs*, const complex_psite< D, G > & *rhs*) [inline]

Is *lhs* not equal to *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::p_complex.

References mln::complex_psite< D, G >::face(), and mln::complex_psite< D, G >::site_set().

9.1.3.39 template<unsigned N, unsigned D, typename P> bool mln::operator!= (const faces_psite< N, D, P > & *lhs*, const faces_psite< N, D, P > & *rhs*) [inline]

Is *lhs* equal to *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::complex.

References mln::faces_psite< N, D, P >::face(), and mln::faces_psite< N, D, P >::site_set().

9.1.3.40 template<typename P, typename S> P mln::operator* (const Gpoint< P > & *p*, const value::scalar_< S > & *s*) [inline]

Multiply a point `p` by a scalar `s`.

9.1.3.41 template<typename S> S & mln::operator++ (value::Scalar< S > & *rhs*) [inline]

Pre-incrementation for any scalar type.

References mln::literal::one.

9.1.3.42 template<typename N1, typename N2> N2 neighb< typename N1::window::regular > mln::operator- (const Neighborhood< N1 > & *nbh1*, const Neighborhood< N2 > & *nbh2*) [inline]

Set difference between a couple of neighborhoods `nbh1` and `nbh2`.

It just calls mln::win::diff.

References mln::win::diff().

9.1.3.43 template<typename P, typename D> P mln::operator- (const Gpoint< P > & *p*, const Gdpoint< D > & *dp*) [inline]

Substract a delta-point `dp` to a grid point `p`.

Parameters:

← ***p*** A grid point.

← ***dp*** A delta-point.

The type of `dp` has to compatible with the type of `p`.

Returns:

A point (temporary object).

See also:

mln::Gdpoint
mln::Gdpoint

9.1.3.44 template<typename S> S & mln::operator-- (value::Scalar< S > & *rhs*) [inline]

Pre-decrementation for any scalar type.

References mln::literal::one.

9.1.3.45 template<typename L, typename R> bool mln::operator< (const Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise test if the pixel values of `lhs` are point-wise less than the pixel values of `rhs`.

Parameters:

← ***lhs*** A first image.

← ***rhs*** A second image.

Precondition:

lhs.domain == rhs.domain

References mln::test::predicate().

9.1.3.46 template<unsigned D, typename G> bool mln::operator< (const complex_psite< D, G > & *lhs*, const complex_psite< D, G > & *rhs*) [inline]

Is *lhs* “less” than *rhs*?

This comparison is required by algorithms sorting psites.

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::p_complex.

9.1.3.47 template<unsigned N, unsigned D, typename P> bool mln::operator< (const faces_psite< N, D, P > & *lhs*, const faces_psite< N, D, P > & *rhs*) [inline]

Is *lhs* “less” than *rhs*?

This comparison is required by algorithms sorting psites.

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::complex.

9.1.3.48 template<typename I, typename G, typename W> std::ostream & mln::operator<< (std::ostream & *ostr*, const complex_window_bkd_piter< I, G, W > & *p*) [inline]

Print an mln::complex_window_bkd_piter.

9.1.3.49 template<typename I, typename G, typename W> std::ostream & mln::operator<< (std::ostream & *ostr*, const complex_window_fwd_piter< I, G, W > & *p*) [inline]

Print an mln::complex_window_fwd_piter.

9.1.3.50 template<typename I, typename G, typename N> std::ostream & mln::operator<< (std::ostream & *ostr*, const complex_neighborhood_bkd_piter< I, G, N > & *p*) `[inline]`

Print an mln::complex_neighborhood_bkd_piter.

9.1.3.51 template<typename I, typename G, typename N> std::ostream & mln::operator<< (std::ostream & *ostr*, const complex_neighborhood_fwd_piter< I, G, N > & *p*) `[inline]`

Print an mln::complex_neighborhood_fwd_piter.

9.1.3.52 template<typename L, typename R> bool mln::operator<= (const Image< L > & *lhs*, const Image< R > & *rhs*) `[inline]`

Point-wise test if the pixel values of `lhs` are point-wise less than or equal to the pixel values of `rhs`.

Parameters:

← ***lhs*** A first image.

← ***rhs*** A second image.

Precondition:

lhs.domain == rhs.domain

References mln::test::predicate().

9.1.3.53 template<typename G, typename F> bool mln::operator<= (const p_vertices< G, F > & *lhs*, const p_vertices< G, F > & *rhs*) `[inline]`

Inclusion of a mln::p_vertices in another one.

This inclusion relation is very strict for the moment, since our infrastructure for graphs is simple: a mln::p_vertices is included in another one if their are equal.

9.1.3.54 template<unsigned N, unsigned D, typename P> bool mln::operator<= (const p_faces< N, D, P > & *lhs*, const p_faces< N, D, P > & *rhs*) `[inline]`

Inclusion of a mln::p_faces in another one.

This inclusion relation is very strict for the moment, since our infrastrure for complexs is simple: a mln::p_faces is included in another one if their are equal.

9.1.3.55 template<typename G, typename F> bool mln::operator<= (const p_edges< G, F > & *lhs*, const p_edges< G, F > & *rhs*) `[inline]`

Inclusion of a mln::p_edges in another one.

9.1.3.56 template<unsigned D, typename G> bool mln::operator<= (const p_complex< D, G > & *lhs*, const p_complex< D, G > & *rhs*) `[inline]`

Inclusion of a mln::p_complex in another one.

This inclusion relation is very strict for the moment, since our infrastrure for complexs is simple: a mln::p_complex is included in another one if their are equal.

9.1.3.57 template<typename L, typename R> bool mln::operator== (const Image< L > & *lhs*, const Image< R > & *rhs*) `[inline]`

Point-wise test if the pixel values of `lhs` are equal to the pixel values of `rhs`.

Parameters:

← ***lhs*** A first image.

← ***rhs*** A second image.

Precondition:

lhs.domain == rhs.domain

References mln::test::predicate().

9.1.3.58 template<typename G, typename F> bool mln::operator== (const p_vertices< G, F > & *lhs*, const p_vertices< G, F > & *rhs*) `[inline]`

Comparison between two mln::p_vertices's.

Two mln::p_vertices's are considered equal if they share the same graph.

References mln::p_vertices< G, F >::graph().

9.1.3.59 template<unsigned N, unsigned D, typename P> bool mln::operator== (const p_faces< N, D, P > & *lhs*, const p_faces< N, D, P > & *rhs*) `[inline]`

Comparison between two mln::p_faces's.

Two mln::p_faces's are considered equal if they share the same complex.

References mln::p_faces< N, D, P >::cplx().

9.1.3.60 template<typename G, typename F> bool mln::operator== (const p_edges< G, F > & *lhs*, const p_edges< G, F > & *rhs*) `[inline]`

Comparison between two mln::p_edges's.

Two mln::p_edges's are considered equal if they share the same graph.

References mln::p_edges< G, F >::graph().

9.1.3.61 template<unsigned D, typename G> bool mln::operator== (const p_complex< D, G > & *lhs*, const p_complex< D, G > & *rhs*) `[inline]`

Comparison between two mln::p_complex's.

Two mln::p_complex's are considered equal if they share the same complex.

References mln::p_complex< D, G >::cplx().

9.1.3.62 template<unsigned D, typename G> bool mln::operator== (const complex_psite< D, G > & *lhs*, const complex_psite< D, G > & *rhs*) [inline]

Comparison of two instances of mln::complex_psite.

Is *lhs* equal to *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::p_complex.

References mln::complex_psite< D, G >::face(), and mln::complex_psite< D, G >::site_set().

9.1.3.63 template<unsigned N, unsigned D, typename P> bool mln::operator== (const faces_psite< N, D, P > & *lhs*, const faces_psite< N, D, P > & *rhs*) [inline]

Comparison of two instances of mln::faces_psite.

Is *lhs* equal to *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::complex.

References mln::faces_psite< N, D, P >::face(), and mln::faces_psite< N, D, P >::site_set().

9.1.3.64 template<typename F, typename S> pw::image< F, S > mln::operator\| (const Function_v2v< F > & *f*, const Site_Set< S > & *ps*) [inline]

Construct an image from a function and a site set.

image = function | site_set.

9.1.3.65 template<typename S, typename F> p_if< S, F > mln::operator\| (const Site_Set< S > & *s*, const Function_v2b< F > & *f*) [inline]

Restrict a site set `s` to points that verify `f`.

Parameters:

← ***s*** A site set.

← ***f*** A function from point to Boolean.

Returns:

A subset of points.

9.1.3.66 template< typename V, typename G, typename P > vertex_image< P, V, G > mln::operator\| (const fun::i2v::array< V > & *vertex_values*, const p_vertices< G, fun::i2v::array< P > > & *pv*) `[inline]`

Construct a vertex image from a fun::i2v::array and a p_vertices.

image = fun::i2v::array | p_vertices.

9.1.3.67 template< typename V, typename G, typename P > edge_image< P, V, G > mln::operator\| (const fun::i2v::array< V > & *edge_values*, const p_edges< G, fun::i2v::array< P > > & *pe*) `[inline]`

Construct a edge image from a fun::i2v::array and a p_edges.

image = fun::i2v::array | p_edges.

9.1.3.68 template< typename I, typename F > image_if< const I, F > mln::operator\| (const Image< I > & *ima*, const Function_v2b< F > & *f*) `[inline]`

ima | f creates an image_if with the image ima and the function f.

9.1.3.69 template< typename I, typename F > image_if< I, F > mln::operator\| (Image< I > & *ima*, const Function_v2b< F > & *f*) `[inline]`

ima | f creates an image_if with the image ima and the function f.

9.1.3.70 template< typename I > const internal::primary_type< I >::ret & mln::primary (const Image< I > & *input*) `[inline]`

FIXME: Doc!

Referenced by mln::border::resize().

9.1.3.71 template< typename S, typename F > p_transformed< S, F > mln::ptransform (const Site_Set< S > & *s*, const Function_v2v< F > & *f*) `[inline]`

Transform a site set `s` through the function `f`.

Parameters:

← ***s*** A site set.

← ***f*** A function from site to site.

Returns:

The transformed site set.

9.1.4 Variable Documentation

9.1.4.1 const dpoint1d mln::before = dpoint1d(-1)

Definition of a shortcut for delta point in 1d.

9.1.4.2 const dpoint3d mln::sagittal_dec = dpoint3d(0, 0, -1)

Definition of a shortcut for delta point in 3d.

9.1.4.3 const dpoint2d mln::up = dpoint2d(-1, 0)

Definition of a shortcut for delta point in 2d.

9.2 mln::accu Namespace Reference

Namespace of accumulators.

Classes

- struct center

  Mass center accumulator.

- struct convolve

  Generic convolution accumulator class.

- struct count_adjacent_vertices

  Accumulator class counting the number of vertices adjacent to a set of mln::p_edges_psite (i.e., a set of edges).

- struct count_labels

  Count the number of different labels in an image.

- struct count_value

  Count a given value.

- struct histo

  Generic histogram class over a value set with type `V`.

- struct label_used

  References all the labels used.

- struct maj_h

  Compute the majority value.

- struct max_site

  Define an accumulator that computes the first site with the maximum value in an image.

- struct nil

  Define an accumulator that does nothing.

- struct p

  Generic p of accumulators.

- struct pair

  Generic pair of accumulators.

- struct rms

  Generic root mean square accumulator class.

- struct tuple

  Generic tuple of accumulators.

- struct val

  Generic val of accumulators.

Namespaces

- namespace image

  Namespace of accumulator image routines.

- namespace impl

  Implementation namespace of accumulator namespace.

- namespace logic

  Namespace of logical accumulators.

- namespace math

  Namespace of mathematic accumulators.

- namespace shape

  Namespace of shape accumulators.

- namespace stat

  Namespace of statistical accumulators.

Functions

- template<typename A, typename I>
  A::result compute (const Accumulator< A > &a, const Image< I > &input)

  Make an accumulator compute the pixels of the image `input`.

- template<typename Meta_Accu, unsigned Dir, typename I, typename O>
  void line (const Image< I > &input, const typename I::site &p_start, unsigned len, unsigned half_-length, Image< O > &output)
- template<typename A, typename I>
  mln_meta_accu_result (A, util::pix< I >) compute(const Meta_Accumulator< A > &a

  Make an accumulator compute the pixels of the image `input`.

- template<typename A, typename I>
  void take (const Image< I > &input, Accumulator< A > &a)

  Make an accumulator take the pixels of the image `input`.

9.2.1 Detailed Description

Namespace of accumulators.

9.2.2 Function Documentation

9.2.2.1 template<typename A, typename I> A::result mln::accu::compute (const Accumulator< A > & *a*, const Image< I > & *input*) [inline]

Make an accumulator compute the pixels of the image `input`.

Parameters:

← ***input*** The input image.

← ***a*** An accumulator.

This routine runs:

a.take(make::pix(input, p)); on all pixels on the images.

Warning:

This routine does not perform a.init().

9.2.2.2 template<typename Meta_Accu, unsigned Dir, typename I, typename O> void mln::accu::line (const Image< I > & *input*, const typename I::site & *p_start*, unsigned *len*, unsigned *half_length*, Image< O > & *output*) [inline]

Line an accumulator onto the pixel values of the image `input`.

Parameters:

← ***input*** The input image.

← ***p_start*** The starting site of the line.

← ***len*** The line length.

← ***half_length*** The half length of the line.

↔ ***output*** The resulting image.

This routine runs:

tmp = `a`

tmp.init()

accu::take(`input`, tmp)

return tmp.to_result()

9.2.2.3 template<typename A, typename I> mln::accu::mln_meta_accu_result (A, util::pix< I >) const [inline]

Make an accumulator compute the pixels of the image `input`.

Parameters:

← ***input*** The input image.

← ***a*** A meta accumulator.

This routine runs:

a.take(make::pix(input, p)); on all pixels on the images.

Warning:

This routine does not perform a.init().

9.2.2.4 template<typename A, typename I> void mln::accu::take (const Image< I > & *input*, Accumulator< A > & *a*) [inline]

Make an accumulator take the pixels of the image `input`.

Parameters:

← ***input*** The input image.

↔ ***a*** The accumulator.

This routine runs:

for all p of `input`, `a.take`(pix(`input`, p))

Warning:

This routine does not perform a.init().

9.3 mln::accu::image Namespace Reference

Namespace of accumulator image routines.

9.3.1 Detailed Description

Namespace of accumulator image routines.

9.4 mln::accu::impl Namespace Reference

Implementation namespace of accumulator namespace.

9.4.1 Detailed Description

Implementation namespace of accumulator namespace.

9.5 mln::accu::logic Namespace Reference

Namespace of logical accumulators.

Classes

- struct land

    "Logical-and" accumulator.

- struct land_basic

    "Logical-and" accumulator.

- struct lor

    "Logical-or" accumulator.

- struct lor_basic

    "Logical-or" accumulator class.

9.5.1 Detailed Description

Namespace of logical accumulators.

9.6 mln::accu::math Namespace Reference

Namespace of mathematic accumulators.

Classes

- struct count

  Generic counter accumulator.

- struct inf

  Generic inf accumulator class.

- struct sum

  Generic sum accumulator class.

- struct sup

  Generic sup accumulator class.

9.6.1 Detailed Description

Namespace of mathematic accumulators.

9.7 mln::accu::meta::logic Namespace Reference

Namespace of logical meta-accumulators.

Classes

- struct land

    Meta accumulator for land.

- struct land_basic

    Meta accumulator for land_basic.

- struct lor

    Meta accumulator for lor.

- struct lor_basic

    Meta accumulator for lor_basic.

9.7.1 Detailed Description

Namespace of logical meta-accumulators.

9.8 mln::accu::meta::math Namespace Reference

Namespace of mathematic meta-accumulators.

Classes

- struct count

    Meta accumulator for count.

- struct inf

    Meta accumulator for inf.

- struct sum

    Meta accumulator for sum.

- struct sup

    Meta accumulator for sup.

9.8.1 Detailed Description

Namespace of mathematic meta-accumulators.

9.9 mln::accu::meta::shape Namespace Reference

Namespace of shape meta-accumulators.

Classes

- struct bbox

  Meta accumulator for bbox.

- struct height

  Meta accumulator for height.

- struct volume

  Meta accumulator for volume.

9.9.1 Detailed Description

Namespace of shape meta-accumulators.

9.10 mln::accu::meta::stat Namespace Reference

Namespace of statistical meta-accumulators.

Classes

- struct max
  Meta accumulator for max.
- struct max_h
  Meta accumulator for max.
- struct mean
  Meta accumulator for mean.
- struct median_alt
  Meta accumulator for median_alt.
- struct median_h
  Meta accumulator for median_h.
- struct min
  Meta accumulator for min.
- struct min_h
  Meta accumulator for min.
- struct rank
  Meta accumulator for rank.
- struct rank_high_quant
  Meta accumulator for rank_high_quant.

9.10.1 Detailed Description

Namespace of statistical meta-accumulators.

9.11 mln::accu::shape Namespace Reference

Namespace of shape accumulators.

Classes

- struct bbox

  Generic bounding box accumulator class.

- struct height

  Height accumulator.

- struct volume

  Volume accumulator class.

9.11.1 Detailed Description

Namespace of shape accumulators.

9.12 mln::accu::stat Namespace Reference

Namespace of statistical accumulators.

Classes

- struct deviation

  Generic standard deviation accumulator class.

- struct max

  Generic max accumulator class.

- struct max_h

  Generic max function based on histogram over a value set with type `V`.

- struct mean

  Generic mean accumulator class.

- struct median_alt

  Generic median_alt function based on histogram over a value set with type `S`.

- struct median_h

  Generic median function based on histogram over a value set with type `V`.

- struct min

  Generic min accumulator class.

- struct min_h

  Generic min function based on histogram over a value set with type `V`.

- struct min_max

  Generic min and max accumulator class.

- struct rank

  Generic rank accumulator class.

- struct rank< bool >

  rank accumulator class for Boolean.

- struct rank_high_quant

  Generic rank accumulator class.

- struct var

  Var accumulator class.

- struct variance

  Variance accumulator class.

9.12.1 Detailed Description

Namespace of statistical accumulators.

9.13 mln::algebra Namespace Reference

Namespace of algebraic structure.

Classes

- struct h_mat

  N-Dimensional matrix with homogeneous coordinates.

- struct h_vec

  N-Dimensional vector with homogeneous coordinates.

Functions

- template<unsigned N, typename T>
  bool ldlt_decomp (mat< N, N, T > &A, vec< N, T > &rdiag)

  Perform LDL^T decomposition of a symmetric positive definite matrix.

- template<unsigned N, typename T>
  void ldlt_solve (const mat< N, N, T > &A, const vec< N, T > &rdiag, const vec< N, T > &B, vec< N, T > &x)

  Solve A x = B after mln::algebra::ldlt_decomp.

- template<unsigned n, typename T, typename U>
  mln::trait::value_< typename mln::trait::op::times< T, U >::ret >::sum operator* (const vec< n, T > &lhs, const vec< n, U > &rhs)

  Scalar product (dot product).

- template<typename T, typename U>
  vec< 3, typename mln::trait::op::times< T, U >::ret > vprod (const vec< 3, T > &lhs, const vec< 3, U > &rhs)

  Vectorial product (cross product).

9.13.1 Detailed Description

Namespace of algebraic structure.

9.13.2 Function Documentation

9.13.2.1 template<unsigned N, typename T> bool mln::algebra::ldlt_decomp (mat< N, N, T > & *A*, vec< N, T > & *rdiag*) [inline]

Perform LDL^T decomposition of a symmetric positive definite matrix.

Like Cholesky, but no square roots. Overwrites lower triangle of matrix.

From Trimesh's ldltdc routine.

Referenced by mln::geom::mesh_curvature().

9.13.2.2 template< unsigned N, typename T> void mln::algebra::ldlt_solve (const mat< N, N, T > & *A*, const vec< N, T > & *rdiag*, const vec< N, T > & *B*, vec< N, T > & *x*) [inline]

Solve A x = B after mln::algebra::ldlt_decomp.

Referenced by mln::geom::mesh_curvature().

9.13.2.3 template< unsigned n, typename T, typename U> mln::trait::value_< typename mln::trait::op::times< T, U >::ret >::sum mln::algebra::operator* (const vec< n, T > & *lhs*, const vec< n, U > & *rhs*) [inline]

Scalar product (dot product).

References mln::literal::zero.

9.13.2.4 template< typename T, typename U> vec< 3, typename mln::trait::op::times< T, U >::ret > mln::algebra::vprod (const vec< 3, T > & *lhs*, const vec< 3, U > & *rhs*) [inline]

Vectorial product (cross product).

References vprod().

Referenced by mln::geom::mesh_corner_point_area(), mln::geom::mesh_curvature(), mln::geom::mesh_normal(), and vprod().

9.14 mln::arith Namespace Reference

Namespace of arithmetic.

Namespaces

- namespace impl

    Implementation namespace of arith namespace.

Functions

- template<typename I>
  mln::trait::concrete< I >::ret diff_abs (const Image< I > &lhs, const Image< I > &rhs)

    Point-wise absolute difference of images `lhs` *and* `rhs`.

- template<typename L, typename R, typename O>
  void div (const Image< L > &lhs, const Image< R > &rhs, Image< O > &output)

    Point-wise division of images `lhs` *and* `rhs`.

- template<typename I, typename V, typename O>
  void div_cst (const Image< I > &input, const V &val, Image< O > &output)

    Point-wise division of the value `val` *to image* `input`.

- template<typename L, typename R>
  void div_inplace (Image< L > &lhs, const Image< R > &rhs)

    Point-wise division of image `rhs` *in image* `lhs`.

- template<typename L, typename R>
  mln::trait::concrete< L >::ret min (const Image< L > &lhs, const Image< R > &rhs)

    Point-wise min of images `lhs` *and* `rhs`.

- template<typename L, typename R>
  void min_inplace (Image< L > &lhs, const Image< R > &rhs)

    Point-wise min of image `lhs` *in image* `rhs`.

- template<typename L, typename R, typename F>
  mln::trait::ch_value< L, typename F::result >::ret minus (const Image< L > &lhs, const Image< R > &rhs, const Function_v2v< F > &f)

    Point-wise addition of images `lhs` *and* `rhs`.

- template<typename L, typename R>
  mln::trait::op::minus< L, R >::ret minus (const Image< L > &lhs, const Image< R > &rhs)

    Point-wise addition of images `lhs` *and* `rhs`.

- template<typename I, typename V, typename F>
  mln::trait::ch_value< I, typename F::result >::ret minus_cst (const Image< I > &input, const V &val, const Function_v2v< F > &f)

    Point-wise addition of the value `val` *to image* `input`.

- template<typename I, typename V>
  mln::trait::op::minus< I, V >::ret minus_cst (const Image< I > &input, const V &val)

  Point-wise addition of the value `val` *to image* `input`.

- template<typename I, typename V>
  I & minus_cst_inplace (Image< I > &input, const V &val)

  Point-wise addition of the value `val` *to image* `input`.

- template<typename L, typename R>
  void minus_inplace (Image< L > &lhs, const Image< R > &rhs)

  Point-wise addition of image `rhs` *in image* `lhs`.

- template<typename L, typename R, typename F>
  mln::trait::ch_value< L, typename F::result >::ret plus (const Image< L > &lhs, const Image< R > &rhs, const Function_v2v< F > &f)

  Point-wise addition of images `lhs` *and* `rhs`.

- template<typename L, typename R>
  mln::trait::op::plus< L, R >::ret plus (const Image< L > &lhs, const Image< R > &rhs)

  Point-wise addition of images `lhs` *and* `rhs`.

- template<typename I, typename V, typename F>
  mln::trait::ch_value< I, typename F::result >::ret plus_cst (const Image< I > &input, const V &val, const Function_v2v< F > &f)

  Point-wise addition of the value `val` *to image* `input`.

- template<typename I, typename V>
  mln::trait::op::plus< I, V >::ret plus_cst (const Image< I > &input, const V &val)

  Point-wise addition of the value `val` *to image* `input`.

- template<typename I, typename V>
  I & plus_cst_inplace (Image< I > &input, const V &val)

  Point-wise addition of the value `val` *to image* `input`.

- template<typename L, typename R>
  void plus_inplace (Image< L > &lhs, const Image< R > &rhs)

  Point-wise addition of image `rhs` *in image* `lhs`.

- template<typename I>
  mln::trait::concrete< I >::ret revert (const Image< I > &input)

  Point-wise reversion of image `input`.

- template<typename I>
  void revert_inplace (Image< I > &input)

  Point-wise in-place reversion of image `input`.

- template<typename L, typename R, typename O>
  void times (const Image< L > &lhs, const Image< R > &rhs, Image< O > &output)

  Point-wise addition of images `lhs` *and* `rhs`.

- template<typename I, typename V, typename O>
  void times_cst (const Image< I > &input, const V &val, Image< O > &output)

  Point-wise addition of the value `val` *to image* `input`.

- template<typename L, typename R>
  void times_inplace (Image< L > &lhs, const Image< R > &rhs)

  Point-wise addition of image `rhs` *in image* `lhs`.

9.14.1 Detailed Description

Namespace of arithmetic.

9.14.2 Function Documentation

9.14.2.1 template<typename I> mln::trait::concrete< I >::ret mln::arith::diff_abs (const Image< I > & *lhs*, const Image< I > & *rhs*) [inline]

Point-wise absolute difference of images `lhs` and `rhs`.

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

Returns:

The result image.

Precondition:

`lhs.domain == rhs.domain`

References mln::data::transform().

9.14.2.2 template<typename L, typename R, typename O> void mln::arith::div (const Image< L > & *lhs*, const Image< R > & *rhs*, Image< O > & *output*) [inline]

Point-wise division of images `lhs` and `rhs`.

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

→ ***output*** The result image.

Precondition:

`output.domain == lhs.domain == rhs.domain`

9.14.2.3 template<typename I, typename V, typename O> void mln::arith::div_cst (const Image< I > & *input*, const V & *val*, Image< O > & *output*) [inline]

Point-wise division of the value `val` to image `input`.

Parameters:

← ***input*** The image.

← ***val*** The value.

→ ***output*** The result image.

Precondition:

`output.domain == input.domain`

References div_cst().

Referenced by div_cst().

9.14.2.4 template<typename L, typename R> void mln::arith::div_inplace (Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise division of image `rhs` in image `lhs`.

Parameters:

← ***lhs*** First operand image (subject to division).

↔ ***rhs*** Second operand image (to div `lhs`).

This addition performs:

for all p of rhs.domain

lhs(p) /= rhs(p)

Precondition:

`rhs.domain <= lhs.domain`

References div_inplace().

Referenced by div_inplace().

9.14.2.5 template<typename L, typename R> mln::trait::concrete< L >::ret mln::arith::min (const Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise min of images `lhs` and `rhs`.

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

Returns:

The result image.

Precondition:

`lhs.domain == rhs.domain`

References mln::initialize().

9.14.2.6 template< typename L, typename R > void mln::arith::min_inplace (Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise min of image `lhs` in image `rhs`.

Parameters:

↔ ***lhs*** First operand image.

← ***rhs*** Second operand image.

Precondition:

`rhs.domain == lhs.domain`

9.14.2.7 template< typename L, typename R, typename F > mln::trait::ch_value< L, typename F::result >::ret mln::arith::minus (const Image< L > & *lhs*, const Image< R > & *rhs*, const Function_v2v< F > & *f*) [inline]

Point-wise addition of images `lhs` and `rhs`.

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

← ***f*** Function.

Returns:

The result image.

Precondition:

`lhs.domain == rhs.domain`

References mln::initialize().

9.14.2.8 template< typename L, typename R > mln::trait::ch_value< L, V >::ret mln::arith::minus (const Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise addition of images `lhs` and `rhs`.

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

Returns:

The result image.

Precondition:

`lhs.domain == rhs.domain`

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

Returns:

The result image.

The free parameter `V` sets the destination value type.

Precondition:

`lhs.domain == rhs.domain`

References mln::initialize().

9.14.2.9 template<typename I, typename V, typename F> mln::trait::ch_value< I, typename F::result >::ret mln::arith::minus_cst (const Image< I > & *input*, const V & *val*, const Function_v2v< F > & *f*) `[inline]`

Point-wise addition of the value `val` to image `input`.

Parameters:

← ***input*** The image.

← ***val*** The value.

← ***f*** Function.

Returns:

The result image.

Precondition:

`input.is_valid`

9.14.2.10 template<typename I, typename V> mln::trait::op::minus< I, V >::ret mln::arith::minus_cst (const Image< I > & *input*, const V & *val*) `[inline]`

Point-wise addition of the value `val` to image `input`.

Parameters:

← ***input*** The image.

← ***val*** The value.

Returns:

The result image.

Precondition:

input.is_valid

9.14.2.11 template<typename I, typename V> I & mln::arith::minus_cst_inplace (Image< I > & *input*, const V & *val*) [inline]

Point-wise addition of the value val to image input.

Parameters:

↔ ***input*** The image.

← ***val*** The value.

Precondition:

input.is_valid

References minus_cst_inplace(), and minus_inplace().

Referenced by minus_cst_inplace().

9.14.2.12 template<typename L, typename R> void mln::arith::minus_inplace (Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise addition of image rhs in image lhs.

Parameters:

↔ ***lhs*** First operand image (subject to addition).

← ***rhs*** Second operand image (to be added to lhs).

This addition performs:

for all p of rhs.domain

lhs(p) -= rhs(p)

Precondition:

rhs.domain == lhs.domain

References minus_inplace().

Referenced by minus_cst_inplace(), and minus_inplace().

9.14.2.13 template<typename L, typename R, typename F> mln::trait::ch_value< L, typename F::result >::ret mln::arith::plus (const Image< L > & *lhs*, const Image< R > & *rhs*, const Function_v2v< F > & *f*) [inline]

Point-wise addition of images lhs and rhs.

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

← ***f*** Function.

Returns:

The result image.

Precondition:

`lhs.domain == rhs.domain`

References mln::initialize().

9.14.2.14 template<typename L, typename R> mln::trait::ch_value< L, V >::ret mln::arith::plus (const Image< L > & *lhs*, const Image< R > & *rhs*) `[inline]`

Point-wise addition of images `lhs` and `rhs`.

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

Returns:

The result image.

Precondition:

`lhs.domain == rhs.domain`

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

Returns:

The result image.

The free parameter `V` sets the destination value type.

Precondition:

`lhs.domain == rhs.domain`

References mln::initialize().

Referenced by mln::morpho::contrast().

9.14.2.15 template<typename I, typename V, typename F> mln::trait::ch_value< I, typename F::result >::ret mln::arith::plus_cst (const Image< I > & *input*, const V & *val*, const Function_v2v< F > & *f*) [inline]

Point-wise addition of the value `val` to image `input`.

Parameters:

← ***input*** The image.

← ***val*** The value.

← ***f*** Function.

Returns:

The result image.

Precondition:

`input.is_valid`

9.14.2.16 template<typename I, typename V> mln::trait::ch_value< I, W >::ret mln::arith::plus_cst (const Image< I > & *input*, const V & *val*) [inline]

Point-wise addition of the value `val` to image `input`.

Parameters:

← ***input*** The image.

← ***val*** The value.

Returns:

The result image.

Precondition:

`input.is_valid`

9.14.2.17 template<typename I, typename V> I & mln::arith::plus_cst_inplace (Image< I > & *input*, const V & *val*) [inline]

Point-wise addition of the value `val` to image `input`.

Parameters:

↔ ***input*** The image.

← ***val*** The value.

Precondition:

`input.is_valid`

References plus_cst_inplace(), and plus_inplace().

Referenced by plus_cst_inplace().

9.14.2.18 template<typename L, typename R> void mln::arith::plus_inplace (Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise addition of image `rhs` in image `lhs`.

Parameters:

↔ ***lhs*** First operand image (subject to addition).

← ***rhs*** Second operand image (to be added to `lhs`).

This addition performs:

for all p of rhs.domain

lhs(p) += rhs(p)

Precondition:

`rhs.domain` == `lhs.domain`

Referenced by plus_cst_inplace().

9.14.2.19 template<typename I> mln::trait::concrete< I >::ret mln::arith::revert (const Image< I > & *input*) [inline]

Point-wise reversion of image `input`.

Parameters:

← ***input*** the input image.

Returns:

The result image.

Precondition:

`input.is_valid`

It performs:

for all p of input.domain

output(p) = min + (max - input(p))

References mln::initialize().

9.14.2.20 template<typename I> void mln::arith::revert_inplace (Image< I > & *input*) [inline]

Point-wise in-place reversion of image `input`.

Parameters:

↔ ***input*** The target image.

Precondition:

`input.is_valid`

It performs:

for all p of input.domain

input(p) = min + (max - input(p))

9.14.2.21 template<typename L, typename R, typename O> void mln::arith::times (const Image< L > & *lhs*, const Image< R > & *rhs*, Image< O > & *output*) [inline]

Point-wise addition of images `lhs` and `rhs`.

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

→ ***output*** The result image.

Precondition:

`output.domain == lhs.domain == rhs.domain`

9.14.2.22 template<typename I, typename V, typename O> void mln::arith::times_cst (const Image< I > & *input*, const V & *val*, Image< O > & *output*) [inline]

Point-wise addition of the value `val` to image `input`.

Parameters:

← ***input*** The image.

← ***val*** The value.

→ ***output*** The result image.

Precondition:

`output.domain == input.domain`

References times_cst().

Referenced by times_cst().

9.14.2.23 template<typename L, typename R> void mln::arith::times_inplace (Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise addition of image `rhs` in image `lhs`.

Parameters:

← ***lhs*** First operand image (subject to addition).

↔ ***rhs*** Second operand image (to be added to `lhs`).

This addition performs:

for all p of rhs.domain

lhs(p) $*$= rhs(p)

Precondition:

`rhs.domain` <= `lhs.domain`

References times_inplace().

Referenced by times_inplace().

9.15 mln::arith::impl Namespace Reference

Implementation namespace of arith namespace.

Namespaces

- namespace generic

  Generic implementation namespace of arith namespace.

9.15.1 Detailed Description

Implementation namespace of arith namespace.

9.16 mln::arith::impl::generic Namespace Reference

Generic implementation namespace of arith namespace.

9.16.1 Detailed Description

Generic implementation namespace of arith namespace.

9.17 mln::binarization Namespace Reference

Namespace of "point-wise" expression tools.

Functions

- template<typename I, typename F>
  mln::trait::ch_value< I, bool >::ret binarization (const Image< I > &input, const Function_v2b< F > &fun)

  Thresholds the values of `input` *so that they can be stored in the* `output` *binary image.*

- template<typename I>
  mln::trait::ch_value< I, bool >::ret threshold (const Image< I > &input, const typename I::value threshold)

  Thresholds the values of `input` *so that they can be stored in the* `output` *binary image.*

9.17.1 Detailed Description

Namespace of "point-wise" expression tools.

9.17.2 Function Documentation

9.17.2.1 template<typename I, typename F> mln::trait::ch_value< I, bool >::ret mln::binarization::binarization (const Image< I > & *input*, const Function_v2b< F > & *fun*) `[inline]`

Thresholds the values of `input` so that they can be stored in the `output` binary image.

Parameters:

← ***input*** The input image.
← ***fun*** The thresholding function, from value(I) to bool.

for_all(p), output(p) = fun(p)

Referenced by threshold().

9.17.2.2 template<typename I> mln::trait::ch_value< I, bool >::ret mln::binarization::threshold (const Image< I > & *input*, const typename I::value *threshold*) `[inline]`

Thresholds the values of `input` so that they can be stored in the `output` binary image.

Parameters:

← ***input*** The input image.
← ***threshold*** The threshold.

If input(p) is greater or equal than the threshold, the value in the output image in the same point will be TRUE, else FALSE.

References binarization().

9.18 mln::border Namespace Reference

Namespace of routines related to image virtual (outer) border.

Namespaces

- namespace impl

    Implementation namespace of border namespace.

Functions

- template<typename I>
  void adjust (const Image< I > &ima, unsigned min_thickness)
- template<typename I>
  void duplicate (const Image< I > &ima)
- template<typename I, typename J>
  void equalize (const Image< I > &ima1, const Image< J > &ima2, unsigned min_thickness)
- template<typename I>
  void fill (const Image< I > &ima, const typename I::value &v)
- template<typename I>
  unsigned find (const Image< I > &ima)
- template<typename I>
  unsigned get (const Image< I > &ima)
- template<typename I>
  void mirror (const Image< I > &ima)
- template<typename I>
  void resize (const Image< I > &ima, unsigned thickness)

    Facade.

9.18.1 Detailed Description

Namespace of routines related to image virtual (outer) border.

9.18.2 Function Documentation

9.18.2.1 template<typename I> void mln::border::adjust (const Image< I > & *ima*, unsigned *min_thickness*) `[inline]`

Adjust the virtual (outer) border of image `ima` so that its size is at least `min_thickness`.

Parameters:

↔ ***ima*** The image whose border is to be adjusted.

← ***min_thickness*** The expected border minimum thickness.

Precondition:

`ima` has to be initialized.

Warning:

If the image border is already larger than `min_thickness`, this routine is a no-op.

References get(), and resize().

9.18.2.2 template<typename I> void mln::border::duplicate (const Image< I > & *ima*) [inline]

Assign the virtual (outer) border of image `ima` with the duplicate of the inner border of this image.

Parameters:

↔ ***ima*** The image whose border is to be duplicated.

Precondition:

`ima` has to be initialized.

References get().

Referenced by mln::extension::duplicate().

9.18.2.3 template<typename I, typename J> void mln::border::equalize (const Image< I > & *ima1*, const Image< J > & *ima2*, unsigned *min_thickness*) [inline]

Equalize the virtual (outer) border of images `ima1` and `ima2` so that their size is equal and is at least `min_thickness`.

Parameters:

↔ ***ima1*** The first image whose border is to be equalizeed.

↔ ***ima2*** The second image whose border is to be equalizeed.

← ***min_thickness*** The expected border minimum thickness of both images.

Precondition:

`ima1` has to be initialized.
`ima2` has to be initialized.

Warning:

If both image borders already have the same thickness and if this thickness is larger than `min_thickness`, this routine is a no-op.

References get().

9.18.2.4 template<typename I> void mln::border::fill (const Image< I > & *ima*, const typename I::value & *v*) [inline]

Fill the virtual (outer) border of image `ima` with the single value `v`.

Parameters:

↔ ***ima*** The image whose border is to be filled.

← ***v*** The value to assign to all border pixels.

Precondition:

`ima` has to be initialized.

9.18.2.5 template<typename I> unsigned mln::border::find (const Image< I > & *ima*) [inline]

Find the virtual (outer) border thickness of image `ima`.

Parameters:

← ***ima*** The image.

Returns:

The border thickness (0 if there is no border).

Precondition:

`ima` has to be initialized.

9.18.2.6 template<typename I> unsigned mln::border::get (const Image< I > & *ima*) [inline]

Get the virtual (outer) border thickness of image *ima*.

Parameters:

← ***ima*** The image.

Returns:

The border thickness (0 if there is no border).

Precondition:

ima has to be initialized.

Referenced by adjust(), duplicate(), and equalize().

9.18.2.7 template<typename I> void mln::border::mirror (const Image< I > & *ima*) [inline]

Mirror the virtual (outer) border of image `ima` with the (inner) level contents of this image.

Parameters:

↔ ***ima*** The image whose border is to be mirrored.

Precondition:

`ima` has to be initialized.

9.18.2.8 template<typename I> void mln::border::resize (const Image< I > & *ima*, unsigned *thickness*) [inline]

Facade.

Resize the virtual (outer) border of image `ima` to exactly `thickness`.

Parameters:

↔ ***ima*** The image whose border is to be resized.

← ***thickness*** The expected border thickness.

Precondition:

`ima` has to be initialized.

Warning:

If the image border already has the expected thickness, this routine is a no-op.

References mln::primary(), and resize().

Referenced by adjust(), and resize().

9.19 mln::border::impl Namespace Reference

Implementation namespace of border namespace.

Namespaces

- namespace generic

    Generic implementation namespace of border namespace.

9.19.1 Detailed Description

Implementation namespace of border namespace.

9.20 mln::border::impl::generic Namespace Reference

Generic implementation namespace of border namespace.

9.20.1 Detailed Description

Generic implementation namespace of border namespace.

9.21 mln::canvas Namespace Reference

Namespace of canvas.

Classes

- struct chamfer

  Compute chamfer distance.

Namespaces

- namespace browsing

  Namespace of browsing canvas.

- namespace impl

  Implementation namespace of canvas namespace.

- namespace labeling

  Namespace of labeling canvas.

- namespace morpho

  Namespace of morphological canvas.

Functions

- template< typename I, typename N, typename W, typename D, typename F >
  mln::trait::ch_value< I, D >::ret distance_front (const Image< I > &input, const Neighborhood< N > &nbh, const Weighted_Window< W > &w_win, D max, F &functor)

  Canvas of discrete distance computation by thick front propagation.

- template< typename I, typename N, typename D, typename F >
  mln::trait::ch_value< I, D >::ret distance_geodesic (const Image< I > &input, const Neighborhood< N > &nbh, D max, F &functor)

  Discrete geodesic distance canvas.

9.21.1 Detailed Description

Namespace of canvas.

9.21.2 Function Documentation

9.21.2.1 template<typename I, typename N, typename W, typename D, typename F> mln::trait::ch_value< I, D >::ret mln::canvas::distance_front (const Image< I > & *input*, const Neighborhood< N > & *nbh*, const Weighted_Window< W > & *w_win*, D *max*, F & *functor*) `[inline]`

Canvas of discrete distance computation by thick front propagation.

Referenced by mln::transform::distance_front(), and mln::transform::influence_zone_front().

9.21.2.2 template<typename I, typename N, typename D, typename F> mln::trait::ch_value< I, D >::ret mln::canvas::distance_geodesic (const Image< I > & *input*, const Neighborhood< N > & *nbh*, D *max*, F & *functor*) `[inline]`

Discrete geodesic distance canvas.

Referenced by mln::transform::distance_and_closest_point_geodesic(), mln::transform::distance_and_-influence_zone_geodesic(), mln::transform::distance_geodesic(), and mln::transform::influence_zone_-geodesic_saturated().

9.22 mln::canvas::browsing Namespace Reference

Namespace of browsing canvas.

Classes

- struct backdiagonal2d_t

  Browsing in a certain direction.

- struct breadth_first_search_t

  Breadth-first search algorithm for graph, on vertices.

- struct depth_first_search_t

  Breadth-first search algorithm for graph, on vertices.

- struct diagonal2d_t

  Browsing in a certain direction.

- struct dir_struct_elt_incr_update_t

  Browsing in a certain direction with a segment.

- struct directional_t

  Browsing in a certain direction.

- struct fwd_t

  Canvas for forward browsing.

- struct hyper_directional_t

  Browsing in a certain direction.

- struct snake_fwd_t

  Browsing in a snake-way, forward.

- struct snake_generic_t

  Multidimentional Browsing in a given-way.

- struct snake_vert_t

  Browsing in a snake-way, forward.

9.22.1 Detailed Description

Namespace of browsing canvas.

9.23 mln::canvas::impl Namespace Reference

Implementation namespace of canvas namespace.

9.23.1 Detailed Description

Implementation namespace of canvas namespace.

9.24 mln::canvas::labeling Namespace Reference

Namespace of labeling canvas.

Namespaces

- namespace impl

  Implementation namespace of labeling canvas namespace.

Functions

- template<typename I, typename N, typename L, typename F>
  mln::trait::ch_value< I, L >::ret blobs (const Image< I > &input_, const Neighborhood< N > &nbh_, L &nlabels, F &functor)

  Canvas for connected component labeling of the binary objects of a binary image using a queue-based algorithm.

9.24.1 Detailed Description

Namespace of labeling canvas.

9.24.2 Function Documentation

9.24.2.1 template<typename I, typename N, typename L, typename F> mln::trait::ch_value< I, L >::ret mln::canvas::labeling::blobs (const Image< I > & *input_*, const Neighborhood< N > & *nbh_*, L & *nlabels*, F & *functor*) `[inline]`

Canvas for connected component labeling of the binary objects of a binary image using a queue-based algorithm.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of the objects.

→ ***nlabels*** The Number of labels. Its value is set in the algorithms.

↔ ***functor*** A functor computing data while labeling.

Returns:

The label image.

Precondition:

The input image has to be binary (checked at compile-time).

A fast queue is used so that the algorithm is not recursive and can handle large binary objects (blobs).

Referenced by mln::labeling::blobs(), and mln::labeling::blobs_and_compute().

9.25 mln::canvas::labeling::impl Namespace Reference

Implementation namespace of labeling canvas namespace.

9.25.1 Detailed Description

Implementation namespace of labeling canvas namespace.

9.26 mln::canvas::morpho Namespace Reference

Namespace of morphological canvas.

9.26.1 Detailed Description

Namespace of morphological canvas.

9.27 mln::convert Namespace Reference

Namespace of conversion routines.

Functions

- template<typename V>
  void from_to (const unsigned &from, Value< V > &to)

  Conversion of an unsigned `from` *towards a value* `to`.

- template<typename V>
  void from_to (const int &from, Value< V > &to)

  Conversion of a int `from` *towards a value* `to`.

- template<typename V>
  void from_to (const float &from, Value< V > &to)

  Conversion of a float `from` *towards a value* `to`.

- template<typename V>
  void from_to (const double &from, Value< V > &to)

  Conversion of a double `from` *towards a value* `to`.

- template<typename N>
  mln_image_from_grid (typename N::site::grid, bool) to_image(const Neighborhood< N > &nbh)

  Convert a neighborhood `nbh` *into a binary image.*

- template<typename W>
  mln_image_from_grid (typename W::site::grid, mln_weight(W)) to_image(const Weighted_-Window< W > &w_win)

  Convert a weighted window `w_win` *into an image.*

- template<typename W>
  mln_image_from_grid (typename W::site::grid, bool) to_image(const Window< W > &win)

  Convert a window `win` *into a binary image.*

- template<typename S>
  mln_image_from_grid (typename S::site::grid, bool) to_image(const Site_Set< S > &pset

  Convert a point set `pset` *into a binary image.*

- template<typename N>
  mln_window (N) to_window(const Neighborhood< N > &nbh)

  Convert a neighborhood `nbh` *into a window.*

- template<typename T, typename O>
  T to (const O &from)

  Conversion of the object `from` *towards an object with type* `T`.

- template<typename P>
  P::dpoint to_dpoint (const Point_Site< P > &p)

  Convert a point site `p` *into a delta-point.*

- template<typename I>
  pw::value_< I > to_fun (const Image< I > &ima)

  Convert an image into a function.

- template<typename R, typename A>
  fun::C< R(∗)(A)> to_fun (R(∗f)(A))

  Convert a C unary function into an mln::fun::C.

- template<typename T>
  image1d< unsigned > to_image (const histo::array< T > &h)

  Convert an histo `h` *into an image1d<unsigned>.*

- template<typename I>
  p_array< typename I::psite > to_p_array (const Image< I > &img)

  Convert an image `img` *into a p_array.*

- template<typename W>
  p_array< typename W::psite > to_p_array (const Window< W > &win, const typename W::psite &p)

  Convert a window `win` *centered at point* `p` *into a p_array (point set vector).*

- template<typename S>
  p_array< typename S::psite > to_p_array (const Site_Set< S > &pset)

  Convert a point set `pset` *into a p_array (point set vector).*

- template<typename S>
  p_set< typename S::psite > to_p_set (const Site_Set< S > &ps)

  Convert any site set `ps` *into a 'mlnp_set' site set.*

- template<typename P, typename C>
  p_set< P > to_p_set (const std::set< P, C > &s)

  Convert an std::set `s` *of sites into a site set.*

- template<typename W>
  p_set< typename W::psite > to_p_set (const Window< W > &win)

  Convert a Window `win` *into a site set.*

- template<typename I>
  p_set< typename I::psite > to_p_set (const Image< I > &ima)

  Convert a binary image `ima` *into a site set.*

- template<typename N>
  p_set< typename N::psite > to_p_set (const Neighborhood< N > &nbh)

  Convert a neighborhood `nbh` *into a site set.*

- template<typename N>
  window< typename N::dpoint > to_upper_window (const Neighborhood< N > &nbh)

  Convert a neighborhood `nbh` *into an upper window.*

- template<typename W>
  window< typename W::dpsite > to_upper_window (const Window< W > &win)

  Convert a window nbh *into an upper window.*

- template<typename D, typename C>
  window< D > to_window (const std::set< D, C > &s)

  Convert an std::set s *of delta-sites into a window.*

- template<typename S>
  window< typename S::site::dpsite > to_window (const Site_Set< S > &pset)

  Convert a site set pset *into a window.*

- template<typename I>
  window< typename I::site::dpsite > to_window (const Image< I > &ima)

  Convert a binary image ima *into a window.*

9.27.1 Detailed Description

Namespace of conversion routines.

9.27.2 Function Documentation

9.27.2.1 template<typename V> void mln::convert::from_to (const unsigned & *from*, Value< V > & *to*) [inline]

Conversion of an unsigned from towards a value to.

9.27.2.2 template<typename V> void mln::convert::from_to (const int & *from*, Value< V > & *to*) [inline]

Conversion of a int from towards a value to.

9.27.2.3 template<typename V> void mln::convert::from_to (const float & *from*, Value< V > & *to*) [inline]

Conversion of a float from towards a value to.

9.27.2.4 template<typename V> void mln::convert::from_to (const double & *from*, Value< V > & *to*) [inline]

Conversion of a double from towards a value to.

9.27.2.5 template<typename N> mln::convert::mln_image_from_grid (typename N::site::grid, bool) const [inline]

Convert a neighborhood nbh into a binary image.

9.27.2.6 template< typename W > mln::convert::mln_image_from_grid (typename W::site::grid, mln_weight(W)) const [inline]

Convert a weighted window `w_win` into an image.

9.27.2.7 template< typename W > mln::convert::mln_image_from_grid (typename W::site::grid, bool) const [inline]

Convert a window `win` into a binary image.

9.27.2.8 template< typename S > mln::convert::mln_image_from_grid (typename S::site::grid, bool) const [inline]

Convert a point set `pset` into a binary image.

Width of the converted image will be pset.bbox + 2 ∗ `border`.

9.27.2.9 template< typename N > mln::convert::mln_window (N) const [inline]

Convert a neighborhood `nbh` into a window.

9.27.2.10 template< typename T, typename O > T mln::convert::to (const O & *from*) [inline]

Conversion of the object `from` towards an object with type `T`.

References mln::mln_exact().

Referenced by mln::make_debug_graph_image().

9.27.2.11 template< typename P > P::dpoint mln::convert::to_dpoint (const Point_Site< P > & *p*) [inline]

Convert a point site `p` into a delta-point.

9.27.2.12 template< typename I > pw::value_< I > mln::convert::to_fun (const Image< I > & *ima*) [inline]

Convert an image into a function.

9.27.2.13 template< typename R, typename A > fun::C< R(∗)(A)> mln::convert::to_fun (R(∗)(A) *f*) [inline]

Convert a C unary function into an mln::fun::C.

9.27.2.14 template< typename T > image1d< unsigned > mln::convert::to_image (const histo::array< T > & *h*) [inline]

Convert an histo `h` into an image1d<unsigned>.

9.27.2.15 template<typename I> p_array< typename I::psite > mln::convert::to_p_array (const Image< I > & *img*) [inline]

Convert an image `img` into a p_array.

References mln::p_array< P >::append().

9.27.2.16 template<typename W> p_array< typename W::psite > mln::convert::to_p_array (const Window< W > & *win*, const typename W::psite & *p*) [inline]

Convert a window `win` centered at point `p` into a p_array (point set vector).

References mln::p_array< P >::append(), and mln::p_array< P >::reserve().

9.27.2.17 template<typename S> p_array< typename S::psite > mln::convert::to_p_array (const Site_Set< S > & *pset*) [inline]

Convert a point set `pset` into a p_array (point set vector).

References mln::p_array< P >::append().

9.27.2.18 template<typename S> p_set< typename S::psite > mln::convert::to_p_set (const Site_Set< S > & *ps*) [inline]

Convert any site set `ps` into a 'mlnp_set' site set.

References mln::p_set< P >::insert().

9.27.2.19 template<typename P, typename C> p_set< P > mln::convert::to_p_set (const std::set< P, C > & *s*) [inline]

Convert an std::set `s` of sites into a site set.

C is the comparison functor.

References mln::p_set< P >::insert().

9.27.2.20 template<typename W> p_set< typename W::psite > mln::convert::to_p_set (const Window< W > & *win*) [inline]

Convert a Window `win` into a site set.

References mln::p_set< P >::insert().

9.27.2.21 template<typename I> p_set< typename I::psite > mln::convert::to_p_set (const Image< I > & *ima*) [inline]

Convert a binary image `ima` into a site set.

References mln::p_set< P >::insert().

9.27.2.22 template< typename N> p_set< typename N::psite > mln::convert::to_p_set (const Neighborhood< N > & *nbh*) [inline]

Convert a neighborhood `nbh` into a site set.

References mln::p_set< P >::insert().

9.27.2.23 template< typename N> window< typename N::dpoint > mln::convert::to_upper_window (const Neighborhood< N > & *nbh*) [inline]

Convert a neighborhood `nbh` into an upper window.

References mln::window< D >::insert().

9.27.2.24 template< typename W> window< typename W::dpsite > mln::convert::to_upper_window (const Window< W > & *win*) [inline]

Convert a window `nbh` into an upper window.

References mln::window< D >::insert().

9.27.2.25 template< typename D, typename C> window< D > mln::convert::to_window (const std::set< D, C > & *s*) [inline]

Convert an std::set `s` of delta-sites into a window.

References mln::window< D >::insert().

9.27.2.26 template< typename S> window< typename S::site::dpsite > mln::convert::to_window (const Site_Set< S > & *pset*) [inline]

Convert a site set `pset` into a window.

References to_window().

9.27.2.27 template< typename I> window< typename I::site::dpsite > mln::convert::to_window (const Image< I > & *ima*) [inline]

Convert a binary image `ima` into a window.

References mln::window< D >::insert().

Referenced by to_window().

9.28 mln::data Namespace Reference

Namespace of image processing routines related to pixel data.

Namespaces

- namespace approx

  Namespace of image processing routines related to pixel levels with approximation.

- namespace impl

  Implementation namespace of data namespace.

- namespace naive

  Namespace of image processing routines related to pixel levels with naive approach.

Functions

- template<typename I, typename O>
  void abs (const Image< I > &input, Image< O > &output)
- template<typename I>
  void abs_inplace (Image< I > &input)
- template<typename I, typename F>
  void apply (Image< I > &input, const Function_v2v< F > &f)
- template<typename A, typename I>
  A::result compute (Accumulator< A > &a, const Image< I > &input)

  Compute an accumulator onto the pixel values of the image `input`*.*

- template<typename A, typename I>
  A::result compute (const Accumulator< A > &a, const Image< I > &input)

  Compute an accumulator onto the pixel values of the image `input`*.*

- template<typename V, typename I>
  mln::trait::ch_value< I, V >::ret convert (const V &v, const Image< I > &input)

  Convert the image `input` *by changing the value type.*

- template<typename I, typename W, typename O>
  void fast_median (const Image< I > &input, const Window< W > &win, Image< O > &output)
- template<typename I, typename D>
  void fill (Image< I > &ima, const D &data)
- template<typename I, typename J>
  void fill_with_image (Image< I > &ima, const Image< J > &data)

  Fill the image `ima` *with the values of the image* `data`*.*

- template<typename I, typename W>
  mln::trait::concrete< I >::ret median (const Image< I > &input, const Window< W > &win)
- template<typename A, typename I>
  mln_meta_accu_result (A, typename I::value) compute(const Meta_Accumulator< A > &a

  Compute an accumulator onto the pixel values of the image `input`*.*

- template<typename I, typename J>
  void paste (const Image< I > &input, Image< J > &output)

  Paste the contents of image `input` *into the image* `output`.

- template<typename I, typename J>
  void paste_without_localization (const Image< I > &input, Image< J > &output)

  Paste the contents of image `input` *into the image* `output` *without taking into account the localization of sites.*

- template<typename I>
  void replace (Image< I > &input, const typename I::value &old_value, const typename I::value &new_value)
- template<typename I, typename V>
  mln::trait::ch_value< I, V >::ret saturate (const Image< I > &input, const V &min, const V &max)
- template<typename V, typename I>
  mln::trait::ch_value< I, V >::ret saturate (V v, const Image< I > &input)
- template<typename I>
  void saturate_inplace (Image< I > &input, const typename I::value &min, const typename I::value &max)
- template<typename I>
  util::array< unsigned > sort_offsets_increasing (const Image< I > &input)

  Sort pixel offsets of the image `input` *wrt increasing pixel values.*

- template<typename I>
  p_array< typename I::psite > sort_psites_decreasing (const Image< I > &input)
- template<typename I>
  p_array< typename I::psite > sort_psites_increasing (const Image< I > &input)
- template<typename V, typename I>
  mln::trait::ch_value< I, V >::ret stretch (const V &v, const Image< I > &input)

  Generic implementation of data::stretch.

- template<typename I, typename O>
  void to_enc (const Image< I > &input, Image< O > &output)
- template<typename I1, typename I2, typename F>
  mln::trait::ch_value< I1, typename F::result >::ret transform (const Image< I1 > &input1, const Image< I2 > &input2, const Function_vv2v< F > &f)

  Generic implementation of data::transform.

- template<typename I, typename F>
  mln::trait::ch_value< I, typename F::result >::ret transform (const Image< I > &input, const Function_v2v< F > &f)

  Generic implementation of data::transform.

- template<typename I1, typename I2, typename F>
  void transform_inplace (Image< I1 > &ima, const Image< I2 > &aux, const Function_vv2v< F > &f)

  Generic implementation of transform_inplace.

- template<typename I, typename F>
  void transform_inplace (Image< I > &ima, const Function_v2v< F > &f)

  Generic implementation of transform_inplace.

- template<typename A, typename I>
  A::result update (Accumulator< A > &a, const Image< I > &input)

  Generic implementation of data::update.

- template<typename V, typename I>
  mln::trait::ch_value< I, V >::ret wrap (const V &v, const Image< I > &input)

  Routine to wrap values such as 0 -> 0 and [1, lmax] maps to [1, Lmax] (using modulus).

- template<typename I, typename V>
  void fill_with_value (Image< I > &ima, const V &val)

  Fill the whole image `ima` *with the single value* `v`.

9.28.1 Detailed Description

Namespace of image processing routines related to pixel data.

9.28.2 Function Documentation

9.28.2.1 template<typename I, typename O> void mln::data::abs (const Image< I > & *input*, Image< O > & *output*) [inline]

Apply the absolute value (abs) function to image pixel values.

Parameters:

← ***input*** The input image.

→ ***output*** The output image.

References transform().

9.28.2.2 template<typename I> void mln::data::abs_inplace (Image< I > & *input*) [inline]

Apply the absolute value (abs) function to image pixel values.

Parameters:

↔ ***input*** The input image.

References apply().

9.28.2.3 template<typename I, typename F> void mln::data::apply (Image< I > & *input*, const Function_v2v< F > & *f*) [inline]

Apply a function-object to the image `input`.

Parameters:

↔ ***input*** The input image.

← ***f*** The function-object.

This routine runs:

for all p of `input`, `input(p) = f( input(p) )`

This routine is equivalent to data::tranform(input, f, input) but it is faster since a single iterator is required.

Referenced by abs_inplace(), and saturate_inplace().

9.28.2.4 template<typename A, typename I> A::result mln::data::compute (Accumulator< A > & *a*, const Image< I > & *input*) `[inline]`

Compute an accumulator onto the pixel values of the image `input`.

Parameters:

↔ ***a*** An accumulator.

← ***input*** The input image.

Returns:

The accumulator result.

It fully relies on data::update.

9.28.2.5 template<typename A, typename I> A::result mln::data::compute (const Accumulator< A > &, const Image< I > & *input_*) `[inline]`

Compute an accumulator onto the pixel values of the image `input`.

Be ware that the given accumulator won't be modified and won't store any result.

Parameters:

← ***a*** An accumulator.

← ***input*** The input image.

Returns:

The accumulator result.

It fully relies on data::update.

Compute an accumulator onto the pixel values of the image `input`.

Parameters:

← ***input*** The input image.

← ***a*** An accumulator.

This routine runs:

a.take(make::pix(input, p)); on all pixels on the images.

Warning:

This routine does not perform a.init().

Referenced by mln::labeled_image< I >::labeled_image(), mln::estim::mean(), mln::estim::min_max(), mln::labeling::pack(), mln::labeling::pack_inplace(), and mln::estim::sum().

9.28.2.6 template<typename V, typename I> mln::trait::ch_value< I, V >::ret mln::data::convert (const V & *v*, const Image< I > & *input*) [inline]

Convert the image `input` by changing the value type.

Parameters:

← ***v*** A value of the destination type.

← ***input*** The input image.

References transform().

Referenced by mln::morpho::watershed::superpose(), and mln::debug::superpose().

9.28.2.7 template<typename I, typename W, typename O> void mln::data::fast_median (const Image< I > & *input*, const Window< W > & *win*, Image< O > & *output*) [inline]

Compute in `output` the median filter of image `input` by the window `win`.

Parameters:

← ***input*** The image to be filtered.

← ***win*** The window.

↔ ***output*** The output image.

Precondition:

`input` and `output` have to be initialized.

9.28.2.8 template<typename I, typename D> void mln::data::fill (Image< I > & *ima*, const D & *data*) [inline]

Fill the whole image `ima` with the data provided by `aux`.

Parameters:

↔ ***ima*** The image to be filled.

← ***data*** The auxiliary data to fill the image `ima`.

Precondition:

`ima` has to be initialized.

Referenced by mln::topo::detach(), mln::util::display_branch(), mln::transform::distance_and_-closest_point_geodesic(), mln::duplicate(), mln::make::edge_image(), mln::labeling::fill_holes(), mln::morpho::tree::filter::filter(), mln::morpho::impl::generic::hit_or_miss(), mln::transform::hough(), mln::registration::icp(), mln::graph::labeling(), mln::morpho::laplacian(), mln::make_debug_graph_-image(), mln::morpho::tree::filter::max(), mln::geom::mesh_corner_point_area(), mln::geom::mesh_-normal(), mln::morpho::meyer_wst(), mln::morpho::tree::filter::min(), mln::debug::slices_2d(), mln::morpho::watershed::superpose(), mln::debug::superpose(), mln::morpho::watershed::topological(), and mln::geom::translate().

9.28.2.9 template<typename I, typename J> void mln::data::fill_with_image (Image< I > & *ima_*, const Image< J > & *data_*) [inline]

Fill the image `ima` with the values of the image `data`.

Parameters:

↔ ***ima*** The image to be filled.
← ***data*** The image.

Warning:

The definition domain of `ima` has to be included in the one of `data`.

Precondition:

`ima.domain` <= `data.domain`.

Fill the image `ima` with the values of the image `data`.

Parameters:

↔ ***ima_*** The image to be filled.
← ***data_*** The image.

9.28.2.10 template<typename I, typename V> void mln::data::fill_with_value (Image< I > & *ima_*, const V & *val*) [inline]

Fill the whole image `ima` with the single value `v`.

Parameters:

↔ ***ima*** The image to be filled.
← ***val*** The value to assign to all sites.

Precondition:

`ima` has to be initialized.

Parameters:

↔ ***ima_*** The image to be filled.
← ***val*** The value to assign to all sites.

Precondition:

`ima` has to be initialized.

Referenced by mln::p_image< I >::clear().

9.28.2.11 template<typename I, typename W> mln::trait::concrete< I >::ret mln::data::median (const Image< I > & *input*, const Window< W > & *win*) [inline]

Compute in `output` the median filter of image `input` by the window `win`.

Parameters:

← ***input*** The image to be filtered.

← ***win*** The window.

Precondition:

`input` have to be initialized.

References mln::extension::adjust(), and mln::initialize().

Referenced by mln::data::approx::median().

9.28.2.12 template<typename A, typename I> mln::data::mln_meta_accu_result (A, typename I::value) const [inline]

Compute an accumulator onto the pixel values of the image `input`.

Parameters:

← ***a*** A meta-accumulator.

← ***input*** The input image.

Returns:

The accumulator result.

9.28.2.13 template<typename I, typename J> void mln::data::paste (const Image< I > & *input_*, Image< J > & *output_*) [inline]

Paste the contents of image `input` into the image `output`.

Parameters:

← ***input*** The input image providing pixels values.

↔ ***output*** The image in which values are assigned.

This routine runs:

for all p of `input`, `output(p) = input(p).`

Warning:

The definition domain of `input` has to be included in the one of `output`; so using mln::safe_image does not make pasting outside the output domain work.

Precondition:

`input.domain <= output.domain`

Paste the contents of image `input` into the image `output`.

Parameters:

← ***input_*** The input image providing pixels values.

↔ ***output_*** The image in which values are assigned.

Referenced by mln::make::image3d(), mln::draw::line(), mln::geom::rotate(), mln::debug::slices_2d(), and mln::labeling::superpose().

9.28.2.14 template<typename I, typename J> void mln::data::paste_without_localization (const Image< I > & *input*, Image< J > & *output*) `[inline]`

Paste the contents of image `input` into the image `output` without taking into account the localization of sites.

Parameters:

← ***input*** The input image providing pixels values.

↔ ***output*** The image in which values are assigned.

9.28.2.15 template<typename I> void mln::data::replace (Image< I > & *input*, const typename I::value & *old_value*, const typename I::value & *new_value*) `[inline]`

Replace `old_value` by `new_value` in the image `input`

Parameters:

← ***input*** The input image.

← ***old_value*** The value to be replaced...

← ***new_value*** ...by this one.

9.28.2.16 template<typename I, typename V> mln::trait::ch_value< I, V >::ret mln::data::saturate (const Image< I > & *input*, const V & *min*, const V & *max*) `[inline]`

Apply the saturate function to image pixel values.

Parameters:

← ***input*** The input image.

← ***min*** The minimum output value.

← ***max*** The maximum output value.

References transform().

9.28.2.17 template<typename V, typename I> mln::trait::ch_value< I, V >::ret mln::data::saturate (V *v*, const Image< I > & *input*) [inline]

Apply the saturate function to image pixel values.

Parameters:

← ***v*** A value of the output type.

← ***input*** The input image.

The saturation is based on the min and max values of the output value type. This assumes that the range of values in the input image is larger than the one of the output image.

References transform().

9.28.2.18 template<typename I> void mln::data::saturate_inplace (Image< I > & *input*, const typename I::value & *min*, const typename I::value & *max*) [inline]

Apply the saturate function to image pixel values.

Parameters:

↔ ***input*** The input image.

← ***min*** The minimum output value.

← ***max*** The maximum output value

References apply().

9.28.2.19 template<typename I> util::array< unsigned > mln::data::sort_offsets_increasing (const Image< I > & *input*) [inline]

Sort pixel offsets of the image `input` wrt increasing pixel values.

References mln::util::array< T >::append(), and mln::util::array< T >::reserve().

9.28.2.20 template<typename I> p_array< typename I::psite > mln::data::sort_psites_decreasing (const Image< I > & *input*) [inline]

Sort psites the image `input` through a function `f` to set the `output` image in decreasing way.

Parameters:

← ***input*** The input image.

Precondition:

`input.is_valid`

Referenced by mln::morpho::tree::min_tree().

9.28.2.21 template<typename I> p_array< typename I::psite > mln::data::sort_psites_increasing (const Image< I > & *input*) [inline]

Sort psites the image `input` through a function `f` to set the `output` image in increasing way.

Parameters:

← ***input*** The input image.

Precondition:

`input.is_valid`

Referenced by mln::morpho::tree::max_tree().

9.28.2.22 template<typename V, typename I> mln::trait::ch_value< I, V >::ret mln::data::stretch (const V & *v*, const Image< I > & *input*) [inline]

Generic implementation of data::stretch.

Stretch the values of `input` so that they can be stored in `output`.

Parameters:

← ***v*** A value to set the output value type.

← ***input*** The input image.

Returns:

A stretch image with values of the same type as `v`.

Precondition:

input.is_valid

Parameters:

← ***v*** A value to set the output value type.

← ***input*** The input image.

Returns:

A stretch image with values of the same type as `v`.

References mln::initialize(), mln::estim::min_max(), mln::data::impl::stretch(), and transform().

Referenced by stretch().

9.28.2.23 template<typename I, typename O> void mln::data::to_enc (const Image< I > & *input*, Image< O > & *output*) [inline]

Set the `output` image with the encoding values of the image `input` pixels.

Parameters:

← ***input*** The input image.

→ ***output*** The result image.

Precondition:

`output.domain >= input.domain`

References transform().

9.28.2.24 template<typename I1, typename I2, typename F> mln::trait::ch_value< I1, typename F::result >::ret mln::data::transform (const Image< I1 > & *input1_*, const Image< I2 > & *input2_*, const Function_vv2v< F > & *f_*) `[inline]`

Generic implementation of data::transform.

Transform two images `input1` `input2` through a function `f`.

Parameters:

← ***input1*** The 1st input image.

← ***input2*** The 2nd input image.

← ***f*** The function.

This routine runs:

for all p of `input`, `output(p)` = `f( input1(p), input2(p) )`.

Parameters:

← ***input1_*** The 1st input image.

← ***input2_*** The 2nd input image.

← ***f_*** The function.

References mln::initialize().

9.28.2.25 template<typename I, typename F> mln::trait::ch_value< I, typename F::result >::ret mln::data::transform (const Image< I > & *input_*, const Function_v2v< F > & *f_*) `[inline]`

Generic implementation of data::transform.

Transform the image `input` through a function `f`.

Parameters:

← ***input*** The input image.

← ***f*** The function.

This routine runs:

for all p of `input`, `output(p)` = `f( input(p) )`.

Parameters:

← ***input_*** The input image.

← ***f_*** The function.

References mln::initialize().

Referenced by abs(), mln::logical::and_not(), mln::labeling::colorize(), mln::data::impl::generic::convert(), mln::arith::diff_abs(), mln::linear::mln_ch_convolve_grad(), mln::labeling::pack(), mln::labeling::pack_-inplace(), mln::labeling::relabel(), saturate(), mln::data::impl::stretch(), to_enc(), mln::labeling::wrap(), and wrap().

9.28.2.26 template< typename I1, typename I2, typename F > void mln::data::transform_inplace (Image< I1 > & *ima_*, const Image< I2 > & *aux_*, const Function_vv2v< F > & *f_*) `[inline]`

Generic implementation of transform_inplace.

Transform inplace the image `ima` with the image `aux` through a function `f`.

Parameters:

← ***ima*** The image to be transformed.
← ***aux*** The auxiliary image.
← ***f*** The function.

This routine runs:

for all p of `ima`, `ima(p) = f( ima(p), aux(p) )`.

Parameters:

← ***ima_*** The image to be transformed.
← ***aux_*** The auxiliary image.
← ***f_*** The function.

9.28.2.27 template< typename I, typename F > void mln::data::transform_inplace (Image< I > & *ima_*, const Function_v2v< F > & *f_*) `[inline]`

Generic implementation of transform_inplace.

Transform inplace the image `ima` through a function `f`.

Parameters:

↔ ***ima*** The image to be transformed.
← ***f*** The function.

This routine runs:

for all p of `ima`, `ima(p) = f( ima(p) )`.

Parameters:

↔ ***ima_*** The image to be transformed.
← ***f_*** The function.

Referenced by mln::logical::and_inplace(), mln::logical::and_not_inplace(), mln::logical::not_inplace(), mln::logical::or_inplace(), mln::labeling::relabel_inplace(), and mln::logical::xor_inplace().

9.28.2.28 template<typename A, typename I> A::result mln::data::update (Accumulator< A > & *a_*, const Image< I > & *input_*) [inline]

Generic implementation of data::update.

Update an accumulator with the pixel values of the image `input`.

Parameters:

← ***a*** The accumulator.

← ***input*** The input image.

Returns:

The accumulator result.

Parameters:

← ***a_*** The accumulator.

← ***input_*** The input image.

Returns:

The accumulator result.

9.28.2.29 template<typename V, typename I> mln::trait::ch_value< I, V >::ret mln::data::wrap (const V & *v*, const Image< I > & *input*) [inline]

Routine to wrap values such as 0 -> 0 and [1, lmax] maps to [1, Lmax] (using modulus).

Parameters:

← ***v*** The target value type.

← ***input*** Input image.

Returns:

An image with wrapped values.

References transform().

9.29 mln::data::approx Namespace Reference

Namespace of image processing routines related to pixel levels with approximation.

Namespaces

- namespace impl

  Implementation namespace of data::approx namespace.

Functions

- template<typename I>
  mln::trait::concrete< I >::ret median (const Image< I > &input, const win::octagon2d &win)
- template<typename I>
  mln::trait::concrete< I >::ret median (const Image< I > &input, const win::disk2d &win)
- template<typename I>
  mln::trait::concrete< I >::ret median (const Image< I > &input, const win::rectangle2d &win)

9.29.1 Detailed Description

Namespace of image processing routines related to pixel levels with approximation.

9.29.2 Function Documentation

9.29.2.1 template<typename I> mln::trait::concrete< I >::ret mln::data::approx::median (const Image< I > & *input*, const win::octagon2d & *win*) [inline]

Compute in `output` an approximate of the median filter of image `input` by the 2D octagon `win`.

Parameters:

← ***input*** The image to be filtered.

← ***win*** The octagon.

The approximation is based on a vertical median and an horizontal median an two diagonal median.

Precondition:

`input` and `output` have to be initialized.

References median().

9.29.2.2 template<typename I> mln::trait::concrete< I >::ret mln::data::approx::median (const Image< I > & *input*, const win::disk2d & *win*) [inline]

Compute in `output` an approximate of the median filter of image `input` by the 2D disk `win`.

Parameters:

← ***input*** The image to be filtered.

← ***win*** The disk.

The approximation is based on a vertical median and an horizontal median an two diagonal median.

Precondition:

`input` and `output` have to be initialized.

References mln::data::median().

9.29.2.3 template<typename I> mln::trait::concrete< I >::ret mln::data::approx::median (const Image< I > & *input*, const win::rectangle2d & *win*) `[inline]`

Compute in `output` an approximate of the median filter of image `input` by the 2D rectangle `win`.

Parameters:

← ***input*** The image to be filtered.

← ***win*** The rectangle.

The approximation is based on a vertical median ran after an horizontal median.

Precondition:

`input` and `output` have to be initialized.

References mln::data::median().

Referenced by median().

9.30 mln::data::approx::impl Namespace Reference

Implementation namespace of data::approx namespace.

9.30.1 Detailed Description

Implementation namespace of data::approx namespace.

9.31 mln::data::impl Namespace Reference

Implementation namespace of data namespace.

Namespaces

- namespace generic

  Generic implementation namespace of data namespace.

Functions

- template<typename V, typename I>
  mln::trait::ch_value< I, V >::ret stretch (const V &v, const Image< I > &input)

  Generic implementation of data::stretch.

- template<typename I, typename F>
  void transform_inplace_lowq (Image< I > &input_, const Function_v2v< F > &f_)

  Specialized implementation.

- template<typename A, typename I>
  A::result update_fastest (Accumulator< A > &a_, const Image< I > &input_)

  Fastest implementation of data::update.

9.31.1 Detailed Description

Implementation namespace of data namespace.

9.31.2 Function Documentation

9.31.2.1 template<typename V, typename I> mln::trait::ch_value< I , V >::ret mln::data::impl::stretch (const V & *v*, const Image< I > & *input*) [inline]

Generic implementation of data::stretch.

Parameters:

← ***v*** A value to set the output value type.

← ***input*** The input image.

Returns:

A stretch image with values of the same type as `v`.

References mln::initialize(), mln::estim::min_max(), stretch(), and mln::data::transform().

Referenced by mln::data::stretch().

9.31.2.2 template<typename I, typename F> void mln::data::impl::transform_inplace_lowq (Image< I > & *input_*, const Function_v2v< F > & *f_*) [inline]

Specialized implementation.

9.31.2.3 template<typename A, typename I> A ::result mln::data::impl::update_fastest (Accumulator< A > & *a_*, const Image< I > & *input_*) [inline]

Fastest implementation of data::update.

Parameters:

← ***a_*** The accumulator.

← ***input_*** The input image.

Returns:

The accumulator result.

9.32 mln::data::impl::generic Namespace Reference

Generic implementation namespace of data namespace.

Functions

- template< typename V, typename I >
  mln::trait::ch_value< I, V >::ret convert (const V &v, const Image< I > &input)

  Convert the image `input` by changing the value type.

- template< typename I, typename J >
  void fill_with_image (Image< I > &ima_, const Image< J > &data_)

  Generic implementation.

- template< typename I, typename V >
  void fill_with_value (Image< I > &ima_, const V &val)

  Fill the whole image `ima` with the single value `v`.

- template< typename I, typename W >
  mln::trait::concrete< I >::ret median (const Image< I > &input, const Window< W > &win)
- template< typename I, typename J >
  void paste (const Image< I > &input_, Image< J > &output_)

  Generic implementation of data::paste.

- template< typename I >
  util::array< unsigned > sort_offsets_increasing (const Image< I > &input_)

  Sort pixel offsets of the image `input` wrt increasing pixel values.

- template< typename I1, typename I2, typename F >
  mln::trait::ch_value< I1, typename F::result >::ret transform (const Image< I1 > &input1_, const Image< I2 > &input2_, const Function_vv2v< F > &f_)

  Generic implementation of data::transform.

- template< typename I, typename F >
  mln::trait::ch_value< I, typename F::result >::ret transform (const Image< I > &input_, const Function_v2v< F > &f_)

  Generic implementation of data::transform.

- template< typename I1, typename I2, typename F >
  void transform_inplace (Image< I1 > &ima_, const Image< I2 > &aux_, const Function_vv2v< F > &f_)

  Generic implementation of transform_inplace.

- template< typename I, typename F >
  void transform_inplace (Image< I > &ima_, const Function_v2v< F > &f_)

  Generic implementation of transform_inplace.

- template< typename A, typename I >
  A::result update (Accumulator< A > &a_, const Image< I > &input_)

  Generic implementation of data::update.

9.32.1 Detailed Description

Generic implementation namespace of data namespace.

9.32.2 Function Documentation

9.32.2.1 template<typename V, typename I> mln::trait::ch_value< I , V >::ret mln::data::impl::generic::convert (const V & *v*, const Image< I > & *input*) [inline]

Convert the image `input` by changing the value type.

Parameters:

← ***v*** A value of the destination type.

← ***input*** The input image.

References mln::data::transform().

Referenced by mln::morpho::watershed::superpose(), and mln::debug::superpose().

9.32.2.2 template<typename I, typename J> void mln::data::impl::generic::fill_with_image (Image< I > & *ima_*, const Image< J > & *data_*) [inline]

Generic implementation.

Fill the image `ima` with the values of the image `data`.

Parameters:

↔ ***ima_*** The image to be filled.

← ***data_*** The image.

9.32.2.3 template<typename I, typename V> void mln::data::impl::generic::fill_with_value (Image< I > & *ima_*, const V & *val*) [inline]

Fill the whole image `ima` with the single value `v`.

Parameters:

↔ ***ima_*** The image to be filled.

← ***val*** The value to assign to all sites.

Precondition:

`ima` has to be initialized.

Referenced by mln::p_image< I >::clear().

9.32.2.4 template<typename I, typename W> mln::trait::concrete< I >::ret mln::data::impl::generic::median (const Image< I > & *input*, const Window< W > & *win*) [inline]

Compute in `output` the median filter of image `input` by the window `win`.

Parameters:

← ***input*** The image to be filtered.

← ***win*** The window.

Precondition:

`input` have to be initialized.

References mln::extension::adjust(), and mln::initialize().

Referenced by mln::data::approx::median().

9.32.2.5 template<typename I, typename J> void mln::data::impl::generic::paste (const Image< I > & *input_*, Image< J > & *output_*) [inline]

Generic implementation of data::paste.

Paste the contents of image `input` into the image `output`.

Parameters:

← ***input_*** The input image providing pixels values.

↔ ***output_*** The image in which values are assigned.

Referenced by mln::make::image3d(), mln::draw::line(), mln::geom::rotate(), mln::debug::slices_2d(), and mln::labeling::superpose().

9.32.2.6 template<typename I> util::array<unsigned> mln::data::impl::generic::sort_offsets_-increasing (const Image< I > & *input_*) [inline]

Sort pixel offsets of the image `input` wrt increasing pixel values.

References mln::util::array< T >::append(), and mln::util::array< T >::reserve().

9.32.2.7 template<typename I1, typename I2, typename F> mln::trait::ch_value< I1 , typename F ::result >::ret mln::data::impl::generic::transform (const Image< I1 > & *input1_*, const Image< I2 > & *input2_*, const Function_vv2v< F > & *f_*) [inline]

Generic implementation of data::transform.

Parameters:

← ***input1_*** The 1st input image.

← ***input2_*** The 2nd input image.

← ***f_*** The function.

References mln::initialize().

9.32.2.8 template< typename I, typename F > mln::trait::ch_value< I , typename F ::result >::ret mln::data::impl::generic::transform (const Image< I > & *input_*, const Function_v2v< F > & *f_*) [inline]

Generic implementation of data::transform.

Parameters:

← ***input_*** The input image.

← ***f_*** The function.

References mln::initialize().

Referenced by mln::data::abs(), mln::logical::and_not(), mln::labeling::colorize(), convert(), mln::arith::diff_abs(), mln::linear::mln_ch_convolve_grad(), mln::labeling::pack(), mln::labeling::pack_inplace(), mln::labeling::relabel(), mln::data::saturate(), mln::data::impl::stretch(), mln::data::to_enc(), mln::labeling::wrap(), and mln::data::wrap().

9.32.2.9 template< typename I1, typename I2, typename F > void mln::data::impl::generic::transform_inplace (Image< I1 > & *ima_*, const Image< I2 > & *aux_*, const Function_vv2v< F > & *f_*) [inline]

Generic implementation of transform_inplace.

Parameters:

← ***ima_*** The image to be transformed.

← ***aux_*** The auxiliary image.

← ***f_*** The function.

9.32.2.10 template< typename I, typename F > void mln::data::impl::generic::transform_inplace (Image< I > & *ima_*, const Function_v2v< F > & *f_*) [inline]

Generic implementation of transform_inplace.

Parameters:

↔ ***ima_*** The image to be transformed.

← ***f_*** The function.

Referenced by mln::logical::and_inplace(), mln::logical::and_not_inplace(), mln::logical::not_inplace(), mln::logical::or_inplace(), mln::labeling::relabel_inplace(), and mln::logical::xor_inplace().

9.32.2.11 template< typename A, typename I > A ::result mln::data::impl::generic::update (Accumulator< A > & *a_*, const Image< I > & *input_*) [inline]

Generic implementation of data::update.

Parameters:

← ***a_*** The accumulator.

← ***input_*** The input image.

Returns:

The accumulator result.

9.33 mln::data::naive Namespace Reference

Namespace of image processing routines related to pixel levels with naive approach.

Namespaces

- namespace impl

    Implementation namespace of data::naive namespace.

Functions

- template<typename I, typename W, typename O>
  void median (const Image< I > &input, const Window< W > &win, Image< O > &output)

    Compute in `output` *the median filter of image* `input` *by the window* `win`.

9.33.1 Detailed Description

Namespace of image processing routines related to pixel levels with naive approach.

9.33.2 Function Documentation

9.33.2.1 template<typename I, typename W, typename O> void mln::data::naive::median (const Image< I > & *input*, const Window< W > & *win*, Image< O > & *output*) `[inline]`

Compute in `output` the median filter of image `input` by the window `win`.

Parameters:

← ***input*** The image to be filtered.

← ***win*** The window.

↔ ***output*** The output image.

This is a NAIVE version for test / comparison purpose so do NOT use it.

Precondition:

`input` and `output` have to be initialized.

See also:

mln::data::median

9.34 mln::data::naive::impl Namespace Reference

Implementation namespace of data::naive namespace.

9.34.1 Detailed Description

Implementation namespace of data::naive namespace.

9.35 mln::debug Namespace Reference

Namespace of routines that help to debug.

Namespaces

- namespace impl

  Implementation namespace of debug namespace.

Functions

- template<typename I, typename G, typename F, typename V, typename E>
  void draw_graph (Image< I > &ima, const p_vertices< util::line_graph< G >, F > &pv, const Function< V > &vcolor_f_, const Function< E > &ecolor_f_)

  Draw an image `ima` *from a mln::p_vertices* `pv`.

- template<typename I, typename G, typename F, typename V, typename E>
  void draw_graph (Image< I > &ima, const p_vertices< G, F > &pv, const Function< V > &vcolor_f_, const Function< E > &ecolor_f_)

  Draw an image `ima` *from a mln::p_vertices* `pv`.

- template<typename I, typename G, typename F>
  void draw_graph (Image< I > &ima, const p_vertices< G, F > &pv, typename I::value vcolor, typename I::value ecolor)

  Draw an image `ima` *from a mln::p_vertices* `pv`*, with value* `vcolor` *for vertices, value* `ecolor` *for edges and 0 for the background.*

- std::string filename (const std::string &filename, int id)

  Constructs and returns a formatted output file name.

- unsigned short format (unsigned char v)

  Format an unsigned char to print it properly, i.e., like an integer value.

- signed short format (signed char v)

  Format a signed char to print it properly, i.e., like an integer value.

- char format (bool v)

  Format a Boolean to print it nicely: "|" for true and "-" for false.

- template<typename T>
  const T & format (const T &v)

  Default version for formatting a value is a no-op.

- template<typename I>
  void iota (Image< I > &input)
- template<typename I>
  void println (const std::string &msg, const Image< I > &input)

  Print the message `msg` *and the image* `input` *on the standard output.*

- template<typename I>
  void println (const Image< I > &input)

  Print the image input *on the standard output.*

- template<typename I>
  void println_with_border (const Image< I > &input)

  Print the image input *on the standard output.*

- void put_word (image2d< char > &inout, const point2d &word_start, const std::string &word)

  Put the word *starting at location* word_start *in the image* inout*.*

- template<typename I>
  image2d< typename I::value > slices_2d (const Image< I > &input, float ratio_hv, const typename I::value &bg)

  Create a 2D image of the slices of the 3D image input*.*

- template<typename I>
  image2d< typename I::value > slices_2d (const Image< I > &input, unsigned n_horizontal, unsigned n_vertical, const typename I::value &bg)

  Create a 2D image of the slices of the 3D image input*.*

- template<typename I, typename J>
  mln::trait::ch_value< I, value::rgb8 >::ret superpose (const Image< I > &input_, const Image< J > &object_, const value::rgb8 &object_color)

  Superpose two images.

9.35.1 Detailed Description

Namespace of routines that help to debug.

9.35.2 Function Documentation

9.35.2.1 template<typename I, typename G, typename F, typename V, typename E> void mln::debug::draw_graph (Image< I > & *ima*, const p_vertices< util::line_graph< G >, F > & *pv*, const Function< V > & *vcolor_f_*, const Function< E > & *ecolor_f_*) [inline]

Draw an image ima from a mln::p_vertices pv.

Colors for vertices are defined through vcolor_f_. Colors for edges are defined though ecolor_f_.

References mln::p_line2d::begin(), mln::p_line2d::end(), mln::p_vertices< G, F >::graph(), and mln::draw::line().

9.35.2.2 template<typename I, typename G, typename F, typename V, typename E> void mln::debug::draw_graph (Image< I > & *ima*, const p_vertices< G, F > & *pv*, const Function< V > & *vcolor_f_*, const Function< E > & *ecolor_f_*) [inline]

Draw an image ima from a mln::p_vertices pv.

Colors for vertices are defined through vcolor_f_. Colors for edges are defined though ecolor_f_.

References mln::p_vertices< G, F >::graph(), and mln::draw::line().

9.35.2.3 template<typename I, typename G, typename F> void mln::debug::draw_graph (Image< I > & *ima*, const p_vertices< G, F > & *pv*, typename I::value *vcolor*, typename I::value *ecolor*) [inline]

Draw an image `ima` from a mln::p_vertices `pv`, with value `vcolor` for vertices, value `ecolor` for edges and 0 for the background.

References mln::p_vertices< G, F >::graph(), and mln::draw::line().

Referenced by mln::make_debug_graph_image().

9.35.2.4 std::string mln::debug::filename (const std::string & *filename*, int *id* = -1) [inline]

Constructs and returns a formatted output file name.

The file name is formatted as follow:

‘filename_prefix‘_‘id‘_‘filename‘

Where:

- ‘filename_prefix‘ can be set through the global variable debug::internal::filename_prefix.

‘postfix_id‘ is autoincremented by default. Its value can be forced.

- ‘filename‘ is the given filename

9.35.2.5 unsigned short mln::debug::format (unsigned char *v*) [inline]

Format an unsigned char to print it properly, i.e., like an integer value.

9.35.2.6 signed short mln::debug::format (signed char *v*) [inline]

Format a signed char to print it properly, i.e., like an integer value.

9.35.2.7 char mln::debug::format (bool *v*) [inline]

Format a Boolean to print it nicely: "|" for true and "-" for false.

9.35.2.8 template<typename T> const T & mln::debug::format (const T & *v*) [inline]

Default version for formatting a value is a no-op.

Referenced by mln::value::operator<<(), and mln::Gpoint< E >::operator<<().

9.35.2.9 template<typename I> void mln::debug::iota (Image< I > & *input*) [inline]

Fill the image `input` with successive values.

Parameters:

↔ ***input*** The image in which values are assigned.

9.35.2.10 template<typename I> void mln::debug::println (const std::string & *msg*, const Image< I > & *input*) [inline]

Print the message `msg` and the image `input` on the standard output.

References println().

9.35.2.11 template<typename I> void mln::debug::println (const Image< I > & *input*) [inline]

Print the image `input` on the standard output.

References mln::geom::bbox().

Referenced by println().

9.35.2.12 template<typename I> void mln::debug::println_with_border (const Image< I > & *input*) [inline]

Print the image `input` on the standard output.

References mln::geom::bbox().

9.35.2.13 void mln::debug::put_word (image2d< char > & *inout*, const point2d & *word_start*, const std::string & *word*) [inline]

Put the `word` starting at location `word_start` in the image `inout`.

References mln::image2d< T >::has(), and mln::point< G, C >::last_coord().

9.35.2.14 template<typename I> image2d< typename I::value > mln::debug::slices_2d (const Image< I > & *input*, float *ratio_hv*, const typename I::value & *bg*) [inline]

Create a 2D image of the slices of the 3D image `input`.

References slices_2d().

9.35.2.15 template<typename I> image2d< typename I::value > mln::debug::slices_2d (const Image< I > & *input*, unsigned *n_horizontal*, unsigned *n_vertical*, const typename I::value & *bg*) [inline]

Create a 2D image of the slices of the 3D image `input`.

References mln::apply_p2p(), mln::data::fill(), and mln::data::paste().

Referenced by slices_2d().

9.35.2.16 template<typename I, typename J> mln::trait::ch_value< I, value::rgb8 >::ret mln::debug::superpose (const Image< I > & *input_*, const Image< J > & *object_*, const value::rgb8 & *object_color*) `[inline]`

Superpose two images.

Parameters:

← ***input_*** An image. Its value type must be convertible toward value::rgb8 thanks to a conversion operator or convert::from_to.

← ***object_*** A scalar or labeled image. Objects used for superposition. have their pixel values different from 0.

← ***object_color*** The color used to draw the objects in `object_`.

Precondition:

`input_` and `object_` must have the same domain.

Returns:

A color image.

References mln::data::convert(), mln::data::fill(), and mln::literal::zero.

9.36 mln::debug::impl Namespace Reference

Implementation namespace of debug namespace.

9.36.1 Detailed Description

Implementation namespace of debug namespace.

9.37 mln::def Namespace Reference

Namespace for core definitions.

Typedefs

- typedef short coord

  Definition of the default coordinate type: 'short'.

- typedef float coordf

  Definition of the floating coordinate type.

Enumerations

- enum

  Definition of the number of bits of the low quantization threshold.

9.37.1 Detailed Description

Namespace for core definitions.

9.37.2 Typedef Documentation

9.37.2.1 typedef short mln::def::coord

Definition of the default coordinate type: 'short'.

9.37.2.2 typedef float mln::def::coordf

Definition of the floating coordinate type.

9.37.3 Enumeration Type Documentation

9.37.3.1 anonymous enum

Definition of the number of bits of the low quantization threshold.

9.38 mln::display Namespace Reference

Namespace of routines that help to display images.

Namespaces

- namespace impl

  Implementation namespace of display namespace.

9.38.1 Detailed Description

Namespace of routines that help to display images.

9.39 mln::display::impl Namespace Reference

Implementation namespace of display namespace.

Namespaces

- namespace generic

  Generic implementation namespace of display namespace.

9.39.1 Detailed Description

Implementation namespace of display namespace.

9.40 mln::display::impl::generic Namespace Reference

Generic implementation namespace of display namespace.

9.40.1 Detailed Description

Generic implementation namespace of display namespace.

9.41 mln::doc Namespace Reference

The namespace mln::doc is only for documentation purpose.

Classes

- struct Accumulator

    Documentation class for mln::Accumulator.

- struct Box

    Documentation class for mln::Box.

- struct Dpoint

    Documentation class for mln::Dpoint.

- struct Fastest_Image

    Documentation class for the concept of images that have the speed property set to "fastest".

- struct Generalized_Pixel

    Documentation class for mln::Generalized_Pixel.

- struct Image

    Documentation class for mln::Image.

- struct Iterator

    Documentation class for mln::Iterator.

- struct Neighborhood

    Documentation class for mln::Neighborhood.

- struct Object

    Documentation class for mln::Object.

- struct Pixel_Iterator

    Documentation class for mln::Iterator.

- struct Point_Site

    Documentation class for mln::Point_Site.

- struct Site_Iterator

    Documentation class for mln::Site_Iterator.

- struct Site_Set

    Documentation class for mln::Site_Set.

- struct Value_Iterator

    Documentation class for mln::Value_Iterator.

- struct Value_Set

Documentation class for mln::Value_Set.

- struct Weighted_Window

  Documentation class for mln::Weighted_Window.

- struct Window

  Documentation class for mln::Window.

9.41.1 Detailed Description

The namespace mln::doc is only for documentation purpose.

Since concepts are not yet part of the C++ Standard, they are not explicitly expressed in code. Their documentation is handled by their respective ghost class, located in this namespace.

Warning:

The ghost classes located in mln::doc should not be used by the client.

9.42 mln::draw Namespace Reference

Namespace of drawing routines.

Functions

- template<typename I, typename B>
  void box (Image< I > &ima, const Box< B > &b, const typename I::value &v)
- template<typename I>
  void line (Image< I > &ima, const typename I::psite &beg, const typename I::psite &end, const typename I::value &v)
- template<typename I>
  void plot (Image< I > &ima, const typename I::point &p, const typename I::value &v)

9.42.1 Detailed Description

Namespace of drawing routines.

9.42.2 Function Documentation

9.42.2.1 template<typename I, typename B> void mln::draw::box (Image< I > & *ima*, const Box< B > & *b*, const typename I::value & *v*) `[inline]`

Draw a box at value `v` in image `ima`

Parameters:

↔ ***ima*** The image to be drawn.

← ***b*** the boxto draw.

← ***v*** The value to assign to all drawn pixels.

Precondition:

`ima` has to be initialized.
`ima` has `beg`.
`ima` has `end`.

References line().

9.42.2.2 template<typename I> void mln::draw::line (Image< I > & *ima*, const typename I::psite & *beg*, const typename I::psite & *end*, const typename I::value & *v*) `[inline]`

Draw a line at level `v` in image `ima` between the points `beg` and `end`.

Parameters:

↔ ***ima*** The image to be drawn.

← ***beg*** The start point to drawn line.

← ***end*** The end point to drawn line.

← ***v*** The value to assign to all drawn pixels.

Precondition:

`ima` has to be initialized.
`ima` has `beg`.
`ima` has `end`.

References mln::data::paste().

Referenced by box(), and mln::debug::draw_graph().

9.42.2.3 template<typename I> void mln::draw::plot (Image< I > & *ima*, const typename I::point & *p*, const typename I::value & *v*) `[inline]`

Plot a point at level `v` in image `ima`

Parameters:

↔ ***ima*** The image to be drawn.

← ***p*** The point to be plotted.

← ***v*** The value to assign to all drawn pixels.

Precondition:

`ima` has to be initialized.
`ima` has `p`.

9.43 mln::estim Namespace Reference

Namespace of estimation materials.

Functions

- template<typename S, typename I, typename M>
  void mean (const Image< I > &input, M &result)

  Compute the mean value of the pixels of image `input`.

- template<typename I>
  mln::value::props< typename I::value >::sum mean (const Image< I > &input)

  Compute the mean value of the pixels of image `input`.

- template<typename I>
  void min_max (const Image< I > &input, typename I::value &min, typename I::value &max)

  Compute the min and max values of the pixels of image `input`.

- template<typename I, typename S>
  void sum (const Image< I > &input, S &result)

  Compute the sum value of the pixels of image `input`.

- template<typename I>
  mln::value::props< typename I::value >::sum sum (const Image< I > &input)

  Compute the sum value of the pixels of image `input`.

9.43.1 Detailed Description

Namespace of estimation materials.

9.43.2 Function Documentation

9.43.2.1 template<typename S, typename I, typename M> void mln::estim::mean (const Image< I > & *input*, M & *result*) `[inline]`

Compute the mean value of the pixels of image `input`.

Parameters:

← ***input*** The image.

→ ***result*** The mean value.

The free parameter `S` is the type used to compute the summation.

References mln::data::compute().

9.43.2.2 template<typename I> mln::value::props< typename I::value >::sum mln::estim::mean (const Image< I > & *input*) [inline]

Compute the mean value of the pixels of image `input`.

Parameters:

← ***input*** The image.

Returns:

The mean value.

References mln::data::compute().

9.43.2.3 template<typename I> void mln::estim::min_max (const Image< I > & *input*, typename I::value & *min*, typename I::value & *max*) [inline]

Compute the min and max values of the pixels of image `input`.

Parameters:

← ***input*** The image.
→ ***min*** The minimum pixel value of `input`.
→ ***max*** The maximum pixel value of `input`.

References mln::data::compute().

Referenced by mln::data::impl::stretch(), and mln::make::voronoi().

9.43.2.4 template<typename I, typename S> void mln::estim::sum (const Image< I > & *input*, S & *result*) [inline]

Compute the sum value of the pixels of image `input`.

Parameters:

← ***input*** The image.
→ ***result*** The sum value.

References mln::data::compute().

9.43.2.5 template<typename I> mln::value::props< typename I::value >::sum mln::estim::sum (const Image< I > & *input*) [inline]

Compute the sum value of the pixels of image `input`.

Parameters:

← ***input*** The image.

Returns:

The sum value.

References mln::data::compute().

9.44 mln::extension Namespace Reference

Namespace of extension tools.

Functions

- template<typename I>
  void adjust (const Image< I > &ima, unsigned delta)

  Adjust the domain extension of image `ima` *with the size* `delta`*.*

- template<typename I, typename N>
  void adjust (const Image< I > &ima, const Neighborhood< N > &nbh)

  Adjust the domain extension of image `ima` *with the size of the neighborhood* `nbh`*.*

- template<typename I, typename W>
  void adjust (const Image< I > &ima, const Weighted_Window< W > &wwin)

  Adjust the domain extension of image `ima` *with the size of the weighted window* `wwin`*.*

- template<typename I, typename W>
  void adjust (const Image< I > &ima, const Window< W > &win)

  Adjust the domain extension of image `ima` *with the size of the window* `win`*.*

- template<typename I, typename W>
  void adjust_duplicate (const Image< I > &ima, const Window< W > &win)

  Adjust then duplicate.

- template<typename I, typename W>
  void adjust_fill (const Image< I > &ima, const Window< W > &win, const typename I::value &val)

  Adjust then fill.

- template<typename I>
  void duplicate (const Image< I > &ima)

  Assign the contents of the domain extension by duplicating the values of the inner boundary of image `ima`*.*

- template<typename I>
  void fill (const Image< I > &ima, const typename I::value &val)

9.44.1 Detailed Description

Namespace of extension tools.

9.44.2 Function Documentation

9.44.2.1 template<typename I> void mln::extension::adjust (const Image< I > & *ima*, unsigned *delta*) [inline]

Adjust the domain extension of image `ima` with the size `delta`.

9.44.2.2 template<typename I, typename N> void mln::extension::adjust (const Image< I > & *ima*, const Neighborhood< N > & *nbh*) [inline]

Adjust the domain extension of image `ima` with the size of the neighborhood `nbh`.

References mln::geom::delta().

9.44.2.3 template<typename I, typename W> void mln::extension::adjust (const Image< I > & *ima*, const Weighted_Window< W > & *wwin*) [inline]

Adjust the domain extension of image `ima` with the size of the weighted window `wwin`.

References mln::geom::delta().

9.44.2.4 template<typename I, typename W> void mln::extension::adjust (const Image< I > & *ima*, const Window< W > & *win*) [inline]

Adjust the domain extension of image `ima` with the size of the window `win`.

References mln::geom::delta().

Referenced by adjust_duplicate(), adjust_fill(), and mln::data::impl::generic::median().

9.44.2.5 template<typename I, typename W> void mln::extension::adjust_duplicate (const Image< I > & *ima*, const Window< W > & *win*) [inline]

Adjust then duplicate.

References adjust(), and duplicate().

9.44.2.6 template<typename I, typename W> void mln::extension::adjust_fill (const Image< I > & *ima*, const Window< W > & *win*, const typename I::value & *val*) [inline]

Adjust then fill.

References adjust(), and fill().

Referenced by mln::morpho::impl::generic::rank_filter().

9.44.2.7 template<typename I> void mln::extension::duplicate (const Image< I > & *ima*) [inline]

Assign the contents of the domain extension by duplicating the values of the inner boundary of image `ima`.

References mln::border::duplicate().

Referenced by adjust_duplicate().

9.44.2.8 template<typename I> void mln::extension::fill (const Image< I > & *ima*, const typename I::value & *val*) [inline]

Fill the domain extension of image `ima` with the single value `v`.

Parameters:

↔ ***ima*** The image whose domain extension is to be filled.

← ***val*** The value to assign.

Precondition:

`ima` has to be initialized.

Referenced by adjust_fill().

9.45 mln::fun Namespace Reference

Namespace of functions.

Classes

- struct from_accu

    Wrap an accumulator into a function.

Namespaces

- namespace access

    Namespace for access functions.

- namespace i2v

    Namespace of integer-to-value functions.

- namespace p2b

    Namespace of functions from point to boolean.

- namespace p2p

    Namespace of functions from grid point to grid point.

- namespace p2v

    Namespace of functions from point to value.

- namespace stat

    Namespace of statistical functions.

- namespace v2b

    Namespace of functions from value to logic value.

- namespace v2i

    Namespace of value-to-integer functions.

- namespace v2v

    Namespace of functions from value to value.

- namespace v2w2v

    Namespace of bijective functions.

- namespace v2w_w2v

    Namespace of functions from value to value.

- namespace vv2b

    Namespace of functions from value to value.

- namespace vv2v

Namespace of functions from a couple of values to a value.

- namespace x2p

  Namespace of functions from point to value.

- namespace x2v

  Namespace of functions from vector to value.

- namespace x2x

  Namespace of functions from vector to vector.

9.45.1 Detailed Description

Namespace of functions.

Forward declarations.

fun::i2v::array

Forward declaration.

9.46 mln::fun::access Namespace Reference

Namespace for access functions.

9.46.1 Detailed Description

Namespace for access functions.

9.47 mln::fun::i2v Namespace Reference

Namespace of integer-to-value functions.

Functions

- template<typename T>
  std::ostream & operator<< (std::ostream &ostr, const array< T > &a)

  Operator<<.

9.47.1 Detailed Description

Namespace of integer-to-value functions.

9.47.2 Function Documentation

9.47.2.1 template<typename T> std::ostream & mln::fun::i2v::operator<< (std::ostream & *ostr*, const array< T > & *a*) [inline]

Operator<<.

9.48 mln::fun::p2b Namespace Reference

Namespace of functions from point to boolean.

Classes

- struct antilogy

  A p2b function always returning `false`.

- struct tautology

  A p2b function always returning `true`.

9.48.1 Detailed Description

Namespace of functions from point to boolean.

9.49 mln::fun::p2p Namespace Reference

Namespace of functions from grid point to grid point.

9.49.1 Detailed Description

Namespace of functions from grid point to grid point.

9.50 mln::fun::p2v Namespace Reference

Namespace of functions from point to value.

9.50.1 Detailed Description

Namespace of functions from point to value.

9.51 mln::fun::stat Namespace Reference

Namespace of statistical functions.

9.51.1 Detailed Description

Namespace of statistical functions.

9.52 mln::fun::v2b Namespace Reference

Namespace of functions from value to logic value.

Classes

- struct lnot

    Functor computing logical-not on a value.

- struct threshold

    Threshold function.

9.52.1 Detailed Description

Namespace of functions from value to logic value.

9.53 mln::fun::v2i Namespace Reference

Namespace of value-to-integer functions.

9.53.1 Detailed Description

Namespace of value-to-integer functions.

9.54 mln::fun::v2v Namespace Reference

Namespace of functions from value to value.

Classes

- class ch_function_value

  Wrap a function v2v and convert its result to another type.

- struct component

  Functor that accesses the i-th component of a value.

- struct l1_norm

  L1-norm.

- struct l2_norm

  L2-norm.

- struct linear

  Linear function. $f(v) = a * v + b$. V is the type of input values; T is the type used to compute the result; R is the result type.

- struct linfty_norm

  L-infty norm.

Variables

- f_hsi_to_rgb_3x8_t f_hsi_to_rgb_3x8

  Global variable.

- f_hsl_to_rgb_3x8_t f_hsl_to_rgb_3x8

  Global variables.

- f_rgb_to_hsi_f_t f_rgb_to_hsi_f

  Global variables.

- f_rgb_to_hsl_f_t f_rgb_to_hsl_f

  Global variables.

9.54.1 Detailed Description

Namespace of functions from value to value.

9.54.2 Variable Documentation

9.54.2.1 f_hsi_to_rgb_3x8_t mln::fun::v2v::f_hsi_to_rgb_3x8

Global variable.

9.54.2.2 f_hsl_to_rgb_3x8_t mln::fun::v2v::f_hsl_to_rgb_3x8

Global variables.

9.54.2.3 f_rgb_to_hsi_f_t mln::fun::v2v::f_rgb_to_hsi_f

Global variables.

9.54.2.4 f_rgb_to_hsl_f_t mln::fun::v2v::f_rgb_to_hsl_f

Global variables.

9.55 mln::fun::v2w2v Namespace Reference

Namespace of bijective functions.

Classes

- struct cos

  Cosinus bijective functor.

9.55.1 Detailed Description

Namespace of bijective functions.

9.56 mln::fun::v2w_w2v Namespace Reference

Namespace of functions from value to value.

Classes

- struct l1_norm
  L1-norm.
- struct l2_norm
  L2-norm.
- struct linfty_norm
  L-infty norm.

9.56.1 Detailed Description

Namespace of functions from value to value.

9.57 mln::fun::vv2b Namespace Reference

Namespace of functions from value to value.

Classes

- struct eq

  Functor computing equal between two values.

- struct ge

  Functor computing "greater or equal than" between two values.

- struct gt

  Functor computing "greater than" between two values.

- struct implies

  Functor computing logical-implies between two values.

- struct le

  Functor computing "lower or equal than" between two values.

- struct lt

  Functor computing "lower than" between two values.

9.57.1 Detailed Description

Namespace of functions from value to value.

9.58 mln::fun::vv2v Namespace Reference

Namespace of functions from a couple of values to a value.

Classes

- struct diff_abs

  A functor computing the diff_absimum of two values.

- struct land

  Functor computing logical-and between two values.

- struct land_not

  Functor computing logical and-not between two values.

- struct lor

  Functor computing logical-or between two values.

- struct lxor

  Functor computing logical-xor between two values.

- struct max

  A functor computing the maximum of two values.

- struct min

  A functor computing the minimum of two values.

- struct vec

  A functor computing the vecimum of two values.

9.58.1 Detailed Description

Namespace of functions from a couple of values to a value.

9.59 mln::fun::x2p Namespace Reference

Namespace of functions from point to value.

Classes

- struct closest_point

    FIXME: doxygen + concept checking.

9.59.1 Detailed Description

Namespace of functions from point to value.

9.60 mln::fun::x2v Namespace Reference

Namespace of functions from vector to value.

Classes

- struct bilinear

  Represent a bilinear interolation of values from an underlying image.

- struct trilinear

  Represent a trilinear interolation of values from an underlying image.

9.60.1 Detailed Description

Namespace of functions from vector to value.

9.61 mln::fun::x2x Namespace Reference

Namespace of functions from vector to vector.

Classes

- struct composed

  Represent a composition of two transformations.

- struct linear

  Represent a linear interolation of values from an underlying image.

- struct rotation

  Represent a rotation function.

- struct translation

  Translation function-object.

9.61.1 Detailed Description

Namespace of functions from vector to vector.

9.62 mln::geom Namespace Reference

Namespace of all things related to geometry.

Classes

- class complex_geometry

  A functor returning the sites of the faces of a complex where the locations of each 0-face is stored.

Namespaces

- namespace impl

  Implementation namespace of geom namespace.

Functions

- template<typename W>
  box< typename W::psite > bbox (const Weighted_Window< W > &win)

  Compute the precise bounding box of a weighted window `win`.

- template<typename W>
  box< typename W::psite > bbox (const Window< W > &win)

  Compute the precise bounding box of a window `win`.

- template<typename I>
  box< typename I::site > bbox (const Image< I > &ima)

  Compute the precise bounding box of a point set `pset`.

- template<typename S>
  box< typename S::site > bbox (const Site_Set< S > &pset)

  Compute the precise bounding box of a point set `pset`.

- template<typename I, typename W>
  mln::trait::ch_value< I, unsigned >::ret chamfer (const Image< I > &input_, const W &w_win_, unsigned max=mln_max(unsigned))

  Apply chamfer algorithm to a binary image.

- template<typename N>
  unsigned delta (const Neighborhood< N > &nbh)

  Compute the delta of a neighborhood `nbh`.

- template<typename W>
  unsigned delta (const Weighted_Window< W > &wwin)

  Compute the delta of a weighted window `wwin`.

- template<typename W>
  unsigned delta (const Window< W > &win)

Compute the delta of a window `win`*.*

- template<typename B>
  B::point::coord max_col (const Box< B > &b)

  Give the maximum col of an box 2d or 3d.

- template<typename I>
  I::site::coord max_col (const Image< I > &ima)

  Give the maximum column of an image.

- template<typename I>
  I::site::coord max_ind (const Image< I > &ima)

  Give the maximum ind of an image.

- template<typename B>
  B::point::coord max_row (const Box< B > &b)

  Give the maximum row of an box 2d or 3d.

- template<typename I>
  I::site::coord max_row (const Image< I > &ima)

  Give the maximum row of an image.

- template<typename I>
  I::site::coord max_sli (const Image< I > &ima)

  Give the maximum sli of an image.

- std::pair< complex_image< 2, mln::space_2complex_geometry, algebra::vec< 3, float > >, complex_image< 2, mln::space_2complex_geometry, float > > mesh_corner_point_area (const p_-complex< 2, space_2complex_geometry > &mesh)

  Compute the area "belonging" to normals at vertices.

- std::pair< complex_image< 2, mln::space_2complex_geometry, float >, complex_image< 2, mln::space_2complex_geometry, float > > mesh_curvature (const p_complex< 2, space_-2complex_geometry > &mesh)

  Compute the principal curvatures of a surface at vertices.

- complex_image< 2, mln::space_2complex_geometry, algebra::vec< 3, float > > mesh_normal (const p_complex< 2, space_2complex_geometry > &mesh)

  Compute normals at vertices.

- template<typename B>
  B::point::coord min_col (const Box< B > &b)

  Give the minimum column of an box 2d or 3d.

- template<typename I>
  I::site::coord min_col (const Image< I > &ima)

  Give the minimum column of an image.

- template<typename I>
  I::site::coord min_ind (const Image< I > &ima)

  Give the minimum ind of an image.

- template<typename B>
  B::point::coord min_row (const Box< B > &b)

  Give the minimum row of an box 2d or 3d.

- template<typename I>
  I::site::coord min_row (const Image< I > &ima)

  Give the minimum row of an image.

- template<typename I>
  I::site::coord min_sli (const Image< I > &ima)

  Give the minimum sli of an image.

- template<typename B>
  unsigned ncols (const Box< B > &b)

  Give the number of cols of a box 2d or 3d.

- template<typename I>
  unsigned ncols (const Image< I > &ima)

  Give the number of columns of an image.

- template<typename I>
  unsigned ninds (const Image< I > &ima)

  Give the number of inds of an image.

- template<typename B>
  unsigned nrows (const Box< B > &b)

  Give the number of rows of a box 2d or 3d.

- template<typename I>
  unsigned nrows (const Image< I > &ima)

  Give the number of rows of an image.

- template<typename I>
  unsigned nsites (const Image< I > &input)

  Compute the number of sites of the image `input`.

- template<typename I>
  unsigned nslis (const Image< I > &ima)

  Give the number of slices of an image.

- template<typename I>
  void pmin_pmax (const Site_Iterator< I > &p, typename I::site &pmin, typename I::site &pmax)

  Compute the minimum and maximum points, `pmin` *and* `max`*, when browsing with iterator* `p`.

- template<typename I>
  std::pair< typename I::site, typename I::site > pmin_pmax (const Site_Iterator< I > &p)

  Compute the minimum and maximum points when browsing with iterator `p`.

- template<typename S>
  void pmin_pmax (const Site_Set< S > &s, typename S::site &pmin, typename S::site &pmax)

Compute the minimum and maximum points, `pmin` *and* `max`*, of point set* `s`.

- template<typename S>
  std::pair< typename S::site, typename S::site > pmin_pmax (const Site_Set< S > &s)

  Compute the minimum and maximum points of point set `s`.

- template<typename I>
  mln::trait::concrete< I >::ret rotate (const Image< I > &input, double angle)

  This is an overloaded member function, provided for convenience. It differs from the above function only in what argument(s) it accepts. Use literal::zero as default value for the extension.

- template<typename I, typename Ext, typename S>
  mln::trait::concrete< I >::ret rotate (const Image< I > &input, double angle, const Ext &extension, const Site_Set< S > &output_domain)

  Perform a rotation from the center of an image.

- template<typename I, typename N>
  mln::trait::concrete< I >::ret seeds2tiling (const Image< I > &ima_, const Neighborhood< N > &nbh)

  Take a labeled image `ima_` *with seeds and extend them until creating tiles.*

- template<typename I, typename V>
  mln::trait::concrete< I >::ret translate (const Image< I > &input, const algebra::vec< I::site::dim, V > &ref)

  This is an overloaded member function, provided for convenience. It differs from the above function only in what argument(s) it accepts. Use literal::zero as default value for the extension.

- template<typename I, typename V, typename Ext, typename S>
  mln::trait::concrete< I >::ret translate (const Image< I > &input, const algebra::vec< I::site::dim, V > &ref, const Ext &extension, const Site_Set< S > &output_domain)

  Perform a translation from the center of an image.

  - template<typename I, typename N>
    I seeds2tiling_roundness (Image< I > &ima_, const w_window2d_int &w_win, unsigned max, const Neighborhood< N > &nbh_)

    Take a labeled image `ima_` *with seeds and extend them until creating tiles rounder than the primary version.*

9.62.1 Detailed Description

Namespace of all things related to geometry.

Namespace of essential things related to geometry.

9.62.2 Function Documentation

9.62.2.1 template<typename W> box< typename W::psite > mln::geom::bbox (const Weighted_Window< W > & *win*) `[inline]`

Compute the precise bounding box of a weighted window `win`.

References bbox().

9.62.2.2 template<typename W> box< typename W::psite > mln::geom::bbox (const Window< W > & *win*) [inline]

Compute the precise bounding box of a window `win`.

References mln::literal::origin, and mln::accu::shape::bbox< P >::take().

9.62.2.3 template<typename I> box< typename I::site > mln::geom::bbox (const Image< I > & *ima*) [inline]

Compute the precise bounding box of a point set `pset`.

References bbox().

9.62.2.4 template<typename S> box< typename S::site > mln::geom::bbox (const Site_Set< S > & *pset*) [inline]

Compute the precise bounding box of a point set `pset`.

Referenced by bbox(), mln::transform::distance_and_closest_point_geodesic(), mln::registration::icp(), max_col(), max_row(), max_sli(), min_col(), min_row(), min_sli(), mln::debug::println(), mln::debug::println_with_border(), and rotate().

9.62.2.5 template<typename I, typename W> mln::trait::ch_value< I, unsigned >::ret mln::geom::chamfer (const Image< I > & *input_*, const W & *w_win_*, unsigned *max* = `mln_max(unsigned)`) [inline]

Apply chamfer algorithm to a binary image.

Referenced by mln::geom::impl::seeds2tiling_roundness().

9.62.2.6 template<typename N> unsigned mln::geom::delta (const Neighborhood< N > & *nbh*) [inline]

Compute the delta of a neighborhood `nbh`.

References delta().

9.62.2.7 template<typename W> unsigned mln::geom::delta (const Weighted_Window< W > & *wwin*) [inline]

Compute the delta of a weighted window `wwin`.

References delta().

9.62.2.8 template<typename W> unsigned mln::geom::delta (const Window< W > & *win*) [inline]

Compute the delta of a window `win`.

Referenced by mln::extension::adjust(), delta(), and mln::morpho::impl::generic::rank_filter().

9.62.2.9 template<typename B> B::point::coord mln::geom::max_col (const Box< B > & *b*) [inline]

Give the maximum col of an box 2d or 3d.

9.62.2.10 template<typename I> I::site::coord mln::geom::max_col (const Image< I > & *ima*) [inline]

Give the maximum column of an image.

References bbox().

Referenced by ncols().

9.62.2.11 template<typename I> I::site::coord mln::geom::max_ind (const Image< I > & *ima*) [inline]

Give the maximum ind of an image.

Referenced by ninds().

9.62.2.12 template<typename B> B::point::coord mln::geom::max_row (const Box< B > & *b*) [inline]

Give the maximum row of an box 2d or 3d.

9.62.2.13 template<typename I> I::site::coord mln::geom::max_row (const Image< I > & *ima*) [inline]

Give the maximum row of an image.

References bbox().

Referenced by nrows().

9.62.2.14 template<typename I> I::site::coord mln::geom::max_sli (const Image< I > & *ima*) [inline]

Give the maximum sli of an image.

References bbox().

Referenced by nslis().

9.62.2.15 std::pair< complex_image< 2, mln::space_2complex_geometry, algebra::vec<3, float> >, complex_image< 2, mln::space_2complex_geometry, float > > mln::geom::mesh_corner_point_area (const p_complex< 2, space_2complex_geometry > & *mesh*) [inline]

Compute the area “belonging” to normals at vertices.

Inspired from the method Trimesh::need_pointareas of the Trimesh library.

See also:

http://www.cs.princeton.edu/gfx/proj/trimesh2/

From the documentation of Trimesh:

“Compute the area "belonging" to each vertex or each corner of a triangle (defined as Voronoi area restricted to the 1-ring of a vertex, or to the triangle).”

References mln::data::fill(), mln::norm::sqr_l2(), mln::algebra::vprod(), and mln::literal::zero.

Referenced by mesh_curvature().

9.62.2.16 std::pair< complex_image< 2, mln::space_2complex_geometry, float >, complex_image< 2, mln::space_2complex_geometry, float > > mln::geom::mesh_curvature (const p_complex< 2, space_2complex_geometry > & *mesh*) [inline]

Compute the principal curvatures of a surface at vertices.

These princpal curvatures are names kappa_1 and kappa_2 in

Sylvie Philipp-Foliguet, Michel Jordan Laurent Najman and Jean Cousty. Artwork 3D Model Database Indexing and Classification.

Parameters:

← ***mesh*** The surface (triangle mesh) on which the curvature is to be computed.

References mln::c2(), mln::algebra::ldlt_decomp(), mln::algebra::ldlt_solve(), mesh_corner_point_area(), mesh_normal(), mln::algebra::vprod(), and mln::literal::zero.

9.62.2.17 complex_image< 2, mln::space_2complex_geometry, algebra::vec<3, float> > mln::geom::mesh_normal (const p_complex< 2, space_2complex_geometry > & *mesh*) [inline]

Compute normals at vertices.

Inspired from the method Trimesh::need_normals of the Trimesh library.

See also:

http://www.cs.princeton.edu/gfx/proj/trimesh2/

For simplicity purpose, and contrary to Trimesh, this routine only compute normals from a mesh, not from a cloud of points.

References mln::data::fill(), mln::norm::sqr_l2(), mln::algebra::vprod(), and mln::literal::zero.

Referenced by mesh_curvature().

9.62.2.18 template<typename B> B::point::coord mln::geom::min_col (const Box< B > & *b*) [inline]

Give the minimum column of an box 2d or 3d.

9.62.2.19 template<typename I> I::site::coord mln::geom::min_col (const Image< I > & *ima*) [inline]

Give the minimum column of an image.

References bbox().

Referenced by mln::transform::hough(), and ncols().

9.62.2.20 template<typename I> I::site::coord mln::geom::min_ind (const Image< I > & *ima*) [inline]

Give the minimum ind of an image.

Referenced by ninds().

9.62.2.21 template<typename B> B::point::coord mln::geom::min_row (const Box< B > & *b*) [inline]

Give the minimum row of an box 2d or 3d.

9.62.2.22 template<typename I> I::site::coord mln::geom::min_row (const Image< I > & *ima*) [inline]

Give the minimum row of an image.

References bbox().

Referenced by mln::transform::hough(), and nrows().

9.62.2.23 template<typename I> I::site::coord mln::geom::min_sli (const Image< I > & *ima*) [inline]

Give the minimum sli of an image.

References bbox().

Referenced by nslis().

9.62.2.24 template<typename B> unsigned mln::geom::ncols (const Box< B > & *b*) [inline]

Give the number of cols of a box 2d or 3d.

References max_col(), min_col(), and ncols().

9.62.2.25 template<typename I> unsigned mln::geom::ncols (const Image< I > & *ima*) [inline]

Give the number of columns of an image.

References max_col(), and min_col().

Referenced by mln::subsampling::gaussian_subsampling(), mln::transform::hough(), ncols(), and mln::subsampling::subsampling().

9.62.2.26 template<typename I> unsigned mln::geom::ninds (const Image< I > & *ima*) [inline]

Give the number of inds of an image.

References max_ind(), and min_ind().

9.62.2.27 template<typename B> unsigned mln::geom::nrows (const Box< B > & *b*) [inline]

Give the number of rows of a box 2d or 3d.

References max_row(), min_row(), and nrows().

9.62.2.28 template<typename I> unsigned mln::geom::nrows (const Image< I > & *ima*) [inline]

Give the number of rows of an image.

References max_row(), and min_row().

Referenced by mln::subsampling::gaussian_subsampling(), mln::transform::hough(), nrows(), and mln::subsampling::subsampling().

9.62.2.29 template<typename I> unsigned mln::geom::nsites (const Image< I > & *input*) [inline]

Compute the number of sites of the image `input`.

Referenced by pmin_pmax().

9.62.2.30 template<typename I> unsigned mln::geom::nslis (const Image< I > & *ima*) [inline]

Give the number of slices of an image.

References max_sli(), and min_sli().

9.62.2.31 template<typename I> void mln::geom::pmin_pmax (const Site_Iterator< I > & *p*, typename I::site & *pmin*, typename I::site & *pmax*) [inline]

Compute the minimum and maximum points, `pmin` and `max`, when browsing with iterator `p`.

9.62.2.32 template<typename I> std::pair< typename I::site, typename I::site > mln::geom::pmin_pmax (const Site_Iterator< I > & *p*) [inline]

Compute the minimum and maximum points when browsing with iterator `p`.

References pmin_pmax().

9.62.2.33 template<typename S> void mln::geom::pmin_pmax (const Site_Set< S > & *s*, typename S::site & *pmin*, typename S::site & *pmax*) [inline]

Compute the minimum and maximum points, `pmin` and `max`, of point set `s`.

References nsites().

9.62.2.34 template<typename S> std::pair< typename S::site, typename S::site > mln::geom::pmin_pmax (const Site_Set< S > & *s*) [inline]

Compute the minimum and maximum points of point set `s`.

References nsites().

Referenced by pmin_pmax().

9.62.2.35 template<typename I> mln::trait::concrete< I >::ret mln::geom::rotate (const Image< I > & *input*, double *angle*) [inline]

This is an overloaded member function, provided for convenience. It differs from the above function only in what argument(s) it accepts. Use literal::zero as default value for the extension.

References rotate(), and mln::literal::zero.

9.62.2.36 template<typename I, typename Ext, typename S> mln::trait::concrete< I >::ret mln::geom::rotate (const Image< I > & *input*, double *angle*, const Ext & *extension*, const Site_Set< S > & *output_domain*) [inline]

Perform a rotation from the center of an image.

Parameters:

← ***input*** An image.

← ***angle*** An angle in degrees.

← ***extension*** Function, image or value which will be used as extension. This extension allows to map values to sites which where not part of the domain before the rotation.

← ***output_domain*** The domain of the output image. An invalid domain, causes the routine to use the rotated input_ domain.

Returns:

An image with the same domain as `input`.

References bbox(), mln::compose(), mln::extend(), mln::initialize(), mln::mln_exact(), mln::literal::origin, mln::data::paste(), mln::accu::shape::bbox< P >::take(), and mln::accu::shape::bbox< P >::to_result().

Referenced by rotate().

9.62.2.37 template<typename I, typename N> mln::trait::concrete< I >::ret mln::geom::seeds2tiling (const Image< I > & *ima_*, const Neighborhood< N > & *nbh_*) [inline]

Take a labeled image `ima_` with seeds and extend them until creating tiles.

Parameters:

↔ ***ima_*** The labeled image with seed.

← ***nbh*** The neighborhood to use on this algorithm.

Returns:

A tiled image.

Precondition:

`ima_` has to be initialized.

Take a labeled image `ima_` with seeds and extend them until creating tiles.

Parameters:

↔ ***ima_*** The labeled image with seed.

← ***nbh_*** The neighborhood to use on this algorithm.

References mln::duplicate(), mln::p_queue< P >::front(), mln::p_queue< P >::pop(), mln::p_queue< P >::push(), and mln::geom::impl::seeds2tiling().

Referenced by seeds2tiling().

9.62.2.38 template<typename I, typename N> I mln::geom::seeds2tiling_roundness (Image< I > & *ima_*, const w_window2d_int & *w_win*, unsigned *max*, const Neighborhood< N > & *nbh_*) [inline]

Take a labeled image `ima_` with seeds and extend them until creating tiles rounder than the primary version.

Parameters:

↔ ***ima_*** The labeled image with seed.

← ***w_win*** The weight window using by geom::chamfer to compute distance.

← ***max*** Unsigned using by geom::chamfer to compute the distance.

← ***nbh_*** The neighborhood to use on this algorithm.

Precondition:

`ima_` has to be initialized.

References chamfer(), mln::duplicate(), mln::p_priority< P, Q >::pop_front(), mln::p_priority< P, Q >::push(), mln::geom::impl::seeds2tiling_roundness(), and mln::literal::zero.

Referenced by seeds2tiling_roundness().

9.62.2.39 template<typename I, typename V> mln::trait::concrete< I >::ret mln::geom::translate (const Image< I > & *input*, const algebra::vec< I::site::dim, V > & *ref*) [inline]

This is an overloaded member function, provided for convenience. It differs from the above function only in what argument(s) it accepts. Use literal::zero as default value for the extension.

References translate(), and mln::literal::zero.

9.62.2.40 template<typename I, typename V, typename Ext, typename S> mln::trait::concrete< I >::ret mln::geom::translate (const Image< I > & *input*, const algebra::vec< I::site::dim, V > & *ref*, const Ext & *extension*, const Site_Set< S > & *output_domain*) [inline]

Perform a translation from the center of an image.

Parameters:

← ***input*** An image.

← ***ref*** The translation vector.

← ***extension*** Function, image or value which will be used as extension. This extension allows to map values to sites which where not part of the domain before the translation.

← ***output_domain*** The domain of the output image. An invalid domain, causes the routine to use the translated input_ domain.

Returns:

An image with the same domain as `input`.

References mln::extend(), mln::data::fill(), and mln::mln_exact().

Referenced by translate().

9.63 mln::geom::impl Namespace Reference

Implementation namespace of geom namespace.

Functions

- template< typename I, typename N>
  mln::trait::concrete< I >::ret seeds2tiling (const Image< I > &ima_, const Neighborhood< N > &nbh_)

  Generic implementation of geom::seed2tiling.

- template< typename I, typename N>
  I seeds2tiling_roundness (Image< I > &ima_, const w_window2d_int &w_win, unsigned max, const Neighborhood< N > &nbh_)

  Take a labeled image `ima_` with seeds and extend them until creating tiles rounder than the primary version.

9.63.1 Detailed Description

Implementation namespace of geom namespace.

9.63.2 Function Documentation

9.63.2.1 template< typename I, typename N> mln::trait::concrete< I >::ret mln::geom::impl::seeds2tiling (const Image< I > & *ima_*, const Neighborhood< N > & *nbh_*) `[inline]`

Generic implementation of geom::seed2tiling.

Take a labeled image `ima_` with seeds and extend them until creating tiles.

Parameters:

↔ ***ima_*** The labeled image with seed.

← ***nbh_*** The neighborhood to use on this algorithm.

References mln::duplicate(), mln::p_queue< P >::front(), mln::p_queue< P >::pop(), mln::p_queue< P >::push(), and seeds2tiling().

Referenced by mln::geom::seeds2tiling().

9.63.2.2 template< typename I, typename N> I mln::geom::impl::seeds2tiling_roundness (Image< I > & *ima_*, const w_window2d_int & *w_win*, unsigned *max*, const Neighborhood< N > & *nbh_*) `[inline]`

Take a labeled image `ima_` with seeds and extend them until creating tiles rounder than the primary version.

Parameters:

↔ ***ima_*** The labeled image with seed.

← ***w_win*** The weight window using by geom::chamfer to compute distance.

← ***max*** Unsigned using by geom::chamfer to compute the distance.

← ***nbh_*** The neighborhood to use on this algorithm.

Precondition:

`ima_` has to be initialized.

References mln::geom::chamfer(), mln::duplicate(), mln::p_priority< P, Q >::pop_front(), mln::p_-priority< P, Q >::push(), seeds2tiling_roundness(), and mln::literal::zero.

Referenced by mln::geom::seeds2tiling_roundness().

9.64 mln::graph Namespace Reference

Namespace of graph related routines.

Functions

- template< typename G, typename F >
  F::result compute (const Graph< G > &g_, F &functor)

  Base routine to compute attributes on a graph.

- template< typename I, typename N, typename L >
  mln::trait::ch_value< I, L >::ret labeling (const Image< I > &graph_image_, const Neighborhood< N > &nbh_, L &nlabels)

  Label graph components.

- template< typename I, typename M >
  graph_elt_neighborhood_if< mln_graph(I), typename I::domain_t, M > to_neighb (const Image< I > &graph_image_, const Image< M > &graph_mask_image_)

  Make a custom graph neighborhood from a mask image.

- template< typename I, typename M >
  graph_elt_window_if< mln_graph(I), typename I::domain_t, M > to_win (const Image< I > &graph_image_, const Image< M > &graph_mask_image_)

  Make a custom graph window from a mask image.

9.64.1 Detailed Description

Namespace of graph related routines.

9.64.2 Function Documentation

9.64.2.1 template< typename G, typename F > F::result mln::graph::compute (const Graph< G > & *g_*, F & *functor*) [inline]

Base routine to compute attributes on a graph.

Parameters:

← ***g_*** A graph.

← ***functor*** A functor implementing the right interface.

Returns:

The computed data.

See also:

canvas::browsing::depth_first_search

9.64.2.2 template<typename I, typename N, typename L> mln::trait::ch_value< I, L >::ret mln::graph::labeling (const Image< I > & *graph_image_*, const Neighborhood< N > & *nbh_*, L & *nlabels*) [inline]

Label graph components.

Vertex with id 0, usuallly used to represent the background component, will be labeled with an id different from 0. Therefore, the labeling starts from 1.

Parameters:

← ***graph_image_*** A graph image (

See also:

vertex_image, edge_image).

Parameters:

← ***nbh_*** A graph neighborhood.

↔ ***nlabels*** The number of labels found.

Returns:

a Graph image of labels.

References mln::labeling::blobs(), mln::data::fill(), and mln::initialize().

9.64.2.3 template<typename I, typename M> graph_elt_neighborhood_if< mln_graph(I), typename I::domain_t, M > mln::graph::to_neighb (const Image< I > & *graph_image_*, const Image< M > & *graph_mask_image_*) [inline]

Make a custom graph neighborhood from a mask image.

Parameters:

← ***graph_image_*** A graph image (

See also:

vertex_image and edge_image).

Parameters:

← ***graph_mask_image_*** A graph image of bool used as a mask.

Returns:

A masked neighborhood on graph.

9.64.2.4 template<typename I, typename M> graph_elt_window_if< mln_graph(I), typename I::domain_t, M > mln::graph::to_win (const Image< I > & *graph_image_*, const Image< M > & *graph_mask_image_*) [inline]

Make a custom graph window from a mask image.

Parameters:

← ***graph_image_*** A graph image (

See also:

vertex_image and edge_image).

Parameters:

← ***graph_mask_image_*** A graph image of bool used as a mask.

Returns:

A masked window on graph.

9.65 mln::grid Namespace Reference

Namespace of grids definitions.

9.65.1 Detailed Description

Namespace of grids definitions.

Compute the image::space trait from a point type.

9.66 mln::histo Namespace Reference

Namespace of histograms.

Classes

- struct array

  Generic histogram class over a value set with type T.

Namespaces

- namespace impl

  Implementation namespace of histo namespace.

Functions

- template<typename I>
  array< typename I::value > compute (const Image< I > &input)

  Compute the histogram of image input.

9.66.1 Detailed Description

Namespace of histograms.

9.66.2 Function Documentation

9.66.2.1 template<typename I> array< typename I::value > mln::histo::compute (const Image< I > & *input*) [inline]

Compute the histogram of image input.

9.67 mln::histo::impl Namespace Reference

Implementation namespace of histo namespace.

Namespaces

- namespace generic

  Generic implementation namespace of histo namespace.

9.67.1 Detailed Description

Implementation namespace of histo namespace.

9.68 mln::histo::impl::generic Namespace Reference

Generic implementation namespace of histo namespace.

9.68.1 Detailed Description

Generic implementation namespace of histo namespace.

9.69 mln::impl Namespace Reference

Implementation namespace of mln namespace.

9.69.1 Detailed Description

Implementation namespace of mln namespace.

9.70 mln::io Namespace Reference

Namespace of input/output handling.

Namespaces

- namespace cloud

  Namespace of cloud input/output handling.

- namespace dicom

  Namespace of DICOM input/output handling.

- namespace dump

  Namespace of dump input/output handling.

- namespace fits

  Namespace of fits input/output handling.

- namespace fld

  Namespace of pgm input/output handling.

- namespace magick

  Namespace of magick input/output handling.

- namespace off

  Namespace of off input/output handling.

- namespace pbm

  Namespace of pbm input/output handling.

- namespace pbms

  Namespace of pbms input/output handling.

- namespace pfm

  Namespace of pfm input/output handling.

- namespace pgm

  Namespace of pgm input/output handling.

- namespace pgms

  Namespace of pgms input/output handling.

- namespace plot

  Namespace of plot input/output handling.

- namespace pnm

  Namespace of pnm input/output handling.

- namespace pnms

Namespace of pnms input/output handling.

- namespace ppm

  Namespace of ppm input/output handling.

- namespace ppms

  Namespace of ppms input/output handling.

- namespace tiff

  Namespace of tiff input/output handling.

- namespace txt

  Namespace of txt input/output handling.

9.70.1 Detailed Description

Namespace of input/output handling.

9.71 mln::io::cloud Namespace Reference

Namespace of cloud input/output handling.

Functions

- template< typename P >
  void load (p_array< P > &arr, const std::string &filename)

  Load a cloud of points.

- template< typename P >
  void save (const p_array< P > &arr, const std::string &filename)

  Load a cloud of points.

9.71.1 Detailed Description

Namespace of cloud input/output handling.

9.71.2 Function Documentation

9.71.2.1 template< typename P > void mln::io::cloud::load (p_array< P > & *arr*, const std::string & *filename*) [inline]

Load a cloud of points.

Parameters:

↔ ***arr*** the site set where to load the data.

← ***filename*** file to load.

9.71.2.2 template< typename P > void mln::io::cloud::save (const p_array< P > & *arr*, const std::string & *filename*) [inline]

Load a cloud of points.

Parameters:

← ***arr*** the cloud of points to save.

← ***filename*** the destination.

9.72 mln::io::dicom Namespace Reference

Namespace of DICOM input/output handling.

Functions

- template<typename V>
  image2d< V > load (const std::string &filename)

  Load a fits image in a image2d<float>.

- template<typename I>
  void load (Image< I > &ima, const std::string &filename)

  Load a DICOM file in a Milena image.

9.72.1 Detailed Description

Namespace of DICOM input/output handling.

9.72.2 Function Documentation

9.72.2.1 template<typename V> image3d< V > mln::io::dicom::load (const std::string & *filename*) [inline]

Load a fits image in a image2d<float>.

Load a ppm image in a Milena image.

Load a pgm image in a Milena image.

Load a pfm image in a image2d<float>.

Load a pbm image in a image2d<float>.

Parameters:

← ***filename*** The image source.

Returns:

An image2d<float> which contains loaded data.

9.72.2.2 template<typename I> void mln::io::dicom::load (Image< I > & *ima*, const std::string & *filename*) [inline]

Load a DICOM file in a Milena image.

Parameters:

→ ***ima*** A reference to the image which will receive data.

← ***filename*** The source.

References mln::initialize(), and mln::point< G, C >::to_vec().

9.73 mln::io::dump Namespace Reference

Namespace of dump input/output handling.

Functions

- template<typename I>
  void load (Image< I > &ima_, const std::string &filename)

  Load a Milena image by dumped into a file.

- template<typename I>
  void save (const Image< I > &ima_, const std::string &filename)

  Save a Milena image by dumping its data to a file.

9.73.1 Detailed Description

Namespace of dump input/output handling.

9.73.2 Function Documentation

9.73.2.1 template<typename I> void mln::io::dump::load (Image< I > & *ima_*, const std::string & *filename*) [inline]

Load a Milena image by dumped into a file.

Parameters:

↔ ***ima_*** The image to load.

← ***filename*** the destination.

9.73.2.2 template<typename I> void mln::io::dump::save (const Image< I > & *ima_*, const std::string & *filename*) [inline]

Save a Milena image by dumping its data to a file.

Parameters:

← ***ima_*** The image to save.

← ***filename*** the destination.

9.74 mln::io::fits Namespace Reference

Namespace of fits input/output handling.

Functions

- image2d< float > load (const std::string &filename)

  Load a fits image in a image2d<float>.

- void load (image2d< float > &ima, const std::string &filename)

  Load a fits image in a Milena image.

9.74.1 Detailed Description

Namespace of fits input/output handling.

9.74.2 Function Documentation

9.74.2.1 image2d< float > mln::io::fits::load (const std::string & *filename*) `[inline]`

Load a fits image in a image2d<float>.

Parameters:

← ***filename*** The image source.

Returns:

An image2d<float> which contains loaded data.

9.74.2.2 void mln::io::fits::load (image2d< float > & *ima*, const std::string & *filename*) `[inline]`

Load a fits image in a Milena image.

Parameters:

→ ***ima*** A reference to the image2d<float> which will receive data.

← ***filename*** The source.

9.75 mln::io::fld Namespace Reference

Namespace of pgm input/output handling.

Classes

- struct fld_header

    Define the header structure of an AVS field data file.

Functions

- template<typename I>
  void load (Image< I > &ima_, const char *filename)

    Load an image from an AVS field file.

- fld_header read_header (std::istream &ins)

    Read the header form an AVS field file.

- void write_header (std::ostream &file, const fld_header &h)

    Write the AVS header in a file.

9.75.1 Detailed Description

Namespace of pgm input/output handling.

9.75.2 Function Documentation

9.75.2.1 template<typename I> void mln::io::fld::load (Image< I > & *ima_*, const char * *filename*) [inline]

Load an image from an AVS field file.

Parameters:

↔ ***ima_*** The image to load.

← ***filename*** The path to the AVS file.

References mln::io::fld::fld_header::data, mln::io::fld::fld_header::max_ext, mln::io::fld::fld_header::min_ext, mln::io::fld::fld_header::ndim, mln::io::fld::fld_header::nspace, mln::box< P >::pmax(), mln::box< P >::pmin(), read_header(), and mln::io::fld::fld_header::veclen.

9.75.2.2 fld_header mln::io::fld::read_header (std::istream & *ins*) [inline]

Read the header form an AVS field file.

Parameters:

ins The file to read.

Returns:

The header.

References mln::io::fld::fld_header::data, mln::io::fld::fld_header::dim, mln::io::fld::fld_header::field, mln::io::fld::fld_header::max_ext, mln::io::fld::fld_header::min_ext, mln::io::fld::fld_header::ndim, mln::io::fld::fld_header::nspace, and mln::io::fld::fld_header::veclen.

Referenced by load().

9.75.2.3 void mln::io::fld::write_header (std::ostream & *file*, const fld_header & *h*) [inline]

Write the AVS header in a file.

Parameters:

file The file to write.

h The AVS header.

References mln::io::fld::fld_header::data, mln::io::fld::fld_header::dim, mln::io::fld::fld_header::field, mln::io::fld::fld_header::max_ext, mln::io::fld::fld_header::min_ext, mln::io::fld::fld_header::ndim, mln::io::fld::fld_header::nspace, and mln::io::fld::fld_header::veclen.

9.76 mln::io::magick Namespace Reference

Namespace of magick input/output handling.

Functions

- bool do_it (const value::rgb8 &in, bool &out, const std::string &filename)
- Magick::Color get_color (bool value)
- template<typename I>
  void load (Image< I > &ima, const std::string &filename)
- template<typename I>
  void save (const Image< I > &ima, const std::string &filename)

9.76.1 Detailed Description

Namespace of magick input/output handling.

9.76.2 Function Documentation

9.76.2.1 bool mln::io::magick::do_it (const value::rgb8 & *in*, bool & *out*, const std::string & *filename*) [inline]

Load a magick image in a tiled image.

Parameters:

→ ***ima*** A reference to the image which will receive data.

← ***filename*** The source.

References mln::value::rgb< n >::blue(), mln::value::rgb< n >::green(), and mln::value::rgb< n >::red().

Referenced by load().

9.76.2.2 Magick::Color mln::io::magick::get_color (bool *value*) [inline]

Save a Milena tiled image in a magick image.

Parameters:

→ ***ima*** A reference to the image to save.

← ***filename*** The output.

Referenced by save().

9.76.2.3 template<typename I> void mln::io::magick::load (Image< I > & *ima*, const std::string & *filename*) [inline]

Load a magick image in a Milena image.

Parameters:

→ ***ima*** A reference to the image which will receive data.

← ***filename*** The source.

References do_it(), mln::initialize(), and mln::point< G, C >::to_vec().

9.76.2.4 template<typename I> void mln::io::magick::save (const Image< I > & *ima*, const std::string & *filename*) [inline]

Save a Milena image in a magick image.

Parameters:

→ ***ima*** A reference to the image to save.

← ***filename*** The output.

References get_color(), and mln::point< G, C >::to_vec().

9.77 mln::io::off Namespace Reference

Namespace of off input/output handling.

Functions

- void load (bin_2complex_image3df &ima, const std::string &filename)

  Load a (binary) OFF image into a complex image.

- void save (const bin_2complex_image3df &ima, const std::string &filename)

  Save a (binary) OFF image into a complex image.

- template<typename I>
  void save_bin_alt (const I &ima, const std::string &filename)

  FIXME: Similar to mln::io::off::save(const bin_2complex_image3df&, const std::string&), but does not save faces whose value is 'false'.

9.77.1 Detailed Description

Namespace of off input/output handling.

9.77.2 Function Documentation

9.77.2.1 void mln::io::off::load (bin_2complex_image3df & *ima*, const std::string & *filename*)

Load a (binary) OFF image into a complex image.

Load a 3x8-bit RGB (color) OFF image into a complex image.

Load a floating-point OFF image into a complex image.

Parameters:

→ ***ima*** A reference to the image to construct.

← ***filename*** The name of the file to load.

The image is said binary since data only represent the existence of faces.

Parameters:

→ ***ima*** A reference to the image to construct.

← ***filename*** The name of the file to load.

Read floating-point data is attached to 2-faces only; 1-faces and 0-faces are set to 0.0f.

9.77.2.2 void mln::io::off::save (const bin_2complex_image3df & *ima*, const std::string & *filename*)

Save a (binary) OFF image into a complex image.

Save a 3x8-bit RGB (color) OFF image into a complex image.

Save a floating-point value grey-level OFF image into a complex image.

Save an 8-bit grey-level OFF image into a complex image.

Parameters:

← ***ima*** The image to save.

← ***filename*** The name of the file where to save the image.

The image is said binary since data represent only the existence of faces.

Parameters:

← ***ima*** The image to save.

← ***filename*** The name of the file where to save the image.

Only data is attached to 2-faces is saved; the OFF file cannot store data attached to faces of other dimensions.

9.77.2.3 template<typename I> void mln::io::off::save_bin_alt (const I & *ima*, const std::string & *filename*) `[inline]`

FIXME: Similar to mln::io::off::save(const bin_2complex_image3df&, const std::string&), but does not save faces whose value is 'false'.

9.78 mln::io::pbm Namespace Reference

Namespace of pbm input/output handling.

Namespaces

- namespace impl

  Namespace of pbm implementation details.

Functions

- image2d< bool > load (const std::string &filename)

  Load a pbm image in a image2d<float>.

- void load (image2d< bool > &ima, const std::string &filename)

  Load a pbm image in a Milena image.

- template<typename I>
  void save (const Image< I > &ima, const std::string &filename)

9.78.1 Detailed Description

Namespace of pbm input/output handling.

9.78.2 Function Documentation

9.78.2.1 image2d< bool > mln::io::pbm::load (const std::string & *filename*) `[inline]`

Load a pbm image in a image2d<float>.

Parameters:

← ***filename*** The image source.

Returns:

An image2d<float> which contains loaded data.

Load a pbm image in a image2d<float>.

Parameters:

← ***filename*** The image source.

Returns:

An image2d<float> which contains loaded data.

9.78.2.2 void mln::io::pbm::load (image2d< bool > & *ima*, const std::string & *filename*) [inline]

Load a pbm image in a Milena image.

Parameters:

→ ***ima*** A reference to the image2d<bool> which will receive data.

← ***filename*** The source.

9.78.2.3 template<typename I> void mln::io::pbm::save (const Image< I > & *ima*, const std::string & *filename*) [inline]

Save a Milena image as a pbm image.

Parameters:

← ***ima*** The image to save.

↔ ***filename*** the destination.

9.79 mln::io::pbm::impl Namespace Reference

Namespace of pbm implementation details.

9.79.1 Detailed Description

Namespace of pbm implementation details.

9.80 mln::io::pbms Namespace Reference

Namespace of pbms input/output handling.

Namespaces

- namespace impl

  Namespace of pbms implementation details.

Functions

- void load (image3d< bool > &ima, const util::array< std::string > &filenames)

  Load pbms images as slices of a 3D Milena image.

9.80.1 Detailed Description

Namespace of pbms input/output handling.

9.80.2 Function Documentation

9.80.2.1 void mln::io::pbms::load (image3d< bool > & *ima*, const util::array< std::string > & *filenames*) [inline]

Load pbms images as slices of a 3D Milena image.

Parameters:

→ ***ima*** A reference to the 3D image which will receive data.

← ***filenames*** The list of 2D images to load..

References mln::io::pnms::load().

9.81 mln::io::pbms::impl Namespace Reference

Namespace of pbms implementation details.

9.81.1 Detailed Description

Namespace of pbms implementation details.

9.82 mln::io::pfm Namespace Reference

Namespace of pfm input/output handling.

Namespaces

- namespace impl

  Implementation namespace of pfm namespace.

Functions

- image2d< float > load (const std::string &filename)

  Load a pfm image in a image2d<float>.

- void load (image2d< float > &ima, const std::string &filename)

  Load a pfm image in a Milena image.

- template<typename I>
  void save (const Image< I > &ima, const std::string &filename)

  Save a Milena image as a pfm image.

9.82.1 Detailed Description

Namespace of pfm input/output handling.

9.82.2 Function Documentation

9.82.2.1 image2d< float > mln::io::pfm::load (const std::string & *filename*) [inline]

Load a pfm image in a image2d<float>.

Parameters:

← ***filename*** The image source.

Returns:

An image2d<float> which contains loaded data.

Load a pfm image in a image2d<float>.

Load a pbm image in a image2d<float>.

Parameters:

← ***filename*** The image source.

Returns:

An image2d<float> which contains loaded data.

9.82.2.2 void mln::io::pfm::load (image2d< float > & *ima*, const std::string & *filename*) [inline]

Load a pfm image in a Milena image.

Parameters:

→ ***ima*** A reference to the image2d<float> which will receive data.

← ***filename*** The source.

9.82.2.3 template<typename I> void mln::io::pfm::save (const Image< I > & *ima*, const std::string & *filename*) [inline]

Save a Milena image as a pfm image.

Parameters:

← ***ima*** The image to save.

↔ ***filename*** the destination.

9.83 mln::io::pfm::impl Namespace Reference

Implementation namespace of pfm namespace.

9.83.1 Detailed Description

Implementation namespace of pfm namespace.

9.84 mln::io::pgm Namespace Reference

Namespace of pgm input/output handling.

Functions

- template<typename V>
  image2d< V > load (const std::string &filename)

  Load a pgm image in a Milena image.

- template<typename I>
  void load (Image< I > &ima, const std::string &filename)

  Load a pgm image in a Milena image.

- template<typename I>
  void save (const Image< I > &ima, const std::string &filename)

9.84.1 Detailed Description

Namespace of pgm input/output handling.

9.84.2 Function Documentation

9.84.2.1 template<typename V> image2d< V > mln::io::pgm::load (const std::string & *filename*) [inline]

Load a pgm image in a Milena image.

To use this routine, you should specialize the template whith the value type of the image loaded. (ex : load<value::int_u8>("..."))

Parameters:

← ***filename*** The image source.

Returns:

An image2d which contains loaded data.

Load a pgm image in a Milena image.

Load a pfm image in a image2d<float>.

Load a pbm image in a image2d<float>.

Parameters:

← ***filename*** The image source.

Returns:

An image2d<float> which contains loaded data.

9.84.2.2 template<typename I> void mln::io::pgm::load (Image< I > & *ima*, const std::string & *filename*) [inline]

Load a pgm image in a Milena image.

Parameters:

→ ***ima*** A reference to the image which will receive data.

← ***filename*** The source.

9.84.2.3 template<typename I> void mln::io::pgm::save (const Image< I > & *ima*, const std::string & *filename*) [inline]

Save a Milena image as a pgm image.

Parameters:

← ***ima*** The image to save.

↔ ***filename*** the destination.

References mln::io::pnm::save().

9.85 mln::io::pgms Namespace Reference

Namespace of pgms input/output handling.

Functions

- template<typename V>
  void load (image3d< V > &ima, const util::array< std::string > &filenames)

  Load pgm images as slices of a 3D Milena image.

9.85.1 Detailed Description

Namespace of pgms input/output handling.

9.85.2 Function Documentation

9.85.2.1 template<typename V> void mln::io::pgms::load (image3d< V > & *ima*, const util::array< std::string > & *filenames*) [inline]

Load pgm images as slices of a 3D Milena image.

Parameters:

→ ***ima*** A reference to the 3D image which will receive data.

← ***filenames*** The list of 2D images to load..

9.86 mln::io::plot Namespace Reference

Namespace of plot input/output handling.

Functions

- template< typename I >
  void load (util::array< I > &arr, const std::string &filename)
- template< typename T >
  void save (util::array< T > &arr, const std::string &filename, int start_value=0)

  Save a Milena array in a plot file.

- template< typename I >
  void save (const image1d< I > &ima, const std::string &filename)

  Save a Milena 1D image in a plot file.

9.86.1 Detailed Description

Namespace of plot input/output handling.

9.86.2 Function Documentation

9.86.2.1 template< typename I > void mln::io::plot::load (util::array< I > & *arr*, const std::string & *filename*) [inline]

Load a Milena 1D image from a plot file.

Parameters:

← ***ima*** A reference to the image to load.

→ ***filename*** The output file.

← ***start_value*** The start index value of the plot (optional).

Load a Milena array from a plot file.

Parameters:

← ***arr*** A reference to the array to load.

→ ***filename*** The output file.

References mln::util::array< T >::append(), and mln::util::array< T >::clear().

9.86.2.2 template< typename T > void mln::io::plot::save (util::array< T > & *arr*, const std::string & *filename*, int *start_value* = 0) [inline]

Save a Milena array in a plot file.

Parameters:

← ***arr*** A reference to the array to save.

→ ***filename*** The output file.

← ***start_value*** The start index value of the plot (optional).

9.86.2.3 template<typename I> void mln::io::plot::save (const image1d< I > & *ima*, const std::string & *filename*) [inline]

Save a Milena 1D image in a plot file.

Parameters:

← ***ima*** A reference to the image to save.

→ ***filename*** The output file.

9.87 mln::io::pnm Namespace Reference

Namespace of pnm input/output handling.

Namespaces

- namespace impl

  Namespace of pnm's implementation details.

Functions

- template<typename I>
  void load (char type_, Image< I > &ima_, const std::string &filename)

  An other way to load pnm files : the destination is an argument to check if the type match the file to load.

- template<typename V>
  image2d< V > load (char type_, const std::string &filename)

  main function : load pnm format

- template<typename I>
  void load_ascii_builtin (std::ifstream &file, I &ima)

  load_ascii for builtin value types.

- template<typename I>
  void load_ascii_value (std::ifstream &file, I &ima)

  load_ascii for Milena value types.

- template<typename I>
  void load_raw_2d (std::ifstream &file, I &ima)

  load_raw_2d.

- template<typename V>
  unsigned int max_component (const V &)

  Give the maximum value which can be stored as a component value type V.

- template<typename I>
  void save (char type, const Image< I > &ima_, const std::string &filename)

9.87.1 Detailed Description

Namespace of pnm input/output handling.

9.87.2 Function Documentation

9.87.2.1 template<typename I> void mln::io::pnm::load (char *type_*, Image< I > & *ima_*, const std::string & *filename*) [inline]

An other way to load pnm files : the destination is an argument to check if the type match the file to load.

References mln::make::box2d(), load_raw_2d(), and max_component().

9.87.2.2 template<typename V> image2d<V> mln::io::pnm::load (char *type_*, const std::string & *filename*) [inline]

main function : load pnm format

References load_raw_2d(), and max_component().

9.87.2.3 template<typename I> void mln::io::pnm::load_ascii_builtin (std::ifstream & *file*, I & *ima*) [inline]

load_ascii for builtin value types.

9.87.2.4 template<typename I> void mln::io::pnm::load_ascii_value (std::ifstream & *file*, I & *ima*) [inline]

load_ascii for Milena value types.

9.87.2.5 template<typename I> void mln::io::pnm::load_raw_2d (std::ifstream & *file*, I & *ima*) [inline]

load_raw_2d.

for all pnm 8/16 bits formats

Referenced by load().

9.87.2.6 template<typename V> unsigned int mln::io::pnm::max_component (const V &) [inline]

Give the maximum value which can be stored as a component value type V.

Referenced by load().

9.87.2.7 template<typename I> void mln::io::pnm::save (char *type*, const Image< I > & *ima_*, const std::string & *filename*) [inline]

Save a Milena image as a pnm image.

Parameters:

← ***type*** The type of the image to save (can be PPM, PGM, PBM).

← ***ima_*** The image to save.

↔ ***filename*** the destination.

Referenced by mln::io::ppm::save(), and mln::io::pgm::save().

9.88 mln::io::pnm::impl Namespace Reference

Namespace of pnm's implementation details.

9.88.1 Detailed Description

Namespace of pnm's implementation details.

9.89 mln::io::pnms Namespace Reference

Namespace of pnms input/output handling.

Functions

- template< typename V >
  void load (char type, image3d< V > &ima, const util::array< std::string > &filenames)
  Load pnm images as slices of a 3D Milena image.

9.89.1 Detailed Description

Namespace of pnms input/output handling.

9.89.2 Function Documentation

9.89.2.1 template< typename V > void mln::io::pnms::load (char *type*, image3d< V > & *ima*, const util::array< std::string > & *filenames*) [inline]

Load pnm images as slices of a 3D Milena image.

Parameters:

← ***type*** The type of the pnm files.

→ ***ima*** A reference to the 3D image which will receive data.

← ***filenames*** The list of 2D images to load..

References mln::make::image3d(), mln::util::array< T >::is_empty(), and mln::util::array< T >::nelements().

Referenced by mln::io::pbms::load().

9.90 mln::io::ppm Namespace Reference

Namespace of ppm input/output handling.

Functions

- template<typename V>
  image2d< V > load (const std::string &filename)
  Load a ppm image in a Milena image.
- template<typename I>
  void load (Image< I > &ima, const std::string &filename)
  Load a ppm image in a Milena image.
- template<typename I>
  void save (const Image< I > &ima, const std::string &filename)

9.90.1 Detailed Description

Namespace of ppm input/output handling.

9.90.2 Function Documentation

9.90.2.1 template<typename V> image2d< V > mln::io::ppm::load (const std::string & *filename*) [inline]

Load a ppm image in a Milena image.

To use this routine, you should specialize the template whith the value type of the image loaded. (ex : load<value::int_u8>("..."))

Parameters:

← ***filename*** The image source.

Returns:

An image2d which contains loaded data.

Load a ppm image in a Milena image.

Load a pgm image in a Milena image.

Load a pfm image in a image2d<float>.

Load a pbm image in a image2d<float>.

Parameters:

← ***filename*** The image source.

Returns:

An image2d<float> which contains loaded data.

9.90.2.2 template<typename I> void mln::io::ppm::load (Image< I > & *ima*, const std::string & *filename*) [inline]

Load a ppm image in a Milena image.

Parameters:

→ ***ima*** A reference to the image which will receive data.

← ***filename*** The source.

9.90.2.3 template<typename I> void mln::io::ppm::save (const Image< I > & *ima*, const std::string & *filename*) [inline]

Save a Milena image as a ppm image.

Parameters:

← ***ima*** The image to save.

↔ ***filename*** the destination.

References mln::io::pnm::save().

Referenced by mln::registration::icp().

9.91 mln::io::ppms Namespace Reference

Namespace of ppms input/output handling.

Functions

- template<typename V>
  void load (image3d< V > &ima, const util::array< std::string > &filenames)

  Load ppm images as slices of a 3D Milena image.

9.91.1 Detailed Description

Namespace of ppms input/output handling.

9.91.2 Function Documentation

9.91.2.1 template<typename V> void mln::io::ppms::load (image3d< V > & *ima*, const util::array< std::string > & *filenames*) [inline]

Load ppm images as slices of a 3D Milena image.

Parameters:

→ ***ima*** A reference to the 3D image which will receive data.

← ***filenames*** The list of 2D images to load..

9.92 mln::io::tiff Namespace Reference

Namespace of tiff input/output handling.

Functions

- template<typename I>
  void load (Image< I > &ima_, const std::string &filename)

  Load a TIFF image to a Milena image.

9.92.1 Detailed Description

Namespace of tiff input/output handling.

9.92.2 Function Documentation

9.92.2.1 template<typename I> void mln::io::tiff::load (Image< I > & *ima_*, const std::string & *filename*) [inline]

Load a TIFF image to a Milena image.

9.93 mln::io::txt Namespace Reference

Namespace of txt input/output handling.

Functions

- void save (const image2d< char > &ima, const std::string &filename)
  Save an image as txt file.

9.93.1 Detailed Description

Namespace of txt input/output handling.

9.93.2 Function Documentation

9.93.2.1 void mln::io::txt::save (const image2d< char > & *ima*, const std::string & *filename*) [inline]

Save an image as txt file.

Parameters:

← ***ima*** The image to save. Must be an image of char.

← ***filename*** the destination.

References mln::image2d< T >::domain().

9.94 mln::labeling Namespace Reference

Namespace of labeling routines.

Namespaces

- namespace impl

  Implementation namespace of labeling namespace.

Functions

- template<typename I, typename N, typename L>
  mln::trait::ch_value< I, L >::ret background (const Image< I > &input, const Neighborhood< N > &nbh, L &nlabels)
- template<typename I, typename N, typename L>
  mln::trait::ch_value< I, L >::ret blobs (const Image< I > &input, const Neighborhood< N > &nbh, L &nlabels)

  Connected component labeling of the binary objects of a binary image.

- template<typename I, typename N, typename L, typename A>
  util::couple< mln::trait::ch_value< I, L >::ret, util::array< typename A::result > > blobs_and_compute (const Image< I > &input, const Neighborhood< N > &nbh, L &nlabels, const Accumulator< A > &accu)
- template<typename V, typename L>
  mln::trait::ch_value< L, V >::ret colorize (const V &value, const Image< L > &labeled_image, const typename L::value &nlabels)

  Create a new color image from a labeled image and fill each component with a random color.

- template<typename A, typename L>
  util::array< mln_meta_accu_result(A, typename L::psite)> compute (const Meta_Accumulator< A > &a, const Image< L > &label, const typename L::value &nlabels)

  Compute an accumulator onto the pixel sites of each component domain of `label`.

- template<typename A, typename L>
  util::array< typename A::result > compute (const Accumulator< A > &a, const Image< L > &label, const typename L::value &nlabels)

  Compute an accumulator onto the pixel sites of each component domain of `label`.

- template<typename A, typename I, typename L>
  util::array< mln_meta_accu_result(A, typename I::value)> compute (const Meta_Accumulator< A > &a, const Image< I > &input, const Image< L > &label, const typename L::value &nlabels)

  Compute an accumulator onto the pixel values of the image `input`.

- template<typename A, typename I, typename L>
  util::array< typename A::result > compute (const Accumulator< A > &a, const Image< I > &input, const Image< L > &label, const typename L::value &nlabels)

  Compute an accumulator onto the pixel values of the image `input`.

- template<typename A, typename I, typename L>
util::array< typename A::result > compute (util::array< A > &a, const Image< I > &input, const Image< L > &label, const typename L::value &nlabels)

  Compute an accumulator onto the pixel values of the image `input`.

- template<typename A, typename I, typename L>
mln::trait::ch_value< L, mln_meta_accu_result(A, typename I::value) >::ret compute_image (const Meta_Accumulator< A > &accu, const Image< I > &input, const Image< L > &labels, const typename L::value &nlabels)

  Compute an accumulator onto the pixel values of the image `input`.

- template<typename A, typename I, typename L>
mln::trait::ch_value< L, typename A::result >::ret compute_image (const Accumulator< A > &accu, const Image< I > &input, const Image< L > &labels, const typename L::value &nlabels)

  Compute an accumulator onto the pixel values of the image `input`.

- template<typename A, typename I, typename L>
mln::trait::ch_value< L, typename A::result >::ret compute_image (const util::array< typename A::result > &a, const Image< I > &input, const Image< L > &labels, const typename L::value &nlabels)

  Compute an accumulator onto the pixel values of the image `input`.

- template<typename I, typename N, typename L>
I fill_holes (const Image< I > &input, const Neighborhood< N > &nbh, L &nlabels)

  Filling holes of a single object in a binary image.

- template<typename I, typename N, typename L>
mln::trait::ch_value< I, L >::ret flat_zones (const Image< I > &input, const Neighborhood< N > &nbh, L &nlabels)

  Connected component labeling of the flat zones of an image.

- template<typename I, typename N, typename L>
mln::trait::ch_value< I, L >::ret foreground (const Image< I > &input, const Neighborhood< N > &nbh, L &nlabels)
- template<typename I>
mln::trait::concrete< I >::ret pack (const Image< I > &label, typename I::value &new_nlabels, fun::i2v::array< typename I::value > &repack_fun)

  Relabel a labeled image in order to have a contiguous labeling.

- template<typename I>
void pack_inplace (Image< I > &label, typename I::value &new_nlabels, fun::i2v::array< typename I::value > &repack_fun)

  Relabel inplace a labeled image in order to have a contiguous labeling.

- template<typename I, typename N, typename L>
mln::trait::ch_value< I, L >::ret regional_maxima (const Image< I > &input, const Neighborhood< N > &nbh, L &nlabels)
- template<typename I, typename N, typename L>
mln::trait::ch_value< I, L >::ret regional_minima (const Image< I > &input, const Neighborhood< N > &nbh, L &nlabels)

- template<typename I, typename F>
  mln::trait::concrete< I >::ret relabel (const Image< I > &label, const typename I::value &nlabels, const Function_v2v< F > &fv2v)

  Remove components and relabel a labeled image.

- template<typename I, typename F>
  mln::trait::concrete< I >::ret relabel (const Image< I > &label, const typename I::value &nlabels, typename I::value &new_nlabels, const Function_v2b< F > &fv2b)

  Remove components and relabel a labeled image.

- template<typename I, typename F>
  void relabel_inplace (Image< I > &label, typename I::value &nlabels, const Function_v2v< F > &fv2v)

  Remove components and relabel a labeled image inplace.

- template<typename I, typename F>
  void relabel_inplace (Image< I > &label, typename I::value &nlabels, const Function_v2b< F > &fv2b)

  Remove components and relabel a labeled image inplace.

- template<typename I, typename J>
  mln::trait::concrete< I >::ret superpose (const Image< I > &lhs, const typename I::value &lhs_-nlabels, const Image< J > &rhs, const typename J::value &rhs_nlabels, typename I::value &new_-nlabels)

  Superpose two labeled image.

- template<typename I, typename N, typename L>
  mln::trait::ch_value< I, L >::ret value (const Image< I > &input, const typename I::value &val, const Neighborhood< N > &nbh, L &nlabels)

  Connected component labeling of the image sites at a given value.

- template<typename I>
  mln::trait::ch_value< I, mln::value::label_8 >::ret wrap (const Image< I > &input)

  Wrap labels such as 0 -> 0 and [1, lmax] maps to [1, Lmax] (using modulus).

- template<typename V, typename I>
  mln::trait::ch_value< I, V >::ret wrap (const V &value_type, const Image< I > &input)

  Wrap labels such as 0 -> 0 and [1, lmax] maps to [1, Lmax] (using modulus).

9.94.1 Detailed Description

Namespace of labeling routines.

9.94.2 Function Documentation

9.94.2.1 template<typename I, typename N, typename L> mln::trait::ch_value< I, L >::ret mln::labeling::background (const Image< I > & *input*, const Neighborhood< N > & *nbh*, L & *nlabels*) `[inline]`

Connected component labeling of the background part in a binary image.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of the background.

→ ***nlabels*** The number of labels.

Returns:

The label image.

Precondition:

The input image has to be binary (checked at compile-time).

This routine actually calls mln::labeling::value with the value set to `false`.

See also:

mln::labeling::value

References value().

Referenced by fill_holes().

9.94.2.2 template<typename I, typename N, typename L> mln::trait::ch_value< I, L >::ret mln::labeling::blobs (const Image< I > & *input*, const Neighborhood< N > & *nbh*, L & *nlabels*) `[inline]`

Connected component labeling of the binary objects of a binary image.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of the objects.

→ ***nlabels*** The Number of labels. Its value is set in the algorithms.

Returns:

The label image.

Precondition:

The input image has to be binary (checked at compile-time).

A fast queue is used so that the algorithm is not recursive and can handle large binary objects (blobs).

References mln::canvas::labeling::blobs().

Referenced by mln::graph::labeling().

9.94.2.3 template<typename I, typename N, typename L, typename A> util::couple< mln::trait::ch_value< I, L >::ret, util::array< typename A::result > > mln::labeling::blobs_and_compute (const Image< I > & *input*, const Neighborhood< N > & *nbh*, L & *nlabels*, const Accumulator< A > & *accu*) `[inline]`

Label an image and compute given accumulators.

Parameters:

← ***input*** A binary image.

← ***nbh*** A neighborhood used for labeling.

↔ ***nlabels*** The number of labels found.

← ***accu*** An accumulator to be computed while labeling.

References mln::canvas::labeling::blobs(), and mln::make::couple().

9.94.2.4 template<typename V, typename L> mln::trait::ch_value< L, V >::ret mln::labeling::colorize (const V & *value*, const Image< L > & *labeled_image*, const typename L::value & *nlabels*) `[inline]`

Create a new color image from a labeled image and fill each component with a random color.

litera::black is used for component 0, e.g. the background. Min and max values for RGB values can be set through the global variables mln::labeling::colorize_::min_value and mln::labeling::colorize_::max_value.

Parameters:

← ***value*** value type used in the returned image.

← ***labeled_image*** A labeled image (

See also:

labeling::blobs).

Parameters:

← ***nlabels*** Number of labels.

References mln::literal::black, and mln::data::transform().

9.94.2.5 template<typename A, typename L> util::array< mln_meta_accu_result(A, typename L::psite)> mln::labeling::compute (const Meta_Accumulator< A > & *a*, const Image< L > & *label*, const typename L::value & *nlabels*) `[inline]`

Compute an accumulator onto the pixel sites of each component domain of `label`.

Parameters:

← ***a*** A meta-accumulator.

← ***label*** The labeled image.

← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

References compute().

9.94.2.6 template<typename A, typename L> util::array< typename A::result > mln::labeling::compute (const Accumulator< A > & *a_*, const Image< L > & *label_*, const typename L::value & *nlabels*) [inline]

Compute an accumulator onto the pixel sites of each component domain of `label`.

Parameters:

← ***a*** An accumulator.

← ***label*** The labeled image.

← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

Compute an accumulator onto the pixel sites of each component domain of `label`.

Parameters:

← ***a_*** An accumulator.

← ***label_*** The labeled image.

← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

9.94.2.7 template<typename A, typename I, typename L> util::array< mln_meta_accu_result(A, typename I::value)> mln::labeling::compute (const Meta_Accumulator< A > & *a*, const Image< I > & *input*, const Image< L > & *label*, const typename L::value & *nlabels*) [inline]

Compute an accumulator onto the pixel values of the image `input`.

for each component of the image `label`.

Parameters:

← ***a*** A meta-accumulator.

← ***input*** The input image.

← ***label*** The labeled image.

← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

References compute().

9.94.2.8 template< typename A, typename I, typename L > util::array< typename A::result > mln::labeling::compute (const Accumulator< A > & *a_*, const Image< I > & *input_*, const Image< L > & *label_*, const typename L::value & *nlabels*) [inline]

Compute an accumulator onto the pixel values of the image `input`.

for each component of the image `label`.

Parameters:

← ***a*** An accumulator.

← ***input*** The input image.

← ***label*** The labeled image.

← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

Compute an accumulator onto the pixel values of the image `input`.

Parameters:

← ***a_*** An accumulator.

← ***input_*** The input image.

← ***label_*** The labeled image.

← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

9.94.2.9 template< typename A, typename I, typename L > util::array< typename A::result > mln::labeling::compute (util::array< A > & *accus*, const Image< I > & *input_*, const Image< L > & *label_*, const typename L::value & *nlabels*) [inline]

Compute an accumulator onto the pixel values of the image `input`.

for each component of the image `label`.

Parameters:

← ***a*** An array of accumulator.

← ***input*** The input image.

← ***label*** The labeled image.

← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

Compute an accumulator onto the pixel values of the image `input`.

Parameters:

← ***accus*** An array of accumulators.
← ***input_*** The input image.
← ***label_*** The labeled image.
← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

Referenced by compute(), compute_image(), fill_holes(), mln::make::p_edges_with_mass_centers(), and mln::make::p_vertices_with_mass_centers().

9.94.2.10 template<typename A, typename I, typename L> mln::trait::ch_value< L, mln_meta_accu_result(A, typename I::value) >::ret mln::labeling::compute_image (const Meta_Accumulator< A > & *accu*, const Image< I > & *input*, const Image< L > & *labels*, const typename L::value & *nlabels*) `[inline]`

Compute an accumulator onto the pixel values of the image `input`.

for each component of the image `label`.

Parameters:

← ***accu*** The meta-accumulator.
← ***input*** The input image (values).
← ***labels*** The label image.
← ***nlabels*** The count of labels.

Returns:

The image where labels are replaced by the result of the accumulator.

References compute().

9.94.2.11 template<typename A, typename I, typename L> mln::trait::ch_value< L, typename A::result >::ret mln::labeling::compute_image (const Accumulator< A > & *accu*, const Image< I > & *input*, const Image< L > & *labels*, const typename L::value & *nlabels*) `[inline]`

Compute an accumulator onto the pixel values of the image `input`.

for each component of the image `label`.

Parameters:

← ***accu*** The accumulator.
← ***input*** The input image (values).
← ***labels*** The label image.
← ***nlabels*** The count of labels.

Returns:

The image where labels are replaced by the result of the accumulator.

References compute().

9.94.2.12 template<typename A, typename I, typename L> mln::trait::ch_value< L , typename A ::result >::ret mln::labeling::compute_image (const util::array< typename A::result > & *a*, const Image< I > & *input*, const Image< L > & *labels*, const typename L::value & *nlabels*) `[inline]`

Compute an accumulator onto the pixel values of the image `input`.

for each component of the image `label`.

Parameters:

← ***a*** The mln::p_array of accumulator result.

← ***input*** The input image (values).

← ***labels*** The label image.

← ***nlabels*** The count of labels.

Returns:

The image where labels are replaced by the result of the accumulator.

9.94.2.13 template<typename I, typename N, typename L> I mln::labeling::fill_holes (const Image< I > & *input*, const Neighborhood< N > & *nbh*, L & *nlabels*) `[inline]`

Filling holes of a single object in a binary image.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of the background.

→ ***nlabels*** The number of labels.

Returns:

The binary image with a simple object without holes.

Precondition:

The input image has to be binary (checked at compile-time).

This routine actually calls mln::labeling::background

See also:

mln::labeling::background

References background(), compute(), mln::data::fill(), mln::initialize(), and mln::util::array< T >::nelements().

9.94.2.14 template<typename I, typename N, typename L> mln::trait::ch_value< I, L >::ret mln::labeling::flat_zones (const Image< I > & *input*, const Neighborhood< N > & *nbh*, L & *nlabels*) `[inline]`

Connected component labeling of the flat zones of an image.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of the flat zones.

→ ***nlabels*** The number of labels.

Returns:

The label image.

9.94.2.15 template< typename I, typename N, typename L > mln::trait::ch_value< I, L >::ret mln::labeling::foreground (const Image< I > & *input*, const Neighborhood< N > & *nbh*, L & *nlabels*) [inline]

Connected component labeling of the object part in a binary image.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of the foreground.

→ ***nlabels*** The number of labels.

Returns:

The label image.

Precondition:

The input image has to be binary (checked at compile-time).

This routine actually calls mln::labeling::value with the value set to `true`.

See also:

mln::labeling::value

References value().

9.94.2.16 template< typename I > mln::trait::concrete< I >::ret mln::labeling::pack (const Image< I > & *label*, typename I::value & *new_nlabels*, fun::i2v::array< typename I::value > & *repack_fun*) [inline]

Relabel a labeled image in order to have a contiguous labeling.

Parameters:

← ***label*** The labeled image.

→ ***new_nlabels*** The number of labels after relabeling.

→ ***repack_fun*** The function used to repack the labels.

Returns:

The relabeled image.

References mln::data::compute(), mln::make::relabelfun(), and mln::data::transform().

9.94.2.17 template<typename I> void mln::labeling::pack_inplace (Image< I > & *label*, typename I::value & *new_nlabels*, fun::i2v::array< typename I::value > & *repack_fun*) [inline]

Relabel inplace a labeled image in order to have a contiguous labeling.

Parameters:

← ***label*** The labeled image.

→ ***new_nlabels*** The number of labels after relabeling.

→ ***repack_fun*** The function used to repack the labels.

References mln::data::compute(), mln::make::relabelfun(), and mln::data::transform().

9.94.2.18 template<typename I, typename N, typename L> mln::trait::ch_value< I, L >::ret mln::labeling::regional_maxima (const Image< I > & *input*, const Neighborhood< N > & *nbh*, L & *nlabels*) [inline]

Connected component labeling of the regional maxima of an image.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of the regional maxima.

→ ***nlabels*** The number of labeled regions.

Returns:

The label image.

9.94.2.19 template<typename I, typename N, typename L> mln::trait::ch_value< I, L >::ret mln::labeling::regional_minima (const Image< I > & *input*, const Neighborhood< N > & *nbh*, L & *nlabels*) [inline]

Connected component labeling of the regional minima of an image.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of the regional minima.

→ ***nlabels*** The number of labeled regions.

Returns:

The label image.

Referenced by mln::morpho::meyer_wst().

9.94.2.20 template<typename I, typename F> mln::trait::concrete< I >::ret mln::labeling::relabel (const Image< I > & *label*, const typename I::value & *nlabels*, const Function_v2v< F > & *fv2v*) [inline]

Remove components and relabel a labeled image.

Parameters:

← ***label*** the labeled image.

← ***nlabels*** the number of labels in `label`.

← ***fv2v*** function returning the new component id for each pixel value.

Returns:

the relabeled image.

References mln::data::transform().

9.94.2.21 template<typename I, typename F> mln::trait::concrete< I >::ret mln::labeling::relabel (const Image< I > & *label*, const typename I::value & *nlabels*, typename I::value & *new_nlabels*, const Function_v2b< F > & *fv2b*) [inline]

Remove components and relabel a labeled image.

Parameters:

← ***label*** the labeled image.

← ***nlabels*** the number of labels in `label`.

→ ***new_nlabels*** the number of labels after relabeling.

← ***fv2b*** function returning whether a label must be replaced by the background.

Returns:

the relabeled image.

References mln::make::relabelfun().

Referenced by superpose().

9.94.2.22 template<typename I, typename F> void mln::labeling::relabel_inplace (Image< I > & *label*, typename I::value & *nlabels*, const Function_v2v< F > & *fv2v*) [inline]

Remove components and relabel a labeled image inplace.

Parameters:

↔ ***label*** the labeled image.

↔ ***nlabels*** the number of labels in `label`.

← ***fv2v*** function returning the new component id for each pixel value.

References mln::data::transform_inplace().

9.94.2.23 template< typename I, typename F > void mln::labeling::relabel_inplace (Image< I > & *label*, typename I::value & *nlabels*, const Function_v2b< F > & *fv2b*) [inline]

Remove components and relabel a labeled image inplace.

Parameters:

↔ ***label*** the labeled image.

↔ ***nlabels*** the number of labels in `label`.

← ***fv2b*** function returning whether a label must be replaced by the background.

References mln::make::relabelfun().

Referenced by mln::labeled_image_base< I, E >::relabel().

9.94.2.24 template< typename I, typename J > mln::trait::concrete< I >::ret mln::labeling::superpose (const Image< I > & *lhs*, const typename I::value & *lhs_nlabels*, const Image< J > & *rhs*, const typename J::value & *rhs_nlabels*, typename I::value & *new_nlabels*) [inline]

Superpose two labeled image.

Labels in `lhs` are preserved in the output. Labels of `rhs` are renumbered from the last label value of `lhs`. It avoids duplicate label values in several components.

Parameters:

← ***lhs*** A labeled image.

← ***lhs_nlabels*** The number of labels in `lhs`.

← ***rhs*** A labeled image.

← ***rhs_nlabels*** The number of labels in `rhs`.

→ ***new_nlabels*** The number of labels in the output image.

Returns:

An image with all the components of `rhs` and `lhs`.

Precondition:

`rhs` and lhs must have the same domain.
`The` value type of rhs must be convertible towards lhs's.

References mln::duplicate(), mln::data::paste(), relabel(), and mln::literal::zero.

9.94.2.25 template< typename I, typename N, typename L > mln::trait::ch_value< I, L >::ret mln::labeling::value (const Image< I > & *input*, const typename I::value & *val*, const Neighborhood< N > & *nbh*, L & *nlabels*) [inline]

Connected component labeling of the image sites at a given value.

Parameters:

← ***input*** The input image.

← ***val*** The value to consider.

← ***nbh*** The connectivity of components.

→ ***nlabels*** The number of labels.

Returns:

The label image.

Referenced by background(), and foreground().

9.94.2.26 template<typename I> mln::trait::ch_value< I, mln::value::label_8 >::ret mln::labeling::wrap (const Image< I > & *input*) [inline]

Wrap labels such as 0 -> 0 and [1, lmax] maps to [1, Lmax] (using modulus).

Use label_8 as label type.

Parameters:

← ***input*** The label image.

Returns:

A new image with values wrapped with type label_8.

References wrap().

9.94.2.27 template<typename V, typename I> mln::trait::ch_value< I, V >::ret mln::labeling::wrap (const V & *value_type*, const Image< I > & *input*) [inline]

Wrap labels such as 0 -> 0 and [1, lmax] maps to [1, Lmax] (using modulus).

Parameters:

← ***value_type*** The type used to wrap the label type.

← ***input*** The label image.

Returns:

A new image with values wrapped with type V.

References mln::data::transform().

Referenced by wrap().

9.95 mln::labeling::impl Namespace Reference

Implementation namespace of labeling namespace.

Namespaces

- namespace generic

  Generic implementation namespace of labeling namespace.

9.95.1 Detailed Description

Implementation namespace of labeling namespace.

9.96 mln::labeling::impl::generic Namespace Reference

Generic implementation namespace of labeling namespace.

Functions

- template<typename A, typename I, typename L>
  util::array< typename A::result > compute (util::array< A > &accus, const Image< I > &input_, const Image< L > &label_, const typename L::value &nlabels)

  Generic implementation of labeling::compute.

- template<typename A, typename I, typename L>
  util::array< typename A::result > compute (const Accumulator< A > &a_, const Image< I > &input_, const Image< L > &label_, const typename L::value &nlabels)

  Generic implementation of labeling::compute.

- template<typename A, typename L>
  util::array< typename A::result > compute (const Accumulator< A > &a_, const Image< L > &label_, const typename L::value &nlabels)

  Generic implementation of labeling::compute.

9.96.1 Detailed Description

Generic implementation namespace of labeling namespace.

9.96.2 Function Documentation

9.96.2.1 template<typename A, typename I, typename L> util::array<typename A ::result> mln::labeling::impl::generic::compute (util::array< A > & *accus*, const Image< I > & *input_*, const Image< L > & *label_*, const typename L::value & *nlabels*) `[inline]`

Generic implementation of labeling::compute.

Compute an accumulator onto the pixel values of the image `input`.

Parameters:

← ***accus*** An array of accumulators.

← ***input_*** The input image.

← ***label_*** The labeled image.

← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

Referenced by mln::labeling::compute(), mln::labeling::compute_image(), mln::labeling::fill_holes(), mln::make::p_edges_with_mass_centers(), and mln::make::p_vertices_with_mass_centers().

9.96.2.2 template<typename A, typename I, typename L> util::array<typename A ::result> mln::labeling::impl::generic::compute (const Accumulator< A > & *a_*, const Image< I > & *input_*, const Image< L > & *label_*, const typename L::value & *nlabels*) [inline]

Generic implementation of labeling::compute.

Compute an accumulator onto the pixel values of the image `input`.

Parameters:

← ***a_*** An accumulator.

← ***input_*** The input image.

← ***label_*** The labeled image.

← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

9.96.2.3 template<typename A, typename L> util::array<typename A ::result> mln::labeling::impl::generic::compute (const Accumulator< A > & *a_*, const Image< L > & *label_*, const typename L::value & *nlabels*) [inline]

Generic implementation of labeling::compute.

Compute an accumulator onto the pixel sites of each component domain of `label`.

Parameters:

← ***a_*** An accumulator.

← ***label_*** The labeled image.

← ***nlabels*** The number of labels in `label`.

Returns:

A mln::p_array of accumulator result (one result per label).

9.97 mln::linear Namespace Reference

Namespace of linear image processing routines.

Namespaces

- namespace impl

  Namespace of linear image processing routines implementation details.

- namespace local

  Specializations of local linear routines.

Functions

- template<typename I>
  mln::trait::concrete< I >::ret gaussian (const Image< I > &input, float sigma, int dir)
- template<typename I>
  mln::trait::concrete< I >::ret gaussian (const Image< I > &input, float sigma)

  Gaussian filter of an image `input`.

- template<typename I>
  mln::trait::concrete< I >::ret gaussian_1st_derivative (const Image< I > &input, float sigma)
- template<typename I>
  mln::trait::concrete< I >::ret gaussian_1st_derivative (const Image< I > &input, float sigma, int dir)
- template<typename I>
  mln::trait::concrete< I >::ret gaussian_2nd_derivative (const Image< I > &input, float sigma)
- template<typename I>
  mln::trait::concrete< I >::ret gaussian_2nd_derivative (const Image< I > &input, float sigma, int dir)
- template<typename I, typename W>
  mln_ch_convolve (I, W) convolve(const Image< I > &input
- template<typename I>
  mln_ch_convolve_grad (I, int) sobel_2d(const Image< I > &input)

  Compute the vertical component of the 2D Sobel gradient.

  - template<typename I>
    mln_ch_convolve (I, int) sobel_2d_h(const Image< I > &input)

    Sobel_2d gradient components.

9.97.1 Detailed Description

Namespace of linear image processing routines.

9.97.2 Function Documentation

9.97.2.1 template<typename I> mln::trait::concrete< I >::ret mln::linear::gaussian (const Image< I > & *input*, float *sigma*, int *dir*) [inline]

Apply an approximated gaussian filter of `sigma` on `input`. on a specific direction `dir` if `dir` = 0, the filter is applied on the first image dimension. if `dir` = 1, the filter is applied on the second image dimension. And so on...

Precondition:

input.is_valid
dir < dimension(input)

References mln::initialize().

9.97.2.2 template<typename I> mln::trait::concrete< I >::ret mln::linear::gaussian (const Image< I > & *input*, float *sigma*) [inline]

Gaussian filter of an image `input`.

Precondition:

output.domain = input.domain

Apply an approximated gaussian filter of `sigma` on `input`. This filter is applied in all the input image direction.

Precondition:

input.is_valid

References mln::initialize().

Referenced by mln::subsampling::gaussian_subsampling().

9.97.2.3 template<typename I> mln::trait::concrete< I >::ret mln::linear::gaussian_1st_-derivative (const Image< I > & *input*, float *sigma*) [inline]

Apply an approximated first derivative gaussian filter of `sigma` on `input` This filter is applied in all the input image direction.

Precondition:

input.is_valid

References mln::initialize().

9.97.2.4 template<typename I> mln::trait::concrete< I >::ret mln::linear::gaussian_-1st_derivative (const Image< I > & *input*, float *sigma*, int *dir*) [inline]

Apply an approximated first derivative gaussian filter of `sigma` on `input`. on a specific direction `dir` if `dir` = 0, the filter is applied on the first image dimension. if `dir` = 1, the filter is applied on the second image dimension. And so on...

Precondition:

input.is_valid
dir < dimension(input)

References mln::initialize().

9.97.2.5 template<typename I> mln::trait::concrete< I >::ret mln::linear::gaussian_2nd_-derivative (const Image< I > & *input*, float *sigma*) [inline]

Apply an approximated second derivative gaussian filter of `sigma` on `input` This filter is applied in all the input image direction.

Precondition:

input.is_valid

References mln::initialize().

9.97.2.6 template<typename I> mln::trait::concrete< I >::ret mln::linear::gaussian_-2nd_derivative (const Image< I > & *input*, float *sigma*, int *dir*) [inline]

Apply an approximated second derivative gaussian filter of `sigma` on `input`. on a specific direction `dir` if `dir` = 0, the filter is applied on the first image dimension. if `dir` = 1, the filter is applied on the second image dimension. And so on...

Precondition:

input.is_valid
dir < dimension(input)

References mln::initialize().

9.97.2.7 template<typename I> mln::linear::mln_ch_convolve (I, int) const [inline]

Sobel_2d gradient components.

Compute the L1 norm of the 2D Sobel gradient.

Compute the vertical component of the 2D Sobel gradient.

Compute the horizontal component of the 2D Sobel gradient.

References mln_ch_convolve(), and mln::make::w_window2d().

9.97.2.8 template<typename I, typename W> mln::linear::mln_ch_convolve (I, W) const [inline]

Convolution of an image `input` by the weighted window `w_win`.

Warning:

Computation of `output(p)` is performed with the value type of `output`.
The weighted window is used as-is, considering that its symmetrization is handled by the client.

Precondition:

input.is_valid

Convolution of an image `input` by two weighted line-shapes windows.

Warning:

The weighted window is used as-is, considering that its symmetrization is handled by the client.

Precondition:

input.is_valid

Convolution of an image `input` by a line-shaped (directional) weighted window defined by the array of `weights`.

Warning:

Computation of `output(p)` is performed with the value type of `output`.
The weighted window is used as-is, considering that its symmetrization is handled by the client.

Precondition:

input.is_valid

Referenced by mln_ch_convolve(), and mln_ch_convolve_grad().

9.97.2.9 template<typename I> mln::linear::mln_ch_convolve_grad (I, int) const `[inline]`

Compute the vertical component of the 2D Sobel gradient.

References mln_ch_convolve(), and mln::data::transform().

9.98 mln::linear::impl Namespace Reference

Namespace of linear image processing routines implementation details.

9.98.1 Detailed Description

Namespace of linear image processing routines implementation details.

9.99 mln::linear::local Namespace Reference

Specializations of local linear routines.

Namespaces

- namespace impl

  Namespace of local linear routines implementation details.

Functions

- template<typename P, typename W, typename R>
  void convolve (const Generalized_Pixel< P > &p, const Weighted_Window< W > &w_win, R &result)
- template<typename I, typename P, typename W, typename R>
  void convolve (const Image< I > &input, const Site< P > &p, const Weighted_Window< W > &w_win, R &result)

9.99.1 Detailed Description

Specializations of local linear routines.

9.99.2 Function Documentation

9.99.2.1 template<typename P, typename W, typename R> void mln::linear::local::convolve (const Generalized_Pixel< P > & *p*, const Weighted_Window< W > & *w_win*, R & *result*) [inline]

Local convolution around (generalized) pixel `by` the weighted window `w_win`.

Warning:

Computation of the `result` is performed with the type `R`.
The weighted window is used as-is, considering that its symmetrization is handled by the client.

References convolve().

9.99.2.2 template<typename I, typename P, typename W, typename R> void mln::linear::local::convolve (const Image< I > & *input*, const Site< P > & *p*, const Weighted_Window< W > & *w_win*, R & *result*) [inline]

Local convolution of image `input` at point `p` by the weighted window `w_win`.

Warning:

Computation of the `result` is performed with the type `R`.
The weighted window is used as-is, considering that its symmetrization is handled by the client.

Referenced by convolve().

9.100 mln::linear::local::impl Namespace Reference

Namespace of local linear routines implementation details.

9.100.1 Detailed Description

Namespace of local linear routines implementation details.

9.101 mln::literal Namespace Reference

Namespace of literals.

Classes

- struct black_t

    Type of literal black.

- struct blue_t

    Type of literal blue.

- struct brown_t

    Type of literal brown.

- struct cyan_t

    Type of literal cyan.

- struct green_t

    Type of literal green.

- struct identity_t

    Type of literal identity.

- struct light_gray_t

    Type of literal grays.

- struct lime_t

    Type of literal lime.

- struct magenta_t

    Type of literal magenta.

- struct max_t

    Type of literal max.

- struct min_t

    Type of literal min.

- struct olive_t

    Type of literal olive.

- struct one_t

    Type of literal one.

- struct orange_t

    Type of literal orange.

- struct origin_t

Type of literal origin.

- struct pink_t

  Type of literal pink.

- struct purple_t

  Type of literal purple.

- struct red_t

  Type of literal red.

- struct teal_t

  Type of literal teal.

- struct violet_t

  Type of literal violet.

- struct white_t

  Type of literal white.

- struct yellow_t

  Type of literal yellow.

- struct zero_t

  Type of literal zero.

Variables

- const black_t & black = black_t()

  Literal black.

- const blue_t & blue = blue_t()

  Literal blue.

- const brown_t & brown = brown_t()

  Literal brown.

- const cyan_t & cyan = cyan_t()

  Literal cyan.

- const dark_gray_t & dark_gray = dark_gray_t()

  Literal dark gray.

- const green_t & green = green_t()

  Literal green.

- const identity_t & identity = identity_t()

  Literal identity.

- const light_gray_t & light_gray = light_gray_t()
  Literal light gray.
- const lime_t & lime = lime_t()
  Literal lime.
- const magenta_t & magenta = magenta_t()
  Literal magenta.
- const max_t & max = max_t()
  Literal max.
- const medium_gray_t & medium_gray = medium_gray_t()
  Literal medium_gray.
- const min_t & min = min_t()
  Literal min.
- const olive_t & olive = olive_t()
  Literal olive.
- const one_t & one = one_t()
  Literal one.
- const orange_t & orange = orange_t()
  Literal orange.
- const origin_t & origin = origin_t()
  Literal origin.
- const pink_t & pink = pink_t()
  Literal pink.
- const purple_t & purple = purple_t()
  Literal purple.
- const red_t & red = red_t()
  Literal red.
- const teal_t & teal = teal_t()
  Literal teal.
- const violet_t & violet = violet_t()
  Literal violet.
- const white_t & white = white_t()
  Literal white.
- const yellow_t & yellow = yellow_t()
  Literal yellow.

- const zero_t & zero = zero_t()

  Literal zero.

9.101.1 Detailed Description

Namespace of literals.

9.101.2 Variable Documentation

9.101.2.1 const black_t & mln::literal::black = black_t()

Literal black.

Referenced by mln::labeling::colorize(), and mln::registration::icp().

9.101.2.2 const blue_t & mln::literal::blue = blue_t()

Literal blue.

9.101.2.3 const brown_t & mln::literal::brown = brown_t()

Literal brown.

9.101.2.4 const cyan_t & mln::literal::cyan = cyan_t()

Literal cyan.

9.101.2.5 const dark_gray_t & mln::literal::dark_gray = dark_gray_t()

Literal dark gray.

9.101.2.6 const green_t & mln::literal::green = green_t()

Literal green.

Referenced by mln::registration::icp(), and mln::make_debug_graph_image().

9.101.2.7 const identity_t & mln::literal::identity = identity_t()

Literal identity.

9.101.2.8 const light_gray_t & mln::literal::light_gray = light_gray_t()

Literal light gray.

9.101.2.9 const lime_t & mln::literal::lime = lime_t()

Literal lime.

9.101.2.10 const magenta_t & mln::literal::magenta = magenta_t()

Literal magenta.

9.101.2.11 const max_t & mln::literal::max = max_t()

Literal max.

9.101.2.12 const medium_gray_t & mln::literal::medium_gray = medium_gray_t()

Literal medium_gray.

9.101.2.13 const min_t & mln::literal::min = min_t()

Literal min.

9.101.2.14 const olive_t & mln::literal::olive = olive_t()

Literal olive.

9.101.2.15 const one_t & mln::literal::one = one_t()

Literal one.

Referenced by mln::algebra::h_vec< d, C >::h_vec(), mln::operator++(), and mln::operator–().

9.101.2.16 const orange_t & mln::literal::orange = orange_t()

Literal orange.

9.101.2.17 const origin_t & mln::literal::origin = origin_t()

Literal origin.

Referenced by mln::win::ball< G, C >::ball(), mln::geom::bbox(), mln::box< P >::box(), mln::geom::rotate(), and mln::make::w_window().

9.101.2.18 const pink_t & mln::literal::pink = pink_t()

Literal pink.

9.101.2.19 const purple_t & mln::literal::purple = purple_t()

Literal purple.

9.101.2.20 const red_t & mln::literal::red = red_t()

Literal red.

Referenced by mln::morpho::watershed::superpose().

9.101.2.21 const teal_t & mln::literal::teal = teal_t()

Literal teal.

9.101.2.22 const violet_t & mln::literal::violet = violet_t()

Literal violet.

9.101.2.23 const white_t & mln::literal::white = white_t()

Literal white.

Referenced by mln::registration::icp().

9.101.2.24 const yellow_t & mln::literal::yellow = yellow_t()

Literal yellow.

9.101.2.25 const zero_t & mln::literal::zero = zero_t()

Literal zero.

Referenced by mln::morpho::impl::generic::hit_or_miss(), mln::accu::shape::volume< I >::init(), mln::morpho::attribute::sum< I, S >::init(), mln::accu::math::sum< T, S >::init(), mln::accu::rms< T, V >::init(), mln::accu::convolve< T1, T2, R >::init(), mln::accu::center< P, V >::init(), mln::window< D >::is_centered(), mln::accu::stat::var< T >::mean(), mln::geom::mesh_corner_-point_area(), mln::geom::mesh_curvature(), mln::geom::mesh_normal(), mln::morpho::meyer_-wst(), mln::algebra::operator∗(), mln::test::positive(), mln::make::relabelfun(), mln::geom::rotate(), mln::geom::impl::seeds2tiling_roundness(), mln::accu::shape::volume< I >::set_value(), mln::morpho::watershed::superpose(), mln::labeling::superpose(), mln::debug::superpose(), mln::accu::stat::var< T >::to_result(), mln::geom::translate(), and mln::make::w_window_directional().

9.102 mln::logical Namespace Reference

Namespace of logic.

Namespaces

- namespace impl
  Implementation namespace of logical namespace.

Functions

- template<typename L, typename R>
  void and_inplace (Image< L > &lhs, const Image< R > &rhs)
- template<typename L, typename R>
  mln::trait::ch_value< L, typename mln::fun::vv2v::land_not< typename L::value, typename R::value >::result >::ret and_not (const Image< L > &lhs, const Image< R > &rhs)
- template<typename L, typename R>
  void and_not_inplace (Image< L > &lhs, const Image< R > &rhs)
- template<typename I>
  void not_inplace (Image< I > &input)
- template<typename L, typename R>
  void or_inplace (Image< L > &lhs, const Image< R > &rhs)
- template<typename L, typename R>
  void xor_inplace (Image< L > &lhs, const Image< R > &rhs)

9.102.1 Detailed Description

Namespace of logic.

9.102.2 Function Documentation

9.102.2.1 template<typename L, typename R> void mln::logical::and_inplace (Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise in-place "logical and" of image `rhs` in image `lhs`.

Parameters:

↔ ***lhs*** First operand image.

← ***rhs*** Second operand image.

It performs:

for all p of rhs.domain

lhs(p) = lhs(p) and rhs(p)

Precondition:

`rhs.domain >= lhs.domain`

References mln::data::transform_inplace().

9.102.2.2 template<typename L, typename R> mln::trait::ch_value< L, typename mln::fun::vv2v::land_not< typename L::value, typename R::value >::result >::ret mln::logical::and_not (const Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise "logical and-not" between images `lhs` and `rhs`.

Parameters:

← ***lhs*** First operand image.

← ***rhs*** Second operand image.

Returns:

The result image.

Precondition:

`lhs.domain` == `rhs.domain`

References mln::data::transform().

9.102.2.3 template<typename L, typename R> void mln::logical::and_not_inplace (Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise in-place "logical and-not" of image `rhs` in image `lhs`.

Parameters:

↔ ***lhs*** First operand image.

← ***rhs*** Second operand image.

It performs:

for all p of rhs.domain

lhs(p) = lhs(p) and not rhs(p)

Precondition:

`rhs.domain` >= `lhs.domain`

References mln::data::transform_inplace().

9.102.2.4 template<typename I> void mln::logical::not_inplace (Image< I > & *input*) [inline]

Point-wise in-place "logical not" of image `input`.

Parameters:

↔ ***input*** The target image.

It performs:

for all p of input.domain

input(p) = not input(p)

Precondition:

`input.is_valid`

References mln::data::transform_inplace().

9.102.2.5 template<typename L, typename R> void mln::logical::or_inplace (Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise in-place "logical or" of image `rhs` in image `lhs`.

Parameters:

↔ ***lhs*** First operand image.

← ***rhs*** Second operand image.

It performs:

for all p of rhs.domain

lhs(p) = lhs(p) or rhs(p)

Precondition:

`rhs.domain >= lhs.domain`

References mln::data::transform_inplace().

9.102.2.6 template<typename L, typename R> void mln::logical::xor_inplace (Image< L > & *lhs*, const Image< R > & *rhs*) [inline]

Point-wise in-place "logical xor" of image `rhs` in image `lhs`.

Parameters:

↔ ***lhs*** First operand image.

← ***rhs*** Second operand image.

It performs:

for all p of rhs.domain

lhs(p) = lhs(p) xor rhs(p)

Precondition:

`rhs.domain >= lhs.domain`

References mln::data::transform_inplace().

9.103 mln::logical::impl Namespace Reference

Implementation namespace of logical namespace.

Namespaces

- namespace generic

  Generic implementation namespace of logical namespace.

9.103.1 Detailed Description

Implementation namespace of logical namespace.

9.104 mln::logical::impl::generic Namespace Reference

Generic implementation namespace of logical namespace.

9.104.1 Detailed Description

Generic implementation namespace of logical namespace.

9.105 mln::make Namespace Reference

Namespace of routines that help to make Milena's objects.

Functions

- template< unsigned D, typename G, typename V >
  p_set< complex_psite< D, G > > attachment (const complex_psite< D, G > &f, const complex_image< D, G, V > &ima)
  Compute the attachment of the cell corresponding to the facet f *to the image* ima.
- mln::box1d box1d (def::coord min_ind, def::coord max_ind)
  Create an mln::box1d.
- mln::box1d box1d (unsigned ninds)
  Create an mln::box1d.
- mln::box2d box2d (def::coord min_row, def::coord min_col, def::coord max_row, def::coord max_col)
  Create an mln::box2d.
- mln::box2d box2d (unsigned nrows, unsigned ncols)
  Create an mln::box2d.
- mln::box2d_h box2d_h (def::coord min_row, def::coord min_col, def::coord max_row, def::coord max_col)
  Create an mln::box2d_h.
- mln::box2d_h box2d_h (unsigned nrows, unsigned ncols)
  Create an mln::box2d_h.
- mln::box3d box3d (def::coord min_sli, def::coord min_row, def::coord min_col, def::coord max_sli, def::coord max_row, def::coord max_col)
  Create an mln::box3d.
- mln::box3d box3d (unsigned nslis, unsigned nrows, unsigned ncols)
  Create an mln::box3d.
- template< unsigned D, typename G >
  p_set< complex_psite< D, G > > cell (const complex_psite< D, G > &f)
  Compute the set of faces of the cell corresponding to the facet f.
- template< typename T, typename U >
  util::couple< T, U > couple (const T &val1, const T &val2)
  Construct an mln::util::couple on-the-fly.
- template< unsigned D, typename G, typename V >
  p_set< complex_psite< D, G > > detachment (const complex_psite< D, G > &f, const complex_image< D, G, V > &ima)
  Compute the detachment of the cell corresponding to the facet f *to the image* ima.

- mln::dpoint2d_h dpoint2d_h (def::coord row, def::coord col)

  Create an mln::dpoint2d_h.

- template<typename G>
  p_edges< G > dummy_p_edges (const Graph< G > &g)

  Create a p_edges which associate a graph element to a constant site.

- template<typename G, typename P>
  p_edges< G, pw::cst_< P > > dummy_p_edges (const Graph< G > &g_, const P &dummy_site)

  Create a p_edges which associate a graph element to a constant site.

- template<typename G>
  p_vertices< G > dummy_p_vertices (const Graph< G > &g)

  Create a p_vertices which associate a graph element to a constant site.

- template<typename G, typename P>
  p_vertices< G, pw::cst_< P > > dummy_p_vertices (const Graph< G > &g_, const P &dummy_site)

  Create a p_vertices which associate a graph element to a constant site.

- template<typename P, typename V, typename G, typename F>
  mln::edge_image< void, bool, G > edge_image (const mln::vertex_image< P, V, G > &v_ima_, const Function_v2b< F > &fv_)

  Construct an edge image.

- template<typename P, typename V, typename G, typename FV>
  mln::edge_image< void, typename FV::result, G > edge_image (const mln::vertex_image< P, V, G > &v_ima_, const Function_vv2v< FV > &fv_)

  Construct an edge image.

- template<typename P, typename V, typename G, typename FP, typename FV>
  mln::edge_image< typename FP::result, typename FV::result, G > edge_image (const mln::vertex_image< P, V, G > &v_ima_, const p_edges< G, FP > pe, const Function_vv2v< FV > &fv_)

  Construct an edge image.

- template<typename FP, typename FV, typename G>
  mln::edge_image< typename FP::result, typename FV::result, G > edge_image (const Graph< G > &g_, const Function_v2v< FP > &fp, const Function_v2v< FV > &fv)

  Construct an edge image.

- template<typename FV, typename G>
  mln::edge_image< void, typename FV::result, G > edge_image (const Graph< G > &g, const Function_v2v< FV > &fv)

  Construct an edge image.

- template<typename V, typename G>
  mln::edge_image< void, V, G > edge_image (const Graph< G > &g, const fun::i2v::array< V > &fv)

  Construct an edge image.

- template<typename T, unsigned N>
  algebra::h_mat< mlc_sqrt_int(N), T > h_mat (const T(&tab)[N])

  Create an mln::algebra::mat<n,n,T>.

- template<typename V, unsigned S, unsigned R, unsigned C>
  mln::image3d< V > image (V(&values)[S][R][C])

  Create an image3d from an 3D array of values.

- template<typename V, unsigned R, unsigned C>
  mln::image2d< V > image (V(&values)[R][C])

  Create an image2d from an 2D array of values.

- template<typename V, unsigned L>
  mln::image1d< V > image (V(&values)[L])

  Create an image1d from an 1D array of values.

- template<typename V, unsigned S>
  mln::image2d< V > image2d (V(&values)[S])

  Create an image2d from an 2D array of values.

- template<typename I>
  mln::image3d< typename I::value > image3d (const Image< I > &ima)

  Create an image3d from a 2D image.

- template<typename I>
  mln::image3d< typename I::value > image3d (const util::array< I > &ima)

  Create an image3d from an array of 2D images.

- template<typename I, typename N>
  util::graph influence_zone_adjacency_graph (const Image< I > &iz_, const Neighborhood< N > &nbh, const typename I::value &nlabels)

  Create a graph from an influence zone image.

- template<unsigned n, unsigned m, typename T>
  algebra::mat< n, m, T > mat (const T(&tab)[n *m])

  Create an mln::algebra::mat<n,m,T>.

- template<typename T>
  util::ord_pair< T > ord_pair (const T &val1, const T &val2)

  Construct an mln::util::ord_pair on-the-fly.

- template<typename W, typename G>
  p_edges< G, fun::i2v::array< util::site_pair< typename W::site > > > p_edges_with_mass_centers (const Image< W > &wst_, const Graph< G > &g_)

  Construct a p_edges from a watershed image and a region adjacency graph (RAG).

- template<typename W, typename G>
  p_vertices< G, fun::i2v::array< typename W::site > > p_vertices_with_mass_centers (const Image< W > &wst_, const Graph< G > &g_)

  Construct a p_vertices from a watershed image and a region adjacency graph (RAG).

- template<typename I>
  mln::util::pix< I > pix (const Image< I > &ima, const typename I::psite &p)

  Create an mln::util::pix from an image `ima` *and a psite* `p`*.*

- template<typename I>
  mln::pixel< I > pixel (Image< I > &ima, const typename I::psite &p)

  Create a mln::pixel from a mutable image `ima` *and a point* `p`*.*

- template<typename I>
  mln::pixel< const I > pixel (const Image< I > &ima, const typename I::psite &p)

  Create a mln::pixel from a constant image `ima` *and a point* `p`*.*

- mln::point2d_h point2d_h (def::coord row, def::coord col)

  Create an mln::point2d_h.

- template<typename I, typename N>
  util::couple< util::graph, typename mln::trait::concrete< I >::ret > rag_and_labeled_wsl (const Image< I > &wshd_, const Neighborhood< N > &nbh_, const typename I::value &nbasins)

  Create a region adjacency graph and a label image of the watershed line from a watershed image.

- template<typename I, typename N>
  util::graph region_adjacency_graph (const Image< I > &wshd_, const Neighborhood< N > &nbh, const typename I::value &nbasins)

  Create a region adjacency graph from a watershed image.

- template<typename V, typename F>
  fun::i2v::array< V > relabelfun (const Function_v2v< F > &fv2v, const V &nlabels, V &new_-nlabels)

  Create a i2v function from a v2v function.

- template<typename V, typename F>
  fun::i2v::array< V > relabelfun (const Function_v2b< F > &fv2b, const V &nlabels, V &new_-nlabels)

  Create a i2v function from a v2b function.

- template<typename T>
  algebra::vec< 4, T > vec (const T &v_0, const T &v_1, const T &v_2, const T &v_3)

  Create an mln::algebra::vec<4,T>.

- template<typename T>
  algebra::vec< 3, T > vec (const T &v_0, const T &v_1, const T &v_2)

  Create an mln::algebra::vec<3,T>.

- template<typename T>
  algebra::vec< 2, T > vec (const T &v_0, const T &v_1)

  Create an mln::algebra::vec<2,T>.

- template<typename T>
  algebra::vec< 1, T > vec (const T &v_0)

  Create an mln::algebra::vec<n,T>.

- template<typename FP, typename FV, typename G>
  mln::vertex_image< typename FP::result, typename FV::result, G > vertex_image (const Graph< G > &g_, const Function_v2v< FP > &fp, const Function_v2v< FV > &fv)

  Construct a vertex image.

- template<typename G, typename FV>
  mln::vertex_image< void, typename FV::result, G > vertex_image (const Graph< G > &g, const Function_v2v< FV > &fv)

  Construct a vertex image.

- template<typename I, typename N>
  p_vertices< util::graph, fun::i2v::array< typename I::site > > voronoi (Image< I > &ima_, Image< I > &orig_, const Neighborhood< N > &nbh)

  Apply the Voronoi algorithm on `ima_` *with the original image* `orig_` *for node computing with neighborhood* `nbh`.

- template<typename W, typename F>
  mln::w_window< typename W::dpsite, typename F::result > w_window (const Window< W > &win, const Function_v2v< F > &wei)

  Create a mln::w_window from a window and a weight function.

- template<typename W, unsigned M>
  mln::w_window< mln::dpoint1d, W > w_window1d (W(&weights)[M])

  Create a 1D mln::w_window from an array of weights.

- template<unsigned M>
  mln::w_window1d_int w_window1d_int (int(&weights)[M])

  Create a mln::w_window1d_int.

- template<typename W, unsigned S>
  mln::w_window< mln::dpoint2d, W > w_window2d (W(&weights)[S])

  Create a 2D mln::w_window from an array of weights.

- template<unsigned M>
  mln::w_window2d_int w_window2d_int (int(&weights)[M])

  Create a mln::w_window2d_int.

- template<typename W, unsigned M>
  mln::w_window< mln::dpoint3d, W > w_window3d (W(&weights)[M])

  Create a 3D mln::w_window from an array of weights.

- template<unsigned M>
  mln::w_window3d_int w_window3d_int (int(&weights)[M])

  Create a mln::w_window3d_int.

- template<typename D, typename W, unsigned L>
  mln::w_window< D, W > w_window_directional (const Gdpoint< D > &dp, W(&weights)[L])

  Create a directional centered weighted window.

9.105.1 Detailed Description

Namespace of routines that help to make Milena's objects.

9.105.2 Function Documentation

9.105.2.1 template<unsigned D, typename G, typename V> p_set< complex_psite< D, G > > mln::make::attachment (const complex_psite< D, G > & *f*, const complex_image< D, G, V > & *ima*) [inline]

Compute the attachment of the cell corresponding to the facet *f* to the image *ima*.

Precondition:

f is a facet (it does not belong to any face of higher dimension).
ima is an image of Boolean values.

Returns:

a set of faces containing the attachment.

We do not use the fomal definition of the attachment here (see couprie.08.pami). We use the following (equivalent) definition: an N-face F in CELL is in the attachment of CELL to IMA if it is adjacent to at least an (N-1)-face or an (N+1)-face that does not belong to CELL.

References cell(), and mln::topo::is_facet().

Referenced by mln::topo::is_simple_cell< I >::operator()().

9.105.2.2 mln::box1d mln::make::box1d (def::coord *min_ind*, def::coord *max_ind*) [inline]

Create an mln::box1d.

This is an overloaded member function, provided for convenience. It differs from the above function only in what argument(s) it accepts.

Parameters:

← ***min_ind*** Minimum index.

← ***max_ind*** Maximum index.

Precondition:

`max_ind` >= `min_ind`.

Returns:

A 1D box.

9.105.2.3 mln::box1d mln::make::box1d (unsigned *ninds*) [inline]

Create an mln::box1d.

Parameters:

← ***ninds*** Number of indices.

Precondition:

`ninds` != 0 and `ncols` != 0.

Returns:

A 1D box.

Referenced by mln::image1d< T >::image1d().

9.105.2.4 mln::box2d mln::make::box2d (def::coord *min_row*, def::coord *min_col*, def::coord *max_row*, def::coord *max_col*) `[inline]`

Create an mln::box2d.

This is an overloaded member function, provided for convenience. It differs from the above function only in what argument(s) it accepts.

Parameters:

← ***min_row*** Index of the top most row.

← ***min_col*** Index of the left most column.

← ***max_row*** Index of the botton most row.

← ***max_col*** Index of the right most column.

Precondition:

`max_row` >= `min_row` and `max_col` >= `min_col`.

Returns:

A 2D box.

9.105.2.5 mln::box2d mln::make::box2d (unsigned *nrows*, unsigned *ncols*) `[inline]`

Create an mln::box2d.

Parameters:

← ***nrows*** Number of rows.

← ***ncols*** Number of columns.

Precondition:

`nrows` != 0 and `ncols` != 0.

Returns:

A 2D box.

Referenced by mln::image2d< T >::image2d(), and mln::io::pnm::load().

9.105.2.6 mln::box2d_h mln::make::box2d_h (def::coord *min_row*, def::coord *min_col*, def::coord *max_row*, def::coord *max_col*) [inline]

Create an mln::box2d_h.

This is an overloaded member function, provided for convenience. It differs from the above function only in what argument(s) it accepts.

Parameters:

← ***min_row*** Index of the top most row.

← ***min_col*** Index of the left most column.

← ***max_row*** Index of the botton most row.

← ***max_col*** Index of the right most column.

Precondition:

`max_row` >= `min_row` and `max_col` >= `min_col`.

Returns:

A 2D_H box.

References point2d_h().

9.105.2.7 mln::box2d_h mln::make::box2d_h (unsigned *nrows*, unsigned *ncols*) [inline]

Create an mln::box2d_h.

Parameters:

← ***nrows*** Number of rows.

← ***ncols*** Number of columns.

Precondition:

`nrows` != 0 and `ncols` != 0.

Returns:

A 2D_H box.

References point2d_h().

9.105.2.8 mln::box3d mln::make::box3d (def::coord *min_sli*, def::coord *min_row*, def::coord *min_col*, def::coord *max_sli*, def::coord *max_row*, def::coord *max_col*) [inline]

Create an mln::box3d.

This is an overloaded member function, provided for convenience. It differs from the above function only in what argument(s) it accepts.

Parameters:

← ***min_sli*** Index of the lowest slice.

← ***min_row*** Index of the top most row.

← ***min_col*** Index of the left most column.

← ***max_sli*** Index of the highest slice.

← ***max_row*** Index of the botton most row.

← ***max_col*** Index of the right most column.

Precondition:

`max_sli` >= `min_sli`.
`max_row` >= `min_row`.
`max_col` >= `min_col`.

Returns:

A 3D box.

9.105.2.9 mln::box3d mln::make::box3d (unsigned *nslis*, unsigned *nrows*, unsigned *ncols*) [inline]

Create an mln::box3d.

Parameters:

← ***nslis*** Number of slices.

← ***nrows*** Number of rows.

← ***ncols*** Number of columns.

Precondition:

`ninds` != 0 and `ncols` != 0 and `nslis` != 0.

Returns:

A 3D box.

Referenced by image3d(), and mln::image3d< T >::image3d().

9.105.2.10 template<unsigned D, typename G> p_set< complex_psite< D, G > > mln::make::cell (const complex_psite< D, G > & *f*) [inline]

Compute the set of faces of the cell corresponding to the facet *f*.

Precondition:

f is a facet (it does not belong to any face of higher dimension).

Returns:

An mln::p_set of sites (faces) containing the attachment.

References mln::topo::is_facet(), and mln::complex_psite< D, G >::n().

Referenced by attachment(), and detachment().

9.105.2.11 template<typename T, typename U> util::couple<T,U> mln::make::couple (const T & *val1*, const T & *val2*) [inline]

Construct an mln::util::couple on-the-fly.

Referenced by mln::labeling::blobs_and_compute(), mln::transform::distance_and_closest_point_-geodesic(), and mln::transform::distance_and_influence_zone_geodesic().

9.105.2.12 template<unsigned D, typename G, typename V> p_set< complex_psite< D, G > > mln::make::detachment (const complex_psite< D, G > & *f*, const complex_image< D, G, V > & *ima*) [inline]

Compute the detachment of the cell corresponding to the facet *f* to the image *ima*.

Precondition:

f is a facet (it does not belong to any face of higher dimension).
ima is an image of Boolean values.

Returns:

a set of faces containing the detachment.

We do not use the fomal definition of the detachment here (see couprie.08.pami). We use the following (equivalent) definition: an N-face F in CELL is not in the detachment of CELL from IMA if it is adjacent to at least an (N-1)-face or an (N+1)-face that does not belong to CELL.

References cell(), and mln::topo::is_facet().

Referenced by mln::topo::detach().

9.105.2.13 mln::dpoint2d_h mln::make::dpoint2d_h (def::coord *row*, def::coord *col*) [inline]

Create an mln::dpoint2d_h.

Parameters:

← ***row*** Row coordinate.

← ***col*** Column coordinate.

Returns:

A 2D dpoint.

9.105.2.14 template<typename G> p_edges< G > mln::make::dummy_p_edges (const Graph< G > & *g*) [inline]

Create a p_edges which associate a graph element to a constant site.

`0` (int) is used as dummy site.

Parameters:

← ***g*** A graph.

Returns:

A p_edges.

9.105.2.15 template<typename G, typename P> p_edges< G, pw::cst_< P > > mln::make::dummy_p_edges (const Graph< G > & *g_*, const P & *dummy_site*) [inline]

Create a p_edges which associate a graph element to a constant site.

Parameters:

← ***g_*** A graph.

← ***dummy_site*** The dummy site mapped to graph edges.

Returns:

A p_edges.

9.105.2.16 template<typename G> p_vertices< G > mln::make::dummy_p_vertices (const Graph< G > & *g*) [inline]

Create a p_vertices which associate a graph element to a constant site.

`0` (int) is used as dummy site.

Parameters:

← ***g*** A graph.

Returns:

A p_vertices.

9.105.2.17 template<typename G, typename P> p_vertices< G, pw::cst_< P > > mln::make::dummy_p_vertices (const Graph< G > & *g_*, const P & *dummy_site*) [inline]

Create a p_vertices which associate a graph element to a constant site.

Parameters:

← ***g_*** A graph.

← ***dummy_site*** The dummy site mapped to graph vertices.

Returns:

A p_vertices.

9.105.2.18 template<typename P, typename V, typename G, typename F> mln::edge_image< void, bool, G > mln::make::edge_image (const mln::vertex_image< P, V, G > & *v_ima_*, const Function_v2b< F > & *fv_*) [inline]

Construct an edge image.

Parameters:

← ***v_ima_*** A vertex image.

← ***fv_*** A function mapping a vertex ids to a value. The result is associated to the corresponding edge.

Returns:

an edge image without localization information mapped to graph elements.

References mln::data::fill().

9.105.2.19 template<typename P, typename V, typename G, typename FV> mln::edge_image< void, typename FV::result, G > mln::make::edge_image (const mln::vertex_image< P, V, G > & *v_ima_*, const Function_vv2v< FV > & *fv_*) [inline]

Construct an edge image.

Parameters:

← ***v_ima_*** A vertex image.

← ***fv_*** A function mapping two vertices ids to a value. The result is associated to the corresponding edge.

Returns:

an edge image without localization information mapped to graph elements.

9.105.2.20 template<typename P, typename V, typename G, typename FP, typename FV> mln::edge_image< typename FP::result, typename FV::result, G > mln::make::edge_image (const mln::vertex_image< P, V, G > & *v_ima_*, const p_edges< G, FP > *pe*, const Function_vv2v< FV > & *fv_*) [inline]

Construct an edge image.

Parameters:

← ***v_ima_*** A vertex image.

← ***pe*** A p_edges mapping graph element to sites .

← ***fv_*** A function mapping two vertex ids to a value. The result is associated to the corresponding edge.

Returns:

an edge image.

9.105.2.21 template<typename FP, typename FV, typename G> mln::edge_image< typename FP::result, typename FV::result, G > mln::make::edge_image (const Graph< G > & *g_*, const Function_v2v< FP > & *fp*, const Function_v2v< FV > & *fv*) [inline]

Construct an edge image.

Parameters:

← ***g_*** A graph
← ***fp*** A function mapping edge ids to sites.
← ***fv*** A function mapping edge ids to values.

Returns:

an edge image.

9.105.2.22 template<typename FV, typename G> mln::edge_image< void, typename FV::result, G > mln::make::edge_image (const Graph< G > & *g*, const Function_v2v< FV > & *fv*) [inline]

Construct an edge image.

Parameters:

← ***g*** A graph
← ***fv*** A function mapping edge ids to values.

Returns:

an edge image.

9.105.2.23 template<typename V, typename G> mln::edge_image< void, V, G > mln::make::edge_image (const Graph< G > & *g*, const fun::i2v::array< V > & *fv*) [inline]

Construct an edge image.

Parameters:

← ***g*** A graph
← ***fv*** A function mapping edge ids to values.

Returns:

an edge image.

9.105.2.24 template<typename T, unsigned N> algebra::h_mat< mlc_sqrt_int(N), T > mln::make::h_mat (const T(&) *tab*[N]) [inline]

Create an mln::algebra::mat<n,n,T>.

Referenced by mln::fun::x2x::rotation< n, C >::rotation().

9.105.2.25 template<typename V, unsigned S, unsigned R, unsigned C> mln::image3d< V > mln::make::image (V(&) *values*[S][R][C]) `[inline]`

Create an image3d from an 3D array of values.

Parameters:

← ***values*** 3D array.

Returns:

A 3D image.

References mln::opt::at().

9.105.2.26 template<typename V, unsigned R, unsigned C> mln::image2d< V > mln::make::image (V(&) *values*[R][C]) `[inline]`

Create an image2d from an 2D array of values.

Parameters:

← ***values*** 2D array.

Returns:

A 2D image.

References mln::opt::at().

9.105.2.27 template<typename V, unsigned L> mln::image1d< V > mln::make::image (V(&) *values*[L]) `[inline]`

Create an image1d from an 1D array of values.

Parameters:

← ***values*** 1D array.

Returns:

A 1D image.

9.105.2.28 template<typename V, unsigned S> mln::image2d< V > mln::make::image2d (V(&) *values*[S]) `[inline]`

Create an image2d from an 2D array of values.

Parameters:

← ***values*** 2D array.

Returns:

A 2D image.

9.105.2.29 template<typename I> mln::image3d< typename I::value > mln::make::image3d (const Image< I > & *ima*) [inline]

Create an image3d from a 2D image.

References box3d(), and mln::data::paste().

9.105.2.30 template<typename I> mln::image3d< typename I::value > mln::make::image3d (const util::array< I > & *ima*) [inline]

Create an image3d from an array of 2D images.

References box3d(), mln::util::array< T >::is_empty(), mln::util::array< T >::nelements(), mln::data::paste(), mln::box< P >::pmax(), and mln::box< P >::pmin().

Referenced by mln::io::pnms::load().

9.105.2.31 template<typename I, typename N> util::graph mln::make::influence_zone_-adjacency_graph (const Image< I > & *iz_*, const Neighborhood< N > & *nbh_*, const typename I::value & *nlabels*) [inline]

Create a graph from an influence zone image.

Parameters:

← ***iz*** influence zone image.

← ***nbh*** A neighborhood.

← ***nlabels*** number of influence zone in `iz`.

Returns:

util::graph Graph based on the adjacency of the influence zones.

Create a graph from an influence zone image.

Parameters:

← ***iz_*** influence zone image.

← ***nbh_*** A neighborhood.

← ***nlabels*** number of influence zone in `iz`.

Returns:

util::graph Graph based on the adjacency of the influence zones.

9.105.2.32 template<unsigned n, unsigned m, typename T> algebra::mat< n, m, T > mln::make::mat (const T(&) *tab*[n *m]) [inline]

Create an mln::algebra::mat<n,m,T>.

Parameters:

← ***tab*** Array of values.

Precondition:

The array dimension has to be n $*$ m.

9.105.2.33 template<typename T> util::ord_pair< T > mln::make::ord_pair (const T & *val1*, const T & *val2*) [inline]

Construct an mln::util::ord_pair on-the-fly.

References ord_pair().

Referenced by ord_pair().

9.105.2.34 template<typename W, typename G> p_edges< G, fun::i2v::array< util::site_pair< typename W::site > > > mln::make::p_edges_with_mass_centers (const Image< W > & *wst_*, const Graph< G > & *g_*) [inline]

Construct a p_edges from a watershed image and a region adjacency graph (RAG).

Map each graph edge to a pair of mass centers of two adjacent regions.

Parameters:

*wst_* A watershed image.

*g_* A region adjacency graph.

Returns:

A p_edges.

See also:

edge_image, p_edges, make::region_adjacency_graph

References mln::labeling::compute().

9.105.2.35 template<typename W, typename G> p_vertices< G, fun::i2v::array< typename W::site > > mln::make::p_vertices_with_mass_centers (const Image< W > & *wst_*, const Graph< G > & *g_*) [inline]

Construct a p_vertices from a watershed image and a region adjacency graph (RAG).

Map each graph vertex to the mass center of its corresponding region.

Parameters:

*wst_* A watershed image.

*g_* A region adjacency graph.

Returns:

A p_vertices.

See also:

edge_image, vertex_image, p_vertices, p_edges, make::region_adjacency_graph

References mln::labeling::compute().

9.105.2.36 template<typename I> mln::util::pix< I > mln::make::pix (const Image< I > & *ima*, const typename I::psite & *p*) [inline]

Create an mln::util::pix from an image `ima` and a psite `p`.

Parameters:

← ***ima*** The input image.

← ***p*** The point site.

Returns:

An mln::util::pix.

9.105.2.37 template<typename I> mln::pixel< I > mln::make::pixel (Image< I > & *ima*, const typename I::psite & *p*) [inline]

Create a mln::pixel from a mutable image `ima` and a point `p`.

9.105.2.38 template<typename I> mln::pixel< const I > mln::make::pixel (const Image< I > & *ima*, const typename I::psite & *p*) [inline]

Create a mln::pixel from a constant image `ima` and a point `p`.

9.105.2.39 mln::point2d_h mln::make::point2d_h (def::coord *row*, def::coord *col*) [inline]

Create an mln::point2d_h.

Parameters:

← ***row*** Row coordinate.

← ***col*** Column coordinate.

Returns:

A 2D point.

Referenced by box2d_h().

9.105.2.40 template<typename I, typename N> util::couple< util::graph, typename mln::trait::concrete< I >::ret > mln::make::rag_and_labeled_wsl (const Image< I > & *wshd_*, const Neighborhood< N > & *nbh_*, const typename I::value & *nbasins*) [inline]

Create a region adjacency graph and a label image of the watershed line from a watershed image.

Parameters:

← ***wshd_*** Watershed image.

← ***nbh_*** Neighborhood

← ***nbasins*** Number of influence zone in `wshd`.

Returns:

A couple. First element is the graph, second element is an image with a labeled watershed line.

```
    |-----------------|       |-----------------|
    | 1 1 1 0 2 2 0 3 |              | . . . 1 . . 2 . |
    | 1 1 0 2 2 2 0 3 |              | . . 1 . . . 2 . |
    | 1 0 4 0 2 0 3 3 |    ---->     | . 1 . 3 . 4 . . |
    | 0 4 4 4 0 5 0 3 |              | 1 . . . 5 . 6 . |
    |-----------------|              |-----------------|

Watershed image       Labeled watershed line
 (watershed line labeled with 0)


|
|
|
v

  1 -- 2 - 3
   \  /   /
    4 -- 5

    Region Adjacency graph (RAG)
```

9.105.2.41 template<typename I, typename N> util::graph mln::make::region_adjacency_graph (const Image< I > & *wshd_*, const Neighborhood< N > & *nbh*, const typename I::value & *nbasins*) [inline]

Create a region adjacency graph from a watershed image.

Parameters:

← ***wshd_*** watershed image.

← ***nbh*** A neighborhood.

← ***nbasins*** number of influence zone in `wshd`.

Returns:

util::graph Graph based on the adjacency of the influence zones.

9.105.2.42 template<typename V, typename F> fun::i2v::array< V > mln::make::relabelfun (const Function_v2v< F > & *fv2v*, const V & *nlabels*, V & *new_nlabels*) [inline]

Create a i2v function from a v2v function.

This function can be used to relabel a labeled image.

Parameters:

← ***fv2v*** A v2v function. This function maps an id to an already existing one.

← ***nlabels*** The number of labels.

← ***new_nlabels*** The number of labels after relabeling.

Returns:

a i2v function.

See also:

mln::labeling::relabel

References mln::literal::zero.

9.105.2.43 template<typename V, typename F> fun::i2v::array< V > mln::make::relabelfun (const Function_v2b< F > & *fv2b*, const V & *nlabels*, V & *new_nlabels*) [inline]

Create a i2v function from a v2b function.

This function can be used to relabel a labeled image.

Parameters:

← ***fv2b*** A v2b function.

← ***nlabels*** The number of labels.

← ***new_nlabels*** The number of labels after relabeling.

Returns:

a i2v function.

See also:

mln::labeling::relabel

References mln::literal::zero.

Referenced by mln::labeling::pack(), mln::labeling::pack_inplace(), mln::labeling::relabel(), mln::labeled_image_base< I, E >::relabel(), and mln::labeling::relabel_inplace().

9.105.2.44 template<typename T> algebra::vec< 4, T > mln::make::vec (const T & *v_0*, const T & *v_1*, const T & *v_2*, const T & *v_3*) [inline]

Create an mln::algebra::vec<4,T>.

Parameters:

← ***v_0*** First coordinate.

← ***v_1*** Second coordinate.

← ***v_2*** Third coordinate.

← ***v_3*** Fourth coordinate.

Returns:

A 4D vector.

9.105.2.45 template<typename T> algebra::vec< 3, T > mln::make::vec (const T & *v_0*, const T & *v_1*, const T & *v_2*) [inline]

Create an mln::algebra::vec<3,T>.

Parameters:

← ***v_0*** First coordinate.

← ***v_1*** Second coordinate.

← ***v_2*** Third coordinate.

Returns:

A 3D vector.

9.105.2.46 template<typename T> algebra::vec< 2, T > mln::make::vec (const T & *v_0*, const T & *v_1*) [inline]

Create an mln::algebra::vec<2,T>.

Parameters:

← ***v_0*** First coordinate.

← ***v_1*** Second coordinate.

Returns:

A 2D vector.

9.105.2.47 template<typename T> algebra::vec< 1, T > mln::make::vec (const T & *v_0*) [inline]

Create an mln::algebra::vec<n,T>.

Parameters:

← ***v_0*** First coordinate.

Returns:

A 1D vector.

9.105.2.48 template<typename FP, typename FV, typename G> mln::vertex_image< typename FP::result, typename FV::result, G > mln::make::vertex_image (const Graph< G > & *g_*, const Function_v2v< FP > & *fp*, const Function_v2v< FV > & *fv*) [inline]

Construct a vertex image.

Parameters:

← ***g_*** A graph.

← ***fp*** A function mapping vertex ids to sites.

← ***fv*** A function mapping vertex ids to values.

Returns:

A vertex image.

9.105.2.49 template<typename G, typename FV> mln::vertex_image< void, typename FV::result, G > mln::make::vertex_image (const Graph< G > & *g*, const Function_v2v< FV > & *fv*) [inline]

Construct a vertex image.

Parameters:

← ***g*** A graph.

← ***fv*** A function mapping vertex ids to values.

Returns:

A vertex image.

9.105.2.50 template<typename I, typename N> p_vertices< util::graph, fun::i2v::array< typename I::site > > mln::make::voronoi (Image< I > & *ima_*, Image< I > & *orig_*, const Neighborhood< N > & *nbh*) [inline]

Apply the Voronoi algorithm on `ima_` with the original image `orig_` for node computing with neighborhood `nbh`.

Parameters:

← ***ima_*** The labeling image.

← ***orig_*** The original image.

← ***nbh*** The neighborhood for computing algorithm.

Returns:

The computed graph.

References mln::util::graph::add_edge(), mln::util::graph::add_vertex(), and mln::estim::min_max().

9.105.2.51 template<typename W, typename F> mln::w_window< typename W::dpsite, typename F::result > mln::make::w_window (const Window< W > & *win*, const Function_v2v< F > & *wei*) [inline]

Create a mln::w_window from a window and a weight function.

Parameters:

← ***win*** A simple window.

← ***wei*** A weight function.

Returns:

A weighted window.

References mln::w_window< D, W >::insert(), and mln::literal::origin.

9.105.2.52 template<typename W, unsigned M> mln::w_window< mln::dpoint1d, W > mln::make::w_window1d (W(&) *weights*[M]) [inline]

Create a 1D mln::w_window from an array of weights.

Parameters:

← ***weights*** Array.

Precondition:

The array size, M, has to be a square of an odd integer.

Returns:

A 1D weighted window.

References mln::w_window< D, W >::insert().

Referenced by w_window1d_int().

9.105.2.53 template<unsigned M> mln::w_window1d_int mln::make::w_window1d_int (int(&) *weights*[M]) [inline]

Create a mln::w_window1d_int.

Parameters:

← ***weights*** Array of integers.

Precondition:

The array size, M, has to be a square of an odd integer.

Returns:

A 1D int-weighted window.

References w_window1d().

9.105.2.54 template<typename W, unsigned S> mln::w_window< mln::dpoint2d, W > mln::make::w_window2d (W(&) *weights*[S]) [inline]

Create a 2D mln::w_window from an array of weights.

Parameters:

← ***weights*** Array.

Precondition:

The array size, `S`, has to be a square of an odd integer.

Returns:

A 2D weighted window.

Referenced by mln::linear::mln_ch_convolve(), and w_window2d_int().

9.105.2.55 template<unsigned M> mln::w_window2d_int mln::make::w_window2d_int (int(&) *weights*[M]) `[inline]`

Create a mln::w_window2d_int.

Parameters:

← ***weights*** Array of integers.

Precondition:

The array size, `M`, has to be a square of an odd integer.

Returns:

A 2D int-weighted window.

References w_window2d().

9.105.2.56 template<typename W, unsigned M> mln::w_window< mln::dpoint3d, W > mln::make::w_window3d (W(&) *weights*[M]) `[inline]`

Create a 3D mln::w_window from an array of weights.

Parameters:

← ***weights*** Array.

Precondition:

The array size, `M`, has to be a cube of an odd integer.

Returns:

A 3D weighted window.

References mln::w_window< D, W >::insert().

Referenced by w_window3d_int().

9.105.2.57 template<unsigned M> mln::w_window3d_int mln::make::w_window3d_int (int(&) *weights*[M]) `[inline]`

Create a mln::w_window3d_int.

Parameters:

← ***weights*** Array of integers.

Precondition:

The array size, `M`, has to be a cube of an odd integer.

Returns:

A 3D int-weighted window.

References w_window3d().

9.105.2.58 template<typename D, typename W, unsigned L> mln::w_window< D, W > mln::make::w_window_directional (const Gdpoint< D > & *dp*, W(&) *weights*[L]) `[inline]`

Create a directional centered weighted window.

Parameters:

← ***dp*** A delta-point to set the orientation.

← ***weights*** An array of weights.

Returns:

A weighted window.

The window length `L` has to be odd.

References mln::w_window< D, W >::insert(), and mln::literal::zero.

9.106 mln::math Namespace Reference

Namespace of mathematical routines.

Functions

- template<unsigned n>
  value::int_u< n > abs (const value::int_u< n > &v)

  Specialization for mln::value::int_u.

- template<typename T>
  T abs (const T &v)

  Generic version.

- int abs (int v)

  Specializations for existing overloads of std::abs.

9.106.1 Detailed Description

Namespace of mathematical routines.

9.106.2 Function Documentation

9.106.2.1 template<unsigned n> value::int_u< n > mln::math::abs (const value::int_u< n > & *v*) [inline]

Specialization for mln::value::int_u.

9.106.2.2 int mln::math::abs (int *v*) [inline]

Specializations for existing overloads of std::abs.

Reference: ISO/IEC 14882:2003 C++ standard, section 26.5 (C Library, [lib.c.math]).

9.106.2.3 template<typename T> T mln::math::abs (const T & *v*) [inline]

Generic version.

Referenced by mln::morpho::line_gradient().

9.107 mln::metal Namespace Reference

Namespace of meta-programming tools.

Classes

- struct ands

  Ands type.

- struct converts_to

  "converts-to" check.

- struct equal

  Definition of a static 'equal' test.

- struct goes_to

  "goes-to" check.

- struct is

  "is" check.

- struct is_a

  "is_a" check.

- struct is_not

  "is_not" check.

- struct is_not_a

  "is_not_a" static Boolean expression.

Namespaces

- namespace impl

  Implementation namespace of metal namespace.

- namespace math

  Namespace of static mathematical functions.

9.107.1 Detailed Description

Namespace of meta-programming tools.

9.108 mln::metal::impl Namespace Reference

Implementation namespace of metal namespace.

9.108.1 Detailed Description

Implementation namespace of metal namespace.

9.109 mln::metal::math Namespace Reference

Namespace of static mathematical functions.

Namespaces

- namespace impl

    Implementation namespace of metal::math namespace.

9.109.1 Detailed Description

Namespace of static mathematical functions.

9.110 mln::metal::math::impl Namespace Reference

Implementation namespace of metal::math namespace.

9.110.1 Detailed Description

Implementation namespace of metal::math namespace.

9.111 mln::morpho Namespace Reference

Namespace of mathematical morphology routines.

Namespaces

- namespace approx

  Namespace of approximate mathematical morphology routines.

- namespace attribute

  Namespace of attributes used in mathematical morphology.

- namespace elementary

  Namespace of image processing routines of elementary mathematical morphology.

- namespace impl

  Namespace of mathematical morphology routines implementations.

- namespace reconstruction

  Namespace of morphological reconstruction routines.

- namespace tree

  Namespace of morphological tree-related routines.

- namespace watershed

  Namespace of morphological watershed routines.

Functions

- template< typename I >
  mln::trait::concrete< I >::ret complementation (const Image< I > &input)
- template< typename I >
  void complementation_inplace (Image< I > &input)
- template< typename I, typename W >
  mln::trait::concrete< I >::ret contrast (const Image< I > &input, const Window< W > &win)
- template< typename I, typename W >
  mln::trait::concrete< I >::ret dilation (const Image< I > &input, const Window< W > &win)

  Morphological dilation.

- template< typename I, typename W >
  mln::trait::concrete< I >::ret erosion (const Image< I > &input, const Window< W > &win)

  Morphological erosion.

- template< typename Op, typename I, typename W >
  mln::trait::concrete< I >::ret general (const Op &op, const Image< I > &input, const Window< W > &win)

  Morphological general routine.

- template<typename I, typename W>
  mln::trait::concrete< I >::ret gradient (const Image< I > &input, const Window< W > &win)

  Morphological gradient.

- template<typename I, typename W>
  mln::trait::concrete< I >::ret gradient_external (const Image< I > &input, const Window< W > &win)

  Morphological external gradient.

- template<typename I, typename W>
  mln::trait::concrete< I >::ret gradient_internal (const Image< I > &input, const Window< W > &win)

  Morphological internal gradient.

- template<typename I, typename Wh, typename Wm>
  mln::trait::concrete< I >::ret hit_or_miss (const Image< I > &input, const Window< Wh > &win_hit, const Window< Wm > &win_miss)

  Morphological hit-or-miss.

- template<typename I, typename Wh, typename Wm>
  mln::trait::concrete< I >::ret hit_or_miss_background_closing (const Image< I > &input, const Window< Wh > &win_hit, const Window< Wm > &win_miss)

  Morphological hit-or-miss closing of the background.

- template<typename I, typename Wh, typename Wm>
  mln::trait::concrete< I >::ret hit_or_miss_background_opening (const Image< I > &input, const Window< Wh > &win_hit, const Window< Wm > &win_miss)

  Morphological hit-or-miss opening of the background.

- template<typename I, typename Wh, typename Wm>
  mln::trait::concrete< I >::ret hit_or_miss_closing (const Image< I > &input, const Window< Wh > &win_hit, const Window< Wm > &win_miss)

  Morphological hit-or-miss closing.

- template<typename I, typename Wh, typename Wm>
  mln::trait::concrete< I >::ret hit_or_miss_opening (const Image< I > &input, const Window< Wh > &win_hit, const Window< Wm > &win_miss)

  Morphological hit-or-miss opening.

- template<typename I, typename W, typename O>
  void laplacian (const Image< I > &input, const Window< W > &win, Image< O > &output)
- template<typename V>
  edge_image< util::site_pair< point2d >, V, util::graph > line_gradient (const mln::image2d< V > &ima)

  Create a line graph image representing the gradient norm of a mln::image2d.

- template<typename L, typename I, typename N>
  mln::trait::ch_value< I, L >::ret meyer_wst (const Image< I > &input, const Neighborhood< N > &nbh)

  Meyer's Watershed Transform (WST) algorithm, with no count of basins.

- template<typename L, typename I, typename N>
mln::trait::ch_value< I, L >::ret meyer_wst (const Image< I > &input, const Neighborhood< N > &nbh, L &nbasins)

  Meyer's Watershed Transform (WST) algorithm.

- template<typename I, typename J>
mln::trait::concrete< I >::ret min (const Image< I > &lhs, const Image< J > &rhs)
- template<typename I, typename J>
void min_inplace (Image< I > &lhs, const Image< J > &rhs)
- template<typename I, typename J>
mln::trait::concrete< I >::ret minus (const Image< I > &lhs, const Image< J > &rhs)
- template<typename I, typename J>
mln::trait::concrete< I >::ret plus (const Image< I > &lhs, const Image< J > &rhs)
- template<typename I, typename W>
mln::trait::concrete< I >::ret rank_filter (const Image< I > &input, const Window< W > &win, unsigned k)

  Morphological rank_filter.

- template<typename I, typename Wfg, typename Wbg>
mln::trait::concrete< I >::ret thick_miss (const Image< I > &input, const Window< Wfg > &win_fg, const Window< Wbg > &win_bg)
- template<typename I, typename Wfg, typename Wbg>
mln::trait::concrete< I >::ret thickening (const Image< I > &input, const Window< Wfg > &win_fg, const Window< Wbg > &win_bg)
- template<typename I, typename Wfg, typename Wbg>
mln::trait::concrete< I >::ret thin_fit (const Image< I > &input, const Window< Wfg > &win_fg, const Window< Wbg > &win_bg)
- template<typename I, typename Wfg, typename Wbg>
mln::trait::concrete< I >::ret thinning (const Image< I > &input, const Window< Wfg > &win_fg, const Window< Wbg > &win_bg)

  Morphological thinning.

- template<typename I, typename W>
mln::trait::concrete< I >::ret top_hat_black (const Image< I > &input, const Window< W > &win)

  Morphological black top-hat (for background / dark objects).

- template<typename I, typename W>
mln::trait::concrete< I >::ret top_hat_self_complementary (const Image< I > &input, const Window< W > &win)

  Morphological self-complementary top-hat.

- template<typename I, typename W>
mln::trait::concrete< I >::ret top_hat_white (const Image< I > &input, const Window< W > &win)

  Morphological white top-hat (for object / light objects).

9.111.1 Detailed Description

Namespace of mathematical morphology routines.

9.111.2 Function Documentation

9.111.2.1 template<typename I> mln::trait::concrete< I >::ret mln::morpho::complementation (const Image< I > & *input*) [inline]

Morphological complementation: either a logical "not" (if morpho on sets) or an arithmetical complementation (if morpho on functions).

Referenced by hit_or_miss_background_closing(), hit_or_miss_background_opening(), hit_or_miss_-closing(), and thinning().

9.111.2.2 template<typename I> void mln::morpho::complementation_inplace (Image< I > & *input*) [inline]

Morphological complementation, inplace version: either a logical "not" (if morpho on sets) or an arithmetical complementation (if morpho on functions).

9.111.2.3 template<typename I, typename W> mln::trait::concrete< I >::ret mln::morpho::contrast (const Image< I > & *input*, const Window< W > & *win*) [inline]

Morphological contrast operator (based on top-hats).

This operator is Id + wth_B - bth_B.

References mln::arith::plus(), top_hat_black(), and top_hat_white().

9.111.2.4 template<typename I, typename W> mln::trait::concrete< I >::ret mln::morpho::dilation (const Image< I > & *input*, const Window< W > & *win*) [inline]

Morphological dilation.

References general().

Referenced by gradient(), gradient_external(), mln::morpho::impl::generic::hit_or_miss(), hit_or_miss_-background_opening(), hit_or_miss_opening(), laplacian(), mln::morpho::opening::approx::structural(), and mln::morpho::closing::approx::structural().

9.111.2.5 template<typename I, typename W> mln::trait::concrete< I >::ret mln::morpho::erosion (const Image< I > & *input*, const Window< W > & *win*) [inline]

Morphological erosion.

References general().

Referenced by gradient(), gradient_internal(), mln::morpho::impl::generic::hit_or_miss(), laplacian(), mln::morpho::opening::approx::structural(), and mln::morpho::closing::approx::structural().

9.111.2.6 template< typename Op, typename I, typename W > mln::trait::concrete< I >::ret mln::morpho::general (const Op & *op*, const Image< I > & *input*, const Window< W > & *win*) [inline]

Morphological general routine.

Referenced by dilation(), and erosion().

9.111.2.7 template< typename I, typename W > mln::trait::concrete< I >::ret mln::morpho::gradient (const Image< I > & *input*, const Window< W > & *win*) [inline]

Morphological gradient.

This operator is d_B - e_B.

References dilation(), erosion(), minus(), and mln::test::positive().

9.111.2.8 template< typename I, typename W > mln::trait::concrete< I >::ret mln::morpho::gradient_external (const Image< I > & *input*, const Window< W > & *win*) [inline]

Morphological external gradient.

This operator is d_B - Id.

References dilation(), minus(), and mln::test::positive().

9.111.2.9 template< typename I, typename W > mln::trait::concrete< I >::ret mln::morpho::gradient_internal (const Image< I > & *input*, const Window< W > & *win*) [inline]

Morphological internal gradient.

This operator is Id - e_B.

References erosion(), minus(), and mln::test::positive().

9.111.2.10 template< typename I, typename Wh, typename Wm > mln::trait::concrete< I >::ret mln::morpho::hit_or_miss (const Image< I > & *input*, const Window< Wh > & *win_hit*, const Window< Wm > & *win_miss*) [inline]

Morphological hit-or-miss.

This operator is HMT_(Bh,Bm) = e_Bh /\ (e_Bm o C).

References dilation(), erosion(), mln::data::fill(), mln::initialize(), and mln::literal::zero.

Referenced by thickening(), and thinning().

9.111.2.11 template< typename I, typename Wh, typename Wm > mln::trait::concrete< I >::ret mln::morpho::hit_or_miss_background_closing (const Image< I > & *input*, const Window< Wh > & *win_hit*, const Window< Wm > & *win_miss*) [inline]

Morphological hit-or-miss closing of the background.

This operator is C o HMTopeBG o C.

References complementation(), hit_or_miss_background_opening(), and hit_or_miss_closing().

9.111.2.12 template<typename I, typename Wh, typename Wm> mln::trait::concrete< I >::ret mln::morpho::hit_or_miss_background_opening (const Image< I > & *input*, const Window< Wh > & *win_hit*, const Window< Wm > & *win_miss*) [inline]

Morphological hit-or-miss opening of the background.

This operator is HMTopeBG = HMTope_(Bm,Bh) o C = d_(-Bm) o HMT_(Bh,Bm).

References complementation(), dilation(), hit_or_miss_opening(), and mln::win::sym().

Referenced by hit_or_miss_background_closing(), and thick_miss().

9.111.2.13 template<typename I, typename Wh, typename Wm> mln::trait::concrete< I >::ret mln::morpho::hit_or_miss_closing (const Image< I > & *input*, const Window< Wh > & *win_hit*, const Window< Wm > & *win_miss*) [inline]

Morphological hit-or-miss closing.

This operator is C o HMTope o C.

References complementation(), and hit_or_miss_opening().

Referenced by hit_or_miss_background_closing().

9.111.2.14 template<typename I, typename Wh, typename Wm> mln::trait::concrete< I >::ret mln::morpho::hit_or_miss_opening (const Image< I > & *input*, const Window< Wh > & *win_hit*, const Window< Wm > & *win_miss*) [inline]

Morphological hit-or-miss opening.

This operator is HMTope_(Bh,Bm) = d_(-Bh) o HMT_(Bh,Bm).

References dilation(), and mln::win::sym().

Referenced by hit_or_miss_background_opening(), hit_or_miss_closing(), and thin_fit().

9.111.2.15 template<typename I, typename W, typename O> void mln::morpho::laplacian (const Image< I > & *input*, const Window< W > & *win*, Image< O > & *output*) [inline]

Morphological laplacian.

This operator is (d_B - Id) - (Id - e_B).

References dilation(), erosion(), mln::data::fill(), and minus().

9.111.2.16 template<typename V> edge_image< util::site_pair< point2d >, V, util::graph > mln::morpho::line_gradient (const mln::image2d< V > & *ima*) [inline]

Create a line graph image representing the gradient norm of a mln::image2d.

References mln::math::abs(), mln::image2d< T >::domain(), mln::box< P >::has(), mln::window< D >::insert(), and mln::Box< E >::nsites().

9.111.2.17 template<typename L, typename I, typename N> mln::trait::ch_value< I, L >::ret mln::morpho::meyer_wst (const Image< I > & *input*, const Neighborhood< N > & *nbh*) [inline]

Meyer's Watershed Transform (WST) algorithm, with no count of basins.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of markers.

- `L` is the type of labels, used to number the watershed itself (with the minimal value), and the basins.
- `I` is the exact type of the input image.
- `N` is the exact type of the neighborhood used to express *input's* connexity.

Note that the first parameter, `L`, is not automatically valued from the type of the actual argument during implicit instantiation: you have to explicitly pass this parameter at call sites.

9.111.2.18 template<typename L, typename I, typename N> mln::trait::ch_value< I, L >::ret mln::morpho::meyer_wst (const Image< I > & *input*, const Neighborhood< N > & *nbh*, L & *nbasins*) [inline]

Meyer's Watershed Transform (WST) algorithm.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of markers.

→ ***nbasins*** The number of basins.

- `L` is the type of labels, used to number the watershed itself (with the minimal value), and the basins.
- `I` is the exact type of the input image.
- `N` is the exact type of the neighborhood used to express *input's* connexity.

References mln::data::fill(), mln::p_priority< P, Q >::front(), mln::initialize(), mln::p_priority< P, Q >::pop(), mln::p_priority< P, Q >::push(), mln::labeling::regional_minima(), and mln::literal::zero.

9.111.2.19 template<typename I, typename J> mln::trait::concrete< I >::ret mln::morpho::min (const Image< I > & *lhs*, const Image< J > & *rhs*) [inline]

Morphological min: either a logical "and" (if morpho on sets) or an arithmetical min (if morpho on functions).

9.111.2.20 template<typename I, typename J> void mln::morpho::min_inplace (Image< I > & *lhs*, const Image< J > & *rhs*) [inline]

Morphological min, inplace version: either a logical "and" (if morpho on sets) or an arithmetical min (if morpho on functions).

9.111.2.21 template< typename I, typename J > mln::trait::concrete< I >::ret mln::morpho::minus (const Image< I > & *lhs*, const Image< J > & *rhs*) [inline]

Morphological minus: either a logical "and not" (if morpho on sets) or an arithmetical minus (if morpho on functions).

Referenced by gradient(), gradient_external(), gradient_internal(), laplacian(), thin_-fit(), thinning(), top_hat_black(), mln::morpho::elementary::top_hat_black(), top_hat_self_-complementary(), mln::morpho::elementary::top_hat_self_complementary(), top_hat_white(), and mln::morpho::elementary::top_hat_white().

9.111.2.22 template< typename I, typename J > mln::trait::concrete< I >::ret mln::morpho::plus (const Image< I > & *lhs*, const Image< J > & *rhs*) [inline]

Morphological plus: either a "logical or" (if morpho on sets) or an "arithmetical plus" (if morpho on functions).

Referenced by thick_miss(), and thickening().

9.111.2.23 template< typename I, typename W > mln::trait::concrete< I >::ret mln::morpho::rank_filter (const Image< I > & *input*, const Window< W > & *win*, unsigned *k*) [inline]

Morphological rank_filter.

References mln::extension::adjust_fill(), mln::geom::delta(), mln::accu::stat::rank< T >::init(), mln::initialize(), and mln::accu::stat::rank< T >::take().

9.111.2.24 template< typename I, typename Wfg, typename Wbg > mln::trait::concrete< I >::ret mln::morpho::thick_miss (const Image< I > & *input*, const Window< Wfg > & *win_fg*, const Window< Wbg > & *win_bg*) [inline]

Morphological thick-miss.

This operator is THICK_B = Id + HMTopeBG_B, where B = (Bfg, Bbg).

References hit_or_miss_background_opening(), and plus().

9.111.2.25 template< typename I, typename Wfg, typename Wbg > mln::trait::concrete< I >::ret mln::morpho::thickening (const Image< I > & *input*, const Window< Wfg > & *win_fg*, const Window< Wbg > & *win_bg*) [inline]

Morphological thickening.

This operator is THICK_B = Id + HMT_B, where B = (Bfg, Bbg).

References hit_or_miss(), and plus().

Referenced by thinning().

9.111.2.26 template<typename I, typename Wfg, typename Wbg> mln::trait::concrete< I >::ret mln::morpho::thin_fit (const Image< I > & *input*, const Window< Wfg > & *win_fg*, const Window< Wbg > & *win_bg*) [inline]

Morphological thin-fit.

This operator is THIN_B = Id - HMTope_B where B = (Bfg, Bbg).

References hit_or_miss_opening(), and minus().

9.111.2.27 template<typename I, typename Wfg, typename Wbg> mln::trait::concrete< I >::ret mln::morpho::thinning (const Image< I > & *input*, const Window< Wfg > & *win_fg*, const Window< Wbg > & *win_bg*) [inline]

Morphological thinning.

This operator is THIN_B = Id - HMT_B, where B = (Bfg, Bbg).

References complementation(), hit_or_miss(), minus(), and thickening().

9.111.2.28 template<typename I, typename W> mln::trait::concrete< I >::ret mln::morpho::top_hat_black (const Image< I > & *input*, const Window< W > & *win*) [inline]

Morphological black top-hat (for background / dark objects).

This operator is clo_B - Id.

References minus(), and mln::test::positive().

Referenced by contrast().

9.111.2.29 template<typename I, typename W> mln::trait::concrete< I >::ret mln::morpho::top_hat_self_complementary (const Image< I > & *input*, const Window< W > & *win*) [inline]

Morphological self-complementary top-hat.

This operator is

= top_hat_white + top_hat_black

= (input - opening) + (closing - input)

= closing - opening.

References minus(), and mln::test::positive().

9.111.2.30 template<typename I, typename W> mln::trait::concrete< I >::ret mln::morpho::top_hat_white (const Image< I > & *input*, const Window< W > & *win*) [inline]

Morphological white top-hat (for object / light objects).

This operator is Id - ope_B.

References minus(), and mln::test::positive().

Referenced by contrast().

9.112 mln::morpho::approx Namespace Reference

Namespace of approximate mathematical morphology routines.

9.112.1 Detailed Description

Namespace of approximate mathematical morphology routines.

9.113 mln::morpho::attribute Namespace Reference

Namespace of attributes used in mathematical morphology.

Classes

- class card

    Cardinality accumulator class.

- struct count_adjacent_vertices

    Count_Adjacent_Vertices accumulator class.

- struct height

    Height accumulator class.

- struct sharpness

    Sharpness accumulator class.

- class sum

    Suminality accumulator class.

- struct volume

    Volume accumulator class.

9.113.1 Detailed Description

Namespace of attributes used in mathematical morphology.

9.114 mln::morpho::closing::approx Namespace Reference

Namespace of approximate mathematical morphology closing routines.

Functions

- template<typename I, typename W>
  mln::trait::concrete< I >::ret structural (const Image< I > &input, const Window< W > &win)
  Approximate of morphological structural closing.

9.114.1 Detailed Description

Namespace of approximate mathematical morphology closing routines.

9.114.2 Function Documentation

9.114.2.1 template<typename I, typename W> mln::trait::concrete< I >::ret mln::morpho::closing::approx::structural (const Image< I > & *input*, const Window< W > & *win*) [inline]

Approximate of morphological structural closing.

This operator is e_{-B} o d_B.

References mln::morpho::dilation(), mln::morpho::erosion(), and mln::win::sym().

9.115 mln::morpho::elementary Namespace Reference

Namespace of image processing routines of elementary mathematical morphology.

Functions

- template< typename I, typename N >
  mln::trait::concrete< I >::ret closing (const Image< I > &input, const Neighborhood< N > &nbh)

  Morphological elementary closing.

- template< typename I, typename N >
  mln_trait_op_minus_twice (typename mln::trait::concrete< I >::ret) laplacian(const Image< I > &input

  Morphological elementary laplacian.

- template< typename I, typename N >
  mln::trait::concrete< I >::ret opening (const Image< I > &input, const Neighborhood< N > &nbh)

  Morphological elementary opening.

- template< typename I, typename N >
  mln::trait::concrete< I >::ret top_hat_black (const Image< I > &input, const Neighborhood< N > &nbh)

  Morphological elementary black top-hat (for background / dark objects).

- template< typename I, typename N >
  mln::trait::concrete< I >::ret top_hat_self_complementary (const Image< I > &input, const Neighborhood< N > &nbh)

  Morphological elementary self-complementary top-hat.

- template< typename I, typename N >
  mln::trait::concrete< I >::ret top_hat_white (const Image< I > &input, const Neighborhood< N > &nbh)

  Morphological elementary white top-hat (for object / light objects).

9.115.1 Detailed Description

Namespace of image processing routines of elementary mathematical morphology.

9.115.2 Function Documentation

9.115.2.1 template< typename I, typename N > mln::trait::concrete< I >::ret mln::morpho::elementary::closing (const Image< I > & *input*, const Neighborhood< N > & *nbh*) `[inline]`

Morphological elementary closing.

This operator is e o d.

Referenced by top_hat_black(), and top_hat_self_complementary().

9.115.2.2 template<typename I, typename N> mln::morpho::elementary::mln_-trait_op_minus_twice (typename mln::trait::concrete< I >::ret) const [inline]

Morphological elementary laplacian.

This operator is (d - id) - (id - e).

9.115.2.3 template<typename I, typename N> mln::trait::concrete< I >::ret mln::morpho::elementary::opening (const Image< I > & *input*, const Neighborhood< N > & *nbh*) [inline]

Morphological elementary opening.

This operator is d o e.

Referenced by top_hat_self_complementary(), and top_hat_white().

9.115.2.4 template<typename I, typename N> mln::trait::concrete< I >::ret mln::morpho::elementary::top_hat_black (const Image< I > & *input*, const Neighborhood< N > & *nbh*) [inline]

Morphological elementary black top-hat (for background / dark objects).

This operator is clo - Id.

References closing(), mln::morpho::minus(), and mln::test::positive().

9.115.2.5 template<typename I, typename N> mln::trait::concrete< I >::ret mln::morpho::elementary::top_hat_self_complementary (const Image< I > & *input*, const Neighborhood< N > & *nbh*) [inline]

Morphological elementary self-complementary top-hat.

This operator is

= top_hat_white + top_hat_black

= (Id - opening) + (closing - Id)

= closing - opening.

References closing(), mln::morpho::minus(), opening(), and mln::test::positive().

9.115.2.6 template<typename I, typename N> mln::trait::concrete< I >::ret mln::morpho::elementary::top_hat_white (const Image< I > & *input*, const Neighborhood< N > & *nbh*) [inline]

Morphological elementary white top-hat (for object / light objects).

This operator is Id - ope.

References mln::morpho::minus(), opening(), and mln::test::positive().

9.116 mln::morpho::impl Namespace Reference

Namespace of mathematical morphology routines implementations.

Namespaces

- namespace generic

  Namespace of mathematical morphology routines generic implementations.

9.116.1 Detailed Description

Namespace of mathematical morphology routines implementations.

9.117 mln::morpho::impl::generic Namespace Reference

Namespace of mathematical morphology routines generic implementations.

Functions

- template<typename I, typename Wh, typename Wm>
  mln::trait::concrete< I >::ret hit_or_miss (const Image< I > &input_, const Window< Wh > &win_hit_, const Window< Wm > &win_miss_)

  Morphological hit-or-miss.

- template<typename I, typename W>
  mln::trait::concrete< I >::ret rank_filter (const Image< I > &input_, const Window< W > &win_, unsigned k)

  Morphological rank_filter.

9.117.1 Detailed Description

Namespace of mathematical morphology routines generic implementations.

9.117.2 Function Documentation

9.117.2.1 template<typename I, typename Wh, typename Wm> mln::trait::concrete< I >::ret mln::morpho::impl::generic::hit_or_miss (const Image< I > & *input_*, const Window< Wh > & *win_hit_*, const Window< Wm > & *win_miss_*) [inline]

Morphological hit-or-miss.

This operator is HMT_(Bh,Bm) = e_Bh /\ (e_Bm o C).

References mln::morpho::dilation(), mln::morpho::erosion(), mln::data::fill(), mln::initialize(), and mln::literal::zero.

Referenced by mln::morpho::thickening(), and mln::morpho::thinning().

9.117.2.2 template<typename I, typename W> mln::trait::concrete< I >::ret mln::morpho::impl::generic::rank_filter (const Image< I > & *input_*, const Window< W > & *win_*, unsigned *k*) [inline]

Morphological rank_filter.

References mln::extension::adjust_fill(), mln::geom::delta(), mln::accu::stat::rank< T >::init(), mln::initialize(), and mln::accu::stat::rank< T >::take().

9.118 mln::morpho::opening::approx Namespace Reference

Namespace of approximate mathematical morphology opening routines.

Functions

- template<typename I, typename W>
  mln::trait::concrete< I >::ret structural (const Image< I > &input, const Window< W > &win)
  Approximate of morphological structural opening.

9.118.1 Detailed Description

Namespace of approximate mathematical morphology opening routines.

9.118.2 Function Documentation

9.118.2.1 template<typename I, typename W> mln::trait::concrete< I >::ret mln::morpho::opening::approx::structural (const Image< I > & *input*, const Window< W > & *win*) [inline]

Approximate of morphological structural opening.

This operator is d_{-B} o e_B.

References mln::morpho::dilation(), mln::morpho::erosion(), and mln::win::sym().

9.119 mln::morpho::reconstruction Namespace Reference

Namespace of morphological reconstruction routines.

Namespaces

- namespace by_dilation

  Namespace of morphological reconstruction by dilation routines.

- namespace by_erosion

  Namespace of morphological reconstruction by erosion routines.

9.119.1 Detailed Description

Namespace of morphological reconstruction routines.

9.120 mln::morpho::reconstruction::by_dilation Namespace Reference

Namespace of morphological reconstruction by dilation routines.

9.120.1 Detailed Description

Namespace of morphological reconstruction by dilation routines.

9.121 mln::morpho::reconstruction::by_erosion Namespace Reference

Namespace of morphological reconstruction by erosion routines.

9.121.1 Detailed Description

Namespace of morphological reconstruction by erosion routines.

9.122 mln::morpho::tree Namespace Reference

Namespace of morphological tree-related routines.

Namespaces

- namespace filter

  Namespace for attribute filtering.

Functions

- template< typename A, typename T >
  mln::trait::ch_value< typename T::function, typename A::result >::ret compute_attribute_image (const Accumulator< A > &a, const T &t, mln::trait::ch_value< typename T::function, A >::ret ∗accu_image=0)

  Compute an attribute image using tree with a parent relationship between sites.

- template< typename A, typename T, typename V >
  mln::trait::ch_value< typename T::function, typename A::result >::ret compute_attribute_image_from (const Accumulator< A > &a, const T &t, const Image< V > &values, mln::trait::ch_value< typename T::function, A >::ret ∗accu_image=0)

  The same as compute_attribute_image but uses the values stored by `values` *image instead.*

- template< typename I, typename N, typename S >
  mln::trait::ch_value< I, typename I::psite >::ret compute_parent (const Image< I > &f, const Neighborhood< N > &nbh, const Site_Set< S > &s)

  Compute a tree with a parent relationship between sites.

- template< typename I, typename N >
  data< I, p_array< typename I::psite > > dual_input_max_tree (const Image< I > &f, const Image< I > &m, const Neighborhood< N > &nbh)

  Compute the dual input max tree using mask-based connectivity.

- template< typename I, typename N >
  data< I, p_array< typename I::psite > > max_tree (const Image< I > &f, const Neighborhood< N > &nbh)

  Compute a canonized max-tree.

- template< typename I, typename N >
  data< I, p_array< typename I::psite > > min_tree (const Image< I > &f, const Neighborhood< N > &nbh)

  Compute a canonized min-tree.

- template< typename T, typename A, typename P, typename W >
  void propagate_if (const T &tree, Image< A > &a_, const way_of_propagation< W > &prop_, const Function_v2b< P > &pred_, const typename A::value &v)
- template< typename T, typename A, typename W >
  void propagate_if_value (const T &tree, Image< A > &a_, const way_of_propagation< W > &prop_, const typename A::value &v, const typename A::value &v_prop)

- template<typename T, typename A>
  void propagate_node_to_ancestors (typename A::psite n, const T &t, Image< A > &a_)
- template<typename T, typename A>
  void propagate_node_to_ancestors (typename A::psite n, const T &t, Image< A > &a_, const typename A::value &v)
- template<typename T, typename A>
  void propagate_node_to_descendants (typename A::psite &n, const T &t, Image< A > &a_, unsigned *nb_leaves=0)
- template<typename T, typename A>
  void propagate_node_to_descendants (typename A::psite n, const T &t, Image< A > &a_, const typename A::value &v, unsigned *nb_leaves=0)
- template<typename T, typename F>
  void propagate_representative (const T &t, Image< F > &f_)

  Propagate the representative node's value to non-representative points of the component.

9.122.1 Detailed Description

Namespace of morphological tree-related routines.

9.122.2 Function Documentation

9.122.2.1 template<typename A, typename T> mln::trait::ch_value< typename T::function, typename A::result >::ret mln::morpho::tree::compute_attribute_image (const Accumulator< A > & *a*, const T & *t*, mln::trait::ch_value< typename T::function, A >::ret * *accu_image* = 0) `[inline]`

Compute an attribute image using tree with a parent relationship between sites.

In the attribute image, the resulting value at a node is the 'sum' of its sub-components value + the attribute value at this node.

Warning: `s` translates the ordering related to the "natural" childhood relationship. The parenthood is thus inverted w.r.t. to `s`.

It is very convenient since all processing upon the parent tree are performed following `s` (in the default "forward" way).

FIXME: Put it more clearly...

The parent result image verifies:

- p is root iff parent(p) == p
- p is a node iff either p is root or f(parent(p)) != f(p).

Parameters:

← ***a*** Attribute.

← ***t*** Component tree.

→ ***accu_image*** Optional argument used to store image of attribute accumulator.

Returns:

The attribute image.

9.122.2.2 template<typename A, typename T, typename V> mln::trait::ch_value< typename T::function, typename A::result >::ret mln::morpho::tree::compute_attribute_image_-from (const Accumulator< A > & *a*, const T & *t*, const Image< V > & *values*, mln::trait::ch_value< typename T::function, A >::ret * *accu_image* = 0) [inline]

The same as compute_attribute_image but uses the values stored by `values` image instead.

Parameters:

← ***a*** Attribute.

← ***t*** Component tree.

← ***values*** Value image.

→ ***accu_image*** Optional argument used to store image.

Returns:

9.122.2.3 template<typename I, typename N, typename S> mln::trait::ch_value< I, typename I::psite >::ret mln::morpho::tree::compute_parent (const Image< I > & *f*, const Neighborhood< N > & *nbh*, const Site_Set< S > & *s*) [inline]

Compute a tree with a parent relationship between sites.

Warning: `s` translates the ordering related to the "natural" childhood relationship. The parenthood is thus inverted w.r.t. to `s`.

It is very convenient since most processing routines upon the parent tree are performed following `s` (in the default "forward" way). Indeed that is the way to propagate information from parents to children.

The parent result image verifies:

- p is root iff parent(p) == p
- p is a node iff either p is root or f(parent(p)) != f(p).

The choice "s means childhood" is consistent with labeling in binary images. In that particular case, while browsing the image in forward scan (video), we expect to find first a tree root (a first point, representative of a component) and then the other component points. Please note that it leads to increasing values of labels in the "natural" video scan.

Since mathematical morphology on functions is related to morphology on sets, we clearly want to keep the equivalence between "component labeling" and "component filtering" using trees.

FIXME: Put it more clearly... Insert pictures!

A binary image:

- | | - -
- | | - |
- - - - -
- - | | -

where '|' means true and '-' means false.

Its labeling:

0 1 1 0 0

0 1 1 0 2

0 0 0 0 0

0 0 3 3 0

The corresponding forest:

x o . x x

x . . x o

x x x x x

x x o . x

where 'x' means "no data", 'o' is a tree root (representative point for a component), and '.' is a tree regular (non-root) point (in a component by not its representative point).

The forest, with the parent relationship looks like:

o < .

^ r

. . o

o < .

9.122.2.4 template<typename I, typename N> morpho::tree::data< I, p_array< typename I::psite > > mln::morpho::tree::dual_input_max_tree (const Image< I > & *f*, const Image< I > & *m*, const Neighborhood< N > & *nbh*) `[inline]`

Compute the dual input max tree using mask-based connectivity.

Parameters:

← ***f*** The original image.

← ***m*** The connectivity mask.

← ***nbh*** The neighborhood of the mask.

Returns:

The computed tree.

9.122.2.5 template<typename I, typename N> data< I, p_array< typename I::psite > > mln::morpho::tree::max_tree (const Image< I > & *f*, const Neighborhood< N > & *nbh*) `[inline]`

Compute a canonized max-tree.

Parameters:

← ***f*** The input image.

← ***nbh*** The neighborhood.

Returns:

The corresponding max-tree structure.

References mln::data::sort_psites_increasing().

9.122.2.6 template<typename I, typename N> data< I, p_array< typename I::psite > > mln::morpho::tree::min_tree (const Image< I > & *f*, const Neighborhood< N > & *nbh*) `[inline]`

Compute a canonized min-tree.

Parameters:

← ***f*** The input image.

← ***nbh*** The neighborhood.

Returns:

The corresponding min-tree structure.

References mln::data::sort_psites_decreasing().

9.122.2.7 template<typename T, typename A, typename P, typename W> void mln::morpho::tree::propagate_if (const T & *tree*, Image< A > & *a_*, const way_of_propagation< W > & *prop_*, const Function_v2b< P > & *pred_*, const typename A::value & *v*) `[inline]`

Propagate nodes checking the predicate `pred` in the way defined by `way_of_propagation`.

Parameters:

tree Component tree used for propagation.

a_ Attributed image where values are propagated.

prop_ Propagate node in acsendant or descendant way.

pred_ Predicate that node must check to be propagated.

v Value to be propagated. (By default `v` is the value at the node being propagated).

Referenced by mln::morpho::tree::filter::subtractive().

9.122.2.8 template<typename T, typename A, typename W> void mln::morpho::tree::propagate_-if_value (const T & *tree*, Image< A > & *a_*, const way_of_propagation< W > & *prop_*, const typename A::value & *v*, const typename A::value & *v_prop*) `[inline]`

Propagate nodes having the value v in the way defined by `way_of_propagation`.

Parameters:

tree Component tree used for propagation.

a_ Attributed image where values are propagated.

prop_ Propagate node in acsendant or descendant way.

v Value that node must have to be propagated.

v_prop Value to propagate (By default it is the value at the node being propagated).

9.122.2.9 template<typename T, typename A> void mln::morpho::tree::propagate_-node_to_ancestors (typename A::psite *n*, const T & *t*, Image< A > & *a_*) [inline]

Propagate the node's value to its ancestors.

Parameters:

← ***n*** Node to propagate.

← ***t*** Component tree used for propagation.

↔ ***a_*** Attribute image where values are propagated.

References propagate_node_to_ancestors().

9.122.2.10 template<typename T, typename A> void mln::morpho::tree::propagate_node_to_-ancestors (typename A::psite *n*, const T & *t*, Image< A > & *a_*, const typename A::value & *v*) [inline]

Propagate a value `v` from a node `n` to its ancestors.

Parameters:

← ***n*** Node to propagate.

← ***t*** Component tree used for propagation.

← ***a_*** Attribute image where values are propagated.

← ***v*** Value to propagate.

Referenced by propagate_node_to_ancestors().

9.122.2.11 template<typename T, typename A> void mln::morpho::tree::propagate_node_to_-descendants (typename A::psite & *n*, const T & *t*, Image< A > & *a_*, unsigned * *nb_leaves* = 0) [inline]

Propagate the node's value to its descendants.

Parameters:

← ***n*** Node to propagate.

← ***t*** Component tree used for propagation.

← ***a_*** Attribute image where values are propagated.

→ ***nb_leaves*** Optional. Store the number of leaves in the component.

9.122.2.12 template< typename T, typename A > void mln::morpho::tree::propagate_node_to_-descendants (typename A::psite *n*, const T & *t*, Image< A > & *a_*, const typename A::value & *v*, unsigned * *nb_leaves* = 0) [inline]

Propagate a value v from a node n to its descendants.

Parameters:

← ***n*** Node to propagate.

← ***t*** Component tree used for propagation.

← ***a_*** Attribute image where values are propagated.

← ***v*** Value to propagate.

→ ***nb_leaves*** Optional. Store the number of leaves in the component.

9.122.2.13 template< typename T, typename F > void mln::morpho::tree::propagate_-representative (const T & *t*, Image< F > & *f_*) [inline]

Propagate the representative node's value to non-representative points of the component.

Parameters:

t Component tree.

f_ Value image.

9.123 mln::morpho::tree::filter Namespace Reference

Namespace for attribute filtering.

Functions

- template<typename T, typename F, typename P>
  void direct (const T &tree, Image< F > &f_, const Function_v2b< P > &pred_)

  Direct non-pruning strategy.

- template<typename T, typename F, typename P>
  void filter (const T &tree, Image< F > &f_, const Function_v2b< P > &pred_, const typename F::value &v)

  Filter the image `f_` with a given value.

- template<typename T, typename F, typename P>
  void max (const T &tree, Image< F > &f_, const Function_v2b< P > &pred_)

  Max pruning strategy.

- template<typename T, typename F, typename P>
  void min (const T &tree, Image< F > &f_, const Function_v2b< P > &pred_)

  Min pruning strategy.

- template<typename T, typename F, typename P>
  void subtractive (const T &tree, Image< F > &f_, const Function_v2b< P > &pred_)

  Subtractive pruning strategy.

9.123.1 Detailed Description

Namespace for attribute filtering.

9.123.2 Function Documentation

9.123.2.1 template<typename T, typename F, typename P> void mln::morpho::tree::filter::direct (const T & *tree*, Image< F > & *f_*, const Function_v2b< P > & *pred_*) `[inline]`

Direct non-pruning strategy.

A node is removed if it does not verify the predicate. The sub-components remain intact.

Parameters:

← ***tree*** Component tree.

→ ***f_*** Image to filter.

← ***pred_*** Filtering criterion.

9.123.2.2 template<typename T, typename F, typename P> void mln::morpho::tree::filter::filter (const T & *tree*, Image< F > & *f_*, const Function_v2b< P > & *pred_*, const typename F::value & *v*) [inline]

Filter the image `f_` with a given value.

The sub-components of nodes that does not match the predicate `pred_` are filled with the given value `v`.

Parameters:

tree Component tree.

*f_* Image function.

*pred_* Predicate.

v Value to propagate.

References mln::data::fill(), and mln::initialize().

9.123.2.3 template<typename T, typename F, typename P> void mln::morpho::tree::filter::max (const T & *tree*, Image< F > & *f_*, const Function_v2b< P > & *pred_*) [inline]

Max pruning strategy.

A node is removed iif all of its children are removed or if it does not verify the predicate `pred_`.

Parameters:

← *tree* Component tree.

→ *f_* Image to filter.

← *pred_* Filtering criterion.

References mln::data::fill(), and mln::initialize().

9.123.2.4 template<typename T, typename F, typename P> void mln::morpho::tree::filter::min (const T & *tree*, Image< F > & *f_*, const Function_v2b< P > & *pred_*) [inline]

Min pruning strategy.

A node is removed iif its parent is removed or if it does not verify the predicate `pred_`.

Parameters:

← *tree* Component tree.

→ *f_* Image to filter.

← *pred_* Filtering criterion.

References mln::data::fill(), and mln::initialize().

9.123.2.5 template<typename T, typename F, typename P> void mln::morpho::tree::filter::subtractive (const T & *tree*, Image< F > & *f_*, const Function_v2b< P > & *pred_*) [inline]

Subtractive pruning strategy.

The node is removed if it does not verify the predicate. The sub-components values are set to the value of the removed component.

Parameters:

- ← ***tree*** Component tree.
- → ***f_*** Image to filter.
- ← ***pred_*** Filtering criterion.

References mln::morpho::tree::propagate_if().

9.124 mln::morpho::watershed Namespace Reference

Namespace of morphological watershed routines.

Namespaces

- namespace watershed

  Namespace of morphological watershed routines implementations.

Functions

- template<typename L, typename I, typename N>
  mln::trait::ch_value< I, L >::ret flooding (const Image< I > &input, const Neighborhood< N > &nbh)

  Meyer's Watershed Transform (WST) algorithm, with no count of basins.

- template<typename L, typename I, typename N>
  mln::trait::ch_value< I, L >::ret flooding (const Image< I > &input, const Neighborhood< N > &nbh, L &n_basins)

  Meyer's Watershed Transform (WST) algorithm.

- template<typename I, typename J>
  mln::trait::ch_value< I, value::rgb8 >::ret superpose (const Image< I > &input, const Image< J > &ws_ima)

  Convert an image to a rgb8 image and draw the watershed lines.

- template<typename I, typename J>
  mln::trait::ch_value< I, value::rgb8 >::ret superpose (const Image< I > &input_, const Image< J > &ws_ima_, const value::rgb8 &wsl_color)

  Convert an image to a rgb8 image and draw the watershed lines.

- template<class T>
  T::image_t topological (T &tree)

  Compute a toological watershed transform from tree.

9.124.1 Detailed Description

Namespace of morphological watershed routines.

9.124.2 Function Documentation

9.124.2.1 template<typename L, typename I, typename N> mln::trait::ch_value< I, L >::ret mln::morpho::watershed::flooding (const Image< I > & *input*, const Neighborhood< N > & *nbh*) `[inline]`

Meyer's Watershed Transform (WST) algorithm, with no count of basins.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of markers.

- `L` is the type of labels, used to number the watershed itself (with the minimal value), and the basins.
- `I` is the exact type of the input image.
- `N` is the exact type of the neighborhood used to express *input's* connexity.

Note that the first parameter, `L`, is not automatically valued from the type of the actual argument during implicit instantiation: you have to explicitly pass this parameter at call sites.

9.124.2.2 template<typename L, typename I, typename N> mln::trait::ch_value< I, L >::ret mln::morpho::watershed::flooding (const Image< I > & *input*, const Neighborhood< N > & *nbh*, L & *n_basins*) `[inline]`

Meyer's Watershed Transform (WST) algorithm.

Parameters:

← ***input*** The input image.

← ***nbh*** The connexity of markers.

→ ***n_basins*** The number of basins.

- `L` is the type of labels, used to number the watershed itself (with the minimal value), and the basins.
- `I` is the exact type of the input image.
- `N` is the exact type of the neighborhood used to express *input's* connexity.

9.124.2.3 template<typename I, typename J> mln::trait::ch_value< I, value::rgb8 >::ret mln::morpho::watershed::superpose (const Image< I > & *input*, const Image< J > & *ws_ima*) `[inline]`

Convert an image to a rgb8 image and draw the watershed lines.

References mln::literal::red, and superpose().

9.124.2.4 template<typename I, typename J> mln::trait::ch_value< I, value::rgb8 >::ret mln::morpho::watershed::superpose (const Image< I > & *input_*, const Image< J > & *ws_ima_*, const value::rgb8 & *wsl_color*) `[inline]`

Convert an image to a rgb8 image and draw the watershed lines.

References mln::data::convert(), mln::data::fill(), and mln::literal::zero.

Referenced by superpose().

9.124.2.5 template<class T> T::image_t mln::morpho::watershed::topological (T & *tree*) [inline]

Compute a toological watershed transform from *tree*.

References mln::data::fill(), mln::p_priority< P, Q >::front(), mln::initialize(), mln::p_priority< P, Q >::pop(), mln::p_priority< P, Q >::push(), and topological().

Referenced by topological().

9.125 mln::morpho::watershed::watershed Namespace Reference

Namespace of morphological watershed routines implementations.

Namespaces

- namespace generic

  Namespace of morphological watershed routines generic implementations.

9.125.1 Detailed Description

Namespace of morphological watershed routines implementations.

9.126 mln::morpho::watershed::watershed::generic Namespace Reference

Namespace of morphological watershed routines generic implementations.

9.126.1 Detailed Description

Namespace of morphological watershed routines generic implementations.

9.127 mln::norm Namespace Reference

Namespace of norms.

Namespaces

- namespace impl

    Implementation namespace of norm namespace.

Functions

- template<unsigned n, typename C>
  mln::trait::value_< typename mln::trait::op::times< C, C >::ret >::sum l1 (const C(&vec)[n])

    L1-norm of a vector vec.

- template<unsigned n, typename C>
  mln::trait::value_< typename mln::trait::op::times< C, C >::ret >::sum l1_distance (const C(&vec1)[n], const C(&vec2)[n])

    L1-norm distance between vectors vec1 *and* vec2.

- template<unsigned n, typename C>
  mln::trait::value_< typename mln::trait::op::times< C, C >::ret >::sum l2 (const C(&vec)[n])

    L2-norm of a vector vec.

- template<unsigned n, typename C>
  mln::trait::value_< typename mln::trait::op::times< C, C >::ret >::sum l2_distance (const C(&vec1)[n], const C(&vec2)[n])

    L2-norm distance between vectors vec1 *and* `vec2`.

- template<unsigned n, typename C>
  C linfty (const C(&vec)[n])

    L-infinity-norm of a vector vec.

- template<unsigned n, typename C>
  C linfty_distance (const C(&vec1)[n], const C(&vec2)[n])

    L-infinity-norm distance between vectors vec1 *and* vec2.

- template<unsigned n, typename C>
  mln::trait::value_< typename mln::trait::op::times< C, C >::ret >::sum sqr_l2 (const C(&vec)[n])

    Squared L2-norm of a vector vec.

9.127.1 Detailed Description

Namespace of norms.

9.127.2 Function Documentation

9.127.2.1 template<unsigned n, typename C> mln::trait::value_< typename mln::trait::op::times< C, C >::ret >::sum mln::norm::l1 (const C(&) *vec*[n]) [inline]

L1-norm of a vector *vec*.

9.127.2.2 template<unsigned n, typename C> mln::trait::value_< typename mln::trait::op::times< C, C >::ret >::sum mln::norm::l1_distance (const C(&) *vec1*[n], const C(&) *vec2*[n]) [inline]

L1-norm distance between vectors *vec1* and *vec2*.

9.127.2.3 template<unsigned n, typename C> mln::trait::value_< typename mln::trait::op::times< C, C >::ret >::sum mln::norm::l2 (const C(&) *vec*[n]) [inline]

L2-norm of a vector *vec*.

9.127.2.4 template<unsigned n, typename C> mln::trait::value_< typename mln::trait::op::times< C, C >::ret >::sum mln::norm::l2_distance (const C(&) *vec1*[n], const C(&) *vec2*[n]) [inline]

L2-norm distance between vectors *vec1* and `vec2`.

9.127.2.5 template<unsigned n, typename C> C mln::norm::linfty (const C(&) *vec*[n]) [inline]

L-infinity-norm of a vector *vec*.

9.127.2.6 template<unsigned n, typename C> C mln::norm::linfty_distance (const C(&) *vec1*[n], const C(&) *vec2*[n]) [inline]

L-infinity-norm distance between vectors *vec1* and *vec2*.

9.127.2.7 template<unsigned n, typename C> mln::trait::value_< typename mln::trait::op::times< C, C >::ret >::sum mln::norm::sqr_l2 (const C(&) *vec*[n]) [inline]

Squared L2-norm of a vector *vec*.

Referenced by mln::geom::mesh_corner_point_area(), and mln::geom::mesh_normal().

9.128 mln::norm::impl Namespace Reference

Implementation namespace of norm namespace.

9.128.1 Detailed Description

Implementation namespace of norm namespace.

9.129 mln::opt Namespace Reference

Namespace of optional routines.

Namespaces

- namespace impl

    Implementation namespace of opt namespace.

Functions

- template<typename I>
  I::lvalue at (Image< I > &ima, def::coord sli, def::coord row, def::coord col)

    Read-write access to the `ima` *value located at (*`sli`, `row`, `col`*).*

- template<typename I>
  I::rvalue at (const Image< I > &ima, def::coord sli, def::coord row, def::coord col)

    Three dimensions Read-only access to the `ima` *value located at (*`sli`, `row`, `col`*).*

- template<typename I>
  I::lvalue at (Image< I > &ima, def::coord row, def::coord col)

    Read-write access to the `ima` *value located at (*`row`, `col`*).*

- template<typename I>
  I::rvalue at (const Image< I > &ima, def::coord row, def::coord col)

    Two dimensions Read-only access to the `ima` *value located at (*`row`, `col`*).*

- template<typename I>
  I::lvalue at (Image< I > &ima, def::coord ind)

    Read-write access to the `ima` *value located at (*`ind`*).*

- template<typename I>
  I::rvalue at (const Image< I > &ima, def::coord ind)

    One dimension Read-only access to the `ima` *value located at (*`ind`*).*

9.129.1 Detailed Description

Namespace of optional routines.

9.129.2 Function Documentation

9.129.2.1 template<typename I> I::lvalue mln::opt::at (Image< I > & *ima*, def::coord *sli*, def::coord *row*, def::coord *col*) [inline]

Read-write access to the `ima` value located at (`sli`, `row`, `col`).

9.129.2.2 template<typename I> I::rvalue mln::opt::at (const Image< I > & *ima*, def::coord *sli*, def::coord *row*, def::coord *col*) [inline]

Three dimensions Read-only access to the `ima` value located at (`sli`, `row`, `col`).

9.129.2.3 template<typename I> I::lvalue mln::opt::at (Image< I > & *ima*, def::coord *row*, def::coord *col*) [inline]

Read-write access to the `ima` value located at (`row`, `col`).

9.129.2.4 template<typename I> I::rvalue mln::opt::at (const Image< I > & *ima*, def::coord *row*, def::coord *col*) [inline]

Two dimensions Read-only access to the `ima` value located at (`row`, `col`).

9.129.2.5 template<typename I> I::lvalue mln::opt::at (Image< I > & *ima*, def::coord *ind*) [inline]

Read-write access to the `ima` value located at (`ind`).

9.129.2.6 template<typename I> I::rvalue mln::opt::at (const Image< I > & *ima*, def::coord *ind*) [inline]

One dimension Read-only access to the `ima` value located at (`ind`).

Referenced by mln::transform::hough(), and mln::make::image().

9.130 mln::opt::impl Namespace Reference

Implementation namespace of opt namespace.

9.130.1 Detailed Description

Implementation namespace of opt namespace.

Three dimensions.

Two dimensions.

One dimension.

9.131 mln::pw Namespace Reference

Namespace of "point-wise" expression tools.

Classes

- class image

    A generic point-wise image implementation.

9.131.1 Detailed Description

Namespace of "point-wise" expression tools.

9.132 mln::registration Namespace Reference

Namespace of "point-wise" expression tools.

Classes

- class closest_point_basic

  Closest point functor based on map distance.

- class closest_point_with_map

  Closest point functor based on map distance.

Functions

- template<typename P, typename F>
  algebra::quat get_rot (const p_array< P > &P_, const vec3d_f &mu_P, const vec3d_f &mu_Yk, const F &closest_point, const algebra::quat &qR, const vec3d_f &qT)

  FIXME: work only for 3d images.

- template<typename P, typename F>
  composed< translation< P::dim, float >, rotation< P::dim, float > > icp (const p_array< P > &P_, const p_array< P > &X, const F &closest_point)
- template<typename P, typename F>
  std::pair< algebra::quat, mln_vec(P)> icp (const p_array< P > &P_, const p_array< P > &X, const F &closest_point, const algebra::quat &initial_rot, const mln_vec(P)&initial_translation)

  Base version of the ICP algorithm. It is called in other variants.

- template<typename P>
  composed< translation< P::dim, float >, rotation< P::dim, float > > registration1 (const box< P > &domain, const p_array< P > &P_, const p_array< P > &X)

  Call ICP once and return the resulting transformation.

- template<typename P>
  composed< translation< P::dim, float >, rotation< P::dim, float > > registration2 (const box< P > &domain, const p_array< P > &P_, const p_array< P > &X)

  Call ICP 10 times.

- template<typename P>
  composed< translation< P::dim, float >, rotation< P::dim, float > > registration3 (const box< P > &domain, const p_array< P > &P_, const p_array< P > &X)

  Call ICP 10 times.

9.132.1 Detailed Description

Namespace of "point-wise" expression tools.

9.132.2 Function Documentation

9.132.2.1 template<typename P, typename F> algebra::quat mln::registration::get_rot (const p_array< P > & *P_*, const vec3d_f & *mu_P*, const vec3d_f & *mu_Yk*, const F & *closest_point*, const algebra::quat & *qR*, const vec3d_f & *qT*) `[inline]`

FIXME: work only for 3d images.

References mln::p_array< P >::nsites().

9.132.2.2 template<typename P, typename F> composed< translation<P::dim,float>,rotation<P::dim,float> > mln::registration::icp (const p_array< P > & *P_*, const p_array< P > & *X*, const F & *closest_point*) `[inline]`

Register point in `c` using a function of closest points `closest_point`.

Parameters:

← ***P_*** The cloud of points.

← ***X*** the reference surface.

← ***closest_point*** The function of closest points.

Returns:

the rigid transformation which may be use later to create a registered image.

9.132.2.3 template<typename P, typename F> std::pair< algebra::quat, mln_vec(P)> mln::registration::icp (const p_array< P > & *P_*, const p_array< P > & *X*, const F & *closest_point*, const algebra::quat & *initial_rot*, const mln_vec(P)& *initial_translation*) `[inline]`

Base version of the ICP algorithm. It is called in other variants.

Register point in `c` using a function of closest points `closest_point`. This overload allows to specify initial transformations.

Parameters:

← ***P_*** The cloud of points.

← ***X*** the reference surface.

← ***closest_point*** The function of closest points.

← ***initial_rot*** An initial rotation.

← ***initial_translation*** An initial translation.

Returns:

the rigid transformation which may be use later to create a registered image.

WARNING: the function `closest_point` *MUST* take float/double vector as arguments. Otherwise the resulting transformation may be wrong due to the truncation of the vector coordinate values.

Precondition:

`P_` and `X` must not be empty.

Reference article: "A Method for Registration of 3-D Shapes", Paul J. Besl and Neil D. McKay, IEEE, 2, February 1992.

References mln::geom::bbox(), mln::literal::black, mln::set::compute(), mln::duplicate(), mln::box< P >::enlarge(), mln::data::fill(), mln::literal::green, mln::io::ppm::save(), and mln::literal::white.

9.132.2.4 template<typename P> composed< translation< P::dim, float >, rotation< P::dim, float > > mln::registration::registration1 (const box< P > & *domain*, const p_array< P > & *P_*, const p_array< P > & *X*) `[inline]`

Call ICP once and return the resulting transformation.

9.132.2.5 template<typename P> composed< translation< P::dim, float >, rotation< P::dim, float > > mln::registration::registration2 (const box< P > & *domain*, const p_array< P > & *P_*, const p_array< P > & *X*) `[inline]`

Call ICP 10 times.

Do the first call to ICP with all sites then work on a subset of which size is decreasing. For each call, a distance criterion is computed on a subset. Sites part of the subset which are too far or too close are removed. Removed sites are ∗NOT∗ reused later in the subset.

9.132.2.6 template<typename P> composed< translation< P::dim, float >, rotation< P::dim, float > > mln::registration::registration3 (const box< P > & *domain*, const p_array< P > & *P_*, const p_array< P > & *X*) `[inline]`

Call ICP 10 times.

Do the first call to ICP with all sites then work on a subset. For each call, a distance criterion is computed on a subset. A new subset is computed from the whole set of points according to this distance. It will be used in the next call. Removed Sites ∗MAY∗ be reintegrated.

9.133 mln::select Namespace Reference

Select namespace (FIXME doc).

Classes

- struct p_of

    Structure p_of.

9.133.1 Detailed Description

Select namespace (FIXME doc).

9.134 mln::set Namespace Reference

Namespace of image processing routines related to pixel sets.

Functions

- template<typename S>
  unsigned card (const Site_Set< S > &s)

  Compute the cardinality of the site set `s`.

- template<typename A, typename S>
  A::result compute (const Accumulator< A > &a, const Site_Set< S > &s)

  Compute an accumulator onto a site set.

- template<typename A, typename I, typename L>
  util::array< typename A::result > compute_with_weights (const Accumulator< A > &a, const Image< I > &w, const Image< L > &label, const typename L::value &nlabels)

  Compute an accumulator on every labeled sub-site-sets.

- template<typename A, typename I>
  A::result compute_with_weights (const Accumulator< A > &a, const Image< I > &w)

  Compute an accumulator on a site set described by an image.

- template<typename S>
  S::site get (const Site_Set< S > &s, size_t index)

  FIXME.

- template<typename S>
  bool has (const Site_Set< S > &s, const typename S::site &e)

  FIXME.

- template<typename A, typename I>
  mln_meta_accu_result (A, typename I::site) compute_with_weights(const Meta_Accumulator< A > &a

  Compute an accumulator on a site set described by an image.

- template<typename A, typename S>
  mln_meta_accu_result (A, typename S::site) compute(const Meta_Accumulator< A > &a

  Compute an accumulator onto a site set.

9.134.1 Detailed Description

Namespace of image processing routines related to pixel sets.

9.134.2 Function Documentation

9.134.2.1 template<typename S> unsigned mln::set::card (const Site_Set< S > & *s*) `[inline]`

Compute the cardinality of the site set `s`.

9.134.2.2 template<typename A, typename S> A::result mln::set::compute (const Accumulator< A > & *a*, const Site_Set< S > & *s*) [inline]

Compute an accumulator onto a site set.

Parameters:

← ***a*** An accumulator.

← ***s*** A site set.

Returns:

The accumulator result.

Referenced by mln::registration::icp().

9.134.2.3 template<typename A, typename I, typename L> util::array< typename A::result > mln::set::compute_with_weights (const Accumulator< A > & *a_*, const Image< I > & *w_*, const Image< L > & *label_*, const typename L::value & *nlabels*) [inline]

Compute an accumulator on every labeled sub-site-sets.

Parameters:

← ***a*** An accumulator.

← ***w*** An image of weights (a site -> a weight).

← ***label*** A label image.

← ***nlabels*** The number of labels in `label`.

Returns:

An array of accumulator result. One per label.

Compute an accumulator on every labeled sub-site-sets.

Parameters:

← ***a_*** An accumulator.

← ***w_*** An image of weights (a site -> a weight).

← ***label_*** A label image.

← ***nlabels*** The number of labels in `label`.

Returns:

An array of accumulator result. One per label.

9.134.2.4 template<typename A, typename I> A::result mln::set::compute_with_weights (const Accumulator< A > & *a_*, const Image< I > & *w_*) [inline]

Compute an accumulator on a site set described by an image.

Parameters:

← ***a*** An accumulator.

← ***w*** An image of weights (a site -> a weight).

Returns:

The accumulator result.

Compute an accumulator on a site set described by an image.

Parameters:

← ***a_*** An accumulator.

← ***w_*** An image of weights (a site -> a weight).

Returns:

The accumulator result.

9.134.2.5 template<typename S> S::site mln::set::get (const Site_Set< S > & *s*, size_t *index*) [inline]

FIXME.

9.134.2.6 template<typename S> bool mln::set::has (const Site_Set< S > & *s*, const typename S::site & *e*) [inline]

FIXME.

9.134.2.7 template<typename A, typename I> mln::set::mln_meta_accu_result (A, typename I::site) const [inline]

Compute an accumulator on a site set described by an image.

Parameters:

← ***a*** A meta-accumulator.

← ***w*** An image of weights (a site -> a weight).

Returns:

The accumulator result.

9.134.2.8 template<typename A, typename S> mln::set::mln_meta_accu_result (A, typename S::site) const [inline]

Compute an accumulator onto a site set.

Parameters:

← ***a*** A meta-accumulator.

← ***s*** A site set.

9.135 mln::subsampling Namespace Reference

Namespace of "point-wise" expression tools.

Functions

- template< typename I >
  mln::trait::concrete< I >::ret gaussian_subsampling (const Image< I > &input, float sigma, const typename I::dpsite &first_p, const typename I::site::coord &gap)

  Gaussian subsampling FIXME : doxy.

- template< typename I >
  mln::trait::concrete< I >::ret subsampling (const Image< I > &input, const typename I::site::delta &first_p, const typename I::site::coord &gap)

  Subsampling FIXME : doxy.

9.135.1 Detailed Description

Namespace of "point-wise" expression tools.

9.135.2 Function Documentation

9.135.2.1 template< typename I > mln::trait::concrete< I >::ret mln::subsampling::gaussian_subsampling (const Image< I > & *input*, float *sigma*, const typename I::dpsite & *first_p*, const typename I::site::coord & *gap*) `[inline]`

Gaussian subsampling FIXME : doxy.

References mln::linear::gaussian(), mln::geom::ncols(), and mln::geom::nrows().

9.135.2.2 template< typename I > mln::trait::concrete< I >::ret mln::subsampling::subsampling (const Image< I > & *input*, const typename I::site::delta & *first_p*, const typename I::site::coord & *gap*) `[inline]`

Subsampling FIXME : doxy.

References mln::geom::ncols(), and mln::geom::nrows().

9.136 mln::tag Namespace Reference

Namespace of image processing routines related to tags.

9.136.1 Detailed Description

Namespace of image processing routines related to tags.

9.137 mln::test Namespace Reference

Namespace of image processing routines related to pixel tests.

Namespaces

- namespace impl

  Implementation namespace of test namespace.

Functions

- template<typename I>
  bool positive (const Image< I > &input)

  Test if an image only contains positive values.

- template<typename S, typename F>
  bool predicate (const Site_Set< S > &pset, const Function_v2b< F > &f)

  Test if all points of `pset` *verify the predicate* `f`.

- template<typename I, typename J, typename F>
  bool predicate (const Image< I > &lhs, const Image< J > &rhs, const Function_vv2b< F > &f)

  Test if all pixel values of `lhs` *and* `rhs` *verify the predicate* `f`.

- template<typename I, typename F>
  bool predicate (const Image< I > &ima, const Function_v2b< F > &f)

  Test if all pixel values of `ima` *verify the predicate* `f`.

9.137.1 Detailed Description

Namespace of image processing routines related to pixel tests.

9.137.2 Function Documentation

9.137.2.1 template<typename I> bool mln::test::positive (const Image< I > & *input*) `[inline]`

Test if an image only contains positive values.

References predicate(), and mln::literal::zero.

Referenced by mln::morpho::gradient(), mln::morpho::gradient_external(), mln::morpho::gradient_internal(), mln::morpho::top_hat_black(), mln::morpho::elementary::top_hat_black(), mln::morpho::top_hat_self_complementary(), mln::morpho::elementary::top_hat_self_complementary(), mln::morpho::top_hat_white(), and mln::morpho::elementary::top_hat_white().

9.137.2.2 template<typename S, typename F> bool mln::test::predicate (const Site_Set< S > & *pset*, const Function_v2b< F > & *f*) `[inline]`

Test if all points of `pset` verify the predicate `f`.

Parameters:

← ***pset*** The point set.

← ***f*** The predicate.

9.137.2.3 template<typename I, typename J, typename F> bool mln::test::predicate (const Image< I > & *lhs*, const Image< J > & *rhs*, const Function_vv2b< F > & *f*) `[inline]`

Test if all pixel values of `lhs` and `rhs` verify the predicate `f`.

Parameters:

← ***lhs*** The image.

← ***rhs*** The image.

← ***f*** The predicate.

9.137.2.4 template<typename I, typename F> bool mln::test::predicate (const Image< I > & *ima*, const Function_v2b< F > & *f*) `[inline]`

Test if all pixel values of `ima` verify the predicate `f`.

Parameters:

← ***ima*** The image.

← ***f*** The predicate.

Referenced by mln::operator<(), mln::operator<=(), mln::operator==(), and positive().

9.138 mln::test::impl Namespace Reference

Implementation namespace of test namespace.

9.138.1 Detailed Description

Implementation namespace of test namespace.

9.139 mln::topo Namespace Reference

Namespace of "point-wise" expression tools.

Classes

- class adj_higher_dim_connected_n_face_bkd_iter

  Backward iterator on all the n-faces sharing an adjacent (n+1)-face with a (reference) n-face of an mln::complex<D>.

- class adj_higher_dim_connected_n_face_fwd_iter

  Forward iterator on all the n-faces sharing an adjacent (n+1)-face with a (reference) n-face of an mln::complex<D>.

- class adj_higher_face_bkd_iter

  Backward iterator on all the adjacent (n+1)-faces of the n-face of an mln::complex<D>.

- class adj_higher_face_fwd_iter

  Forward iterator on all the adjacent (n+1)-faces of the n-face of an mln::complex<D>.

- class adj_lower_dim_connected_n_face_bkd_iter

  Backward iterator on all the n-faces sharing an adjacent (n-1)-face with a (reference) n-face of an mln::complex<D>.

- class adj_lower_dim_connected_n_face_fwd_iter

  Forward iterator on all the n-faces sharing an adjacent (n-1)-face with a (reference) n-face of an mln::complex<D>.

- class adj_lower_face_bkd_iter

  Backward iterator on all the adjacent (n-1)-faces of the n-face of an mln::complex<D>.

- class adj_lower_face_fwd_iter

  Forward iterator on all the adjacent (n-1)-faces of the n-face of an mln::complex<D>.

- class adj_lower_higher_face_bkd_iter

  Forward iterator on all the adjacent (n-1)-faces and (n+1)-faces of the n-face of an mln::complex<D>.

- class adj_lower_higher_face_fwd_iter

  Forward iterator on all the adjacent (n-1)-faces and (n+1)-faces of the n-face of an mln::complex<D>.

- class adj_m_face_bkd_iter

  Backward iterator on all the m-faces transitively adjacent to a (reference) n-face in a complex.

- class adj_m_face_fwd_iter

  Forward iterator on all the m-faces transitively adjacent to a (reference) n-face in a complex.

- struct algebraic_face

  Algebraic face handle in a complex; the face dimension is dynamic.

- class algebraic_n_face

Algebraic `N-face` handle in a complex.

- class center_only_iter

  Iterator on all the adjacent (n-1)-faces of the n-face of an mln::complex<D>.

- class centered_bkd_iter_adapter

  Forward complex relative iterator adapters adding the central (reference) point to the set of iterated faces.

- class centered_fwd_iter_adapter

  Backward complex relative iterator adapters adding the central (reference) point to the set of iterated faces.

- class complex

  General complex of dimension `D`.

- struct face

  Face handle in a complex; the face dimension is dynamic.

- class face_bkd_iter

  Backward iterator on all the faces of an mln::complex<D>.

- class face_fwd_iter

  Forward iterator on all the faces of an mln::complex<D>.

- struct is_n_face

  A functor testing wheter a mln::complex_psite is an `N` -face.

- class is_simple_cell

  A predicate for the simplicity of a point based on the collapse property of the attachment.

- class n_face

  `N-face` handle in a complex.

- class n_face_bkd_iter

  Backward iterator on all the faces of an mln::complex<D>.

- class n_face_fwd_iter

  Forward iterator on all the faces of an mln::complex<D>.

- class n_faces_set

  Set of face handles of dimension `N`.

- class static_n_face_bkd_iter

  Backward iterator on all the `N-faces` of a mln::complex<D>.

- class static_n_face_fwd_iter

  Forward iterator on all the `N-faces` of a mln::complex<D>.

Functions

- template<unsigned D, typename G>
  void detach (const complex_psite< D, G > &f, complex_image< D, G, bool > &ima)

  Detach the cell corresponding to f *from* ima*.*

- template<unsigned D, typename G>
  bool is_facet (const complex_psite< D, G > &f)

  Is f *a facet, i.e., a face not "included in" (adjacent to) a face of higher dimension?*

- template<unsigned D>
  algebraic_face< D > make_algebraic_face (const face< D > &f, bool sign)

  Create an algebraic face handle of a `D-complex`*.*

- template<unsigned N, unsigned D>
  algebraic_n_face< N, D > make_algebraic_n_face (const n_face< N, D > &f, bool sign)

  Create an algebraic `N-face` *handle of a* `D-complex`*.*

- template<unsigned N, unsigned D>
  std::ostream & operator<< (std::ostream &ostr, const n_face< N, D > &f)

  Print an mln::topo::n_face.

- template<unsigned D>
  std::ostream & operator<< (std::ostream &ostr, const face< D > &f)

  Print an mln::topo::face.

- template<unsigned D>
  std::ostream & operator<< (std::ostream &ostr, const complex< D > &c)

  Pretty print a complex.

- template<unsigned N, unsigned D>
  std::ostream & operator<< (std::ostream &ostr, const algebraic_n_face< N, D > &f)

  Print an mln::topo::algebraic_n_face.

- template<unsigned D>
  std::ostream & operator<< (std::ostream &ostr, const algebraic_face< D > &f)

  Print an mln::topo::algebraic_face.

- template<unsigned D>
  bool operator== (const complex< D > &lhs, const complex< D > &rhs)

  Compare two complexes for equality.

  - template<unsigned D>
    algebraic_n_face< 1, D > edge (const n_face< 0, D > &f1, const n_face< 0, D > &f2)

    Helpers.

  - template<unsigned N, unsigned D>
    bool operator!= (const n_face< N, D > &lhs, const n_face< N, D > &rhs)

    Is lhs *different from* rhs*?*

- template<unsigned N, unsigned D>
  bool operator< (const n_face< N, D > &lhs, const n_face< N, D > &rhs)
  Is lhs *"less" than* rhs*?*

- template<unsigned N, unsigned D>
  bool operator== (const n_face< N, D > &lhs, const n_face< N, D > &rhs)
  Comparison of two instances of mln::topo::n_face.

- template<unsigned D>
  bool operator!= (const face< D > &lhs, const face< D > &rhs)
  Is lhs *different from* rhs*?*

- template<unsigned D>
  bool operator< (const face< D > &lhs, const face< D > &rhs)
  Is lhs *"less" than* rhs*?*

- template<unsigned D>
  bool operator== (const face< D > &lhs, const face< D > &rhs)
  Comparison of two instances of mln::topo::face.

- template<unsigned N, unsigned D>
  bool operator!= (const algebraic_n_face< N, D > &lhs, const algebraic_n_face< N, D > &rhs)
  Is lhs *different from* rhs*?*

- template<unsigned N, unsigned D>
  bool operator< (const algebraic_n_face< N, D > &lhs, const algebraic_n_face< N, D > &rhs)
  Is lhs *"less" than* rhs*?*

- template<unsigned N, unsigned D>
  bool operator== (const algebraic_n_face< N, D > &lhs, const algebraic_n_face< N, D > &rhs)
  Comparison of two instances of mln::topo::algebraic_n_face.

- template<unsigned D>
  bool operator!= (const algebraic_face< D > &lhs, const algebraic_face< D > &rhs)
  Is lhs *different from* rhs*?*

- template<unsigned D>
  bool operator< (const algebraic_face< D > &lhs, const algebraic_face< D > &rhs)
  Is lhs *"less" than* rhs*?*

- template<unsigned D>
  bool operator== (const algebraic_face< D > &lhs, const algebraic_face< D > &rhs)
  Comparison of two instances of mln::topo::algebraic_face.

- template<unsigned N, unsigned D>
  n_faces_set< N, D > operator+ (const algebraic_n_face< N, D > &f1, const algebraic_n_face< N, D > &f2)
  Addition.

- template<unsigned N, unsigned D>
n_faces_set< N, D > operator- (const algebraic_n_face< N, D > &f1, const algebraic_n_face< N, D > &f2)
    Subtraction.

- template<unsigned N, unsigned D>
algebraic_n_face< N, D > operator- (const n_face< N, D > &f)
    Inversion operators.

- template<unsigned D>
algebraic_face< D > operator- (const face< D > &f)
    Inversion operators.

9.139.1 Detailed Description

Namespace of "point-wise" expression tools.

9.139.2 Function Documentation

9.139.2.1 template<unsigned D, typename G> void mln::topo::detach (const complex_psite< D, G > & *f*, complex_image< D, G, bool > & *ima*) [inline]

Detach the cell corresponding to *f* from *ima*.

Precondition:

f is a facet (it does not belong to any face of higher dimension).
ima is an image of Boolean values.

References mln::make::detachment(), mln::data::fill(), and is_facet().

9.139.2.2 template<unsigned D> algebraic_n_face< 1, D > mln::topo::edge (const n_face< 0, D > & *f1*, const n_face< 0, D > & *f2*) [inline]

Helpers.

Return the algebraic 1-face (edge) linking the 0-faces (vertices) *f1* and *f2*. If there is no 1-face between *f1* and *f2*, return an invalid 1-face.

Precondition:

f1 and *f2* must belong to the same complex.

Note: this routine assumes the complex is not degenerated, i.e,

- it does not check that *f1* and *f2* are the only 0-faces adjacent to an hypothetical 1-face; it just checks that *f1* and *f2* *share* a common 1-face;

- if there are several ajacent 1-faces shared by *f1* and *f2* (if the complex is ill-formed), there is no guarantee on the returned 1-face (the current implementation return the first 1-face found, but client code should not rely on this implementation-defined behavior).

References mln::topo::n_face< N, D >::higher_dim_adj_faces().

9.139.2.3 template<unsigned D, typename G> bool mln::topo::is_facet (const complex_psite< D, G > & *f*) [inline]

Is *f* a facet, i.e., a face not “included in” (adjacent to) a face of higher dimension?

Referenced by mln::make::attachment(), mln::make::cell(), detach(), and mln::make::detachment().

9.139.2.4 template<unsigned D> algebraic_face< D > mln::topo::make_algebraic_face (const face< D > & *f*, bool *sign*) [inline]

Create an algebraic face handle of a `D-complex`.

9.139.2.5 template<unsigned N, unsigned D> algebraic_n_face< N, D > mln::topo::make_algebraic_n_face (const n_face< N, D > & *f*, bool *sign*) [inline]

Create an algebraic `N-face` handle of a `D-complex`.

9.139.2.6 template<unsigned N, unsigned D> bool mln::topo::operator!= (const n_face< N, D > & *lhs*, const n_face< N, D > & *rhs*) [inline]

Is *lhs* different from *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.

References mln::topo::n_face< N, D >::cplx().

9.139.2.7 template<unsigned D> bool mln::topo::operator!= (const face< D > & *lhs*, const face< D > & *rhs*) [inline]

Is *lhs* different from *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.

References mln::topo::face< D >::cplx().

9.139.2.8 template<unsigned N, unsigned D> bool mln::topo::operator!= (const algebraic_n_face< N, D > & *lhs*, const algebraic_n_face< N, D > & *rhs*) [inline]

Is *lhs* different from *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.

References mln::topo::n_face< N, D >::cplx().

9.139.2.9 template<unsigned D> bool mln::topo::operator!= (const algebraic_face< D > & *lhs*, const algebraic_face< D > & *rhs*) [inline]

Is *lhs* different from *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.

References mln::topo::face< D >::cplx().

9.139.2.10 template<unsigned N, unsigned D> n_faces_set< N, D > mln::topo::operator+ (const algebraic_n_face< N, D > & *f1*, const algebraic_n_face< N, D > & *f2*) [inline]

Addition.

References mln::topo::n_faces_set< N, D >::add().

9.139.2.11 template<unsigned N, unsigned D> n_faces_set< N, D > mln::topo::operator- (const algebraic_n_face< N, D > & *f1*, const algebraic_n_face< N, D > & *f2*) [inline]

Subtraction.

References mln::topo::n_faces_set< N, D >::add().

9.139.2.12 template<unsigned N, unsigned D> algebraic_n_face< N, D > mln::topo::operator- (const n_face< N, D > & *f*) [inline]

Inversion operators.

9.139.2.13 template<unsigned D> algebraic_face< D > mln::topo::operator- (const face< D > & *f*) [inline]

Inversion operators.

9.139.2.14 template<unsigned N, unsigned D> bool mln::topo::operator< (const n_face< N, D > & *lhs*, const n_face< N, D > & *rhs*) [inline]

Is *lhs* “less” than *rhs*?

This comparison is required by algorithms sorting face handles.

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.

9.139.2.15 template<unsigned D> bool mln::topo::operator< (const face< D > & *lhs*, const face< D > & *rhs*) [inline]

Is *lhs* “less” than *rhs*?

This comparison is required by algorithms sorting face handles.

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.
Arguments *lhs* and *rhs* must have the same dimension.

9.139.2.16 template<unsigned N, unsigned D> bool mln::topo::operator< (const algebraic_n_face< N, D > & *lhs*, const algebraic_n_face< N, D > & *rhs*) [inline]

Is *lhs* “less” than *rhs*?

This comparison is required by algorithms sorting algebraic face handles.

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.

9.139.2.17 template<unsigned D> bool mln::topo::operator< (const algebraic_face< D > & *lhs*, const algebraic_face< D > & *rhs*) [inline]

Is *lhs* “less” than *rhs*?

This comparison is required by algorithms sorting algebraic face handles.

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.
Arguments *lhs* and *rhs* must have the same dimension.

9.139.2.18 template<unsigned N, unsigned D> std::ostream & mln::topo::operator<< (std::ostream & *ostr*, const n_face< N, D > & *f*) [inline]

Print an mln::topo::n_face.

9.139.2.19 template<unsigned D> std::ostream & mln::topo::operator<< (std::ostream & *ostr*, const face< D > & *f*) [inline]

Print an mln::topo::face.

9.139.2.20 template<unsigned D> std::ostream & mln::topo::operator<< (std::ostream & *ostr*, const complex< D > & *c*) [inline]

Pretty print a complex.

References mln::topo::complex< D >::print().

9.139.2.21 template<unsigned N, unsigned D> std::ostream & mln::topo::operator<< (std::ostream & *ostr*, const algebraic_n_face< N, D > & *f*) [inline]

Print an mln::topo::algebraic_n_face.

9.139.2.22 template<unsigned D> std::ostream & mln::topo::operator<< (std::ostream & *ostr*, const algebraic_face< D > & *f*) [inline]

Print an mln::topo::algebraic_face.

9.139.2.23 template<unsigned N, unsigned D> bool mln::topo::operator== (const n_face< N, D > & *lhs*, const n_face< N, D > & *rhs*) [inline]

Comparison of two instances of mln::topo::n_face.

Is *lhs* equal to *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.

References mln::topo::n_face< N, D >::cplx(), and mln::topo::n_face< N, D >::face_id().

9.139.2.24 template<unsigned D> bool mln::topo::operator== (const face< D > & *lhs*, const face< D > & *rhs*) [inline]

Comparison of two instances of mln::topo::face.

Is *lhs* equal to *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.

References mln::topo::face< D >::cplx(), mln::topo::face< D >::face_id(), and mln::topo::face< D >::n().

9.139.2.25 template<unsigned D> bool mln::topo::operator== (const complex< D > & *lhs*, const complex< D > & *rhs*) [inline]

Compare two complexes for equality.

9.139.2.26 template<unsigned N, unsigned D> bool mln::topo::operator== (const algebraic_n_face< N, D > & *lhs*, const algebraic_n_face< N, D > & *rhs*) [inline]

Comparison of two instances of mln::topo::algebraic_n_face.

Is *lhs* equal to *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.

References mln::topo::n_face< N, D >::cplx(), mln::topo::n_face< N, D >::face_id(), and mln::topo::algebraic_n_face< N, D >::sign().

9.139.2.27 template<unsigned D> bool mln::topo::operator== (const algebraic_face< D > & *lhs*, const algebraic_face< D > & *rhs*) [inline]

Comparison of two instances of mln::topo::algebraic_face.

Is *lhs* equal to *rhs*?

Precondition:

Arguments *lhs* and *rhs* must belong to the same mln::topo::complex.

References mln::topo::face< D >::cplx(), mln::topo::face< D >::face_id(), mln::topo::face< D >::n(), and mln::topo::algebraic_face< D >::sign().

9.140 mln::trace Namespace Reference

Namespace of routines related to the trace mechanism.

9.140.1 Detailed Description

Namespace of routines related to the trace mechanism.

9.141 mln::trait Namespace Reference

Namespace where traits are defined.

9.141.1 Detailed Description

Namespace where traits are defined.

Namespace for image traits.

9.142 mln::transform Namespace Reference

Namespace of transforms.

Functions

- template<typename P, typename N, typename D>
  util::couple< mln_image_from_grid(mln_grid(P), D), mln_image_from_grid(mln_grid(P), unsigned)> distance_and_closest_point_geodesic (const p_array< P > &pset, const box< P > &closest_point_domain, const Neighborhood< N > &nbh, D max)

  Discrete geodesic distance transform.

- template<typename I, typename N, typename D>
  util::couple< mln::trait::ch_value< I, D >::ret, mln::trait::ch_value< I, typename I::psite >::ret > distance_and_closest_point_geodesic (const Image< I > &input, const Neighborhood< N > &nbh, D max)

  Discrete geodesic distance transform.

- template<typename I, typename N, typename D>
  util::couple< mln::trait::ch_value< I, D >::ret, I > distance_and_influence_zone_geodesic (const Image< I > &input, const Neighborhood< N > &nbh, D max)

  Discrete geodesic distance transform.

- template<typename I, typename N, typename W, typename D>
  mln::trait::ch_value< I, D >::ret distance_front (const Image< I > &input, const Neighborhood< N > &nbh, const Weighted_Window< W > &w_win, D max)

  Discrete front distance transform.

- template<typename I, typename N, typename D>
  mln::trait::ch_value< I, D >::ret distance_geodesic (const Image< I > &input, const Neighborhood< N > &nbh, D max)

  Discrete geodesic distance transform.

- template<typename I>
  image2d< float > hough (const Image< I > &input_)

  Compute the hough transform from a binary image.

- template<typename I, typename N, typename W>
  mln::trait::concrete< I >::ret influence_zone_front (const Image< I > &input, const Neighborhood< N > &nbh, const Weighted_Window< W > &w_win)

  Influence zone transform.

- template<typename I, typename N, typename W, typename D>
  mln::trait::concrete< I >::ret influence_zone_front (const Image< I > &input, const Neighborhood< N > &nbh, const Weighted_Window< W > &w_win, D max)

  Influence zone transform.

- template<typename I, typename N>
  mln::trait::concrete< I >::ret influence_zone_geodesic (const Image< I > &input, const Neighborhood< N > &nbh)

  Geodesic influence zone transform.

- template<typename I, typename N, typename D>
mln::trait::concrete< I >::ret influence_zone_geodesic_saturated (const Image< I > &input, const Neighborhood< N > &nbh, const D &max, const typename I::value &background_value)

    Geodesic influence zone transform.

9.142.1 Detailed Description

Namespace of transforms.

9.142.2 Function Documentation

9.142.2.1 template<typename P, typename N, typename D> util::couple< mln_image_from_grid(mln_grid(P), D), mln_image_from_grid(mln_grid(P), unsigned)> mln::transform::distance_and_closest_point_geodesic (const p_array< P > & *pset*, const box< P > & *closest_point_domain*, const Neighborhood< N > & *nbh*, D *max*) [inline]

Discrete geodesic distance transform.

Parameters:

← ***pset*** an array of sites.

← ***closest_point_domain*** domain of the returned image.

← ***nbh*** neighborhood

← ***max*** max distance of propagation.

Returns:

A couple of images. The first one is the distance map and the second one is the closest point image. The closest point image contains site indexes.

Postcondition:

The returned image domains are defined on `closest_point_domain`.

References mln::geom::bbox(), mln::make::couple(), mln::canvas::distance_geodesic(), mln::data::fill(), and mln::box< P >::is_valid().

9.142.2.2 template<typename I, typename N, typename D> util::couple< mln::trait::ch_value< I, D >::ret, mln::trait::ch_value< I, typename I::psite >::ret > mln::transform::distance_and_closest_point_geodesic (const Image< I > & *input*, const Neighborhood< N > & *nbh*, D *max*) [inline]

Discrete geodesic distance transform.

Parameters:

← ***input*** Image from which the geodesic distance is computed.

← ***nbh*** Neighborhood

← ***max*** Max distance of propagation.

Returns:

a couple of images. The first one is the distance map and the second one is the closest point image. The closest point image contains sites.

Postcondition:

The returned images have the same domain as `input`.

References mln::make::couple(), and mln::canvas::distance_geodesic().

9.142.2.3 template<typename I, typename N, typename D> util::couple< mln::trait::ch_value< I, D >::ret, I > mln::transform::distance_and_influence_zone_geodesic (const Image< I > & *input*, const Neighborhood< N > & *nbh*, D *max*) `[inline]`

Discrete geodesic distance transform.

Parameters:

← ***input*** Image from which the geodesic distance is computed.

← ***nbh*** Neighborhood

← ***max*** Max distance of propagation.

Returns:

a couple of images. The first one is the distance map and the second one is the closest point image. The closest point image contains sites.

Postcondition:

The returned images have the same domain as `input`.

References mln::make::couple(), and mln::canvas::distance_geodesic().

9.142.2.4 template<typename I, typename N, typename W, typename D> mln::trait::ch_value< I, D >::ret mln::transform::distance_front (const Image< I > & *input*, const Neighborhood< N > & *nbh*, const Weighted_Window< W > & *w_win*, D *max*) `[inline]`

Discrete front distance transform.

References mln::canvas::distance_front().

9.142.2.5 template<typename I, typename N, typename D> mln::trait::ch_value< I, D >::ret mln::transform::distance_geodesic (const Image< I > & *input*, const Neighborhood< N > & *nbh*, D *max*) `[inline]`

Discrete geodesic distance transform.

References mln::canvas::distance_geodesic().

9.142.2.6 template<typename I> image2d< float > mln::transform::hough (const Image< I > & *input_*) [inline]

Compute the hough transform from a binary image.

Objects used for computation must be set to 'true'.

Parameters:

← ***input_*** A binary image.

Returns:

A 2D image of float. Rows are used for the distance and columns are used for the angles. Angles go from 0 to 359. Distance goes from 0 to the maximum distance between the center and a corner. The site having the maximum value indicates through its column index the document inclination.

References mln::opt::at(), mln::data::fill(), mln::geom::min_col(), mln::geom::min_row(), mln::geom::ncols(), and mln::geom::nrows().

9.142.2.7 template<typename I, typename N, typename W> mln::trait::concrete< I >::ret mln::transform::influence_zone_front (const Image< I > & *input*, const Neighborhood< N > & *nbh*, const Weighted_Window< W > & *w_win*) [inline]

Influence zone transform.

References influence_zone_front().

9.142.2.8 template<typename I, typename N, typename W, typename D> mln::trait::concrete< I >::ret mln::transform::influence_zone_front (const Image< I > & *input*, const Neighborhood< N > & *nbh*, const Weighted_Window< W > & *w_win*, D *max*) [inline]

Influence zone transform.

References mln::canvas::distance_front().

Referenced by influence_zone_front().

9.142.2.9 template<typename I, typename N> mln::trait::concrete< I >::ret mln::transform::influence_zone_geodesic (const Image< I > & *input*, const Neighborhood< N > & *nbh*) [inline]

Geodesic influence zone transform.

Parameters:

← ***input*** An image.

← ***nbh*** A neighborhood.

Returns:

An image of influence zone.

9.142.2.10 template<typename I, typename N, typename D> mln::trait::concrete< I >::ret mln::transform::influence_zone_geodesic_saturated (const Image< I > & *input*, const Neighborhood< N > & *nbh*, const D & *max*, const typename I::value & *background_value*) [inline]

Geodesic influence zone transform.

Parameters:

← ***input*** An image.

← ***nbh*** A neighborhood.

← ***max*** The maximum influence zone distance.

← ***background_value*** The value used as background (i.e. not propagated).

Returns:

An image of influence zone.

References mln::canvas::distance_geodesic().

9.143 mln::util Namespace Reference

Namespace of tools using for more complex algorithm.

Classes

- class adjacency_matrix

  A class of adjacency matrix.

- class array

  A dynamic array class.

- class branch

  Class of generic branch.

- class branch_iter

  Basic 2D image class.

- class branch_iter_ind

  Basic 2D image class.

- class couple

  Definition of a couple.

- struct eat

  Eat structure.

- class edge

  Edge of a graph G.

- class fibonacci_heap

  Fibonacci heap.

- class graph

  Undirected graph.

- class greater_point

  A "greater than" functor comparing points w.r.t.

- class greater_psite

  A "greater than" functor comparing psites w.r.t.

- class head

  Top structure of the soft heap.

- struct ignore

  Ignore structure.

- struct ilcell

Element of an item list. Store the data (key) used in soft_heap.

- class line_graph

  Undirected line graph of a graph of type `G`.

- struct nil

  Nil structure.

- class node

  Meta-data of an element in the heap.

- class object_id

  Base class of an object id.

- struct ord

  Function-object that defines an ordering between objects with type `T`: lhs *R* rhs.

- struct ord_pair

  Ordered pair structure s.a.

- struct pix

  Structure pix.

- class set

  An "efficient" mathematical set class.

- class site_pair

  A pair of sites.

- class soft_heap

  Soft heap.

- class timer

  Timer structure.

- struct tracked_ptr

  Smart pointer for shared data with tracking.

- class tree

  Class of generic tree.

- class tree_node

  Class of generic tree_node for tree.

- class vertex

  Vertex of a graph `G`.

- struct yes

  Object that always says "yes".

Namespaces

- namespace impl

  Implementation namespace of util namespace.

Typedefs

- typedef object_id< vertex_tag, unsigned > vertex_id_t

  Vertex id type.

Functions

- template<typename I, typename J>
  void display_branch (const Image< J > &ima_, tree_node< I > *tree_node)

  Display an arborescence from `tree_node`.

- template<typename I, typename J>
  void display_tree (const Image< J > &ima_, tree< I > &tree)

  Display a tree.

- template<typename I>
  I::psite lemmings (const Image< I > &ima, const typename I::psite &pt, const typename I::psite::delta &dpt, const typename I::value &val)

  Launch a lemmings on an image.

- template<typename I>
  greater_point< I > make_greater_point (const Image< I > &ima)

  Helper to build a mln::util::greater_point.

- template<typename I>
  greater_psite< I > make_greater_psite (const Image< I > &ima)

  Helper to build a mln::util::greater_psite.

- template<typename G>
  bool operator< (const vertex< G > &lhs, const vertex< G > &rhs)

  Less operator. Test whether lhs.id() < rhs.id().

- template<typename G>
  std::ostream & operator<< (std::ostream &ostr, const vertex< G > &v)

  Push the vertex `v` in the output stream `ostr`.

- template<typename T>
  std::ostream & operator<< (std::ostream &ostr, const array< T > &a)

  Operator<<.

- template<typename G>
  bool operator== (const vertex< G > &v1, const vertex< G > &v2)

  Equality operator.

- template<typename T>
  bool operator== (const array< T > &lhs, const array< T > &rhs)

  Operator==.

- template<typename T>
  bool ord_strict (const T &lhs, const T &rhs)

  Routine to test if lhs *is strictly "less-than"* rhs.

- template<typename T>
  bool ord_weak (const T &lhs, const T &rhs)

  Routine to test if lhs *is "less-than or equal-to"* rhs.

- template<typename T, typename I>
  void tree_fast_to_image (tree_fast< T > &tree, Image< I > &output_)
- template<typename T>
  tree_fast< T > tree_to_fast (tree< T > &input)

  Facade.

- template<typename T, typename I>
  void tree_to_image (tree< T > &tree, Image< I > &output_)

  Convert a tree into an image.

9.143.1 Detailed Description

Namespace of tools using for more complex algorithm.

Forward declaration.

9.143.2 Typedef Documentation

9.143.2.1 typedef object_id<vertex_tag, unsigned> mln::util::vertex_id_t

Vertex id type.

9.143.3 Function Documentation

9.143.3.1 template<typename I, typename J> void mln::util::display_branch (const Image< J > & *ima_*, tree_node< I > * *tree_node*) [inline]

Display an arborescence from `tree_node`.

Parameters:

← ***ima_*** The domain of output image.

← ***tree_node*** The root tree_node to display.

References mln::data::fill().

9.143.3.2 template<typename I, typename J> void mln::util::display_tree (const Image< J > & *ima_*, tree< I > & *tree*) [inline]

Display a tree.

Parameters:

← *ima_* The domain of output image.

← *tree* The tree to display.

References mln::util::tree< T >::root().

9.143.3.3 template<typename I> I::psite mln::util::lemmings (const Image< I > & *ima*, const typename I::psite & *pt*, const typename I::psite::delta & *dpt*, const typename I::value & *val*) [inline]

Launch a lemmings on an image.

A lemmings is the point `pt` that you put on an image `ima` . This point will move through the image using the delta-point `dpt` while consider his value on the given image.

Returns:

The first point that is not in the domain `domain` or which value on the given image is different to the value `val`.

Precondition:

The domain `domain` must be contained in the domain of `ima`.

9.143.3.4 template<typename I> greater_point< I > mln::util::make_greater_point (const Image< I > & *ima*) [inline]

Helper to build a mln::util::greater_point.

References make_greater_point().

Referenced by make_greater_point().

9.143.3.5 template<typename I> greater_psite< I > mln::util::make_greater_psite (const Image< I > & *ima*) [inline]

Helper to build a mln::util::greater_psite.

References make_greater_psite().

Referenced by make_greater_psite().

9.143.3.6 template<typename G> bool mln::util::operator< (const vertex< G > & *lhs*, const vertex< G > & *rhs*) [inline]

Less operator. Test whether lhs.id() < rhs.id().

9.143.3.7 template<typename G> std::ostream & mln::util::operator<< (std::ostream & *ostr*, const vertex< G > & *v*) [inline]

Push the vertex `v` in the output stream `ostr`.

9.143.3.8 template<typename T> std::ostream & mln::util::operator<< (std::ostream & *ostr*, const array< T > & *a*) [inline]

Operator<<.

References mln::util::array< T >::nelements().

9.143.3.9 template<typename G> bool mln::util::operator== (const vertex< G > & *v1*, const vertex< G > & *v2*) [inline]

Equality operator.

Test whether two vertices have the same id.

References mln::util::vertex< G >::graph(), and mln::util::vertex< G >::id().

9.143.3.10 template<typename T> bool mln::util::operator== (const array< T > & *lhs*, const array< T > & *rhs*) [inline]

Operator==.

References mln::util::array< T >::std_vector().

9.143.3.11 template<typename T> bool mln::util::ord_strict (const T & *lhs*, const T & *rhs*) [inline]

Routine to test if *lhs* is strictly "less-than" *rhs*.

References ord_strict().

Referenced by mln::util::ord_pair< T >::change_both(), mln::util::ord_pair< T >::change_first(), mln::util::ord_pair< T >::change_second(), and ord_strict().

9.143.3.12 template<typename T> bool mln::util::ord_weak (const T & *lhs*, const T & *rhs*) [inline]

Routine to test if *lhs* is "less-than or equal-to" *rhs*.

References ord_weak().

Referenced by mln::util::ord_pair< T >::change_both(), mln::util::ord_pair< T >::change_first(), mln::util::ord_pair< T >::change_second(), mln::box< P >::is_valid(), and ord_weak().

9.143.3.13 template<typename T, typename I> void mln::util::tree_fast_to_image (tree_fast< T > & *tree*, Image< I > & *output_*) [inline]

Convert a tree_fast into an image.

Parameters:

← ***tree*** The tree to convert.

→ ***output_*** The image containing tree informations.

References mln::util::impl::tree_fast_to_image().

Referenced by tree_fast_to_image().

9.143.3.14 template<typename T> tree_fast< T > mln::util::tree_to_fast (tree< T > & *input*) [inline]

Facade.

Convert a tree into an tree_fast.

Parameters:

← ***input*** The tree to convert.

Returns:

The tree_fast containing tree informations.

References mln::util::tree< T >::root().

9.143.3.15 template<typename T, typename I> void mln::util::tree_to_image (tree< T > & *tree*, Image< I > & *output_*) [inline]

Convert a tree into an image.

Parameters:

← ***tree*** The tree to convert.

→ ***output_*** The image containing tree information.

9.144 mln::util::impl Namespace Reference

Implementation namespace of util namespace.

Functions

- template<typename T, typename I>
  void tree_fast_to_image (tree_fast< T > &tree, Image< I > &output_)

9.144.1 Detailed Description

Implementation namespace of util namespace.

9.144.2 Function Documentation

9.144.2.1 template<typename T, typename I> void mln::util::impl::tree_fast_to_image (tree_fast< T > & *tree*, Image< I > & *output_*) [inline]

Convert a tree_fast into an image.

Parameters:

← ***tree*** The tree to convert.

→ ***output_*** The image containing tree informations.

References tree_fast_to_image().

Referenced by mln::util::tree_fast_to_image().

9.145 mln::value Namespace Reference

Namespace of materials related to pixel value types.

Classes

- class float01

  Class for floating values restricted to the interval [0.

- struct float01_f

  Class for floating values restricted to the interval [0..1].

- struct graylevel

  General gray-level class on n bits.

- struct graylevel_f

  General gray-level class on n bits.

- struct int_s

  Signed integer value class.

- struct int_u

  Unsigned integer value class.

- struct int_u_sat

  Unsigned integer value class with saturation behavior.

- struct Integer

  Concept of integer.

- struct Integer< void >

  Category flag type.

- struct label

  Label value class.

- struct lut_vec

  Class that defines FIXME.

- class proxy

  Generic proxy class for an image pixel value.

- struct rgb

  Color class for red-green-blue where every component is n-bit encoded.

- struct set

  Class that defines the set of values of type `T`.

- class sign

The sign class represents the value type composed by the set (-1, 0, 1) sign value type is a subset of the int value type.

- struct stack_image

  Stack image class.

- struct super_value< sign >

  Specializations:.

- struct value_array

  Generic array class over indexed by a value set with type `T`.

Namespaces

- namespace impl

  Implementation namespace of value namespace.

Typedefs

- typedef float01_< 16 > float01_16

  Alias for 16 bit float01.

- typedef float01_< 8 > float01_8

  Alias for 8 bit float01.

- typedef graylevel< 16 > gl16

  Alias for 16 bit graylevel.

- typedef graylevel< 8 > gl8

  Alias for 8 bit graylevel.

- typedef graylevel_f glf

  Alias for graylevels encoded by float.

- typedef int_s< 16 > int_s16

  Alias for signed 16-bit integers.

- typedef int_s< 32 > int_s32

  Alias for signed 32-bit integers.

- typedef int_s< 8 > int_s8

  Alias for signed 8-bit integers.

- typedef int_u< 12 > int_u12

  Alias for unsigned 12-bit integers.

- typedef int_u< 16 > int_u16

Alias for unsigned 16-bit integers.

- typedef mln::value::int_u< 32 > int_u32

  Alias for unsigned 32-bit integers.

- typedef mln::value::int_u< 8 > int_u8

  Alias for unsigned 8-bit integers.

- typedef label< 16 > label_16

  Alias for 16-bit integers.

- typedef label< 32 > label_32

  Alias for 32-bit integers.

- typedef mln::value::label< 8 > label_8

  Alias for 8-bit labels.

- typedef rgb< 16 > rgb16

  Color class for red-green-blue where every component is 16-bit encoded.

- typedef rgb< 8 > rgb8

  Color class for red-green-blue where every component is 8-bit encoded.

Functions

- template<typename Dest, typename Src>
  Dest cast (const Src &src)

  Cast a value `src` *from type* `Src` *to type* `Dest`.

- template<typename V>
  internal::equiv_< V >::ret equiv (const mln::Value< V > &v)

  Access to the equivalent value.

- template<unsigned n>
  rgb< n >::interop operator+ (const rgb< n > &lhs, const rgb< n > &rhs)

  Addition.

- template<typename H, typename S, typename L>
  hsl_< H, S, L > operator+ (const hsl_< H, S, L > &lhs, const hsl_< H, S, L > &rhs)

  Addition.

- std::ostream & operator<< (std::ostream &ostr, const sign &i)

  Print an signed integer `i` *into the output stream* `ostr`.

- template<typename T>
  std::ostream & operator<< (std::ostream &ostr, const scalar_< T > &s)

  Print a scalar `s` *in an output stream* `ostr`.

- template<unsigned n>
  std::ostream & operator<< (std::ostream &ostr, const rgb< n > &c)

  Print an rgb `c` *into the output stream* `ostr`.

- template<unsigned n>
  std::ostream & operator<< (std::ostream &ostr, const label< n > &l)

  Print a label `l` *into the output stream* `ostr`.

- template<unsigned n>
  std::ostream & operator<< (std::ostream &ostr, const int_u_sat< n > &i)

  Print a saturated unsigned integer `i` *into the output stream* `ostr`.

- template<unsigned n>
  std::ostream & operator<< (std::ostream &ostr, const int_u< n > &i)

  Print an unsigned integer `i` *into the output stream* `ostr`.

- template<unsigned n>
  std::ostream & operator<< (std::ostream &ostr, const int_s< n > &i)

  Print an signed integer `i` *into the output stream* `ostr`.

- template<typename H, typename S, typename L>
  std::ostream & operator<< (std::ostream &ostr, const hsl_< H, S, L > &c)

  Print an hsl `c` *into the output stream* `ostr`.

- std::ostream & operator<< (std::ostream &ostr, const graylevel_f &g)

  Op<<.

- template<unsigned n>
  std::ostream & operator<< (std::ostream &ostr, const graylevel< n > &g)

  Op<<.

- template<unsigned n>
  std::ostream & operator<< (std::ostream &ostr, const float01_< n > &f)

  Op<<.

- bool operator== (const sign &lhs, const sign &rhs)

  Comparaison operator.

- template<typename V>
  V other (const V &val)

  Give an other value than `val`.

- template<unsigned n, typename S>
  rgb< n >::interop operator* (const rgb< n > &lhs, const mln::value::scalar_< S > &s)

  Product.

- template<typename H, typename S, typename L, typename S2>
  hsl_< H, S, L > operator* (const hsl_< H, S, L > &lhs, const mln::value::scalar_< S2 > &s)

  Product.

- template<unsigned n>
  rgb< n >::interop operator- (const rgb< n > &lhs, const rgb< n > &rhs)
  Subtraction.

- template<typename H, typename S, typename L>
  hsl_< H, S, L > operator- (const hsl_< H, S, L > &lhs, const hsl_< H, S, L > &rhs)
  Subtraction.

- template<unsigned n, typename S>
  rgb< n >::interop operator/ (const rgb< n > &lhs, const mln::value::scalar_< S > &s)
  Division.

- template<typename H, typename S, typename L, typename S2>
  hsl_< H, S, L > operator/ (const hsl_< H, S, L > &lhs, const mln::value::scalar_< S2 > &s)
  Division.

- template<typename H, typename S, typename L>
  bool operator== (const hsl_< H, S, L > &lhs, const hsl_< H, S, L > &rhs)
  Comparison.

- template<typename I>
  stack_image< 2, const I > stack (const Image< I > &ima1, const Image< I > &ima2)
  Shortcut to build a stack with two images.

9.145.1 Detailed Description

Namespace of materials related to pixel value types.

9.145.2 Typedef Documentation

9.145.2.1 typedef float01_<16> mln::value::float01_16

Alias for 16 bit float01.

9.145.2.2 typedef float01_<8> mln::value::float01_8

Alias for 8 bit float01.

9.145.2.3 typedef graylevel<16> mln::value::gl16

Alias for 16 bit graylevel.

9.145.2.4 typedef graylevel<8> mln::value::gl8

Alias for 8 bit graylevel.

9.145.2.5 typedef graylevel_f mln::value::glf

Alias for graylevels encoded by float.

9.145.2.6 typedef int_s<16> mln::value::int_s16

Alias for signed 16-bit integers.

9.145.2.7 typedef int_s<32> mln::value::int_s32

Alias for signed 32-bit integers.

9.145.2.8 typedef int_s<8> mln::value::int_s8

Alias for signed 8-bit integers.

9.145.2.9 typedef int_u<12> mln::value::int_u12

Alias for unsigned 12-bit integers.

9.145.2.10 typedef int_u<16> mln::value::int_u16

Alias for unsigned 16-bit integers.

9.145.2.11 typedef mln::value::int_u<32> mln::value::int_u32

Alias for unsigned 32-bit integers.

9.145.2.12 typedef mln::value::int_u<8> mln::value::int_u8

Alias for unsigned 8-bit integers.

9.145.2.13 typedef label<16> mln::value::label_16

Alias for 16-bit integers.

9.145.2.14 typedef label<32> mln::value::label_32

Alias for 32-bit integers.

9.145.2.15 typedef mln::value::label<8> mln::value::label_8

Alias for 8-bit labels.

9.145.2.16 typedef rgb<16> mln::value::rgb16

Color class for red-green-blue where every component is 16-bit encoded.

9.145.2.17 typedef rgb<8> mln::value::rgb8

Color class for red-green-blue where every component is 8-bit encoded.

9.145.3 Function Documentation

9.145.3.1 template<typename Dest, typename Src> Dest mln::value::cast (const Src & *src*) `[inline]`

Cast a value `src` from type `Src` to type `Dest`.

9.145.3.2 template<typename V> internal::equiv_< V >::ret mln::value::equiv (const mln::Value< V > & *v*) `[inline]`

Access to the equivalent value.

9.145.3.3 template<unsigned n, typename S> rgb< n >::interop mln::value::operator* (const rgb< n > & *lhs*, const mln::value::scalar_< S > & *s*) `[inline]`

Product.

9.145.3.4 template<typename H, typename S, typename L, typename S2> hsl_< H, S, L > mln::value::operator* (const hsl_< H, S, L > & *lhs*, const mln::value::scalar_< S2 > & *s*) `[inline]`

Product.

9.145.3.5 template<unsigned n> rgb< n >::interop mln::value::operator+ (const rgb< n > & *lhs*, const rgb< n > & *rhs*) `[inline]`

Addition.

{

9.145.3.6 template<typename H, typename S, typename L> hsl_< H, S, L > mln::value::operator+ (const hsl_< H, S, L > & *lhs*, const hsl_< H, S, L > & *rhs*) `[inline]`

Addition.

{

9.145.3.7 template<unsigned n> rgb< n >::interop mln::value::operator- (const rgb< n > & *lhs*, const rgb< n > & *rhs*) [inline]

Subtraction.

9.145.3.8 template<typename H, typename S, typename L> hsl_< H, S, L > mln::value::operator- (const hsl_< H, S, L > & *lhs*, const hsl_< H, S, L > & *rhs*) [inline]

Subtraction.

9.145.3.9 template<unsigned n, typename S> rgb< n >::interop mln::value::operator/ (const rgb< n > & *lhs*, const mln::value::scalar_< S > & *s*) [inline]

Division.

9.145.3.10 template<typename H, typename S, typename L, typename S2> hsl_< H, S, L > mln::value::operator/ (const hsl_< H, S, L > & *lhs*, const mln::value::scalar_< S2 > & *s*) [inline]

Division.

9.145.3.11 std::ostream & mln::value::operator<< (std::ostream & *ostr*, const sign & *i*) [inline]

Print an signed integer `i` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***i*** An sign value

Returns:

The modified output stream `ostr`.

References mln::debug::format().

9.145.3.12 template<typename T> std::ostream & mln::value::operator<< (std::ostream & *ostr*, const scalar_< T > & *s*) [inline]

Print a scalar `s` in an output stream `ostr`.

9.145.3.13 template<unsigned n> std::ostream & mln::value::operator<< (std::ostream & *ostr*, const rgb< n > & *c*) [inline]

Print an rgb `c` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***c*** An rgb.

Returns:

The modified output stream `ostr`.

References mln::debug::format().

9.145.3.14 template<unsigned n> std::ostream & mln::value::operator<< (std::ostream & *ostr*, const label< n > & *l*) `[inline]`

Print a label `l` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***l*** A label.

Returns:

The modified output stream `ostr`.

References mln::debug::format().

9.145.3.15 template<unsigned n> std::ostream & mln::value::operator<< (std::ostream & *ostr*, const int_u_sat< n > & *i*) `[inline]`

Print a saturated unsigned integer `i` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***i*** A saturated unsigned integer.

Returns:

The modified output stream `ostr`.

References mln::debug::format().

9.145.3.16 template<unsigned n> std::ostream & mln::value::operator<< (std::ostream & *ostr*, const int_u< n > & *i*) `[inline]`

Print an unsigned integer `i` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***i*** An unsigned integer.

Returns:

The modified output stream `ostr`.

References mln::debug::format().

9.145.3.17 template<unsigned n> std::ostream & mln::value::operator<< (std::ostream & *ostr*, const int_s< n > & *i*) [inline]

Print an signed integer i into the output stream ostr.

Parameters:

↔ ***ostr*** An output stream.

← ***i*** An signed integer.

Returns:

The modified output stream ostr.

References mln::debug::format().

9.145.3.18 template<typename H, typename S, typename L> std::ostream & mln::value::operator<< (std::ostream & *ostr*, const hsl_< H, S, L > & *c*) [inline]

Print an hsl c into the output stream ostr.

Parameters:

↔ ***ostr*** An output stream.

← ***c*** An rgb.

Returns:

The modified output stream ostr.

References mln::debug::format().

9.145.3.19 std::ostream & mln::value::operator<< (std::ostream & *ostr*, const graylevel_f & *g*) [inline]

Op<<.

References mln::value::graylevel_f::value().

9.145.3.20 template<unsigned n> std::ostream & mln::value::operator<< (std::ostream & *ostr*, const graylevel< n > & *g*) [inline]

Op<<.

9.145.3.21 template<unsigned n> std::ostream & mln::value::operator<< (std::ostream & *ostr*, const float01_< n > & *f*) [inline]

Op<<.

9.145.3.22 bool mln::value::operator== (const sign & *lhs*, const sign & *rhs*) [inline]

Comparaison operator.

9.145.3.23 template<typename H, typename S, typename L> bool mln::value::operator== (const hsl_< H, S, L > & *lhs*, const hsl_< H, S, L > & *rhs*) [inline]

Comparison.

9.145.3.24 template<typename V> V mln::value::other (const V & *val*) [inline]

Give an other value than `val`.

9.145.3.25 template<typename I> stack_image< 2, const I > mln::value::stack (const Image< I > & *ima1*, const Image< I > & *ima2*) [inline]

Shortcut to build a stack with two images.

9.146 mln::value::impl Namespace Reference

Implementation namespace of value namespace.

9.146.1 Detailed Description

Implementation namespace of value namespace.

9.147 mln::win Namespace Reference

Namespace of image processing routines related to win.

Classes

- struct backdiag2d
  Diagonal line window defined on the 2D square grid.
- struct ball
  Generic ball window defined on a given grid.
- struct cube3d
  Cube window defined on the 3D grid.
- struct cuboid3d
  Cuboid defined on the 3-D square grid.
- struct diag2d
  Diagonal line window defined on the 2D square grid.
- struct line
  Generic line window defined on a given grid in the given dimension.
- class multiple
  Multiple window.
- class multiple_size
  Definition of a multiple-size window.
- struct octagon2d
  Octagon window defined on the 2D square grid.
- struct rectangle2d
  Rectangular window defined on the 2D square grid.

Typedefs

- typedef ball< grid::square, def::coord > disk2d
  2D disk window; precisely, ball-shaped window defined on the 2D square grid.
- typedef line< grid::square, 1, def::coord > hline2d
  Horizontal line window defined on the 2D square grid.
- typedef line< grid::tick, 0, def::coord > segment1d
  Segment window defined on the 1D grid.
- typedef ball< grid::cube, def::coord > sphere3d

3D sphere window; precisely, ball-shaped window defined on the 3D cubic grid.

- typedef line< grid::square, 0, def::coord > vline2d

  Vertical line window defined on the 2D square grid.

Functions

- template<typename N1, typename N2>
  neighb< typename N1::window::regular > diff (const Neighborhood< N1 > &nbh1, const Neighborhood< N2 > &nbh2)

  Set difference between a couple of neighborhoods `nbh1` *and* `nbh2`.

- template<typename W>
  mln_regular (W) shift(const Window< W > &win

  Shift a window `win` *with a delta-point* `dp`.

- template<typename W1, typename W2>
  mln_regular (W1) diff(const Window< W1 > &win1

  Set difference between a couple of windows `win1` *and* `win2`.

- template<typename W>
  W sym (const Weighted_Window< W > &w_win)

  Give the symmetrical weighted window of `w_win`.

- template<typename W>
  W sym (const Window< W > &win)

  Give the symmetrical window of `win`.

9.147.1 Detailed Description

Namespace of image processing routines related to win.

9.147.2 Function Documentation

9.147.2.1 template<typename N1, typename N2> N2 neighb< typename N1::window::regular > mln::win::diff (const Neighborhood< N1 > & *nbh1*, const Neighborhood< N2 > & *nbh2*) [inline]

Set difference between a couple of neighborhoods `nbh1` and `nbh2`.

Referenced by mln::operator-().

9.147.2.2 template<typename W> mln::win::mln_regular (W) const [inline]

Shift a window `win` with a delta-point `dp`.

9.147.2.3 template<typename W1, typename W2> mln::win::mln_regular (W1) const [inline]

Set difference between a couple of windows `win1` and `win2`.

9.147.2.4 template<typename W> W mln::win::sym (const Weighted_Window< W > & *w_win*) [inline]

Give the symmetrical weighted window of `w_win`.

9.147.2.5 template<typename W> W mln::win::sym (const Window< W > & *win*) [inline]

Give the symmetrical window of `win`.

Referenced by mln::c18(), mln::c26(), mln::c4_3d(), mln::c6(), mln::morpho::hit_or_miss_background_-opening(), mln::morpho::hit_or_miss_opening(), mln::morpho::opening::approx::structural(), and mln::morpho::closing::approx::structural().

Chapter 10

Class Documentation

10.1 mln::accu::center< P, V > Struct Template Reference

Mass center accumulator.

`#include <center.hh>`

Inherits mln::accu::internal::base< V, mln::accu::center< P, V > >.

Public Member Functions

- bool is_valid () const

    Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

    Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

    Take `n` *times the value* `t`.

- V to_result () const

    Get the value of the accumulator.

- void init ()

    Manipulators.

10.1.1 Detailed Description

template<typename P, typename V = typename P::vec> struct mln::accu::center< P, V >

Mass center accumulator.

Template Parameters:

P the type of site.

V the type of vector to be used as result. The default vector type is the one provided by P.

10.1.2 Member Function Documentation

10.1.2.1 template<typename P, typename V> void mln::accu::center< P, V >::init () `[inline]`

Manipulators.

References mln::literal::zero.

10.1.2.2 template<typename P, typename V> bool mln::accu::center< P, V >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Referenced by mln::accu::center< P, V >::to_result().

10.1.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) `[inline, inherited]`

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.1.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) `[inline, inherited]`

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.1.2.5 template<typename P, typename V> V mln::accu::center< P, V >::to_result () const `[inline]`

Get the value of the accumulator.

References mln::accu::center< P, V >::is_valid().

10.2 mln::accu::convolve< T1, T2, R > Struct Template Reference

Generic convolution accumulator class.

`#include <convolve.hh>`

Inherits mln::accu::internal::base< R, mln::accu::convolve< T1, T2, R > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- R to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.2.1 Detailed Description

template<typename T1, typename T2, typename R = typename mln::trait::value_< typename mln::trait::op::times< T1 , T2 >::ret >::sum> struct mln::accu::convolve< T1, T2, R >

Generic convolution accumulator class.

Parameters `T1` and `T2` are the type of values to be convolved. Parameter `R` is the result type.

10.2.2 Member Function Documentation

10.2.2.1 template<typename T1, typename T2, typename R> void mln::accu::convolve< T1, T2, R >::init () `[inline]`

Manipulators.

References mln::literal::zero.

10.2.2.2 template<typename T1, typename T2, typename R> bool mln::accu::convolve< T1, T2, R >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.2.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.2.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.2.2.5 template<typename T1, typename T2, typename R> R mln::accu::convolve< T1, T2, R >::to_result () const [inline]

Get the value of the accumulator.

10.3 mln::accu::count_adjacent_vertices< F, S > Struct Template Reference

Accumulator class counting the number of vertices adjacent to a set of mln::p_edges_psite (i.e., a set of edges).

`#include <count_adjacent_vertices.hh>`

Inherits mln::accu::internal::base< unsigned, mln::accu::count_adjacent_vertices< F, S > >.

Public Member Functions

- bool is_valid () const

  Return whether this accu can return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- unsigned to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

  - void set_value (unsigned c)

    Force the value of the counter to c.

10.3.1 Detailed Description

template<typename F, typename S> struct mln::accu::count_adjacent_vertices< F, S >

Accumulator class counting the number of vertices adjacent to a set of mln::p_edges_psite (i.e., a set of edges).

The type to be count is mln::util::pix< pw::image<F, S> > where `F` and `S` are the parameters of this class.

This accumulator is used by mln::closing_area_on_vertices and mln::opening_area_on_vertices.

10.3.2 Member Function Documentation

10.3.2.1 template<typename F, typename S> void mln::accu::count_adjacent_vertices< F, S >::init () `[inline]`

Manipulators.

10.3.2.2 template<typename F, typename S> bool mln::accu::count_adjacent_vertices< F, S >::is_valid () const [inline]

Return whether this accu can return a result.

10.3.2.3 template<typename F, typename S> void mln::accu::count_adjacent_vertices< F, S >::set_value (unsigned *c*) [inline]

Force the value of the counter to *c*.

10.3.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.3.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.3.2.6 template<typename F, typename S> unsigned mln::accu::count_adjacent_vertices< F, S >::to_result () const [inline]

Get the value of the accumulator.

10.4 mln::accu::count_labels< L > Struct Template Reference

Count the number of different labels in an image.

`#include <count_labels.hh>`

Inherits mln::accu::internal::base< unsigned, mln::accu::count_labels< L > >.

Public Member Functions

- bool is_valid () const
  Check whether this accu is able to return a result.
- template<typename T>
  void take_as_init (const T &t)
  Take as initialization the value `t`*.*
- template<typename T>
  void take_n_times (unsigned n, const T &t)
  Take `n` *times the value* `t`*.*
- unsigned to_result () const
  Get the value of the accumulator.

  - void init ()
    Manipulators.
  - void set_value (unsigned c)
    Force the value of the counter to c*.*

10.4.1 Detailed Description

template<typename L> struct mln::accu::count_labels< L >

Count the number of different labels in an image.

The parameter *L* is the label type to be count.

10.4.2 Member Function Documentation

10.4.2.1 template<typename L> void mln::accu::count_labels< L >::init () `[inline]`

Manipulators.

10.4.2.2 template<typename L> bool mln::accu::count_labels< L >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.4.2.3 template<typename L> void mln::accu::count_labels< L >::set_value (unsigned *c*) [inline]

Force the value of the counter to *c*.

10.4.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.4.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.4.2.6 template<typename L> unsigned mln::accu::count_labels< L >::to_result () const [inline]

Get the value of the accumulator.

10.5 mln::accu::count_value< V > Struct Template Reference

Count a given value.

`#include <count_value.hh>`

Inherits mln::accu::internal::base< unsigned, mln::accu::count_value< V > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`*.*

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`*.*

- unsigned to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

  - void set_value (unsigned c)

    Force the value of the counter to c*.*

10.5.1 Detailed Description

template<typename V> struct mln::accu::count_value< V >

Count a given value.

10.5.2 Member Function Documentation

10.5.2.1 template<typename V> void mln::accu::count_value< V >::init () `[inline]`

Manipulators.

10.5.2.2 template<typename V> bool mln::accu::count_value< V >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.5.2.3 template< typename V > void mln::accu::count_value< V >::set_value (unsigned *c*) [inline]

Force the value of the counter to *c*.

10.5.2.4 template< typename E > template< typename T > void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.5.2.5 template< typename E > template< typename T > void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.5.2.6 template< typename V > unsigned mln::accu::count_value< V >::to_result () const [inline]

Get the value of the accumulator.

10.6 mln::accu::histo< V > Struct Template Reference

Generic histogram class over a value set with type V.

`#include <histo.hh>`

Inherits mln::accu::internal::base< const std::vector< unsigned > &, mln::accu::histo< V > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value t.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take n *times the value* t.

- void take (const argument &t)

  Manipulators.

- const std::vector< unsigned > & vect () const

  Get the value of the accumulator.

10.6.1 Detailed Description

template<typename V> struct mln::accu::histo< V >

Generic histogram class over a value set with type V.

10.6.2 Member Function Documentation

10.6.2.1 template<typename V> bool mln::accu::histo< V >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.6.2.2 template<typename V> void mln::accu::histo< V >::take (const argument & *t*) [inline]

Manipulators.

10.6.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.6.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.6.2.5 template<typename V> const std::vector< unsigned > & mln::accu::histo< V >::vect () const [inline]

Get the value of the accumulator.

10.7 mln::accu::label_used< L > Struct Template Reference

References all the labels used.

`#include <label_used.hh>`

Inherits mln::accu::internal::base< const mln::fun::i2v::array< bool > &, mln::accu::label_used< L > >.

Public Member Functions

- void init ()
  Initialize accumulator attributes.
- bool is_valid () const
  Check whether this accu is able to return a result.
- template<typename T>
  void take_as_init (const T &t)
  Take as initialization the value `t`.
- template<typename T>
  void take_n_times (unsigned n, const T &t)
  Take `n` *times the value* `t`.
- const fun::i2v::array< bool > & to_result () const
  Get the value of the accumulator.

- void take (const argument &)
  Manipulators.

10.7.1 Detailed Description

template<typename L> struct mln::accu::label_used< L >

References all the labels used.

The parameter *L* is the label type.

10.7.2 Member Function Documentation

10.7.2.1 template<typename L> void mln::accu::label_used< L >::init () `[inline]`

Initialize accumulator attributes.

10.7.2.2 template<typename L> bool mln::accu::label_used< L >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.7.2.3 template<typename L> void mln::accu::label_used< L >::take (const argument & *l*) [inline]

Manipulators.

10.7.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.7.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.7.2.6 template<typename L> const fun::i2v::array< bool > & mln::accu::label_used< L >::to_result () const [inline]

Get the value of the accumulator.

10.8 mln::accu::logic::land Struct Reference

"Logical-and" accumulator.

`#include <land.hh>`

Inherits mln::accu::internal::base< bool, mln::accu::logic::land >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- bool to_result () const

  Get the value of the accumulator.

- void init ()

  Manipulators.

10.8.1 Detailed Description

"Logical-and" accumulator.

10.8.2 Member Function Documentation

10.8.2.1 void mln::accu::logic::land::init () [inline]

Manipulators.

10.8.2.2 bool mln::accu::logic::land::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.8.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.8.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.8.2.5 bool mln::accu::logic::land::to_result () const [inline]

Get the value of the accumulator.

10.9 mln::accu::logic::land_basic Struct Reference

"Logical-and" accumulator.

`#include <land_basic.hh>`

Inherits mln::accu::internal::base< bool, mln::accu::logic::land_basic >.

Public Member Functions

- bool can_stop () const
  Test if it is worth for this accumulator to take extra data.
- bool is_valid () const
  Check whether this accu is able to return a result.
- template<typename T>
  void take_as_init (const T &t)
  Take as initialization the value `t`.
- template<typename T>
  void take_n_times (unsigned n, const T &t)
  Take `n` *times the value* `t`.
- bool to_result () const
  Get the value of the accumulator.

  - void init ()
    Manipulators.

10.9.1 Detailed Description

"Logical-and" accumulator.

Conversely to accu::logic::land, this version does not have the 'untake' method but features the 'can_stop' method.

10.9.2 Member Function Documentation

10.9.2.1 bool mln::accu::logic::land_basic::can_stop () const `[inline]`

Test if it is worth for this accumulator to take extra data.

If the result is already 'false' (because this accumulator has already taken a 'false' value), can_stop returns true.

10.9.2.2 void mln::accu::logic::land_basic::init () `[inline]`

Manipulators.

10.9.2.3 bool mln::accu::logic::land_basic::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.9.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.9.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.9.2.6 bool mln::accu::logic::land_basic::to_result () const [inline]

Get the value of the accumulator.

10.10 mln::accu::logic::lor Struct Reference

"Logical-or" accumulator.

`#include <lor.hh>`

Inherits mln::accu::internal::base< bool, mln::accu::logic::lor >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- bool to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.10.1 Detailed Description

"Logical-or" accumulator.

10.10.2 Member Function Documentation

10.10.2.1 void mln::accu::logic::lor::init () `[inline]`

Manipulators.

10.10.2.2 bool mln::accu::logic::lor::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.10.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) `[inline, inherited]`

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.10.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.10.2.5 bool mln::accu::logic::lor::to_result () const [inline]

Get the value of the accumulator.

10.11 mln::accu::logic::lor_basic Struct Reference

"Logical-or" accumulator class.

`#include <lor_basic.hh>`

Inherits mln::accu::internal::base< bool, mln::accu::logic::lor_basic >.

Public Member Functions

- bool can_stop () const
  Test if it is worth for this accumulator to take extra data.
- bool is_valid () const
  Check whether this accu is able to return a result.
- template<typename T>
  void take_as_init (const T &t)
  Take as initialization the value `t`.
- template<typename T>
  void take_n_times (unsigned n, const T &t)
  Take `n` *times the value* `t`.
- bool to_result () const
  Get the value of the accumulator.

- void init ()
  Manipulators.

10.11.1 Detailed Description

"Logical-or" accumulator class.

Conversely to accu::logic::lor, this version does not have the 'untake' method but features the 'can_stop' method.

10.11.2 Member Function Documentation

10.11.2.1 bool mln::accu::logic::lor_basic::can_stop () const [inline]

Test if it is worth for this accumulator to take extra data.

If the result is already 'true' (because this accumulator has already taken a 'true' value), can_stop returns true.

10.11.2.2 void mln::accu::logic::lor_basic::init () [inline]

Manipulators.

10.11.2.3 bool mln::accu::logic::lor_basic::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.11.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.11.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.11.2.6 bool mln::accu::logic::lor_basic::to_result () const [inline]

Get the value of the accumulator.

10.12 mln::accu::maj_h< T > Struct Template Reference

Compute the majority value.

`#include <maj_h.hh>`

Inherits mln::accu::internal::base< const T &, mln::accu::maj_h< T > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- const T & to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.12.1 Detailed Description

template<typename T> struct mln::accu::maj_h< T >

Compute the majority value.

It is based on a histogram. The parameter `T` is the type of values.

10.12.2 Member Function Documentation

10.12.2.1 template<typename T> void mln::accu::maj_h< T >::init () `[inline]`

Manipulators.

10.12.2.2 template<typename T> bool mln::accu::maj_h< T >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.12.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.12.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.12.2.5 template<typename T> const T & mln::accu::maj_h< T >::to_result () const [inline]

Get the value of the accumulator.

10.13 mln::accu::math::count< T > Struct Template Reference

Generic counter accumulator.

`#include <count.hh>`

Inherits mln::accu::internal::base< unsigned, mln::accu::math::count< T > >.

Public Member Functions

- bool is_valid () const
  Check whether this accu is able to return a result.
- template<typename T>
  void take_as_init (const T &t)
  Take as initialization the value `t`.
- template<typename T>
  void take_n_times (unsigned n, const T &t)
  Take `n` *times the value* `t`.
- unsigned to_result () const
  Get the value of the accumulator.

  - void init ()
    Manipulators.
  - void set_value (unsigned c)
    Force the value of the counter to c.

10.13.1 Detailed Description

template<typename T> struct mln::accu::math::count< T >

Generic counter accumulator.

The parameter *T* is the type to be count.

10.13.2 Member Function Documentation

10.13.2.1 template<typename T> void mln::accu::math::count< T >::init () `[inline]`

Manipulators.

10.13.2.2 template<typename T> bool mln::accu::math::count< T >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.13.2.3 template<typename T> void mln::accu::math::count< T >::set_value (unsigned *c*) [inline]

Force the value of the counter to *c*.

10.13.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.13.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.13.2.6 template<typename T> unsigned mln::accu::math::count< T >::to_result () const [inline]

Get the value of the accumulator.

10.14 mln::accu::math::inf< T > Struct Template Reference

Generic inf accumulator class.

`#include <inf.hh>`

Inherits mln::accu::internal::base< const T &, mln::accu::math::inf< T > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`*.*

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`*.*

- const T & to_result () const

  Get the value of the accumulator.

- void init ()

  Manipulators.

10.14.1 Detailed Description

template<typename T> struct mln::accu::math::inf< T >

Generic inf accumulator class.

The parameter `T` is the type of values.

10.14.2 Member Function Documentation

10.14.2.1 template<typename T> void mln::accu::math::inf< T >::init () `[inline]`

Manipulators.

10.14.2.2 template<typename T> bool mln::accu::math::inf< T >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.14.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.14.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.14.2.5 template<typename T> const T & mln::accu::math::inf< T >::to_result () const [inline]

Get the value of the accumulator.

10.15 mln::accu::math::sum< T, S > Struct Template Reference

Generic sum accumulator class.

`#include <sum.hh>`

Inherits mln::accu::internal::base< const S &, mln::accu::math::sum< T, S > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- const S & to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.15.1 Detailed Description

template<typename T, typename S = typename mln::value::props< T >::sum> struct mln::accu::math::sum< T, S >

Generic sum accumulator class.

Parameter `T` is the type of values that we sum. Parameter `S` is the type to store the value sum; the default type of `S` is the summation type (property) of `T`.

10.15.2 Member Function Documentation

10.15.2.1 template<typename T, typename S> void mln::accu::math::sum< T, S >::init () `[inline]`

Manipulators.

References mln::literal::zero.

10.15.2.2 template<typename T, typename S> bool mln::accu::math::sum< T, S >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.15.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.15.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.15.2.5 template<typename T, typename S> const S & mln::accu::math::sum< T, S >::to_result () const [inline]

Get the value of the accumulator.

10.16 mln::accu::math::sup< T > Struct Template Reference

Generic sup accumulator class.

```
#include <sup.hh>
```

Inherits mln::accu::internal::base< const T &, mln::accu::math::sup< T > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- const T & to_result () const

  Get the value of the accumulator.

- void init ()

  Manipulators.

10.16.1 Detailed Description

template<typename T> struct mln::accu::math::sup< T >

Generic sup accumulator class.

The parameter `T` is the type of values.

10.16.2 Member Function Documentation

10.16.2.1 template<typename T> void mln::accu::math::sup< T >::init () `[inline]`

Manipulators.

10.16.2.2 template<typename T> bool mln::accu::math::sup< T >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.16.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.16.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.16.2.5 template<typename T> const T & mln::accu::math::sup< T >::to_result () const [inline]

Get the value of the accumulator.

10.17 mln::accu::max_site< I > Struct Template Reference

Define an accumulator that computes the first site with the maximum value in an image.

`#include <max_site.hh>`

Inherits mln::accu::internal::base< I::psite, mln::accu::max_site< I > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- I::psite to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.17.1 Detailed Description

template<typename I> struct mln::accu::max_site< I >

Define an accumulator that computes the first site with the maximum value in an image.

10.17.2 Member Function Documentation

10.17.2.1 template<typename I> void mln::accu::max_site< I >::init () `[inline]`

Manipulators.

10.17.2.2 template<typename I> bool mln::accu::max_site< I >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

Referenced by mln::accu::max_site< I >::to_result().

10.17.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.17.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.17.2.5 template<typename I> I::psite mln::accu::max_site< I >::to_result () const [inline]

Get the value of the accumulator.

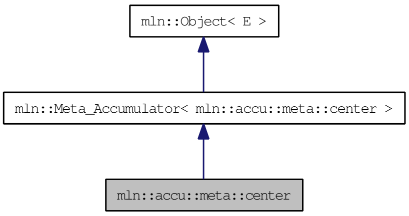
References mln::accu::max_site< I >::is_valid().

10.18 mln::accu::meta::center Struct Reference

Meta accumulator for center.

`#include <center.hh>`

Inheritance diagram for mln::accu::meta::center:



10.18.1 Detailed Description

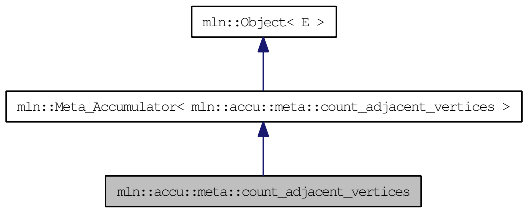
Meta accumulator for center.

10.19 mln::accu::meta::count_adjacent_vertices Struct Reference

Meta accumulator for count_adjacent_vertices.

`#include <count_adjacent_vertices.hh>`

Inheritance diagram for mln::accu::meta::count_adjacent_vertices:



10.19.1 Detailed Description

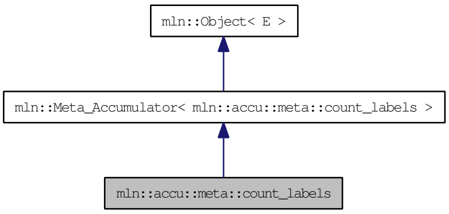
Meta accumulator for count_adjacent_vertices.

10.20 mln::accu::meta::count_labels Struct Reference

Meta accumulator for count_labels.

`#include <count_labels.hh>`

Inheritance diagram for mln::accu::meta::count_labels:



10.20.1 Detailed Description

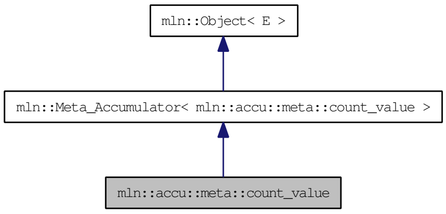
Meta accumulator for count_labels.

10.21 mln::accu::meta::count_value Struct Reference

FIXME: How to write a meta accumulator with a constructor taking a generic argument? Meta accumulator for count_value.

`#include <count_value.hh>`

Inheritance diagram for mln::accu::meta::count_value:



10.21.1 Detailed Description

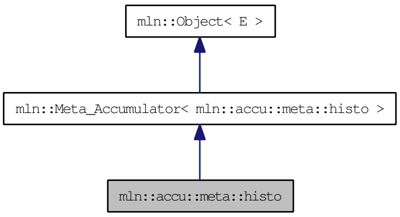
FIXME: How to write a meta accumulator with a constructor taking a generic argument? Meta accumulator for count_value.

10.22 mln::accu::meta::histo Struct Reference

Meta accumulator for histo.

```
#include <histo.hh>
```

Inheritance diagram for mln::accu::meta::histo:



10.22.1 Detailed Description

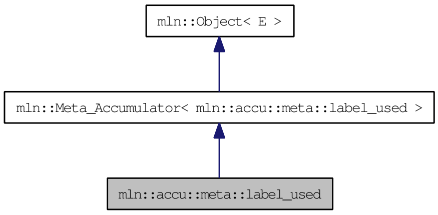
Meta accumulator for histo.

10.23 mln::accu::meta::label_used Struct Reference

Meta accumulator for label_used.

`#include <label_used.hh>`

Inheritance diagram for mln::accu::meta::label_used:



10.23.1 Detailed Description

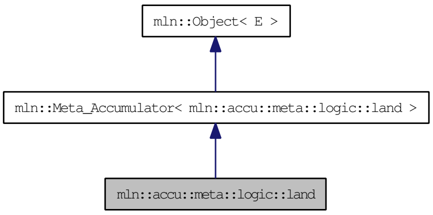
Meta accumulator for label_used.

10.24 mln::accu::meta::logic::land Struct Reference

Meta accumulator for land.

```
#include <land.hh>
```

Inheritance diagram for mln::accu::meta::logic::land:



10.24.1 Detailed Description

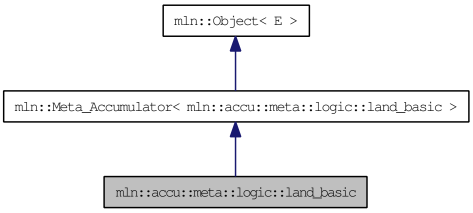
Meta accumulator for land.

10.25 mln::accu::meta::logic::land_basic Struct Reference

Meta accumulator for land_basic.

`#include <land_basic.hh>`

Inheritance diagram for mln::accu::meta::logic::land_basic:



10.25.1 Detailed Description

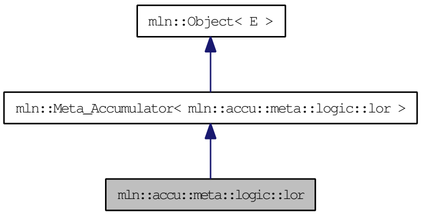
Meta accumulator for land_basic.

10.26 mln::accu::meta::logic::lor Struct Reference

Meta accumulator for lor.

`#include <lor.hh>`

Inheritance diagram for mln::accu::meta::logic::lor:



10.26.1 Detailed Description

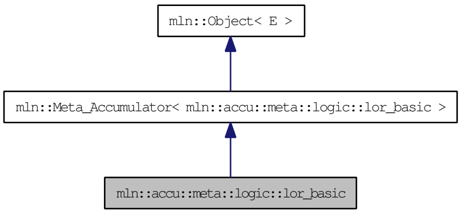
Meta accumulator for lor.

10.27 mln::accu::meta::logic::lor_basic Struct Reference

Meta accumulator for lor_basic.

`#include <lor_basic.hh>`

Inheritance diagram for mln::accu::meta::logic::lor_basic:



10.27.1 Detailed Description

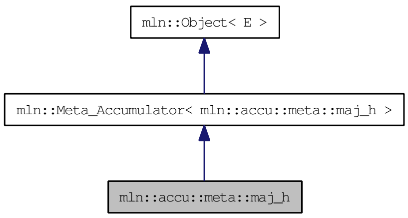
Meta accumulator for lor_basic.

10.28 mln::accu::meta::maj_h Struct Reference

Meta accumulator for maj_h.

`#include <maj_h.hh>`

Inheritance diagram for mln::accu::meta::maj_h:



10.28.1 Detailed Description

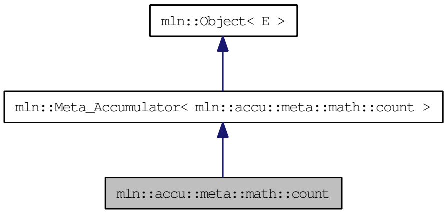
Meta accumulator for maj_h.

10.29 mln::accu::meta::math::count Struct Reference

Meta accumulator for count.

`#include <count.hh>`

Inheritance diagram for mln::accu::meta::math::count:



10.29.1 Detailed Description

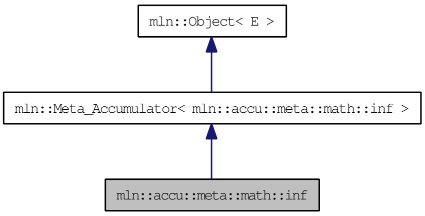
Meta accumulator for count.

10.30 mln::accu::meta::math::inf Struct Reference

Meta accumulator for inf.

`#include <inf.hh>`

Inheritance diagram for mln::accu::meta::math::inf:



10.30.1 Detailed Description

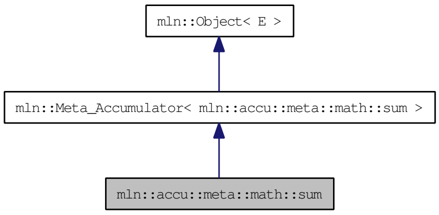
Meta accumulator for inf.

10.31 mln::accu::meta::math::sum Struct Reference

Meta accumulator for sum.

`#include <sum.hh>`

Inheritance diagram for mln::accu::meta::math::sum:



10.31.1 Detailed Description

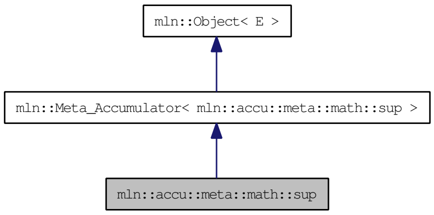
Meta accumulator for sum.

10.32 mln::accu::meta::math::sup Struct Reference

Meta accumulator for sup.

`#include <sup.hh>`

Inheritance diagram for mln::accu::meta::math::sup:



10.32.1 Detailed Description

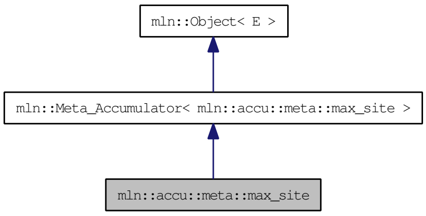
Meta accumulator for sup.

10.33 mln::accu::meta::max_site Struct Reference

Meta accumulator for max_site.

`#include <max_site.hh>`

Inheritance diagram for mln::accu::meta::max_site:



10.33.1 Detailed Description

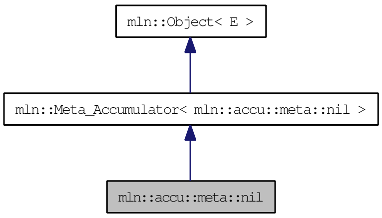
Meta accumulator for max_site.

10.34 mln::accu::meta::nil Struct Reference

Meta accumulator for nil.

`#include <nil.hh>`

Inheritance diagram for mln::accu::meta::nil:



10.34.1 Detailed Description

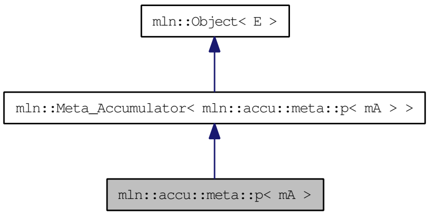
Meta accumulator for nil.

10.35 mln::accu::meta::p< mA > Struct Template Reference

Meta accumulator for p.

`#include <p.hh>`

Inheritance diagram for mln::accu::meta::p< mA >:



10.35.1 Detailed Description

template<typename mA> struct mln::accu::meta::p< mA >

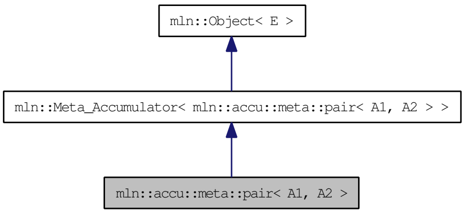
Meta accumulator for p.

10.36 mln::accu::meta::pair< A1, A2 > Struct Template Reference

Meta accumulator for pair.

`#include <pair.hh>`

Inheritance diagram for mln::accu::meta::pair< A1, A2 >:



10.36.1 Detailed Description

template<typename A1, typename A2> struct mln::accu::meta::pair< A1, A2 >

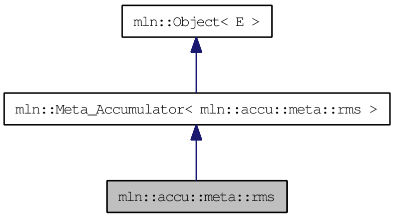
Meta accumulator for pair.

10.37 mln::accu::meta::rms Struct Reference

Meta accumulator for rms.

`#include <rms.hh>`

Inheritance diagram for mln::accu::meta::rms:



10.37.1 Detailed Description

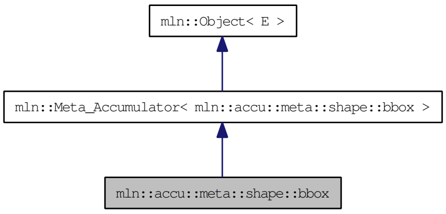
Meta accumulator for rms.

10.38 mln::accu::meta::shape::bbox Struct Reference

Meta accumulator for bbox.

`#include <bbox.hh>`

Inheritance diagram for mln::accu::meta::shape::bbox:



10.38.1 Detailed Description

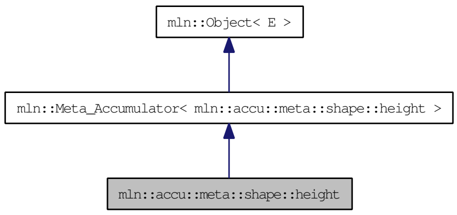
Meta accumulator for bbox.

10.39 mln::accu::meta::shape::height Struct Reference

Meta accumulator for height.

`#include <height.hh>`

Inheritance diagram for mln::accu::meta::shape::height:



10.39.1 Detailed Description

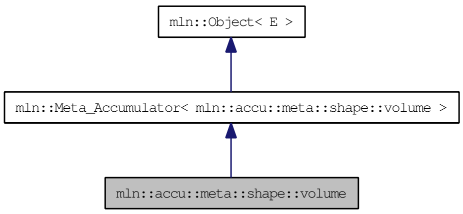
Meta accumulator for height.

10.40 mln::accu::meta::shape::volume Struct Reference

Meta accumulator for volume.

`#include <volume.hh>`

Inheritance diagram for mln::accu::meta::shape::volume:



10.40.1 Detailed Description

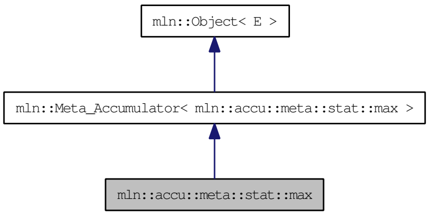
Meta accumulator for volume.

10.41 mln::accu::meta::stat::max Struct Reference

Meta accumulator for max.

`#include <max.hh>`

Inheritance diagram for mln::accu::meta::stat::max:



10.41.1 Detailed Description

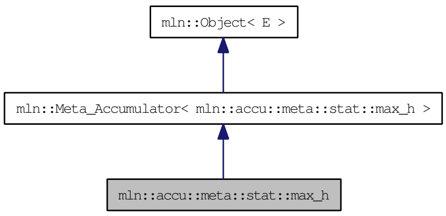
Meta accumulator for max.

10.42 mln::accu::meta::stat::max_h Struct Reference

Meta accumulator for max.

`#include <max_h.hh>`

Inheritance diagram for mln::accu::meta::stat::max_h:



10.42.1 Detailed Description

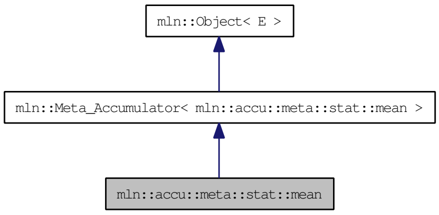
Meta accumulator for max.

10.43 mln::accu::meta::stat::mean Struct Reference

Meta accumulator for mean.

`#include <mean.hh>`

Inheritance diagram for mln::accu::meta::stat::mean:



10.43.1 Detailed Description

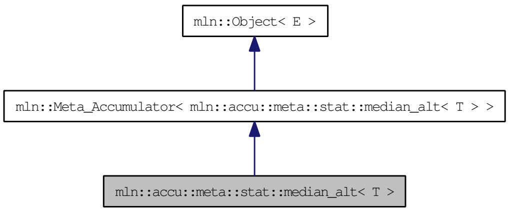
Meta accumulator for mean.

10.44 mln::accu::meta::stat::median_alt< T > Struct Template Reference

Meta accumulator for median_alt.

`#include <median_alt.hh>`

Inheritance diagram for mln::accu::meta::stat::median_alt< T >:



10.44.1 Detailed Description

template<typename T> struct mln::accu::meta::stat::median_alt< T >

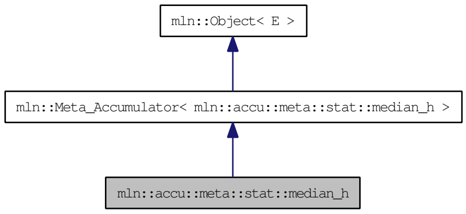
Meta accumulator for median_alt.

10.45 mln::accu::meta::stat::median_h Struct Reference

Meta accumulator for median_h.

`#include <median_h.hh>`

Inheritance diagram for mln::accu::meta::stat::median_h:



10.45.1 Detailed Description

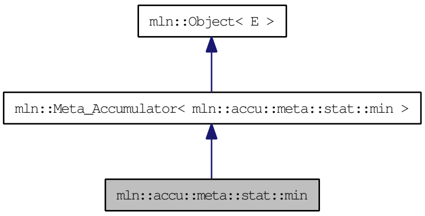
Meta accumulator for median_h.

10.46 mln::accu::meta::stat::min Struct Reference

Meta accumulator for min.

`#include <min.hh>`

Inheritance diagram for mln::accu::meta::stat::min:



10.46.1 Detailed Description

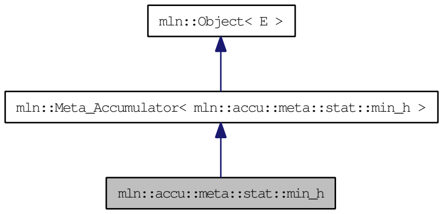
Meta accumulator for min.

10.47 mln::accu::meta::stat::min_h Struct Reference

Meta accumulator for min.

`#include <min_h.hh>`

Inheritance diagram for mln::accu::meta::stat::min_h:



10.47.1 Detailed Description

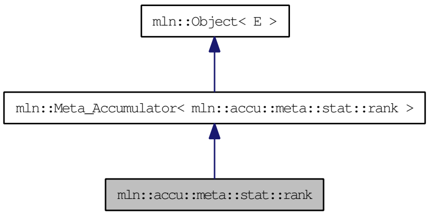
Meta accumulator for min.

10.48 mln::accu::meta::stat::rank Struct Reference

Meta accumulator for rank.

`#include <rank.hh>`

Inheritance diagram for mln::accu::meta::stat::rank:



10.48.1 Detailed Description

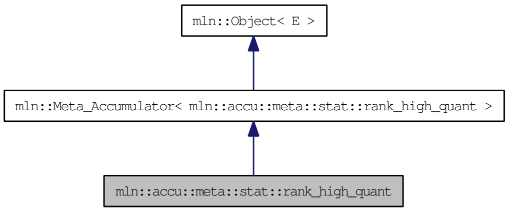
Meta accumulator for rank.

10.49 mln::accu::meta::stat::rank_high_quant Struct Reference

Meta accumulator for rank_high_quant.

`#include <rank_high_quant.hh>`

Inheritance diagram for mln::accu::meta::stat::rank_high_quant:



10.49.1 Detailed Description

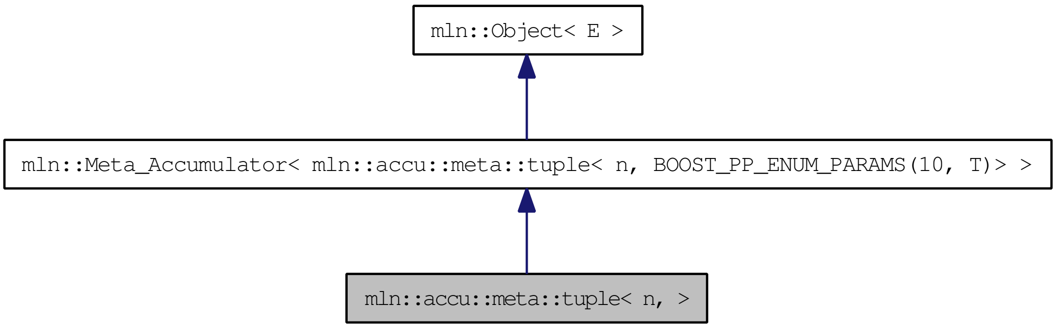
Meta accumulator for rank_high_quant.

10.50 mln::accu::meta::tuple< n, > Struct Template Reference

Meta accumulator for tuple.

```
#include <tuple.hh>
```

Inheritance diagram for mln::accu::meta::tuple< n, >:



10.50.1 Detailed Description

template<unsigned n, BOOST_PP_ENUM_PARAMS_WITH_A_DEFAULT(10, typename T, boost::tuples::null_type)> struct mln::accu::meta::tuple< n, >

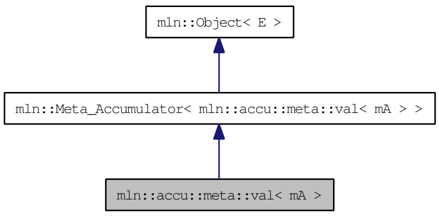
Meta accumulator for tuple.

10.51 mln::accu::meta::val< mA > Struct Template Reference

Meta accumulator for val.

```
#include <v.hh>
```

Inheritance diagram for mln::accu::meta::val< mA >:



10.51.1 Detailed Description

template<typename mA> struct mln::accu::meta::val< mA >

Meta accumulator for val.

10.52 mln::accu::nil< T > Struct Template Reference

Define an accumulator that does nothing.

`#include <nil.hh>`

Inherits mln::accu::internal::base< mln::util::ignore, mln::accu::nil< T > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- util::ignore to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.52.1 Detailed Description

template<typename T> struct mln::accu::nil< T >

Define an accumulator that does nothing.

10.52.2 Member Function Documentation

10.52.2.1 template<typename T> void mln::accu::nil< T >::init () `[inline]`

Manipulators.

10.52.2.2 template<typename T> bool mln::accu::nil< T >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.52.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.52.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.52.2.5 template<typename T> util::ignore mln::accu::nil< T >::to_result () const [inline]

Get the value of the accumulator.

10.53 mln::accu::p< A > Struct Template Reference

Generic p of accumulators.

`#include <p.hh>`

Inherits mln::accu::internal::base< const A::result &, mln::accu::p< A > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`*.*

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`*.*

- const A::result & to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.53.1 Detailed Description

template<typename A> struct mln::accu::p< A >

Generic p of accumulators.

The parameter `V` is the type of values.

10.53.2 Member Function Documentation

10.53.2.1 template<typename A> void mln::accu::p< A >::init () `[inline]`

Manipulators.

10.53.2.2 template<typename A> bool mln::accu::p< A >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.53.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.53.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.53.2.5 template<typename A> const A::result & mln::accu::p< A >::to_result () const [inline]

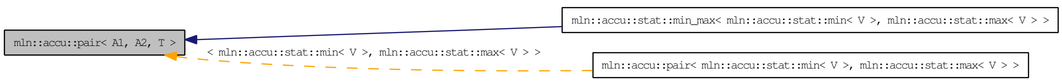
Get the value of the accumulator.

10.54 mln::accu::pair< A1, A2, T > Struct Template Reference

Generic pair of accumulators.

`#include <pair.hh>`

Inheritance diagram for mln::accu::pair< A1, A2, T >:



Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- std::pair< typename A1::result, typename A2::result > to_result () const

  Get the value of the accumulator.

- void init ()

  Manipulators.

10.54.1 Detailed Description

template<typename A1, typename A2, typename T = mln_argument(A1)> struct mln::accu::pair< A1, A2, T >

Generic pair of accumulators.

The parameter `T` is the type of values.

10.54.2 Member Function Documentation

10.54.2.1 template<typename A1, typename A2, typename T> void mln::accu::pair< A1, A2, T >::init () `[inline]`

Manipulators.

10.54.2.2 template<typename A1, typename A2, typename T> bool mln::accu::pair< A1, A2, T >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.54.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.54.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.54.2.5 template<typename A1, typename A2, typename T> std::pair< typename A1::result, typename A2::result > mln::accu::pair< A1, A2, T >::to_result () const [inline]

Get the value of the accumulator.

10.55 mln::accu::rms< T, V > Struct Template Reference

Generic root mean square accumulator class.

`#include <rms.hh>`

Inherits mln::accu::internal::base< V, mln::accu::rms< T, V > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- V to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.55.1 Detailed Description

template<typename T, typename V> struct mln::accu::rms< T, V >

Generic root mean square accumulator class.

The parameter `T` is the type of the root mean square value.

10.55.2 Member Function Documentation

10.55.2.1 template<typename T, typename V> void mln::accu::rms< T, V >::init () `[inline]`

Manipulators.

References mln::literal::zero.

10.55.2.2 template<typename T, typename V> bool mln::accu::rms< T, V >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.55.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.55.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.55.2.5 template<typename T, typename V> V mln::accu::rms< T, V >::to_result () const [inline]

Get the value of the accumulator.

10.56 mln::accu::shape::bbox< P > Struct Template Reference

Generic bounding box accumulator class.

`#include <bbox.hh>`

Inherits mln::accu::internal::base< const mln::box< P > &, mln::accu::shape::bbox< P > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`*.*

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`*.*

- const box< P > & to_result () const

  Get the value of the accumulator.

- void init ()

  Manipulators.

10.56.1 Detailed Description

template<typename P> struct mln::accu::shape::bbox< P >

Generic bounding box accumulator class.

The parameter `P` is the type of points.

10.56.2 Member Function Documentation

10.56.2.1 template<typename P> void mln::accu::shape::bbox< P >::init () `[inline]`

Manipulators.

10.56.2.2 template<typename P> bool mln::accu::shape::bbox< P >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.56.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.56.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.56.2.5 template<typename P> const box< P > & mln::accu::shape::bbox< P >::to_result () const [inline]

Get the value of the accumulator.

Referenced by mln::geom::rotate().

10.57 mln::accu::shape::height< I > Struct Template Reference

Height accumulator.

`#include <height.hh>`

Inherits mln::accu::internal::base< unsigned, mln::accu::shape::height< I > >.

Public Types

- typedef util::pix< I > argument

  The accumulated data type.

- typedef argument::value value

  The value type associated to the pixel type.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`*.*

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`*.*

- unsigned to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

  - void set_value (unsigned h)

    Force the value of the counter to h*.*

10.57.1 Detailed Description

template<typename I> struct mln::accu::shape::height< I >

Height accumulator.

The parameter `I` is the image type on which the accumulator of pixels is built.

10.57.2 Member Typedef Documentation

10.57.2.1 template<typename I> typedef util::pix<I> mln::accu::shape::height< I >::argument

The accumulated data type.

The height of component is represented by the height of its root pixel. See mln::morpho::closing_-height and mln::morpho::opening_height for actual uses of this accumulator. FIXME: Replaced by mln::morpho::attribute::height

10.57.2.2 template<typename I> typedef argument::value mln::accu::shape::height< I >::value

The value type associated to the pixel type.

10.57.3 Member Function Documentation

10.57.3.1 template<typename I> void mln::accu::shape::height< I >::init () [inline]

Manipulators.

10.57.3.2 template<typename I> bool mln::accu::shape::height< I >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.57.3.3 template<typename I> void mln::accu::shape::height< I >::set_value (unsigned *h*) [inline]

Force the value of the counter to *h*.

10.57.3.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.57.3.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.57.3.6 template<typename I> unsigned mln::accu::shape::height< I >::to_result () const [inline]

Get the value of the accumulator.

10.58 mln::accu::shape::volume< I > Struct Template Reference

Volume accumulator class.

`#include <volume.hh>`

Inherits mln::accu::internal::base< unsigned, mln::accu::shape::volume< I > >.

Public Types

- typedef util::pix< I > argument

  The accumulated data type.

- typedef argument::value value

  The value type associated to the pixel type.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- unsigned to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

  - void set_value (unsigned v)

    Force the value of the counter to v.

10.58.1 Detailed Description

template<typename I> struct mln::accu::shape::volume< I >

Volume accumulator class.

The parameter `I` is the image type on which the accumulator of pixels is built.

10.58.2 Member Typedef Documentation

10.58.2.1 template<typename I> typedef util::pix<I> mln::accu::shape::volume< I >::argument

The accumulated data type.

The volume of component is represented by the volume of its root pixel. See mln::morpho::closing_-volume and mln::morpho::opening_volume for actual uses of this accumulator. FIXME: Replaced by mln::morpho::attribute::volume

10.58.2.2 template<typename I> typedef argument::value mln::accu::shape::volume< I >::value

The value type associated to the pixel type.

10.58.3 Member Function Documentation

10.58.3.1 template<typename I> void mln::accu::shape::volume< I >::init () [inline]

Manipulators.

References mln::literal::zero.

10.58.3.2 template<typename I> bool mln::accu::shape::volume< I >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.58.3.3 template<typename I> void mln::accu::shape::volume< I >::set_value (unsigned *v*) [inline]

Force the value of the counter to *v*.

References mln::literal::zero.

10.58.3.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.58.3.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.58.3.6 template<typename I> unsigned mln::accu::shape::volume< I >::to_result () const [inline]

Get the value of the accumulator.

10.59 mln::accu::site_set::rectangularity< P > Class Template Reference

Compute the rectangularity of a site set.

`#include <rectangularity.hh>`

Inherits mln::accu::internal::couple< mln::accu::shape::bbox< P >, mln::accu::math::count< P >, float, mln::accu::site_set::rectangularity< P > >.

Public Member Functions

- A2::result area () const

  Return the site set area.

- A1::result bbox () const

  Return the site set bounding box.

- rectangularity ()

  Constructor.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- result to_result () const

  Return the rectangularity value.

10.59.1 Detailed Description

template<typename P> class mln::accu::site_set::rectangularity< P >

Compute the rectangularity of a site set.

10.59.2 Constructor & Destructor Documentation

10.59.2.1 template<typename P> mln::accu::site_set::rectangularity< P >::rectangularity () [inline]

Constructor.

10.59.3 Member Function Documentation

10.59.3.1 template<typename P> rectangularity< P >::A2::result mln::accu::site_set::rectangularity< P >::area () const [inline]

Return the site set area.

10.59.3.2 template<typename P> rectangularity< P >::A1::result mln::accu::site_set::rectangularity< P >::bbox () const [inline]

Return the site set bounding box.

10.59.3.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.59.3.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.59.3.5 template<typename P> rectangularity< P >::result mln::accu::site_set::rectangularity< P >::to_result () const [inline]

Return the rectangularity value.

10.60 mln::accu::stat::deviation< T, S, M > Struct Template Reference

Generic standard deviation accumulator class.

`#include <deviation.hh>`

Inherits mln::accu::internal::base< M, mln::accu::stat::deviation< T, S, M > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- M to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.60.1 Detailed Description

template<typename T, typename S = typename mln::value::props< T >::sum, typename M = S> struct mln::accu::stat::deviation< T, S, M >

Generic standard deviation accumulator class.

Parameter `T` is the type of values that we sum. Parameter `S` is the type to store the standard deviation; the default type of `S` is the summation type (property) of `T`. Parameter `M` is the type of the mean value; the default type of `M` is `S`.

10.60.2 Member Function Documentation

10.60.2.1 template<typename T, typename S, typename M> void mln::accu::stat::deviation< T, S, M >::init () `[inline]`

Manipulators.

10.60.2.2 template<typename T, typename S, typename M> bool mln::accu::stat::deviation< T, S, M >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.60.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.60.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.60.2.5 template<typename T, typename S, typename M> M mln::accu::stat::deviation< T, S, M >::to_result () const [inline]

Get the value of the accumulator.

10.61 mln::accu::stat::max< T > Struct Template Reference

Generic max accumulator class.

`#include <max.hh>`

Inherits mln::accu::internal::base< const T &, mln::accu::stat::max< T > >.

Public Member Functions

- bool is_valid () const

    Check whether this accu is able to return a result.

- void set_value (const T &t)

    Force the value of the min to t*.*

- template<typename T>
  void take_as_init (const T &t)

    Take as initialization the value `t`*.*

- template<typename T>
  void take_n_times (unsigned n, const T &t)

    Take `n` *times the value* `t`*.*

- const T & to_result () const

    Get the value of the accumulator.

    - void init ()

        Manipulators.

10.61.1 Detailed Description

template<typename T> struct mln::accu::stat::max< T >

Generic max accumulator class.

The parameter `T` is the type of values.

10.61.2 Member Function Documentation

10.61.2.1 template<typename T> void mln::accu::stat::max< T >::init () `[inline]`

Manipulators.

10.61.2.2 template<typename T> bool mln::accu::stat::max< T >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.61.2.3 template<typename T> void mln::accu::stat::max< T >::set_value (const T & *t*) [inline]

Force the value of the min to *t*.

10.61.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.61.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.61.2.6 template<typename T> const T & mln::accu::stat::max< T >::to_result () const [inline]

Get the value of the accumulator.

10.62 mln::accu::stat::max_h< V > Struct Template Reference

Generic max function based on histogram over a value set with type V.

`#include <max_h.hh>`

Inherits mln::accu::internal::base< const V &, mln::accu::stat::max_h< V > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value t.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take n *times the value* t.

- const argument & to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.62.1 Detailed Description

template<typename V> struct mln::accu::stat::max_h< V >

Generic max function based on histogram over a value set with type V.

10.62.2 Member Function Documentation

10.62.2.1 template<typename V> void mln::accu::stat::max_h< V >::init () [inline]

Manipulators.

10.62.2.2 template<typename V> bool mln::accu::stat::max_h< V >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.62.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.62.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.62.2.5 template<typename V> const max_h< V >::argument & mln::accu::stat::max_h< V >::to_result () const [inline]

Get the value of the accumulator.

10.63 mln::accu::stat::mean< T, S, M > Struct Template Reference

Generic mean accumulator class.

`#include <mean.hh>`

Inherits mln::accu::internal::base< M, mln::accu::stat::mean< T, S, M > >.

Public Member Functions

- accu::math::count< T >::result count () const
  Get the cardinality.
- bool is_valid () const
  Check whether this accu is able to return a result.
- accu::math::sum< T >::result sum () const
  Get the sum of values.
- template<typename T>
  void take_as_init (const T &t)
  Take as initialization the value `t`.
- template<typename T>
  void take_n_times (unsigned n, const T &t)
  Take `n` *times the value* `t`.
- M to_result () const
  Get the value of the accumulator.

  - void init ()
    Manipulators.

10.63.1 Detailed Description

template<typename T, typename S = typename mln::value::props< T >::sum, typename M = S> struct mln::accu::stat::mean< T, S, M >

Generic mean accumulator class.

Parameter `T` is the type of values that we sum. Parameter `S` is the type to store the sum of values; the default type of `S` is the summation type (property) of `T`. Parameter `M` is the type of the mean value; the default type of `M` is `S`.

10.63.2 Member Function Documentation

10.63.2.1 template<typename T, typename S, typename M> accu::math::count< T >::result mln::accu::stat::mean< T, S, M >::count () const [inline]

Get the cardinality.

10.63.2.2 template<typename T, typename S, typename M> void mln::accu::stat::mean< T, S, M >::init () [inline]

Manipulators.

10.63.2.3 template<typename T, typename S, typename M> bool mln::accu::stat::mean< T, S, M >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.63.2.4 template<typename T, typename S, typename M> accu::math::sum< T >::result mln::accu::stat::mean< T, S, M >::sum () const [inline]

Get the sum of values.

10.63.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.63.2.6 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.63.2.7 template<typename T, typename S, typename M> M mln::accu::stat::mean< T, S, M >::to_result () const [inline]

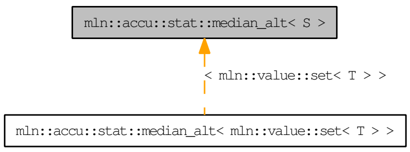
Get the value of the accumulator.

10.64 mln::accu::stat::median_alt< S > Struct Template Reference

Generic median_alt function based on histogram over a value set with type `S`.

`#include <median_alt.hh>`

Inheritance diagram for mln::accu::stat::median_alt< S >:



Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- const argument & to_result () const

  Get the value of the accumulator.

  - void take (const argument &t)

    Manipulators.

10.64.1 Detailed Description

template<typename S> struct mln::accu::stat::median_alt< S >

Generic median_alt function based on histogram over a value set with type `S`.

10.64.2 Member Function Documentation

10.64.2.1 template<typename S> bool mln::accu::stat::median_alt< S >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.64.2.2 template<typename S> void mln::accu::stat::median_alt< S >::take (const argument & *t*) [inline]

Manipulators.

10.64.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.64.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.64.2.5 template<typename S> const median_alt< S >::argument & mln::accu::stat::median_alt< S >::to_result () const [inline]

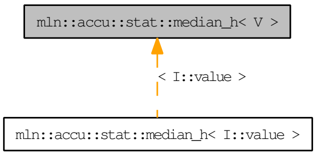
Get the value of the accumulator.

10.65 mln::accu::stat::median_h< V > Struct Template Reference

Generic median function based on histogram over a value set with type V.

```
#include <median_h.hh>
```

Inheritance diagram for mln::accu::stat::median_h< V >:



Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value t.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take n *times the value* t.

- const argument & to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.65.1 Detailed Description

template<typename V> struct mln::accu::stat::median_h< V >

Generic median function based on histogram over a value set with type V.

10.65.2 Member Function Documentation

10.65.2.1 template<typename V> void mln::accu::stat::median_h< V >::init () [inline]

Manipulators.

10.65.2.2 template<typename V> bool mln::accu::stat::median_h< V >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.65.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.65.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.65.2.5 template<typename V> const median_h< V >::argument & mln::accu::stat::median_h< V >::to_result () const [inline]

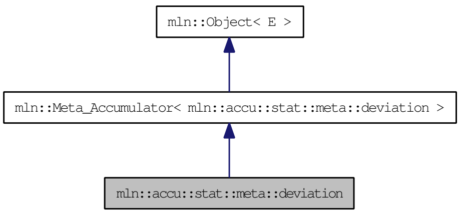
Get the value of the accumulator.

10.66 mln::accu::stat::meta::deviation Struct Reference

Meta accumulator for deviation.

`#include <deviation.hh>`

Inheritance diagram for mln::accu::stat::meta::deviation:



10.66.1 Detailed Description

Meta accumulator for deviation.

10.67 mln::accu::stat::min< T > Struct Template Reference

Generic min accumulator class.

`#include <min.hh>`

Inherits mln::accu::internal::base< const T &, mln::accu::stat::min< T > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- void set_value (const T &t)

  Force the value of the min to t.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- const T & to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.67.1 Detailed Description

template<typename T> struct mln::accu::stat::min< T >

Generic min accumulator class.

The parameter `T` is the type of values.

10.67.2 Member Function Documentation

10.67.2.1 template<typename T> void mln::accu::stat::min< T >::init () `[inline]`

Manipulators.

10.67.2.2 template<typename T> bool mln::accu::stat::min< T >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.67.2.3 template<typename T> void mln::accu::stat::min< T >::set_value (const T & *t*) [inline]

Force the value of the min to *t*.

10.67.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.67.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.67.2.6 template<typename T> const T & mln::accu::stat::min< T >::to_result () const [inline]

Get the value of the accumulator.

10.68 mln::accu::stat::min_h< V > Struct Template Reference

Generic min function based on histogram over a value set with type V.

`#include <min_h.hh>`

Inherits mln::accu::internal::base< const V &, mln::accu::stat::min_h< V > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`*.*

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`*.*

- const argument & to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.68.1 Detailed Description

template<typename V> struct mln::accu::stat::min_h< V >

Generic min function based on histogram over a value set with type V.

10.68.2 Member Function Documentation

10.68.2.1 template<typename V> void mln::accu::stat::min_h< V >::init () [inline]

Manipulators.

10.68.2.2 template<typename V> bool mln::accu::stat::min_h< V >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.68.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value t.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.68.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take n times the value t.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.68.2.5 template<typename V> const min_h< V >::argument & mln::accu::stat::min_h< V >::to_result () const [inline]

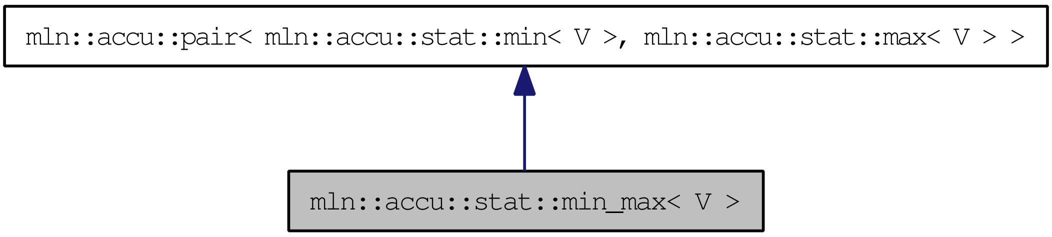
Get the value of the accumulator.

10.69 mln::accu::stat::min_max< V > Struct Template Reference

Generic min and max accumulator class.

`#include <min_max.hh>`

Inheritance diagram for mln::accu::stat::min_max< V >:



Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- std::pair< typename A1::result, typename A2::result > to_result () const

  Get the value of the accumulator.

- void init ()

  Manipulators.

10.69.1 Detailed Description

template<typename V> struct mln::accu::stat::min_max< V >

Generic min and max accumulator class.

The parameter `V` is the type of values.

10.69.2 Member Function Documentation

10.69.2.1 template<typename A1, typename A2, typename T> void mln::accu::pair< A1, A2, T >::init () [inline, inherited]

Manipulators.

10.69.2.2 template<typename A1, typename A2, typename T> bool mln::accu::pair< A1, A2, T >::is_valid () const [inline, inherited]

Check whether this accu is able to return a result.

Always true here.

10.69.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.69.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.69.2.5 template<typename A1, typename A2, typename T> std::pair< typename A1::result, typename A2::result > mln::accu::pair< A1, A2, T >::to_result () const [inline, inherited]

Get the value of the accumulator.

10.70 mln::accu::stat::rank< T > Struct Template Reference

Generic rank accumulator class.

`#include <rank.hh>`

Inherits mln::accu::internal::base< const T &, mln::accu::stat::rank< T > >.

Public Member Functions

- bool is_valid () const
  Check whether this accu is able to return a result.
- unsigned k () const
  Give the rank.
- template<typename T>
  void take_as_init (const T &t)
  Take as initialization the value `t`.
- template<typename T>
  void take_n_times (unsigned n, const T &t)
  Take `n` *times the value* `t`.
- const T & to_result () const
  Get the value of the accumulator.

  - void init ()
    Manipulators.

10.70.1 Detailed Description

template<typename T> struct mln::accu::stat::rank< T >

Generic rank accumulator class.

The parameter `T` is the type of values.

10.70.2 Member Function Documentation

10.70.2.1 template<typename T> void mln::accu::stat::rank< T >::init () `[inline]`

Manipulators.

Referenced by mln::morpho::impl::generic::rank_filter().

10.70.2.2 template<typename T> bool mln::accu::stat::rank< T >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.70.2.3 template<typename T> unsigned mln::accu::stat::rank< T >::k () const [inline]

Give the rank.

10.70.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.70.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.70.2.6 template<typename T> const T & mln::accu::stat::rank< T >::to_result () const [inline]

Get the value of the accumulator.

10.71 mln::accu::stat::rank< bool > Struct Template Reference

rank accumulator class for Boolean.

`#include <rank_bool.hh>`

Inherits mln::accu::internal::base< bool, mln::accu::stat::rank< bool > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- bool to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.71.1 Detailed Description

template<> struct mln::accu::stat::rank< bool >

rank accumulator class for Boolean.

10.71.2 Member Function Documentation

10.71.2.1 void mln::accu::stat::rank< bool >::init () `[inline]`

Manipulators.

10.71.2.2 bool mln::accu::stat::rank< bool >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.71.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.71.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.71.2.5 bool mln::accu::stat::rank< bool >::to_result () const [inline]

Get the value of the accumulator.

10.72 mln::accu::stat::rank_high_quant< T > Struct Template Reference

Generic rank accumulator class.

`#include <rank_high_quant.hh>`

Inherits mln::accu::internal::base< const T &, mln::accu::stat::rank_high_quant< T > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- const T & to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.72.1 Detailed Description

template<typename T> struct mln::accu::stat::rank_high_quant< T >

Generic rank accumulator class.

The parameter `T` is the type of values.

10.72.2 Member Function Documentation

10.72.2.1 template<typename T> void mln::accu::stat::rank_high_quant< T >::init () `[inline]`

Manipulators.

10.72.2.2 template<typename T> bool mln::accu::stat::rank_high_quant< T >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.72.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.72.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.72.2.5 template<typename T> const T & mln::accu::stat::rank_high_quant< T >::to_result () const [inline]

Get the value of the accumulator.

10.73 mln::accu::stat::var< T > Struct Template Reference

Var accumulator class.

`#include <var.hh>`

Inherits mln::accu::internal::base< mln::algebra::mat< T::dim, T::dim, float >, mln::accu::stat::var< T > >.

Public Types

- typedef algebra::vec< dim, float > mean_t

  Type equipment.

Public Member Functions

- bool is_valid () const

  Check whether this accu returns a valid result.

- mean_t mean () const

  Get the mean vector.

- unsigned n_items () const

  Get the number of items.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- result to_result () const

  Get the accumulator result (the var value).

- result variance () const

  Get the variance matrix.

  - void init ()

    Manipulators.

10.73.1 Detailed Description

template<typename T> struct mln::accu::stat::var< T >

Var accumulator class.

Parameter `T` is the type of vectors

10.73.2 Member Typedef Documentation

10.73.2.1 template<typename T> typedef algebra::vec<dim,float> mln::accu::stat::var< T >::mean_t

Type equipment.

10.73.3 Member Function Documentation

10.73.3.1 template<typename T> void mln::accu::stat::var< T >::init () [inline]

Manipulators.

10.73.3.2 template<typename T> bool mln::accu::stat::var< T >::is_valid () const [inline]

Check whether this accu returns a valid result.

10.73.3.3 template<typename T> var< T >::mean_t mln::accu::stat::var< T >::mean () const [inline]

Get the mean vector.

References mln::literal::zero.

10.73.3.4 template<typename T> unsigned mln::accu::stat::var< T >::n_items () const [inline]

Get the number of items.

10.73.3.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.73.3.6 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.73.3.7 template<typename T> var< T >::result mln::accu::stat::var< T >::to_result () const [inline]

Get the accumulator result (the var value).

References mln::literal::zero.

Referenced by mln::accu::stat::var< T >::variance().

10.73.3.8 template<typename T> var< T >::result mln::accu::stat::var< T >::variance () const [inline]

Get the variance matrix.

References mln::accu::stat::var< T >::to_result().

10.74 mln::accu::stat::variance< T, S, R > Struct Template Reference

Variance accumulator class.

`#include <variance.hh>`

Inherits mln::accu::internal::base< R, mln::accu::stat::variance< T, S, R > >.

Public Member Functions

- bool is_valid () const
  Check whether this accu is able to return a result.
- R mean () const
  Get the mean value.
- unsigned n_items () const
  Get the number of items.
- R standard_deviation () const
  Get the standard deviation value.
- S sum () const
  Get the sum value.
- template<typename T>
  void take_n_times (unsigned n, const T &t)
  Take `n` *times the value* `t`.
- R to_result () const
  Get the accumulator result (the variance value).
- R var () const
  Get the variance value.

  - void init ()
    Manipulators.
  - void take_as_init (const argument &t)
    Take as initialization the value `t`.

10.74.1 Detailed Description

template<typename T, typename S = typename mln::value::props< T >::sum, typename R = S> struct mln::accu::stat::variance< T, S, R >

Variance accumulator class.

Parameter `T` is the type of values that we sum. Parameter `S` is the type to store the value sum and the sum of value $*$ value; the default type of `S` is the summation type (property) of `T`. Parameter `R` is the type of the mean and variance values; the default type of `R` is `S`.

10.74.2 Member Function Documentation

10.74.2.1 template<typename T, typename S, typename R> void mln::accu::stat::variance< T, S, R >::init () `[inline]`

Manipulators.

10.74.2.2 template<typename T, typename S, typename R> bool mln::accu::stat::variance< T, S, R >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.74.2.3 template<typename T, typename S, typename R> R mln::accu::stat::variance< T, S, R >::mean () const `[inline]`

Get the mean value.

10.74.2.4 template<typename T, typename S, typename R> unsigned mln::accu::stat::variance< T, S, R >::n_items () const `[inline]`

Get the number of items.

10.74.2.5 template<typename T, typename S, typename R> R mln::accu::stat::variance< T, S, R >::standard_deviation () const `[inline]`

Get the standard deviation value.

References mln::accu::stat::variance< T, S, R >::to_result().

10.74.2.6 template<typename T, typename S, typename R> S mln::accu::stat::variance< T, S, R >::sum () const `[inline]`

Get the sum value.

10.74.2.7 template<typename T, typename S, typename R> void mln::accu::stat::variance< T, S, R >::take_as_init (const argument & *t*) `[inline]`

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented from mln::Accumulator< E >.

10.74.2.8 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take n times the value t.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.74.2.9 template<typename T, typename S, typename R> R mln::accu::stat::variance< T, S, R >::to_result () const [inline]

Get the accumulator result (the variance value).

Referenced by mln::accu::stat::variance< T, S, R >::standard_deviation(), and mln::accu::stat::variance< T, S, R >::var().

10.74.2.10 template<typename T, typename S, typename R> R mln::accu::stat::variance< T, S, R >::var () const [inline]

Get the variance value.

References mln::accu::stat::variance< T, S, R >::to_result().

10.75 mln::accu::tuple< A, n, > Struct Template Reference

Generic tuple of accumulators.

`#include <tuple.hh>`

Inherits mln::accu::internal::base< boost::tuple< BOOST_PP_REPEAT(10, RESULT_ACCU, Le Ricard ya que ca de vrai!) >, mln::accu::tuple< A, n, BOOST_PP_ENUM_PARAMS(10, T)> >.

Public Member Functions

- bool is_valid () const
  Check whether this accu is able to return a result.
- template<typename T>
  void take_as_init (const T &t)
  Take as initialization the value `t`*.*
- template<typename T>
  void take_n_times (unsigned n, const T &t)
  Take `n` *times the value* `t`*.*
- res to_result () const
  Get the value of the accumulator.

- void init ()
  Manipulators.

10.75.1 Detailed Description

template<typename A, unsigned n, BOOST_PP_ENUM_PARAMS_WITH_A_DEFAULT(10, typename T, boost::tuples::null_type)> struct mln::accu::tuple< A, n, >

Generic tuple of accumulators.

The parameter `T` is the type of values.

10.75.2 Member Function Documentation

10.75.2.1 template<typename A, unsigned n, BOOST_PP_ENUM_PARAMS(10, typename T) > void mln::accu::tuple< A, n, >::init () `[inline]`

Manipulators.

10.75.2.2 template<typename A, unsigned n, BOOST_PP_ENUM_PARAMS(10, typename T) > bool mln::accu::tuple< A, n, >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.75.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value t.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.75.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take n times the value t.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.75.2.5 template<typename A, unsigned n, BOOST_PP_ENUM_PARAMS(10, typename T) > tuple< A, n, BOOST_PP_ENUM_PARAMS(10, T) >::res mln::accu::tuple< A, n, >::to_result () const [inline]

Get the value of the accumulator.

10.76 mln::accu::val< A > Struct Template Reference

Generic val of accumulators.

`#include <v.hh>`

Inherits mln::accu::internal::base< const A::result &, mln::accu::val< A > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- const A::result & to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.76.1 Detailed Description

template<typename A> struct mln::accu::val< A >

Generic val of accumulators.

10.76.2 Member Function Documentation

10.76.2.1 template<typename A> void mln::accu::val< A >::init () `[inline]`

Manipulators.

10.76.2.2 template<typename A> bool mln::accu::val< A >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.76.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value t.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.76.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take n times the value t.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.76.2.5 template<typename A> const A::result & mln::accu::val< A >::to_result () const [inline]

Get the value of the accumulator.

10.77 mln::Accumulator< E > Struct Template Reference

Base class for implementation of accumulators.

`#include <accumulator.hh>`

Inherits mln::Proxy< E >.

Inherited by mln::accu::internal::base< R, E >.

Public Member Functions

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`*.*

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`*.*

10.77.1 Detailed Description

template<typename E> struct mln::Accumulator< E >

Base class for implementation of accumulators.

The parameter *E* is the exact type.

See also:

mln::doc::Accumulator for a complete documentation of this class contents.

10.77.2 Member Function Documentation

10.77.2.1 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.77.2.2 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.78 mln::algebra::h_mat< d, T > Struct Template Reference

N-Dimensional matrix with homogeneous coordinates.

`#include <h_mat.hh>`

Inherits mln::algebra::mat< d+1, d+1, T >.

Public Types

- enum

  Dimension is the 'natural' one (3 for 3D), not the one of the vector (dim + 1).

Public Member Functions

- mat< n, m, T > _1 () const

  Return the inverse of the matrix.

- h_mat (const mat< d+1, d+1, T > &x)

  Constructor with the underlying matrix.

- h_mat ()

  Constructor without argument.

- mat< m, n, T > t () const

  Return the transpose of the matrix.

10.78.1 Detailed Description

template<unsigned d, typename T> struct mln::algebra::h_mat< d, T >

N-Dimensional matrix with homogeneous coordinates.

10.78.2 Member Enumeration Documentation

10.78.2.1 template<unsigned d, typename T> anonymous enum

Dimension is the 'natural' one (3 for 3D), not the one of the vector (dim + 1).

10.78.3 Constructor & Destructor Documentation

10.78.3.1 template<unsigned d, typename T> mln::algebra::h_mat< d, T >::h_mat () [inline]

Constructor without argument.

10.78.3.2 template<unsigned d, typename T> mln::algebra::h_mat< d, T >::h_mat (const mat< d+1, d+1, T > & *x*) [inline]

Constructor with the underlying matrix.

10.78.4 Member Function Documentation

10.78.4.1 template<unsigned n, unsigned m, typename T> mat< n, m, T > mln::algebra::mat< n, m, T >::_1 () const [inline, inherited]

Return the inverse of the matrix.

Only compile on square matrix.

10.78.4.2 template<unsigned n, unsigned m, typename T> mat< m, n, T > mln::algebra::mat< n, m, T >::t () const [inline, inherited]

Return the transpose of the matrix.

10.79 mln::algebra::h_vec< d, C > Struct Template Reference

N-Dimensional vector with homogeneous coordinates.

`#include <h_vec.hh>`

Inherits mln::algebra::vec< d+1, C >.

Public Types

- enum

  Dimension is the 'natural' one (3 for 3D), not the one of the vector (dim + 1).

Public Member Functions

- h_vec (const vec< d+1, C > &other)

  Constructor with the underlying vector.

- h_vec ()

  Constructor without argument.

- template<typename U>
  operator mat< n, 1, U > () const

  Conversion to a matrix.

- mat< 1, n, T > t () const

  Transposition.

- vec< d, C > to_vec () const

  Back to the natural (non-homogeneous) space.

Static Public Attributes

- static const vec< n, T > origin = all_to(0)

  Origin value.

- static const vec< n, T > zero = all_to(0)

  Zero value.

10.79.1 Detailed Description

template<unsigned d, typename C> struct mln::algebra::h_vec< d, C >

N-Dimensional vector with homogeneous coordinates.

10.79.2 Member Enumeration Documentation

10.79.2.1 template<unsigned d, typename C> anonymous enum

Dimension is the 'natural' one (3 for 3D), not the one of the vector (dim + 1).

10.79.3 Constructor & Destructor Documentation

10.79.3.1 template<unsigned d, typename C> mln::algebra::h_vec< d, C >::h_vec () `[inline]`

Constructor without argument.

References mln::literal::one.

10.79.3.2 template<unsigned d, typename C> mln::algebra::h_vec< d, C >::h_vec (const vec< d+1, C > & *other*) `[inline]`

Constructor with the underlying vector.

10.79.4 Member Function Documentation

10.79.4.1 template<unsigned n, typename T> template<typename U> mln::algebra::vec< n, T >::operator mat< n, 1, U > () const `[inline, inherited]`

Conversion to a matrix.

10.79.4.2 template<unsigned n, typename T> mat< 1, n, T > mln::algebra::vec< n, T >::t () const `[inline, inherited]`

Transposition.

10.79.4.3 template<unsigned d, typename C> vec< d, C > mln::algebra::h_vec< d, C >::to_vec () const `[inline]`

Back to the natural (non-homogeneous) space.

10.79.5 Member Data Documentation

10.79.5.1 template<unsigned n, typename T> const vec< n, T > mln::algebra::vec< n, T >::origin = all_to(0) `[inline, static, inherited]`

Origin value.

10.79.5.2 template<unsigned n, typename T> const vec< n, T > mln::algebra::vec< n, T >::zero = all_to(0) `[inline, static, inherited]`

Zero value.

10.80 mln::bkd_pixter1d< I > Class Template Reference

Backward pixel iterator on a 1-D image with border.

`#include <pixter1d.hh>`

Inherits mln::internal::backward_pixel_iterator_base_< I, mln::bkd_pixter1d< I > >.

Public Types

- typedef I image

  Image type.

Public Member Functions

- bkd_pixter1d (I &image)

  Constructor.

- void next ()

  Go to the next element.

10.80.1 Detailed Description

template<typename I> class mln::bkd_pixter1d< I >

Backward pixel iterator on a 1-D image with border.

10.80.2 Member Typedef Documentation

10.80.2.1 template<typename I> typedef I mln::bkd_pixter1d< I >::image

Image type.

10.80.3 Constructor & Destructor Documentation

10.80.3.1 template<typename I> mln::bkd_pixter1d< I >::bkd_pixter1d (I & *image*) `[inline]`

Constructor.

Parameters:

← ***image*** The image this pixel iterator is bound to.

10.80.4 Member Function Documentation

10.80.4.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.81 mln::bkd_pixter2d< I > Class Template Reference

Backward pixel iterator on a 2-D image with border.

`#include <pixter2d.hh>`

Inherits mln::internal::backward_pixel_iterator_base_< I, mln::bkd_pixter2d< I > >.

Public Types

- typedef I image

  Image type.

Public Member Functions

- bkd_pixter2d (I &image)

  Constructor.

- void next ()

  Go to the next element.

10.81.1 Detailed Description

template<typename I> class mln::bkd_pixter2d< I >

Backward pixel iterator on a 2-D image with border.

10.81.2 Member Typedef Documentation

10.81.2.1 template<typename I> typedef I mln::bkd_pixter2d< I >::image

Image type.

10.81.3 Constructor & Destructor Documentation

10.81.3.1 template<typename I> mln::bkd_pixter2d< I >::bkd_pixter2d (I & *image*) `[inline]`

Constructor.

Parameters:

$\leftarrow$ ***image*** The image this pixel iterator is bound to.

10.81.4 Member Function Documentation

10.81.4.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.82 mln::bkd_pixter3d< I > Class Template Reference

Backward pixel iterator on a 3-D image with border.

`#include <pixter3d.hh>`

Inherits mln::internal::backward_pixel_iterator_base_< I, mln::bkd_pixter3d< I > >.

Public Types

- typedef I image

    Image type.

Public Member Functions

- bkd_pixter3d (I &image)

    Constructor.

- void next ()

    Go to the next element.

10.82.1 Detailed Description

template<typename I> class mln::bkd_pixter3d< I >

Backward pixel iterator on a 3-D image with border.

10.82.2 Member Typedef Documentation

10.82.2.1 template<typename I> typedef I mln::bkd_pixter3d< I >::image

Image type.

10.82.3 Constructor & Destructor Documentation

10.82.3.1 template<typename I> mln::bkd_pixter3d< I >::bkd_pixter3d (I & *image*) `[inline]`

Constructor.

Parameters:

← ***image*** The image this pixel iterator is bound to.

10.82.4 Member Function Documentation

10.82.4.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

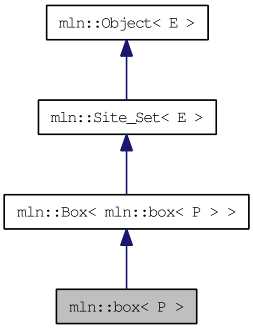
The iterator is valid.

10.83 mln::box< P > Struct Template Reference

Generic box class: site set containing points of a regular grid.

```
#include <box.hh>
```

Inheritance diagram for mln::box< P >:



Public Types

- enum

  Dimension.

- typedef box_bkd_piter_< P > bkd_piter

  Backward Site_Iterator associated type.

- typedef P element

  Element associated type.

- typedef box_fwd_piter_< P > fwd_piter

  Forward Site_Iterator associated type.

- typedef fwd_piter piter

  Site_Iterator associated type.

- typedef P psite

  Psite associated type.

- typedef P site

  Site associated type.

Public Member Functions

- const E & bbox () const

  Give the bounding box of this site set.

- box (const site &pmin, const site &pmax)

Constructor of a box going from `pmin` *to* `pmax`.

- box ()

  Constructor without argument.

- P center () const

  Return the approximated central site of this box.

- void crop_wrt (const box< P > &b)

  Crop this bbox in order to fit in the reference box `b`.

- void enlarge (unsigned dim, unsigned b)

  Enlarge the box with a border `b` *for dimension* `dim`.

- void enlarge (unsigned b)

  Enlarge the box with a border `b`.

- bool has (const P &p) const

  Test if `p` *belongs to the box.*

- bool is_empty () const

  Test if this box is empty.

- bool is_valid () const

  Test that the box owns valid data, i.e., is initialized and with pmin being 'less-than' pmax.

- unsigned len (unsigned i) const

  Give the length of the `i-th` *side of the box.*

- std::size_t memory_size () const

  Return the size of this site set in memory.

- unsigned nsites () const

  Give the number of sites of this box.

- P & pmax ()

  Reference to the maximum point.

- P pmax () const

  Maximum point.

- P & pmin ()

  Reference to the minimum point.

- P pmin () const

  Minimum point.

- box< P > to_larger (unsigned b) const

  Give a larger box.

  - box (typename P::coord ninds)

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Bl, typename Br>
  bool operator< (const Box< Bl > &lhs, const Box< Br > &rhs)

  Strict inclusion test between boxes `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename P>
  std::ostream & operator<< (std::ostream &ostr, const box< P > &b)

  Print a generic box `b` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Bl, typename Br>
  bool operator<= (const Box< Bl > &lhs, const Box< Br > &rhs)

  Inclusion test between boxes `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.83.1 Detailed Description

template<typename P> struct mln::box< P >

Generic box class: site set containing points of a regular grid.

Parameter `P` is the corresponding type of point.

10.83.2 Member Typedef Documentation

10.83.2.1 template<typename P> typedef box_bkd_piter_<P> mln::box< P >::bkd_piter

Backward Site_Iterator associated type.

10.83.2.2 template<typename P> typedef P mln::box< P >::element

Element associated type.

10.83.2.3 template<typename P> typedef box_fwd_piter_<P> mln::box< P >::fwd_piter

Forward Site_Iterator associated type.

10.83.2.4 template<typename P> typedef fwd_piter mln::box< P >::piter

Site_Iterator associated type.

10.83.2.5 template<typename P> typedef P mln::box< P >::psite

Psite associated type.

10.83.2.6 template<typename P> typedef P mln::box< P >::site

Site associated type.

10.83.3 Member Enumeration Documentation

10.83.3.1 template<typename P> anonymous enum

Dimension.

10.83.4 Constructor & Destructor Documentation

10.83.4.1 template<typename P> mln::box< P >::box () `[inline]`

Constructor without argument.

10.83.4.2 template<typename P> mln::box< P >::box (const site & *pmin*, const site & *pmax*) [inline]

Constructor of a box going from pmin to pmax.

References mln::box< P >::is_valid().

10.83.4.3 template<typename P> mln::box< P >::box (typename P::coord *ninds*) [inline, explicit]

Constructors with different numbers of arguments (sizes) w.r.t. the dimension.

References mln::literal::origin.

10.83.5 Member Function Documentation

10.83.5.1 template<typename E> const E & mln::Box< E >::bbox () const [inline, inherited]

Give the bounding box of this site set.

Return the bounding box of this site set, so that is itself. This method is declared by the mln::Site_Set concept.

Warning:

This method is final for all box classes.

10.83.5.2 template<typename P> P mln::box< P >::center () const [inline]

Return the approximated central site of this box.

References mln::box< P >::is_valid().

10.83.5.3 template<typename P> void mln::box< P >::crop_wrt (const box< P > & *b*) [inline]

Crop this bbox in order to fit in the reference box b.

References mln::box< P >::pmax(), and mln::box< P >::pmin().

Referenced by mln::make_debug_graph_image().

10.83.5.4 template<typename P> void mln::box< P >::enlarge (unsigned *dim*, unsigned *b*) [inline]

Enlarge the box with a border b for dimension dim.

References mln::box< P >::is_valid().

10.83.5.5 template<typename P> void mln::box< P >::enlarge (unsigned *b*) [inline]

Enlarge the box with a border b.

References mln::box< P >::is_valid().

Referenced by mln::registration::icp().

10.83.5.6 template<typename P> bool mln::box< P >::has (const P & *p*) const [inline]

Test if p belongs to the box.

Parameters:

← ***p*** A point site.

References mln::box< P >::is_valid().

Referenced by mln::morpho::line_gradient().

10.83.5.7 template<typename E> bool mln::Box< E >::is_empty () const [inline, inherited]

Test if this box is empty.

10.83.5.8 template<typename P> bool mln::box< P >::is_valid () const [inline]

Test that the box owns valid data, i.e., is initialized and with pmin being 'less-than' pmax.

References mln::util::ord_weak().

Referenced by mln::box< P >::box(), mln::box< P >::center(), mln::transform::distance_and_closest_-point_geodesic(), mln::box< P >::enlarge(), mln::box< P >::has(), mln::box< P >::pmax(), mln::box< P >::pmin(), and mln::box< P >::to_larger().

10.83.5.9 template<typename E> unsigned mln::Box< E >::len (unsigned *i*) const [inline, inherited]

Give the length of the i-th side of the box.

Precondition:

i < site::dim

Warning:

This method is final for all box classes.

10.83.5.10 template<typename P> std::size_t mln::box< P >::memory_size () const [inline]

Return the size of this site set in memory.

10.83.5.11 template<typename E> unsigned mln::Box< E >::nsites () const [inline, inherited]

Give the number of sites of this box.

Return the number of sites of this box. This method is declared by the mln::Site_Set concept.

Warning:

This method is final for all box classes.

Referenced by mln::morpho::line_gradient().

10.83.5.12 template<typename P> P & mln::box< P >::pmax () [inline]

Reference to the maximum point.

10.83.5.13 template<typename P> P mln::box< P >::pmax () const [inline]

Maximum point.

References mln::box< P >::is_valid().

Referenced by mln::box< P >::crop_wrt(), mln::make::image3d(), mln::larger_than(), and mln::io::fld::load().

10.83.5.14 template<typename P> P & mln::box< P >::pmin () [inline]

Reference to the minimum point.

10.83.5.15 template<typename P> P mln::box< P >::pmin () const [inline]

Minimum point.

References mln::box< P >::is_valid().

Referenced by mln::box< P >::crop_wrt(), mln::make::image3d(), mln::larger_than(), and mln::io::fld::load().

10.83.5.16 template<typename P> box< P > mln::box< P >::to_larger (unsigned *b*) const [inline]

Give a larger box.

References mln::box< P >::is_valid().

10.83.6 Friends And Related Function Documentation

10.83.6.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.83.6.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.83.6.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.83.6.4 template<typename Bl, typename Br> bool operator< (const Box< Bl > & *lhs*, const Box< Br > & *rhs*) [related, inherited]

Strict inclusion test between boxes `lhs` and `rhs`.

Parameters:

← ***lhs*** A box (strictly included?).

← ***rhs*** Another box (includor?).

10.83.6.5 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.83.6.6 template<typename P> std::ostream & operator<< (std::ostream & *ostr*, const box< P > & *b*) [related]

Print a generic box `b` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***b*** A generic box.

Returns:

The modified output stream `ostr`.

10.83.6.7 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.83.6.8 template<typename Bl, typename Br> bool operator<= (const Box< Bl > & *lhs*, const Box< Br > & *rhs*) `[related, inherited]`

Inclusion test between boxes `lhs` and `rhs`.

Parameters:

← ***lhs*** A box (included?).

← ***rhs*** Another box (includor?).

10.83.6.9 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.83.6.10 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.83.6.11 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.83.6.12 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) `[related, inherited]`

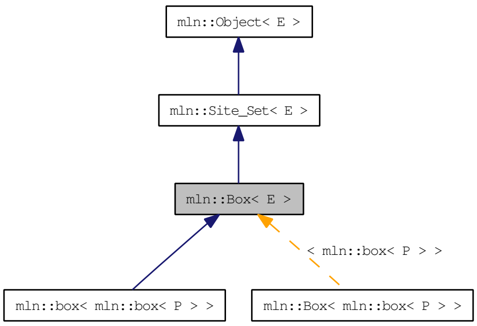
Give the unique set of `s`.

10.84 mln::Box< E > Struct Template Reference

Base class for implementation classes of boxes.

`#include <box.hh>`

Inheritance diagram for mln::Box< E >:



Public Member Functions

- const E & bbox () const

  Give the bounding box of this site set.

- bool is_empty () const

  Test if this box is empty.

- unsigned len (unsigned i) const

  Give the length of the `i-th` *side of the box.*

- unsigned nsites () const

  Give the number of sites of this box.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Bl, typename Br>
  bool operator< (const Box< Bl > &lhs, const Box< Br > &rhs)

  Strict inclusion test between boxes `lhs` *and* `rhs`*.*

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`*.*

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`*.*

- template<typename Bl, typename Br>
  bool operator<= (const Box< Bl > &lhs, const Box< Br > &rhs)

  Inclusion test between boxes `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`*.*

10.84.1 Detailed Description

template<typename E> struct mln::Box< E >

Base class for implementation classes of boxes.

Boxes are particular site sets useful to bound any set of sites defined on a regular grid.

See also:

mln::doc::Box for a complete documentation of this class contents.

10.84.2 Member Function Documentation

10.84.2.1 template<typename E> const E & mln::Box< E >::bbox () const [inline]

Give the bounding box of this site set.

Return the bounding box of this site set, so that is itself. This method is declared by the mln::Site_Set concept.

Warning:

This method is final for all box classes.

10.84.2.2 template<typename E> bool mln::Box< E >::is_empty () const [inline]

Test if this box is empty.

10.84.2.3 template<typename E> unsigned mln::Box< E >::len (unsigned *i*) const [inline]

Give the length of the `i-th` side of the box.

Precondition:

i < site::dim

Warning:

This method is final for all box classes.

10.84.2.4 template<typename E> unsigned mln::Box< E >::nsites () const [inline]

Give the number of sites of this box.

Return the number of sites of this box. This method is declared by the mln::Site_Set concept.

Warning:

This method is final for all box classes.

Referenced by mln::morpho::line_gradient().

10.84.3 Friends And Related Function Documentation

10.84.3.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.84.3.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.84.3.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.84.3.4 template<typename Bl, typename Br> bool operator< (const Box< Bl > & *lhs*, const Box< Br > & *rhs*) `[related]`

Strict inclusion test between boxes `lhs` and `rhs`.

Parameters:

← ***lhs*** A box (strictly included?).

← ***rhs*** Another box (includor?).

10.84.3.5 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) `[related, inherited]`

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.84.3.6 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.84.3.7 template<typename Bl, typename Br> bool operator<= (const Box< Bl > & *lhs*, const Box< Br > & *rhs*) `[related]`

Inclusion test between boxes `lhs` and `rhs`.

Parameters:

← ***lhs*** A box (included?).

← ***rhs*** Another box (includor?).

10.84.3.8 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.84.3.9 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.84.3.10 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Union of a couple of point sets.

10.84.3.11 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

Give the unique set of `s`.

10.85 mln::box_runend_piter< P > Class Template Reference

A generic backward iterator on points by lines.

`#include <box_runend_piter.hh>`

Inherits mln::internal::site_set_iterator_base< mln::box< P >, mln::box_runend_piter< P > >.

Public Member Functions

- box_runend_piter (const box< P > &b)

  Constructor.

- void next ()

  Go to the next element.

- unsigned run_length () const

  Give the lenght of the run.

10.85.1 Detailed Description

template<typename P> class mln::box_runend_piter< P >

A generic backward iterator on points by lines.

The parameter `P` is the type of points.

10.85.2 Constructor & Destructor Documentation

10.85.2.1 template<typename P> mln::box_runend_piter< P >::box_runend_piter (const box< P > & *b*) `[inline]`

Constructor.

Parameters:

← ***b*** A box.

10.85.3 Member Function Documentation

10.85.3.1 template<typename E> void mln::Site_Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.85.3.2 template<typename P> unsigned mln::box_runend_piter< P >::run_length () const [inline]

Give the lenght of the run.

10.86 mln::box_runstart_piter< P > Class Template Reference

A generic forward iterator on points by lines.

`#include <box_runstart_piter.hh>`

Inherits mln::internal::site_set_iterator_base< mln::box< P >, mln::box_runstart_piter< P > >.

Public Member Functions

- box_runstart_piter (const box< P > &b)

  Constructor.

- void next ()

  Go to the next element.

- unsigned run_length () const

  Give the lenght of the run.

10.86.1 Detailed Description

template<typename P> class mln::box_runstart_piter< P >

A generic forward iterator on points by lines.

The parameter `P` is the type of points.

10.86.2 Constructor & Destructor Documentation

10.86.2.1 template<typename P> mln::box_runstart_piter< P >::box_runstart_piter (const box< P > & b) `[inline]`

Constructor.

Parameters:

← ***b*** A box.

10.86.3 Member Function Documentation

10.86.3.1 template<typename E> void mln::Site_Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the the *next_* method.

Precondition:

The iterator is valid.

10.86.3.2 template<typename P> unsigned mln::box_runstart_piter< P >::run_length () const [inline]

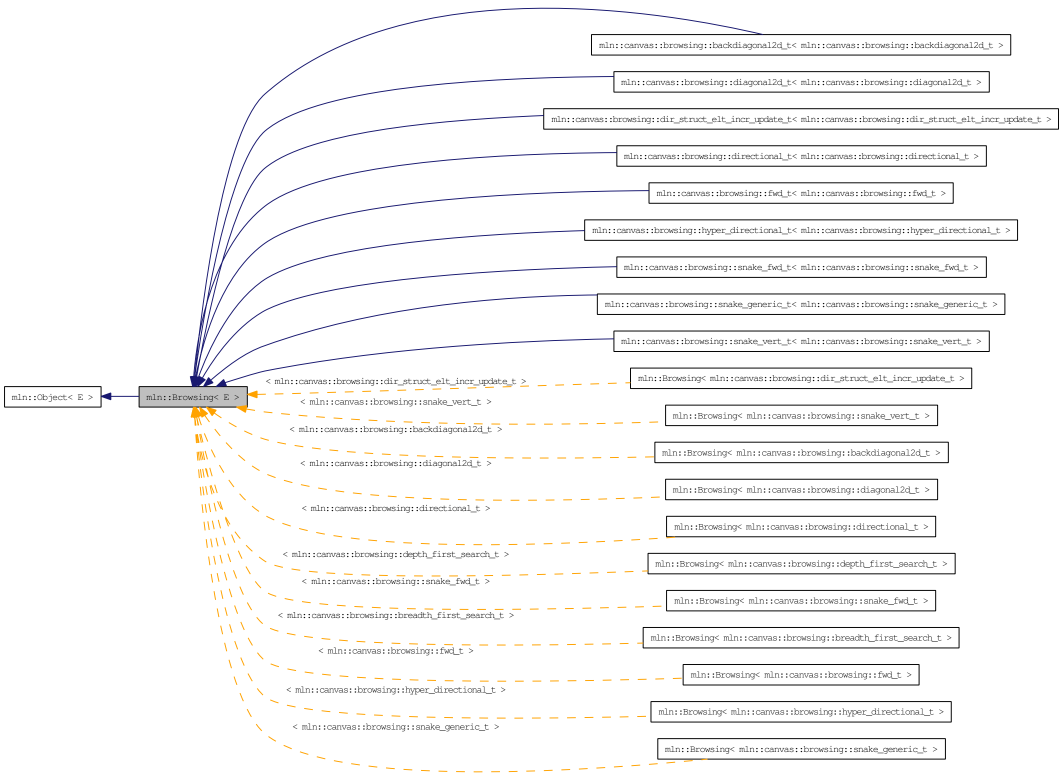
Give the lenght of the run.

10.87 mln::Browsing< E > Struct Template Reference

Base class for implementation classes that are browsings.

`#include <browsing.hh>`

Inheritance diagram for mln::Browsing< E >:



10.87.1 Detailed Description

template<typename E> struct mln::Browsing< E >

Base class for implementation classes that are browsings.

See also:

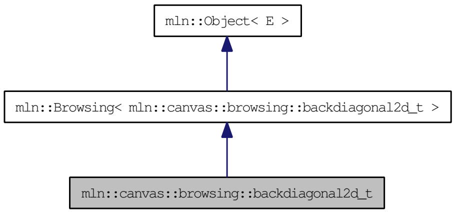
mln::doc::Browsing for a complete documentation of this class contents.

10.88 mln::canvas::browsing::backdiagonal2d_t Struct Reference

Browsing in a certain direction.

`#include <backdiagonal2d.hh>`

Inheritance diagram for mln::canvas::browsing::backdiagonal2d_t:



10.88.1 Detailed Description

Browsing in a certain direction.

This canvas browse all the point of an image 'input' of type 'I' and of dimension 'dim' in the direction 'dir'.

The functor should provide (In addition to 'input', 'I', 'dim' and 'dir') three methods :

- init() : Will be called at the beginning.
- next() : Will be called at each point 'p' (also provided by the fonctor).
- final(): Will be called at the end.

F shall features :

{

— as types:

I;

— as attributes:

dim;

dir; // and test dir < dim

input;

p;

— as methods:

void init();

void next();

void final();

}

Example :

——-> | 4 7 9 | 2 5 8 | 1 3 6

10.89 mln::canvas::browsing::breadth_first_search_t Struct Reference

Breadth-first search algorithm for graph, on vertices.

```
#include <breadth_first_search.hh>
```

Inherits mln::canvas::browsing::internal::graph_first_search_t< mln::canvas::browsing::breadth_first_search_t, std::queue< T > >.

10.89.1 Detailed Description

Breadth-first search algorithm for graph, on vertices.

10.90 mln::canvas::browsing::depth_first_search_t Struct Reference

Breadth-first search algorithm for graph, on vertices.

`#include <depth_first_search.hh>`

Inherits mln::canvas::browsing::internal::graph_first_search_t< mln::canvas::browsing::depth_first_search_t, std::stack< T > >.

10.90.1 Detailed Description

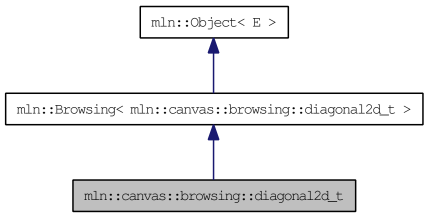
Breadth-first search algorithm for graph, on vertices.

10.91 mln::canvas::browsing::diagonal2d_t Struct Reference

Browsing in a certain direction.

```
#include <diagonal2d.hh>
```

Inheritance diagram for mln::canvas::browsing::diagonal2d_t:



10.91.1 Detailed Description

Browsing in a certain direction.

This canvas browse all the point of an image 'input' of type 'I' and of dimension 'dim' in the direction 'dir'.

The functor should provide (In addition to 'input', 'I', 'dim' and 'dir') three methods :

- init() : Will be called at the beginning.
- next() : Will be called at each point 'p' (also provided by the fonctor).
- final(): Will be called at the end.

F shall features :

{

— as types:

I;

— as attributes:

dim;

dir; // and test dir < dim

input;

p;

— as methods:

void init();

void next();

void final();

}

Example :

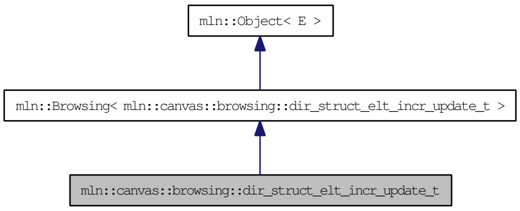
| 1 3 6 | 2 5 8 | 4 7 9 L——>

10.92 mln::canvas::browsing::dir_struct_elt_incr_update_t Struct Reference

Browsing in a certain direction with a segment.

`#include <dir_struct_elt_incr_update.hh>`

Inheritance diagram for mln::canvas::browsing::dir_struct_elt_incr_update_t:



10.92.1 Detailed Description

Browsing in a certain direction with a segment.

This canvas browse all the point of an image 'input' of type 'I', of dimension 'dim' in the direction 'dir' with considering weigh the 'length' nearest points.

The functor should provide (In addition to 'input', 'I', 'dim', 'dir' and 'length') six methods :

- init() : Will be called at the beginning.
- init_line() : Will be called at the beginning of each line.
- add_point(q) : Will be called for taking the new point 'q' into account.
- remove_point(q): Will be called for untaking the new point 'q' into account.
- next() : Will be called at each point 'p' (also provided by the functor).
- final() : Will be called at the end.

F shall features :

{

— as types:

I;

— as attributes:

dim;

dir; // and test dir $<$ dim

input;

p;

length;

— as methods:

void init();

void init_line();

void add_point(q)

void remove_point(q)

void next();

void final();

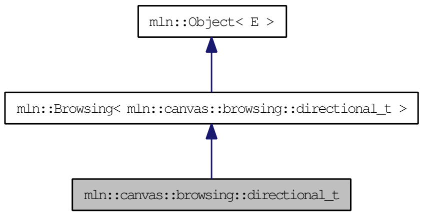
}

10.93 mln::canvas::browsing::directional_t Struct Reference

Browsing in a certain direction.

```
#include <directional.hh>
```

Inheritance diagram for mln::canvas::browsing::directional_t:



10.93.1 Detailed Description

Browsing in a certain direction.

This canvas browse all the point of an image 'input' of type 'I' and of dimension 'dim' in the direction 'dir'.

The functor should provide (In addition to 'input', 'I', 'dim' and 'dir') three methods :

- init() : Will be called at the beginning.
- next() : Will be called at each point 'p' (also provided by the fonctor).
- final(): Will be called at the end.

F shall features :

{

— as types:

I;

— as attributes:

dim;

dir; // and test dir $<$ dim

input;

p;

— as methods:

void init();

void next();

void final();

}

Example :

1 0 0 2 0 0 3 0 0

4 0 0 5 0 0 6 0 0

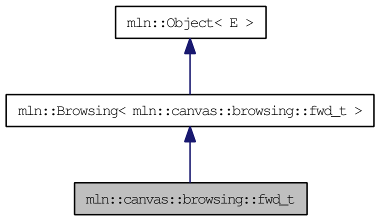
7 0 0 8 0 0 9 0 0

10.94 mln::canvas::browsing::fwd_t Struct Reference

Canvas for forward browsing.

`#include <fwd.hh>`

Inheritance diagram for mln::canvas::browsing::fwd_t:



10.94.1 Detailed Description

Canvas for forward browsing.

This canvas browse all the points of an image 'input' of type 'I' from left to right and from top to bottom

The fonctor should provide (In addition of 'I' and 'input') three methods :

- init() : Will be called at the beginning.
- next() : Will be called at each point 'p' (also provided by the functor).
- final(): Will be called at the end.

F shall feature:

{

— as typedef:

I;

–as attributes:

input;

p;

— as method:

void init();

void next();

void final();

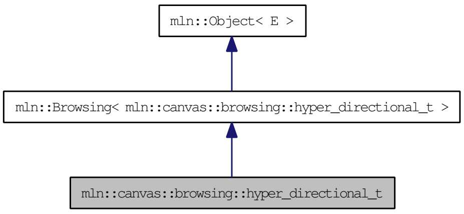
}

10.95 mln::canvas::browsing::hyper_directional_t Struct Reference

Browsing in a certain direction.

`#include <hyper_directional.hh>`

Inheritance diagram for mln::canvas::browsing::hyper_directional_t:



10.95.1 Detailed Description

Browsing in a certain direction.

This canvas browse all the point of an image 'input' of type 'I' and of dimension 'dim' in the direction 'dir'.

The functor should provide (In addition to 'input', 'I', 'dim' and 'dir') three methods :

- init() : Will be called at the beginning.
- next() : Will be called at each point 'p' (also provided by the fonctor).
- final(): Will be called at the end.

F shall features :

{

— as types:

I;

— as attributes:

dim;

dir; // and test dir < dim

input;

p;

— as methods:

void init();

void next();

void final();

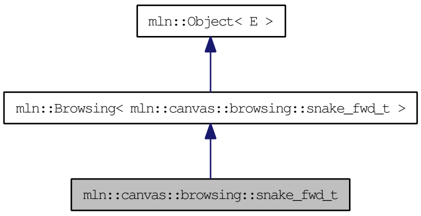
}

10.96 mln::canvas::browsing::snake_fwd_t Struct Reference

Browsing in a snake-way, forward.

```
#include <snake_fwd.hh>
```

Inheritance diagram for mln::canvas::browsing::snake_fwd_t:



10.96.1 Detailed Description

Browsing in a snake-way, forward.

This canvas browse all the point of an image ’input’ like this :

——-> <——’ ’——>

The fonctor should provide (In addition to ’input’) four methods :

- init() : Will be called at the beginning.
- down() : Will be called after each moving down. (will also be called once at the first point).
- fwd() : Will be called after each moving right.
- bwd() : Will ba called after each moving left.

This methods should acces to the current working point ’p’ also provided by the functor.

Warning: This canvas works only on 2D.

F shall feature:

{

— as attributes:

input;

p;

— as methods:

void init();

void down();

void fwd();

void bkd();

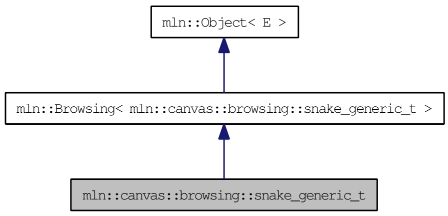
}

10.97 mln::canvas::browsing::snake_generic_t Struct Reference

Multidimentional Browsing in a given-way.

```
#include <snake_generic.hh>
```

Inheritance diagram for mln::canvas::browsing::snake_generic_t:



10.97.1 Detailed Description

Multidimentional Browsing in a given-way.

F shall feature:

{

— as attributes:

input;

p;

— as methods:

void init();

void *() moves[];

dpsite dps[];

}

init is called before browsing

The snake follow dimension using the delta point site of dps. dps[0] = delta psite following the global dimension (forward) dps[1] = delta psite following the 2nd dimension to follow (forward). dps[2] = delta psite following the 2nd dimension to follow (backward). dps[3] = delta psite following the 3nd dimension to follow (forward). dps[3] = delta psite following the 3nd dimension to follow (backward).

moves contains pointer to f's members. These merbers will be call in each time the snake progress in the correct dimension :

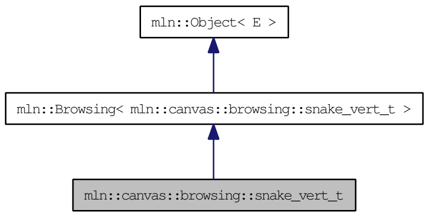
moves[i] is called at each move following the delta psite dps[i]

10.98 mln::canvas::browsing::snake_vert_t Struct Reference

Browsing in a snake-way, forward.

```
#include <snake_vert.hh>
```

Inheritance diagram for mln::canvas::browsing::snake_vert_t:



10.98.1 Detailed Description

Browsing in a snake-way, forward.

This canvas browse all the point of an image 'input' like this :

| /\ | | | | \/ | \/

The fonctor should provide (In addition to 'input') four methods :

- init() : Will be called at the beginning.
- down() : Will be called after each moving down.
- up() : Will ba called after each moving up.
- fwd() : Will be called after each moving right. (will also be called once at the first point).

This methods should acces to the current working point 'p' also provided by the functor.

Warning: This canvas works only on 2D.

F shall feature:

{

— as attributes:

input;

p;

— as methods:

void init();

void down();

void up();

void fwd();

}

10.99 mln::canvas::chamfer< F > Struct Template Reference

Compute chamfer distance.

`#include <chamfer.hh>`

10.99.1 Detailed Description

template<typename F> struct mln::canvas::chamfer< F >

Compute chamfer distance.

10.100 mln::category< R(∗)(A) > Struct Template Reference

Category declaration for a unary C function.

`#include <c.hh>`

10.100.1 Detailed Description

template<typename R, typename A> struct mln::category< R(∗)(A) >

Category declaration for a unary C function.

10.101 mln::complex_image< D, G, V > Class Template Reference

Image based on a complex.

`#include <complex_image.hh>`

Inherits mln::internal::image_primary< V, mln::p_complex< D, G >, mln::complex_image< D, G, V > >.

Public Types

- typedef G geom
  The geometry type of the complex.
- typedef V & lvalue
  Return type of read-write access.
- typedef const V & rvalue
  Return type of read-only access.
- typedef complex_image< D, tag::psite_< G >, tag::value_< V > > skeleton
  Skeleton.
- typedef V value
  Value associated type.

Public Member Functions

- lvalue operator() (const complex_psite< D, G > &p)
  Read-write access of face value at point site `p`*.*
- rvalue operator() (const complex_psite< D, G > &p) const
  Read-only access of face value at point site `p`*.*

  - complex_image ()
    Constructors.

  - const p_complex< D, G > & domain () const
    Accessors.
  - const metal::vec< D+1, std::vector< mlc_unbool(V) > > & values () const
    Return the array of values associated to the faces.

Static Public Attributes

- static const unsigned dim = D
  The dimension of the complex.

10.101.1 Detailed Description

template<unsigned D, typename G, typename V> class mln::complex_image< D, G, V >

Image based on a complex.

Values attached to each face of the complex.

Template Parameters:

- ***D*** The dimension of the complex.
- ***G*** The geometry type of the complex.
- ***V*** The value type of the image.

10.101.2 Member Typedef Documentation

10.101.2.1 template<unsigned D, typename G, typename V> typedef G mln::complex_image< D, G, V >::geom

The geometry type of the complex.

10.101.2.2 template<unsigned D, typename G, typename V> typedef V& mln::complex_image< D, G, V >::lvalue

Return type of read-write access.

10.101.2.3 template<unsigned D, typename G, typename V> typedef const V& mln::complex_image< D, G, V >::rvalue

Return type of read-only access.

10.101.2.4 template<unsigned D, typename G, typename V> typedef complex_image< D, tag::psite_<G>, tag::value_<V> > mln::complex_image< D, G, V >::skeleton

Skeleton.

10.101.2.5 template<unsigned D, typename G, typename V> typedef V mln::complex_image< D, G, V >::value

Value associated type.

10.101.3 Constructor & Destructor Documentation

10.101.3.1 template<unsigned D, typename G, typename V> mln::complex_image< D, G, V >::complex_image () `[inline]`

Constructors.

10.101.4 Member Function Documentation

10.101.4.1 template<unsigned D, typename G, typename V> const p_complex< D, G > & mln::complex_image< D, G, V >::domain () const [inline]

Accessors.

Return the domain of psites od the image.

10.101.4.2 template<unsigned D, typename G, typename V> complex_image< D, G, V >::lvalue mln::complex_image< D, G, V >::operator() (const complex_psite< D, G > & *p*) [inline]

Read-write access of face value at point site `p`.

References mln::complex_psite< D, G >::face_id(), and mln::complex_psite< D, G >::n().

10.101.4.3 template<unsigned D, typename G, typename V> complex_image< D, G, V >::rvalue mln::complex_image< D, G, V >::operator() (const complex_psite< D, G > & *p*) const [inline]

Read-only access of face value at point site `p`.

References mln::complex_psite< D, G >::face_id(), and mln::complex_psite< D, G >::n().

10.101.4.4 template<unsigned D, typename G, typename V> const metal::vec< D+1, std::vector< mlc_unbool(V) > > & mln::complex_image< D, G, V >::values () const [inline]

Return the array of values associated to the faces.

10.101.5 Member Data Documentation

10.101.5.1 template<unsigned D, typename G, typename V> const unsigned mln::complex_image< D, G, V >::dim = D [static]

The dimension of the complex.

10.102 mln::complex_neighborhood_bkd_piter< I, G, N > Class Template Reference

Backward iterator on complex neighborhood.

`#include <complex_neighborhood_piter.hh>`

Inherits mln::internal::site_relative_iterator_base< N, mln::complex_neighborhood_bkd_piter< I, G, N > >.

Public Types

- typedef N::complex_bkd_iter iter_type

  The type of the underlying complex iterator.

- typedef N::psite psite

  The Pseudo_Site type.

Public Member Functions

- void next ()

  Go to the next element.

- complex_neighborhood_bkd_piter ()

  Construction.

- const iter_type & iter () const

  Accessors.

10.102.1 Detailed Description

template<typename I, typename G, typename N> class mln::complex_neighborhood_bkd_piter< I, G, N >

Backward iterator on complex neighborhood.

10.102.2 Member Typedef Documentation

10.102.2.1 template<typename I, typename G, typename N> typedef N::complex_bkd_iter mln::complex_neighborhood_bkd_piter< I, G, N >::iter_type

The type of the underlying complex iterator.

10.102.2.2 template<typename I, typename G, typename N> typedef N ::psite mln::complex_neighborhood_bkd_piter< I, G, N >::psite

The Pseudo_Site type.

10.102.3 Constructor & Destructor Documentation

10.102.3.1 template<typename I, typename G, typename N> mln::complex_-neighborhood_bkd_piter< I, G, N >::complex_neighborhood_bkd_piter () [inline]

Construction.

10.102.4 Member Function Documentation

10.102.4.1 template<typename I, typename G, typename N> const N::complex_bkd_iter & mln::complex_neighborhood_bkd_piter< I, G, N >::iter () const [inline]

Accessors.

10.102.4.2 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.103 mln::complex_neighborhood_fwd_piter< I, G, N > Class Template Reference

Forward iterator on complex neighborhood.

`#include <complex_neighborhood_piter.hh>`

Inherits mln::internal::site_relative_iterator_base< N, mln::complex_neighborhood_fwd_piter< I, G, N > >.

Public Types

- typedef N::complex_fwd_iter iter_type

  The type of the underlying complex iterator.

- typedef N::psite psite

  The Pseudo_Site type.

Public Member Functions

- void next ()

  Go to the next element.

  - complex_neighborhood_fwd_piter ()

    Construction.

  - const iter_type & iter () const

    Accessors.

10.103.1 Detailed Description

template<typename I, typename G, typename N> class mln::complex_neighborhood_fwd_piter< I, G, N >

Forward iterator on complex neighborhood.

10.103.2 Member Typedef Documentation

10.103.2.1 template<typename I, typename G, typename N> typedef N::complex_fwd_iter mln::complex_neighborhood_fwd_piter< I, G, N >::iter_type

The type of the underlying complex iterator.

10.103.2.2 template<typename I, typename G, typename N> typedef N ::psite mln::complex_neighborhood_fwd_piter< I, G, N >::psite

The Pseudo_Site type.

10.103.3 Constructor & Destructor Documentation

10.103.3.1 template<typename I, typename G, typename N> mln::complex_-neighborhood_fwd_piter< I, G, N >::complex_neighborhood_fwd_piter () [inline]

Construction.

10.103.4 Member Function Documentation

10.103.4.1 template<typename I, typename G, typename N> const N::complex_fwd_iter & mln::complex_neighborhood_fwd_piter< I, G, N >::iter () const [inline]

Accessors.

10.103.4.2 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.104 mln::complex_psite< D, G > Class Template Reference

Point site associated to a mln::p_complex.

`#include <complex_psite.hh>`

Inherits mln::internal::pseudo_site_base_< const G::site &, mln::complex_psite< D, G > >.

Public Member Functions

- void change_target (const target &new_target)

  Set the target site_set.

- const target & site_set () const

  Site set manipulators.

- complex_psite (const p_complex< D, G > &pc, const topo::face< D > &face)
- complex_psite ()

  Construction and assignment.

- const topo::face< D > & face () const

  Face handle manipulators.

- unsigned face_id () const

  Return the id of the face of this psite.

- unsigned n () const

  Return the dimension of the face of this psite.

- void invalidate ()

  Invalidate this psite.

- bool is_valid () const

  Psite manipulators.

10.104.1 Detailed Description

template<unsigned D, typename G> class mln::complex_psite< D, G >

Point site associated to a mln::p_complex.

Template Parameters:

D The dimension of the complex this psite belongs to.

G The geometry of the complex.

10.104.2 Constructor & Destructor Documentation

10.104.2.1 template<unsigned D, typename G> mln::complex_psite< D, G >::complex_psite () [inline]

Construction and assignment.

References mln::complex_psite< D, G >::invalidate().

10.104.2.2 template<unsigned D, typename G> mln::complex_psite< D, G >::complex_psite (const p_complex< D, G > & *pc*, const topo::face< D > & *face*) [inline]

Precondition:

pc.cplx() == face.cplx().

References mln::topo::face< D >::cplx(), mln::p_complex< D, G >::cplx(), and mln::complex_psite< D, G >::is_valid().

10.104.3 Member Function Documentation

10.104.3.1 template<unsigned D, typename G> void mln::complex_psite< D, G >::change_target (const target & *new_target*) [inline]

Set the target site_set.

References mln::p_complex< D, G >::cplx(), and mln::complex_psite< D, G >::invalidate().

10.104.3.2 template<unsigned D, typename G> const topo::face< D > & mln::complex_psite< D, G >::face () const [inline]

Face handle manipulators.

Return the face handle of this point site.

Referenced by mln::operator!=(), and mln::operator==().

10.104.3.3 template<unsigned D, typename G> unsigned mln::complex_psite< D, G >::face_id () const [inline]

Return the id of the face of this psite.

Referenced by mln::complex_image< D, G, V >::operator()().

10.104.3.4 template<unsigned D, typename G> void mln::complex_psite< D, G >::invalidate () [inline]

Invalidate this psite.

Referenced by mln::complex_psite< D, G >::change_target(), and mln::complex_psite< D, G >::complex_psite().

10.104.3.5 template<unsigned D, typename G> bool mln::complex_psite< D, G >::is_valid () const [inline]

Psite manipulators.

Is this psite valid?

Referenced by mln::complex_psite< D, G >::complex_psite(), and mln::p_complex< D, G >::has().

10.104.3.6 template<unsigned D, typename G> unsigned mln::complex_psite< D, G >::n () const [inline]

Return the dimension of the face of this psite.

Referenced by mln::make::cell(), and mln::complex_image< D, G, V >::operator()().

10.104.3.7 template<unsigned D, typename G> const p_complex< D, G > & mln::complex_psite< D, G >::site_set () const [inline]

Site set manipulators.

Return the mln::p_complex this site is built on. (shortcut for *target()).

Precondition:

Member face_ is valid.

Referenced by mln::p_complex< D, G >::has(), mln::operator!=(), and mln::operator==().

10.105 mln::complex_window_bkd_piter< I, G, W > Class Template Reference

Backward iterator on complex window.

`#include <complex_window_piter.hh>`

Inherits mln::internal::site_relative_iterator_base< W, mln::complex_window_bkd_piter< I, G, W > >.

Public Types

- typedef W::complex_bkd_iter iter_type

  The type of the underlying complex iterator.

- typedef W::psite psite

  The Pseudo_Site type.

Public Member Functions

- void next ()

  Go to the next element.

  - complex_window_bkd_piter ()

    Construction.

  - const iter_type & iter () const

    Accessors.

10.105.1 Detailed Description

template<typename I, typename G, typename W> class mln::complex_window_bkd_piter< I, G, W >

Backward iterator on complex window.

10.105.2 Member Typedef Documentation

10.105.2.1 template<typename I, typename G, typename W> typedef W::complex_bkd_iter mln::complex_window_bkd_piter< I, G, W >::iter_type

The type of the underlying complex iterator.

10.105.2.2 template<typename I, typename G, typename W> typedef W ::psite mln::complex_window_bkd_piter< I, G, W >::psite

The Pseudo_Site type.

10.105.3 Constructor & Destructor Documentation

10.105.3.1 template<typename I, typename G, typename W> mln::complex_window_bkd_piter< I, G, W >::complex_window_bkd_piter () [inline]

Construction.

10.105.4 Member Function Documentation

10.105.4.1 template<typename I, typename G, typename W> const W::complex_bkd_iter & mln::complex_window_bkd_piter< I, G, W >::iter () const [inline]

Accessors.

10.105.4.2 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.106 mln::complex_window_fwd_piter< I, G, W > Class Template Reference

Forward iterator on complex window.

`#include <complex_window_piter.hh>`

Inherits mln::internal::site_relative_iterator_base< W, mln::complex_window_fwd_piter< I, G, W > >.

Public Types

- typedef W::complex_fwd_iter iter_type
  The type of the underlying complex iterator.
- typedef W::psite psite
  The Pseudo_Site type.

Public Member Functions

- void next ()
  Go to the next element.
  - complex_window_fwd_piter ()
    Construction.
  - const iter_type & iter () const
    Accessors.

10.106.1 Detailed Description

template<typename I, typename G, typename W> class mln::complex_window_fwd_piter< I, G, W >

Forward iterator on complex window.

10.106.2 Member Typedef Documentation

10.106.2.1 template<typename I, typename G, typename W> typedef W::complex_fwd_iter mln::complex_window_fwd_piter< I, G, W >::iter_type

The type of the underlying complex iterator.

10.106.2.2 template<typename I, typename G, typename W> typedef W ::psite mln::complex_window_fwd_piter< I, G, W >::psite

The Pseudo_Site type.

10.106.3 Constructor & Destructor Documentation

10.106.3.1 template<typename I, typename G, typename W> mln::complex_window_fwd_piter< I, G, W >::complex_window_fwd_piter () [inline]

Construction.

10.106.4 Member Function Documentation

10.106.4.1 template<typename I, typename G, typename W> const W::complex_fwd_iter & mln::complex_window_fwd_piter< I, G, W >::iter () const [inline]

Accessors.

10.106.4.2 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.107 mln::decorated_image< I, D > Struct Template Reference

Image that can have additional features.

`#include <decorated_image.hh>`

Inherits mln::internal::decorated_image_impl_< I, mln::decorated_image< I, D > >, and mln::internal::image_identity< I, I::domain_t, mln::decorated_image< I, D > >.

Package Types

- typedef impl_::lvalue lvalue

  Return type of read-write access.

- typedef I::psite psite

  Type of the psite.

- typedef I::rvalue rvalue

  Return type of read-only access.

- typedef decorated_image< tag::image_< I >, tag::data_< D > > skeleton

  Skeleton.

Package Functions

- decorated_image ()

  Ctors.

- D & decoration ()

  Give the decoration.

- const D & decoration () const

  Give the decoration.

- operator decorated_image< const I, D > () const

  Const promotion via conversion.

- lvalue operator() (const psite &p)

  Read-write access of pixel value at point site `p`.

- rvalue operator() (const psite &p) const

  Read-only access of pixel value at point site `p`.

- ∼decorated_image ()

  Dtor.

10.107.1 Detailed Description

template<typename I, typename D> struct mln::decorated_image< I, D >

Image that can have additional features.

10.107.2 Member Typedef Documentation

10.107.2.1 template<typename I, typename D> typedef impl_::lvalue mln::decorated_image< I, D >::lvalue [package]

Return type of read-write access.

10.107.2.2 template<typename I, typename D> typedef I ::psite mln::decorated_image< I, D >::psite [package]

Type of the psite.

10.107.2.3 template<typename I, typename D> typedef I ::rvalue mln::decorated_image< I, D >::rvalue [package]

Return type of read-only access.

10.107.2.4 template<typename I, typename D> typedef decorated_image< tag::image_<I>, tag::data_<D> > mln::decorated_image< I, D >::skeleton [package]

Skeleton.

10.107.3 Constructor & Destructor Documentation

10.107.3.1 template<typename I, typename D> mln::decorated_image< I, D >::decorated_image () [inline, package]

Ctors.

10.107.3.2 template<typename I, typename D> mln::decorated_image< I, D >::~decorated_image () [inline, package]

Dtor.

10.107.4 Member Function Documentation

10.107.4.1 template<typename I, typename D> D & mln::decorated_image< I, D >::decoration () [inline, package]

Give the decoration.

10.107.4.2 template<typename I, typename D> const D & mln::decorated_image< I, D >::decoration () const [inline, package]

Give the decoration.

10.107.4.3 template<typename I, typename D> mln::decorated_image< I, D >::operator decorated_image< const I, D > () const [inline, package]

Const promotion via conversion.

10.107.4.4 template<typename I, typename D> decorated_image< I, D >::lvalue mln::decorated_image< I, D >::operator() (const psite & *p*) [inline, package]

Read-write access of pixel value at point site `p`.

10.107.4.5 template<typename I, typename D> decorated_image< I, D >::rvalue mln::decorated_image< I, D >::operator() (const psite & *p*) const [inline, package]

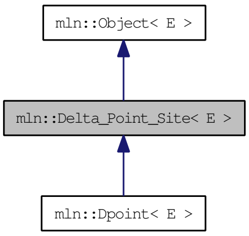
Read-only access of pixel value at point site `p`.

10.108 mln::Delta_Point_Site< E > Struct Template Reference

FIXME: Doc!

`#include <delta_point_site.hh>`

Inheritance diagram for mln::Delta_Point_Site< E >:



10.108.1 Detailed Description

template<typename E> struct mln::Delta_Point_Site< E >

FIXME: Doc!

10.109 mln::Delta_Point_Site< void > Struct Template Reference

Delta point site category flag type.

```
#include <delta_point_site.hh>
```

10.109.1 Detailed Description

template<> struct mln::Delta_Point_Site< void >

Delta point site category flag type.

10.110 mln::doc::Accumulator< E > Struct Template Reference

Documentation class for mln::Accumulator.

`#include <accumulator.hh>`

Public Types

- typedef void argument

  The argument type of elements to accumulate.

Public Member Functions

- void init ()

  Initialize the accumulator.

- void take (const E &other)

  Take into account another accumulator `other`.

- void take (const argument &t)

  Take into account a argument `t` *(an element).*

10.110.1 Detailed Description

template<typename E> struct mln::doc::Accumulator< E >

Documentation class for mln::Accumulator.

See also:

mln::Accumulator

10.110.2 Member Typedef Documentation

10.110.2.1 template<typename E> typedef void mln::doc::Accumulator< E >::argument

The argument type of elements to accumulate.

10.110.3 Member Function Documentation

10.110.3.1 template<typename E> void mln::doc::Accumulator< E >::init ()

Initialize the accumulator.

10.110.3.2 template<typename E> void mln::doc::Accumulator< E >::take (const E & *other*)

Take into account another accumulator `other`.

10.110.3.3 template<typename E> void mln::doc::Accumulator< E >::take (const argument & *t*)

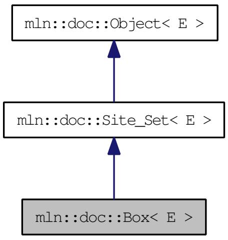
Take into account a argument `t` (an element).

10.111 mln::doc::Box< E > Struct Template Reference

Documentation class for mln::Box.

`#include <box.hh>`

Inheritance diagram for mln::doc::Box< E >:



Public Types

- typedef void bkd_piter

    Backward Site_Iterator associated type.

- typedef void fwd_piter

    Forward Site_Iterator associated type.

- typedef void psite

    PSite associated type.

- typedef void site

    Site associated type.

Public Member Functions

- const E & bbox () const

    Return the bounding box of this point set.

- bool has (const psite &p) const

    Test if p *belongs to this site set.*

- unsigned nsites () const

    Return the number of points of this box.

- const site & pmax () const

    Give the box "maximum" point.

- const site & pmin () const

    Give the box "minimum" point.

10.111.1 Detailed Description

template<typename E> struct mln::doc::Box< E >

Documentation class for mln::Box.

See also:

mln::Box

10.111.2 Member Typedef Documentation

10.111.2.1 template<typename E> typedef void mln::doc::Site_Set< E >::bkd_piter [inherited]

Backward Site_Iterator associated type.

10.111.2.2 template<typename E> typedef void mln::doc::Site_Set< E >::fwd_piter [inherited]

Forward Site_Iterator associated type.

10.111.2.3 template<typename E> typedef void mln::doc::Site_Set< E >::psite [inherited]

PSite associated type.

10.111.2.4 template<typename E> typedef void mln::doc::Site_Set< E >::site [inherited]

Site associated type.

10.111.3 Member Function Documentation

10.111.3.1 template<typename E> const E& mln::doc::Box< E >::bbox () const

Return the bounding box of this point set.

Return the bounding box of this point set, so that is itself. This method is declared by the mln::Site_Set concept.

Warning:

This method is final for all box classes.

10.111.3.2 template<typename E> bool mln::doc::Site_Set< E >::has (const psite & *p*) const [inherited]

Test if `p` belongs to this site set.

Parameters:

← ***p*** A psite.

Returns:

True if p is an element of the site set.

10.111.3.3 template<typename E> unsigned mln::doc::Box< E >::nsites () const

Return the number of points of this box.

Return the number of points of this box. This method is declared by the mln::Site_Set concept.

Warning:

This method is final for all box classes.

10.111.3.4 template<typename E> const site& mln::doc::Box< E >::pmax () const

Give the box "maximum" point.

Return the "maximum" point w.r.t. the ordering between points. For instance, with mln::box2d, this maximum is the bottom right point of the box.

10.111.3.5 template<typename E> const site& mln::doc::Box< E >::pmin () const

Give the box "minimum" point.

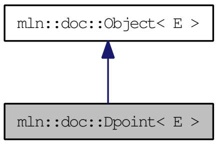
Return the "minimum" point w.r.t. the ordering between points. For instance, with mln::box2d, this minimum is the top left point of the box.

10.112 mln::doc::Dpoint< E > Struct Template Reference

Documentation class for mln::Dpoint.

`#include <dpoint.hh>`

Inheritance diagram for mln::doc::Dpoint< E >:



Public Types

- enum { dim }
- typedef void coord
- typedef void dpoint

  Dpsite associated type.
- typedef void point

  Site associated type.

Public Member Functions

- coord operator[ ] (unsigned i) const

  Read-only access to the `i-th` *coordinate value.*

10.112.1 Detailed Description

template<typename E> struct mln::doc::Dpoint< E >

Documentation class for mln::Dpoint.

See also:

mln::Dpoint

10.112.2 Member Typedef Documentation

10.112.2.1 template<typename E> typedef void mln::doc::Dpoint< E >::coord

Coordinate associated type.

10.112.2.2 template<typename E> typedef void mln::doc::Dpoint< E >::dpoint

Dpsite associated type.

Invariant:

This type has to derive from mln::Dpoint.

10.112.2.3 template<typename E> typedef void mln::doc::Dpoint< E >::point

Site associated type.

Invariant:

This type has to derive from mln::Point.

10.112.3 Member Enumeration Documentation

10.112.3.1 template<typename E> anonymous enum

Enumerator:

dim Dimension of the space.

Invariant:

dim > 0

10.112.4 Member Function Documentation

10.112.4.1]

template<typename E> **coord mln::doc::Dpoint**< E >::operator[ ] (unsigned *i*) const

Read-only access to the `i-th` coordinate value.

Parameters:

← ***i*** The coordinate index.

Precondition:

`i < dim`

Returns:

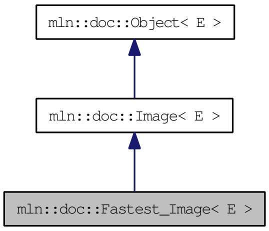
The value of the `i-th` coordinate.

10.113 mln::doc::Fastest_Image< E > Struct Template Reference

Documentation class for the concept of images that have the speed property set to "fastest".

`#include <image_fastest.hh>`

Inheritance diagram for mln::doc::Fastest_Image< E >:



Public Types

- typedef void bkd_piter

  Backward point iterator associated type.

- typedef void coord

  Coordinate associated type.

- typedef void dpoint

  Dpsite associated type.

- typedef void fwd_piter

  Forward point iterator associated type.

- typedef void lvalue

  Type returned by the read-write pixel value operator.

- typedef void point

  Site associated type.

- typedef void pset

  Point set associated type.

- typedef void psite

  Point_Site associated type.

- typedef void rvalue

  Type returned by the read pixel value operator.

- typedef void skeleton

  Associate type that describes how this type of image is constructed.

- typedef void value

  Value associated type.

- typedef void vset

  Value set associated type.

Public Member Functions

- const box< point > & bbox () const

  Give a bounding box of the image domain.

- unsigned border ()

  Give the border thickness.

- const value * buffer () const

  Give a hook to the value buffer.

- int delta_index (const dpoint &dp)

  Give the offset corresponding to the delta-point `dp`.

- const pset & domain () const

  Give the definition domain of the image.

- bool has (const psite &p) const

  Test if `p` *belongs to the image domain.*

- bool has (const psite &p) const

  Test if the image owns the point site `p`.

- bool is_valid () const

  Test if the image have been initialized.

- unsigned nelements () const

  Give the number of pixels of the image including those of the virtual border.

- unsigned nsites () const

  Give the number of points of the image domain.

- lvalue operator() (const psite &p)

  Read-write access to the image value located at `p`.

- rvalue operator() (const psite &p) const

  Read-only access to the image value located at `p`.

- lvalue operator[ ] (unsigned o)

  Read-write access to the image value at offset `o`.

- rvalue operator[ ] (unsigned o) const

  Read-only access to the image value at offset `o`.

- point point_at_index (unsigned o) const

  Give the point at offset o.

- const vset & values () const

  Give the set of values of the image.

10.113.1 Detailed Description

template<typename E> struct mln::doc::Fastest_Image< E >

Documentation class for the concept of images that have the speed property set to "fastest".

10.113.2 Member Typedef Documentation

10.113.2.1 template<typename E> typedef void mln::doc::Image< E >::bkd_piter [inherited]

Backward point iterator associated type.

Invariant:

This type has to derive from mln::Site_Iterator.

10.113.2.2 template<typename E> typedef void mln::doc::Image< E >::coord [inherited]

Coordinate associated type.

10.113.2.3 template<typename E> typedef void mln::doc::Image< E >::dpoint [inherited]

Dpsite associated type.

Invariant:

This type has to derive from mln::Dpoint.

10.113.2.4 template<typename E> typedef void mln::doc::Image< E >::fwd_piter [inherited]

Forward point iterator associated type.

Invariant:

This type has to derive from mln::Site_Iterator.

10.113.2.5 template<typename E> typedef void mln::doc::Image< E >::lvalue [inherited]

Type returned by the read-write pixel value operator.

10.113.2.6 template<typename E> typedef void mln::doc::Image< E >::point [inherited]

Site associated type.

Invariant:

This type has to derive from mln::Point.

10.113.2.7 template<typename E> typedef void mln::doc::Image< E >::pset [inherited]

Point set associated type.

Invariant:

This type has to derive from mln::Site_Set.

10.113.2.8 template<typename E> typedef void mln::doc::Image< E >::psite [inherited]

Point_Site associated type.

Invariant:

This type has to derive from mln::Point_Site.

10.113.2.9 template<typename E> typedef void mln::doc::Image< E >::rvalue [inherited]

Type returned by the read pixel value operator.

10.113.2.10 template<typename E> typedef void mln::doc::Image< E >::skeleton [inherited]

Associate type that describes how this type of image is constructed.

10.113.2.11 template<typename E> typedef void mln::doc::Image< E >::value [inherited]

Value associated type.

Invariant:

This type is neither qualified by const, nor by reference.

10.113.2.12 template<typename E> typedef void mln::doc::Image< E >::vset [inherited]

Value set associated type.

Invariant:

This type has to derive from mln::Value_Set.

10.113.3 Member Function Documentation

10.113.3.1 template<typename E> const box<point>& mln::doc::Image< E >::bbox () const [inherited]

Give a bounding box of the image domain.

This bounding box may be larger than the smallest bounding box (the optimal one). Practically an image type is not obliged to update its bounding box so that it is always optimal.

Returns:

A bounding box of the image domain.

10.113.3.2 template<typename E> unsigned mln::doc::Fastest_Image< E >::border ()

Give the border thickness.

Precondition:

The image has to be initialized.

10.113.3.3 template<typename E> const value∗ mln::doc::Fastest_Image< E >::buffer () const

Give a hook to the value buffer.

Precondition:

The image has to be initialized.

10.113.3.4 template<typename E> int mln::doc::Fastest_Image< E >::delta_index (const dpoint & *dp*)

Give the offset corresponding to the delta-point `dp`.

Parameters:

← ***dp*** A delta-point.

Precondition:

The image has to be initialized.

10.113.3.5 template<typename E> const pset& mln::doc::Image< E >::domain () const [inherited]

Give the definition domain of the image.

Returns:

A reference to the domain point set.

10.113.3.6 template<typename E> bool mln::doc::Image< E >::has (const psite & *p*) const [inherited]

Test if p belongs to the image domain.

Parameters:

← *p* A point site.

Returns:

True if p belongs to the image domain.

Invariant:

has(p) is true => has(p) is also true.

10.113.3.7 template<typename E> bool mln::doc::Image< E >::has (const psite & *p*) const [inherited]

Test if the image owns the point site p.

Returns:

True if accessing the image value at p is possible, that is, does not abort the execution.

10.113.3.8 template<typename E> bool mln::doc::Image< E >::is_valid () const [inherited]

Test if the image have been initialized.

10.113.3.9 template<typename E> unsigned mln::doc::Fastest_Image< E >::nelements () const

Give the number of pixels of the image including those of the virtual border.

Precondition:

The image has to be initialized.

10.113.3.10 template<typename E> unsigned mln::doc::Image< E >::nsites () const [inherited]

Give the number of points of the image domain.

10.113.3.11 template<typename E> lvalue mln::doc::Image< E >::operator() (const psite & *p*) [inherited]

Read-write access to the image value located at p.

Parameters:

← *p* A point site.

Precondition:

The image has to own the site p.

Returns:

The value at p (assignable).

10.113.3.12 template<typename E> rvalue mln::doc::Image< E >::operator() (const psite & *p*) const [inherited]

Read-only access to the image value located at p.

Parameters:

← ***p*** A point site.

Precondition:

The image has to own the site p.

Returns:

The value at p (not assignable).

10.113.3.13]

template<typename E> **lvalue mln::doc::Fastest_Image**< E >::operator[ ] (unsigned *o*)

Read-write access to the image value at offset o.

Parameters:

← ***o*** An offset.

Precondition:

o < nelements()

Returns:

The value at o (assignable).

10.113.3.14]

template<typename E> **rvalue mln::doc::Fastest_Image**< E >::operator[ ] (unsigned *o*) const

Read-only access to the image value at offset o.

Parameters:

← ***o*** An offset.

Precondition:

o < nelements()

Returns:

The value at o (not assignable).

10.113.3.15 template<typename E> point mln::doc::Fastest_Image< E >::point_at_index (unsigned *o*) const

Give the point at offset `o`.

Parameters:

← ***o*** An offset.

Precondition:

The image has to be initialized.
o < nelements()

10.113.3.16 template<typename E> const vset& mln::doc::Image< E >::values () const `[inherited]`

Give the set of values of the image.

Returns:

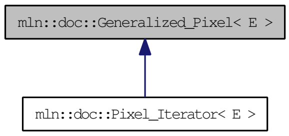
A reference to the value set.

10.114 mln::doc::Generalized_Pixel< E > Struct Template Reference

Documentation class for mln::Generalized_Pixel.

`#include <generalized_pixel.hh>`

Inheritance diagram for mln::doc::Generalized_Pixel< E >:



Public Types

- typedef void image
  Image associated type (with possible const qualification).
- typedef void rvalue
  Read-only value associated type.
- typedef void value
  Value associated type.

Public Member Functions

- image & ima () const
  Give the image of this generalized pixel.
- rvalue val () const
  Give the value of this generalized pixel.

10.114.1 Detailed Description

template<typename E> struct mln::doc::Generalized_Pixel< E >

Documentation class for mln::Generalized_Pixel.

See also:

mln::Generalized_Pixel

10.114.2 Member Typedef Documentation

10.114.2.1 template<typename E> typedef void mln::doc::Generalized_Pixel< E >::image

Image associated type (with possible const qualification).

10.114.2.2 template<typename E> typedef void mln::doc::Generalized_Pixel< E >::rvalue

Read-only value associated type.

10.114.2.3 template<typename E> typedef void mln::doc::Generalized_Pixel< E >::value

Value associated type.

10.114.3 Member Function Documentation

10.114.3.1 template<typename E> image& mln::doc::Generalized_Pixel< E >::ima () const

Give the image of this generalized pixel.

The constness of a pixel object is not transmitted to the underlying image.

10.114.3.2 template<typename E> rvalue mln::doc::Generalized_Pixel< E >::val () const

Give the value of this generalized pixel.

Returns:

A read-only value.

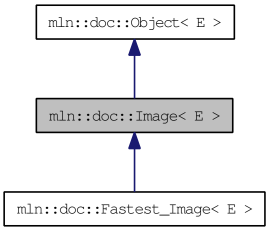
Reimplemented in mln::doc::Pixel_Iterator< E >.

10.115 mln::doc::Image< E > Struct Template Reference

Documentation class for mln::Image.

```
#include <image.hh>
```

Inheritance diagram for mln::doc::Image< E >:



Public Types

- typedef void bkd_piter

  Backward point iterator associated type.

- typedef void coord

  Coordinate associated type.

- typedef void dpoint

  Dpsite associated type.

- typedef void fwd_piter

  Forward point iterator associated type.

- typedef void lvalue

  Type returned by the read-write pixel value operator.

- typedef void point

  Site associated type.

- typedef void pset

  Point set associated type.

- typedef void psite

  Point_Site associated type.

- typedef void rvalue

  Type returned by the read pixel value operator.

- typedef void skeleton

  Associate type that describes how this type of image is constructed.

- typedef void value

  Value associated type.

- typedef void vset

    Value set associated type.

Public Member Functions

- const box< point > & bbox () const

    Give a bounding box of the image domain.

- const pset & domain () const

    Give the definition domain of the image.

- bool has (const psite &p) const

    Test if `p` *belongs to the image domain.*

- bool has (const psite &p) const

    Test if the image owns the point site `p`*.*

- bool is_valid () const

    Test if the image have been initialized.

- unsigned nsites () const

    Give the number of points of the image domain.

- lvalue operator() (const psite &p)

    Read-write access to the image value located at `p`*.*

- rvalue operator() (const psite &p) const

    Read-only access to the image value located at `p`*.*

- const vset & values () const

    Give the set of values of the image.

10.115.1 Detailed Description

template<typename E> struct mln::doc::Image< E >

Documentation class for mln::Image.

See also:

mln::Image

10.115.2 Member Typedef Documentation

10.115.2.1 template<typename E> typedef void mln::doc::Image< E >::bkd_piter

Backward point iterator associated type.

Invariant:

This type has to derive from mln::Site_Iterator.

10.115.2.2 template<typename E> typedef void mln::doc::Image< E >::coord

Coordinate associated type.

10.115.2.3 template<typename E> typedef void mln::doc::Image< E >::dpoint

Dpsite associated type.

Invariant:

This type has to derive from mln::Dpoint.

10.115.2.4 template<typename E> typedef void mln::doc::Image< E >::fwd_piter

Forward point iterator associated type.

Invariant:

This type has to derive from mln::Site_Iterator.

10.115.2.5 template<typename E> typedef void mln::doc::Image< E >::lvalue

Type returned by the read-write pixel value operator.

10.115.2.6 template<typename E> typedef void mln::doc::Image< E >::point

Site associated type.

Invariant:

This type has to derive from mln::Point.

10.115.2.7 template<typename E> typedef void mln::doc::Image< E >::pset

Point set associated type.

Invariant:

This type has to derive from mln::Site_Set.

10.115.2.8 template<typename E> typedef void mln::doc::Image< E >::psite

Point_Site associated type.

Invariant:

This type has to derive from mln::Point_Site.

10.115.2.9 template<typename E> typedef void mln::doc::Image< E >::rvalue

Type returned by the read pixel value operator.

10.115.2.10 template<typename E> typedef void mln::doc::Image< E >::skeleton

Associate type that describes how this type of image is constructed.

10.115.2.11 template<typename E> typedef void mln::doc::Image< E >::value

Value associated type.

Invariant:

This type is neither qualified by const, nor by reference.

10.115.2.12 template<typename E> typedef void mln::doc::Image< E >::vset

Value set associated type.

Invariant:

This type has to derive from mln::Value_Set.

10.115.3 Member Function Documentation

10.115.3.1 template<typename E> const box<point>& mln::doc::Image< E >::bbox () const

Give a bounding box of the image domain.

This bounding box may be larger than the smallest bounding box (the optimal one). Practically an image type is not obliged to update its bounding box so that it is always optimal.

Returns:

A bounding box of the image domain.

10.115.3.2 template<typename E> const pset& mln::doc::Image< E >::domain () const

Give the definition domain of the image.

Returns:

A reference to the domain point set.

10.115.3.3 template<typename E> bool mln::doc::Image< E >::has (const psite & *p*) const

Test if p belongs to the image domain.

Parameters:

← ***p*** A point site.

Returns:

True if p belongs to the image domain.

Invariant:

has(p) is true => has(p) is also true.

10.115.3.4 template<typename E> bool mln::doc::Image< E >::has (const psite & *p*) const

Test if the image owns the point site p.

Returns:

True if accessing the image value at p is possible, that is, does not abort the execution.

10.115.3.5 template<typename E> bool mln::doc::Image< E >::is_valid () const

Test if the image have been initialized.

10.115.3.6 template<typename E> unsigned mln::doc::Image< E >::nsites () const

Give the number of points of the image domain.

10.115.3.7 template<typename E> lvalue mln::doc::Image< E >::operator() (const psite & *p*)

Read-write access to the image value located at p.

Parameters:

← ***p*** A point site.

Precondition:

The image has to own the site p.

Returns:

The value at p (assignable).

10.115.3.8 template<typename E> rvalue mln::doc::Image< E >::operator() (const psite & *p*) const

Read-only access to the image value located at `p`.

Parameters:

← ***p*** A point site.

Precondition:

The image has to own the site `p`.

Returns:

The value at `p` (not assignable).

10.115.3.9 template<typename E> const vset& mln::doc::Image< E >::values () const

Give the set of values of the image.

Returns:

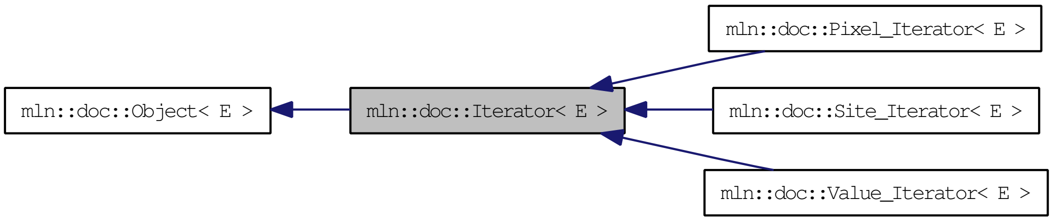
A reference to the value set.

10.116 mln::doc::Iterator< E > Struct Template Reference

Documentation class for mln::Iterator.

`#include <iterator.hh>`

Inheritance diagram for mln::doc::Iterator< E >:



Public Member Functions

- void invalidate ()

  Invalidate the iterator.

- bool is_valid () const

  Returns true if the iterator is valid, that is, designates an element.

- void start ()

  Start an iteration.

10.116.1 Detailed Description

template<typename E> struct mln::doc::Iterator< E >

Documentation class for mln::Iterator.

See also:

mln::Iterator

10.116.2 Member Function Documentation

10.116.2.1 template<typename E> void mln::doc::Iterator< E >::invalidate ()

Invalidate the iterator.

10.116.2.2 template<typename E> bool mln::doc::Iterator< E >::is_valid () const

Returns true if the iterator is valid, that is, designates an element.

10.116.2.3 template<typename E> void mln::doc::Iterator< E >::start ()

Start an iteration.

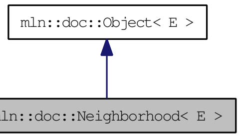
Make the iterator designate the first element if it exists. If this first element does not exist, the iterator is not valid.

10.117 mln::doc::Neighborhood< E > Struct Template Reference

Documentation class for mln::Neighborhood.

`#include <neighborhood.hh>`

Inheritance diagram for mln::doc::Neighborhood< E >:



Public Types

- typedef void bkd_niter

  Site_Iterator type associated to this neighborhood to browse neighbors in a backward way.

- typedef void dpoint

  Dpsite associated type.

- typedef void fwd_niter

  Site_Iterator type associated to this neighborhood to browse neighbors in a forward way.

- typedef void niter

  Site_Iterator type associated to this neighborhood to browse neighbors.

- typedef void point

  Site associated type.

10.117.1 Detailed Description

template<typename E> struct mln::doc::Neighborhood< E >

Documentation class for mln::Neighborhood.

See also:

mln::Neighborhood

10.117.2 Member Typedef Documentation

10.117.2.1 template<typename E> typedef void mln::doc::Neighborhood< E >::bkd_niter

Site_Iterator type associated to this neighborhood to browse neighbors in a backward way.

10.117.2.2 template<typename E> typedef void mln::doc::Neighborhood< E >::dpoint

Dpsite associated type.

10.117.2.3 template<typename E> typedef void mln::doc::Neighborhood< E >::fwd_niter

Site_Iterator type associated to this neighborhood to browse neighbors in a forward way.

10.117.2.4 template<typename E> typedef void mln::doc::Neighborhood< E >::niter

Site_Iterator type associated to this neighborhood to browse neighbors.

10.117.2.5 template<typename E> typedef void mln::doc::Neighborhood< E >::point

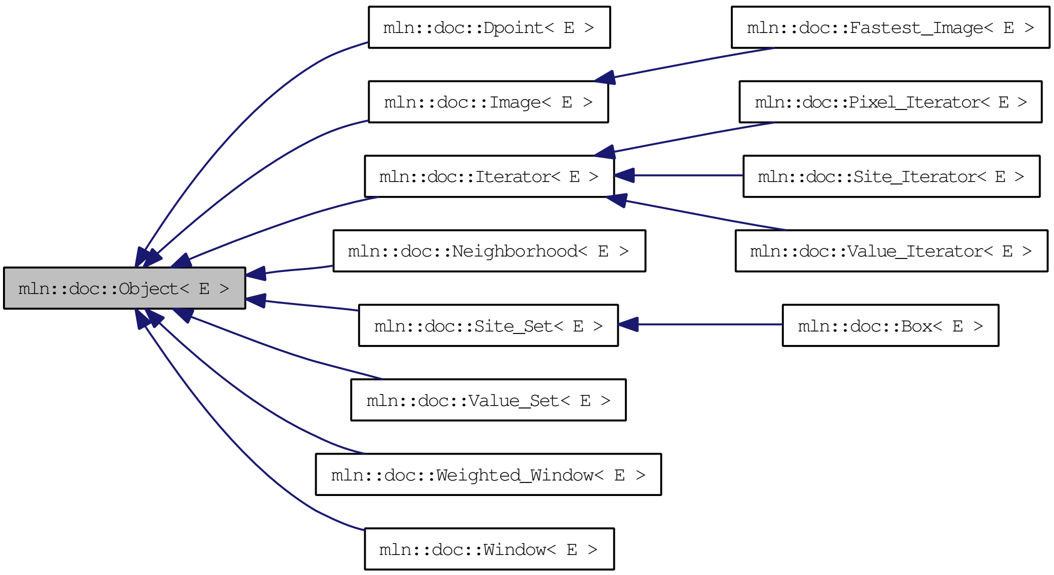
Site associated type.

10.118 mln::doc::Object< E > Struct Template Reference

Documentation class for mln::Object.

`#include <object.hh>`

Inheritance diagram for mln::doc::Object< E >:



10.118.1 Detailed Description

template<typename E> struct mln::doc::Object< E >

Documentation class for mln::Object.

See also:

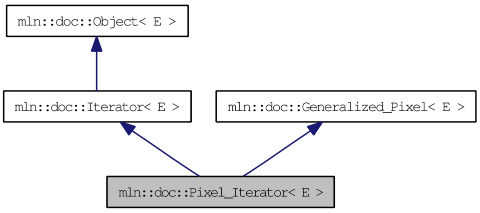
mln::Object

10.119 mln::doc::Pixel_Iterator< E > Struct Template Reference

Documentation class for mln::Iterator.

`#include <pixel_iterator.hh>`

Inheritance diagram for mln::doc::Pixel_Iterator< E >:



Public Types

- typedef void image

    Image associated type (with possible const qualification).

- typedef void lvalue

    Type returned by the read-write dereference operator.

- typedef void rvalue

    Read-only value associated type.

- typedef void value

    Value associated type.

Public Member Functions

- image & ima () const

    Give the image of this generalized pixel.

- void invalidate ()

    Invalidate the iterator.

- bool is_valid () const

    Returns true if the iterator is valid, that is, designates an element.

- void start ()

    Start an iteration.

- lvalue val () const

    Give the pixel value.

10.119.1 Detailed Description

template<typename E> struct mln::doc::Pixel_Iterator< E >

Documentation class for mln::Iterator.

See also:

mln::Pixel_Iterator

10.119.2 Member Typedef Documentation

10.119.2.1 template<typename E> typedef void mln::doc::Generalized_Pixel< E >::image `[inherited]`

Image associated type (with possible const qualification).

10.119.2.2 template<typename E> typedef void mln::doc::Pixel_Iterator< E >::lvalue

Type returned by the read-write dereference operator.

10.119.2.3 template<typename E> typedef void mln::doc::Generalized_Pixel< E >::rvalue `[inherited]`

Read-only value associated type.

10.119.2.4 template<typename E> typedef void mln::doc::Generalized_Pixel< E >::value `[inherited]`

Value associated type.

10.119.3 Member Function Documentation

10.119.3.1 template<typename E> image& mln::doc::Generalized_Pixel< E >::ima () const `[inherited]`

Give the image of this generalized pixel.

The constness of a pixel object is not transmitted to the underlying image.

10.119.3.2 template<typename E> void mln::doc::Iterator< E >::invalidate () `[inherited]`

Invalidate the iterator.

10.119.3.3 template<typename E> bool mln::doc::Iterator< E >::is_valid () const `[inherited]`

Returns true if the iterator is valid, that is, designates an element.

10.119.3.4 template<typename E> void mln::doc::Iterator< E >::start () [inherited]

Start an iteration.

Make the iterator designate the first element if it exists. If this first element does not exist, the iterator is not valid.

10.119.3.5 template<typename E> lvalue mln::doc::Pixel_Iterator< E >::val () const

Give the pixel value.

Returns:

The current pixel value; this value cannot be modified.

Reimplemented from mln::doc::Generalized_Pixel< E >.

10.120 mln::doc::Point_Site< E > Struct Template Reference

Documentation class for mln::Point_Site.

```
#include <point_site.hh>
```

Public Types

- enum { dim }
- typedef void coord
- typedef void dpoint

  Dpsite associated type.

- typedef void mesh

  Mesh associated type.

- typedef void point

  Site associated type.

Public Member Functions

- coord operator[ ] (unsigned i) const

  Read-only access to the `i-th` *coordinate value.*

- const point & to_point () const

  Give a reference to the corresponding point.

10.120.1 Detailed Description

template<typename E> struct mln::doc::Point_Site< E >

Documentation class for mln::Point_Site.

See also:

mln::Point_Site

10.120.2 Member Typedef Documentation

10.120.2.1 template<typename E> typedef void mln::doc::Point_Site< E >::coord

Coordinate associated type.

10.120.2.2 template<typename E> typedef void mln::doc::Point_Site< E >::dpoint

Dpsite associated type.

Invariant:

This type has to derive from mln::Dpoint.

10.120.2.3 template<typename E> typedef void mln::doc::Point_Site< E >::mesh

Mesh associated type.

Invariant:

This type has to derive from mln::Mesh.

10.120.2.4 template<typename E> typedef void mln::doc::Point_Site< E >::point

Site associated type.

Invariant:

This type has to derive from mln::Point.

10.120.3 Member Enumeration Documentation

10.120.3.1 template<typename E> anonymous enum

Enumerator:

dim Dimension of the space.

Invariant:

dim $>$ 0

10.120.4 Member Function Documentation

10.120.4.1]

template<typename E> **coord mln::doc::Point_Site**< E >::operator[ ] (unsigned *i*) const

Read-only access to the `i-th` coordinate value.

Parameters:

← ***i*** The coordinate index.

Precondition:

`i` $<$ `dim`

Returns:

The value of the `i-th` coordinate.

10.120.4.2 template<typename E> const point& mln::doc::Point_Site< E >::to_point () const

Give a reference to the corresponding point.

This method allows for iterators to refer to a point.

Returns:

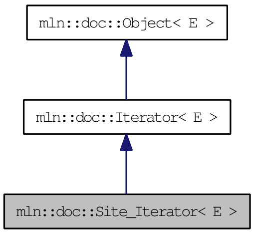
A point constant reference.

10.121 mln::doc::Site_Iterator< E > Struct Template Reference

Documentation class for mln::Site_Iterator.

`#include <point_iterator.hh>`

Inheritance diagram for mln::doc::Site_Iterator< E >:



Public Types

- typedef void psite

    Point_Site associated type.

Public Member Functions

- void invalidate ()

    Invalidate the iterator.

- bool is_valid () const

    Returns true if the iterator is valid, that is, designates an element.

- operator psite () const

    Conversion into a point-site.

- void start ()

    Start an iteration.

10.121.1 Detailed Description

template<typename E> struct mln::doc::Site_Iterator< E >

Documentation class for mln::Site_Iterator.

See also:

mln::Site_Iterator

10.121.2 Member Typedef Documentation

10.121.2.1 template<typename E> typedef void mln::doc::Site_Iterator< E >::psite

Point_Site associated type.

Invariant:

This type has to derive from mln::Point_Site.

10.121.3 Member Function Documentation

10.121.3.1 template<typename E> void mln::doc::Iterator< E >::invalidate () [inherited]

Invalidate the iterator.

10.121.3.2 template<typename E> bool mln::doc::Iterator< E >::is_valid () const [inherited]

Returns true if the iterator is valid, that is, designates an element.

10.121.3.3 template<typename E> mln::doc::Site_Iterator< E >::operator psite () const

Conversion into a point-site.

Returns:

A point site.

10.121.3.4 template<typename E> void mln::doc::Iterator< E >::start () [inherited]

Start an iteration.

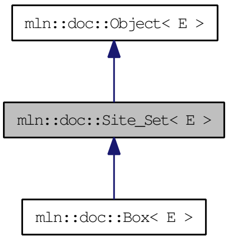
Make the iterator designate the first element if it exists. If this first element does not exist, the iterator is not valid.

10.122 mln::doc::Site_Set< E > Struct Template Reference

Documentation class for mln::Site_Set.

`#include <site_set.hh>`

Inheritance diagram for mln::doc::Site_Set< E >:



Public Types

- typedef void bkd_piter

    Backward Site_Iterator associated type.

- typedef void fwd_piter

    Forward Site_Iterator associated type.

- typedef void psite

    PSite associated type.

- typedef void site

    Site associated type.

Public Member Functions

- bool has (const psite &p) const

    Test if `p` *belongs to this site set.*

10.122.1 Detailed Description

template<typename E> struct mln::doc::Site_Set< E >

Documentation class for mln::Site_Set.

See also:

mln::Site_Set

10.122.2 Member Typedef Documentation

10.122.2.1 template<typename E> typedef void mln::doc::Site_Set< E >::bkd_piter

Backward Site_Iterator associated type.

10.122.2.2 template<typename E> typedef void mln::doc::Site_Set< E >::fwd_piter

Forward Site_Iterator associated type.

10.122.2.3 template<typename E> typedef void mln::doc::Site_Set< E >::psite

PSite associated type.

10.122.2.4 template<typename E> typedef void mln::doc::Site_Set< E >::site

Site associated type.

10.122.3 Member Function Documentation

10.122.3.1 template<typename E> bool mln::doc::Site_Set< E >::has (const psite & *p*) const

Test if `p` belongs to this site set.

Parameters:

← ***p*** A psite.

Returns:

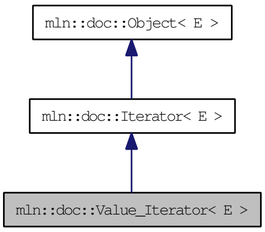
True if `p` is an element of the site set.

10.123 mln::doc::Value_Iterator< E > Struct Template Reference

Documentation class for mln::Value_Iterator.

`#include <value_iterator.hh>`

Inheritance diagram for mln::doc::Value_Iterator< E >:



Public Types

- typedef void value

  Value associated type.

Public Member Functions

- void invalidate ()

  Invalidate the iterator.

- bool is_valid () const

  Returns true if the iterator is valid, that is, designates an element.

- operator value () const

  Conversion into a value.

- void start ()

  Start an iteration.

10.123.1 Detailed Description

template<typename E> struct mln::doc::Value_Iterator< E >

Documentation class for mln::Value_Iterator.

See also:

mln::Value_Iterator

10.123.2 Member Typedef Documentation

10.123.2.1 template<typename E> typedef void mln::doc::Value_Iterator< E >::value

Value associated type.

10.123.3 Member Function Documentation

10.123.3.1 template<typename E> void mln::doc::Iterator< E >::invalidate () [inherited]

Invalidate the iterator.

10.123.3.2 template<typename E> bool mln::doc::Iterator< E >::is_valid () const [inherited]

Returns true if the iterator is valid, that is, designates an element.

10.123.3.3 template<typename E> mln::doc::Value_Iterator< E >::operator value () const

Conversion into a value.

Returns:

A value.

10.123.3.4 template<typename E> void mln::doc::Iterator< E >::start () [inherited]

Start an iteration.

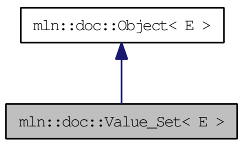
Make the iterator designate the first element if it exists. If this first element does not exist, the iterator is not valid.

10.124 mln::doc::Value_Set< E > Struct Template Reference

Documentation class for mln::Value_Set.

`#include <value_set.hh>`

Inheritance diagram for mln::doc::Value_Set< E >:



Public Types

- typedef void bkd_viter

  Backward Value_Iterator associated type.

- typedef void fwd_viter

  Forward Value_Iterator associated type.

- typedef void value

  Value associated type.

Public Member Functions

- bool has (const value &v) const

  Test if `v` *belongs to this set of values.*

- unsigned index_of (const value &v) const

  Give the index of value `v` *in this set.*

- unsigned nvalues () const

  Give the number of values in this set.

- value operator[ ] (unsigned i) const

  Give the `i-th` *value of this set.*

10.124.1 Detailed Description

template<typename E> struct mln::doc::Value_Set< E >

Documentation class for mln::Value_Set.

See also:

mln::Value_Set

10.124.2 Member Typedef Documentation

10.124.2.1 template<typename E> typedef void mln::doc::Value_Set< E >::bkd_viter

Backward Value_Iterator associated type.

10.124.2.2 template<typename E> typedef void mln::doc::Value_Set< E >::fwd_viter

Forward Value_Iterator associated type.

10.124.2.3 template<typename E> typedef void mln::doc::Value_Set< E >::value

Value associated type.

10.124.3 Member Function Documentation

10.124.3.1 template<typename E> bool mln::doc::Value_Set< E >::has (const value & *v*) const

Test if `v` belongs to this set of values.

Parameters:

← ***v*** A value.

Returns:

True if `v` is an element of the set of values.

10.124.3.2 template<typename E> unsigned mln::doc::Value_Set< E >::index_of (const value & *v*) const

Give the index of value `v` in this set.

10.124.3.3 template<typename E> unsigned mln::doc::Value_Set< E >::nvalues () const

Give the number of values in this set.

10.124.3.4]

template<typename E> **value mln::doc::Value_Set**< E >::operator[ ] (unsigned *i*) const

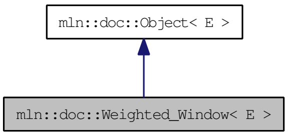
Give the `i-th` value of this set.

10.125 mln::doc::Weighted_Window< E > Struct Template Reference

Documentation class for mln::Weighted_Window.

`#include <weighted_window.hh>`

Inheritance diagram for mln::doc::Weighted_Window< E >:



Public Types

- typedef void bkd_qiter

  Site_Iterator type associated to this weighted_window to browse its points in a backward way.

- typedef void dpoint

  Dpsite associated type.

- typedef void fwd_qiter

  Site_Iterator type associated to this weighted_window to browse its points in a forward way.

- typedef void point

  Site associated type.

- typedef void weight

  Weight associated type.

- typedef void window

  Window associated type.

Public Member Functions

- unsigned delta () const

  Give the maximum coordinate gap between the window center and a window point.

- bool is_centered () const

  Test if the weighted_window is centered.

- bool is_empty () const

  Test if the weighted window is empty.

- E & sym ()

  Apply a central symmetry to the target weighted window.

- const window & win () const

  Give the corresponding window.

10.125.1 Detailed Description

template<typename E> struct mln::doc::Weighted_Window< E >

Documentation class for mln::Weighted_Window.

A weighted_window is the definition of a set of points located around a central point, with a weight associated to each point.

See also:

mln::Weighted_Window

10.125.2 Member Typedef Documentation

10.125.2.1 template<typename E> typedef void mln::doc::Weighted_Window< E >::bkd_qiter

Site_Iterator type associated to this weighted_window to browse its points in a backward way.

10.125.2.2 template<typename E> typedef void mln::doc::Weighted_Window< E >::dpoint

Dpsite associated type.

10.125.2.3 template<typename E> typedef void mln::doc::Weighted_Window< E >::fwd_qiter

Site_Iterator type associated to this weighted_window to browse its points in a forward way.

10.125.2.4 template<typename E> typedef void mln::doc::Weighted_Window< E >::point

Site associated type.

10.125.2.5 template<typename E> typedef void mln::doc::Weighted_Window< E >::weight

Weight associated type.

10.125.2.6 template<typename E> typedef void mln::doc::Weighted_Window< E >::window

Window associated type.

10.125.3 Member Function Documentation

10.125.3.1 template<typename E> unsigned mln::doc::Weighted_Window< E >::delta () const

Give the maximum coordinate gap between the window center and a window point.

10.125.3.2 template<typename E> bool mln::doc::Weighted_Window< E >::is_centered () const

Test if the weighted_window is centered.

A weighted window is centered is the origin belongs to it.

10.125.3.3 template<typename E> bool mln::doc::Weighted_Window< E >::is_empty () const

Test if the weighted window is empty.

A weighted_window of null size is empty.

10.125.3.4 template<typename E> E& mln::doc::Weighted_Window< E >::sym ()

Apply a central symmetry to the target weighted window.

10.125.3.5 template<typename E> const window& mln::doc::Weighted_Window< E >::win () const

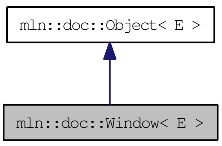
Give the corresponding window.

10.126 mln::doc::Window< E > Struct Template Reference

Documentation class for mln::Window.

```
#include <window.hh>
```

Inheritance diagram for mln::doc::Window< E >:



Public Types

- typedef void bkd_qiter

  Site_Iterator type associated to this window to browse its points in a backward way.

- typedef void fwd_qiter

  Site_Iterator type associated to this window to browse its points in a forward way.

- typedef void qiter

  Site_Iterator type associated to this window to browse its points.

10.126.1 Detailed Description

template<typename E> struct mln::doc::Window< E >

Documentation class for mln::Window.

A window is the definition of a set of points located around a central point.

See also:

mln::Window

10.126.2 Member Typedef Documentation

10.126.2.1 template<typename E> typedef void mln::doc::Window< E >::bkd_qiter

Site_Iterator type associated to this window to browse its points in a backward way.

10.126.2.2 template<typename E> typedef void mln::doc::Window< E >::fwd_qiter

Site_Iterator type associated to this window to browse its points in a forward way.

10.126.2.3 template<typename E> typedef void mln::doc::Window< E >::qiter

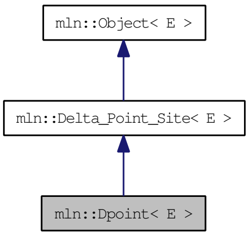
Site_Iterator type associated to this window to browse its points.

10.127 mln::Dpoint< E > Struct Template Reference

Base class for implementation of delta-point classes.

`#include <dpoint.hh>`

Inheritance diagram for mln::Dpoint< E >:



Public Member Functions

- const E & to_dpoint () const
  It is a Dpoint so it returns itself.

10.127.1 Detailed Description

template<typename E> struct mln::Dpoint< E >

Base class for implementation of delta-point classes.

A delta-point is a vector defined by a couple of points.

Given two points, A and B, the vector AB is mapped into the delta-point D = AB. Practically one can write: D = B - A.

See also:

mln::doc::Dpoint for a complete documentation of this class contents.

10.127.2 Member Function Documentation

10.127.2.1 template<typename E> const E & mln::Dpoint< E >::to_dpoint () const `[inline]`

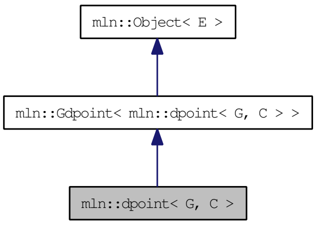
It is a Dpoint so it returns itself.

10.128 mln::dpoint< G, C > Struct Template Reference

Generic delta-point class.

```
#include <dpoint.hh>
```

Inheritance diagram for mln::dpoint< G, C >:



Public Types

- enum { dim = G::dim }
- typedef C coord

  Coordinate associated type.

- typedef G grid

  Grid associated type.

- typedef point< G, C > psite

  Psite associated type.

- typedef point< G, C > site

  Site associated type.

- typedef algebra::vec< G::dim, C > vec

  Algebra vector (vec) associated type.

Public Member Functions

- template<typename F>
  dpoint (const Function_v2v< F > &f)

  Constructor; coordinates are set by function `f`.

- template<typename C2>
  dpoint (const algebra::vec< dim, C2 > &v)

  Constructor from an algebra vector.

- dpoint ()

  Constructor without argument.

- template<typename Q>
  operator mln::algebra::vec< dpoint< G, C >::dim, Q > () const

Conversion towards a algebra::vec.

- C & operator[ ] (unsigned i)

  Read-write access to the `i-th` *coordinate value.*

- C operator[ ] (unsigned i) const

  Read-only access to the `i-th` *coordinate value.*

- void set_all (C c)

  Set all coordinates to the value `c`*.*

- vec to_vec () const

  Explicit conversion.

  - dpoint (const literal::zero_t &)

    Constructors/assignments with literals.

  - dpoint (C ind)

10.128.1 Detailed Description

template<typename G, typename C> struct mln::dpoint< G, C >

Generic delta-point class.

Parameters are `G` the dimension of the space and `C` the coordinate type in this space.

10.128.2 Member Typedef Documentation

10.128.2.1 template<typename G, typename C> typedef C mln::dpoint< G, C >::coord

Coordinate associated type.

10.128.2.2 template<typename G, typename C> typedef G mln::dpoint< G, C >::grid

Grid associated type.

10.128.2.3 template<typename G, typename C> typedef point<G,C> mln::dpoint< G, C >::psite

Psite associated type.

10.128.2.4 template<typename G, typename C> typedef point<G,C> mln::dpoint< G, C >::site

Site associated type.

10.128.2.5 template<typename G, typename C> typedef algebra::vec<G::dim, C> mln::dpoint< G, C >::vec

Algebra vector (vec) associated type.

10.128.3 Member Enumeration Documentation

10.128.3.1 template<typename G, typename C> anonymous enum

Enumerator:

dim Dimension of the space.

Invariant:

dim > 0

10.128.4 Constructor & Destructor Documentation

10.128.4.1 template<typename G, typename C> mln::dpoint< G, C >::dpoint () `[inline]`

Constructor without argument.

10.128.4.2 template<typename G, typename C> template<typename C2> mln::dpoint< G, C >::dpoint (const algebra::vec< dim, C2 > & *v*) `[inline]`

Constructor from an algebra vector.

References mln::dpoint< G, C >::dim.

10.128.4.3 template<typename G, typename C> mln::dpoint< G, C >::dpoint (C *ind*) `[inline]`

Constructors with different numbers of arguments (coordinates) w.r.t. the dimension.

10.128.4.4 template<typename G, typename C> mln::dpoint< G, C >::dpoint (const literal::zero_t &) `[inline]`

Constructors/assignments with literals.

10.128.4.5 template<typename G, typename C> template<typename F> mln::dpoint< G, C >::dpoint (const Function_v2v< F > & *f*) `[inline]`

Constructor; coordinates are set by function `f`.

References mln::dpoint< G, C >::dim.

10.128.5 Member Function Documentation

10.128.5.1 template<typename G, typename C> template<typename Q> mln::dpoint< G, C >::operator mln::algebra::vec< dpoint< G, C >::dim, Q > () const [inline]

Conversion towards a algebra::vec.

References mln::dpoint< G, C >::to_vec().

10.128.5.2]

template<typename G, typename C> C & **mln::dpoint**< G, C >::operator[ ] (unsigned *i*) [inline]

Read-write access to the `i-th` coordinate value.

Parameters:

← ***i*** The coordinate index.

Precondition:

`i < dim`

References mln::dpoint< G, C >::dim.

10.128.5.3]

template<typename G, typename C> C **mln::dpoint**< G, C >::operator[ ] (unsigned *i*) const [inline]

Read-only access to the `i-th` coordinate value.

Parameters:

← ***i*** The coordinate index.

Precondition:

`i < dim`

References mln::dpoint< G, C >::dim.

10.128.5.4 template<typename G, typename C> void mln::dpoint< G, C >::set_all (C *c*) [inline]

Set all coordinates to the value `c`.

References mln::dpoint< G, C >::dim.

Referenced by mln::win::line< M, i, C >::line().

10.128.5.5 template<typename G, typename C> dpoint< G, C >::vec mln::dpoint< G, C >::to_vec () const [inline]

Explicit conversion.

References mln::dpoint< G, C >::dim.

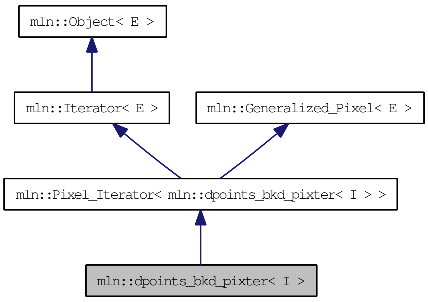
Referenced by mln::dpoint< G, C >::operator mln::algebra::vec< dpoint< G, C >::dim, Q >().

10.129 mln::dpoints_bkd_pixter< I > Class Template Reference

A generic backward iterator on the pixels of a dpoint-based window or neighborhood.

`#include <dpoints_pixter.hh>`

Inheritance diagram for mln::dpoints_bkd_pixter< I >:



Public Member Functions

- const I::value & center_val () const

  The value around which this iterator moves.

- template<typename Dps, typename Pref>
  dpoints_bkd_pixter (const Generalized_Pixel< Pref > &pxl_ref, const Dps &dps)

  Constructor (using a generalized pixel).

- template<typename Dps, typename Pref>
  dpoints_bkd_pixter (I &image, const Dps &dps, const Pref &p_ref)

  Constructor (using an image).

- void next ()

  Go to the next element.

  - void invalidate ()

    Invalidate the iterator.

  - bool is_valid () const

    Test the iterator validity.

  - void start ()

    Manipulation.

  - void update ()

    Force this iterator to update its location to take into account that its center point may have moved.

10.129.1 Detailed Description

template<typename I> class mln::dpoints_bkd_pixter< I >

A generic backward iterator on the pixels of a dpoint-based window or neighborhood.

Parameter `I` is the image type.

10.129.2 Constructor & Destructor Documentation

10.129.2.1 template<typename I> template<typename Dps, typename Pref> mln::dpoints_bkd_pixter< I >::dpoints_bkd_pixter (I & *image*, const Dps & *dps*, const Pref & *p_ref*) `[inline]`

Constructor (using an image).

Parameters:

← ***image*** The image to iterate over.

← ***dps*** An object (neighborhood or window) that can provide a set of delta-points.

← ***p_ref*** Center (resp. reference) point of the neighborhood (resp. window).

10.129.2.2 template<typename I> template<typename Dps, typename Pref> mln::dpoints_bkd_pixter< I >::dpoints_bkd_pixter (const Generalized_Pixel< Pref > & *pxl_ref*, const Dps & *dps*) `[inline]`

Constructor (using a generalized pixel).

Parameters:

← ***pxl_ref*** Center (generalized) pixel to iterate around.

← ***dps*** An object (neighborhood or window) that can provide a set of delta-points.

10.129.3 Member Function Documentation

10.129.3.1 template<typename I> const I::value & mln::dpoints_bkd_pixter< I >::center_val () const `[inline]`

The value around which this iterator moves.

10.129.3.2 template<typename I> void mln::dpoints_bkd_pixter< I >::invalidate () `[inline]`

Invalidate the iterator.

10.129.3.3 template<typename I> bool mln::dpoints_bkd_pixter< I >::is_valid () const `[inline]`

Test the iterator validity.

Referenced by mln::dpoints_bkd_pixter< I >::update().

10.129.3.4 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.129.3.5 template<typename I> void mln::dpoints_bkd_pixter< I >::start () [inline]

Manipulation.

Start an iteration.

References mln::dpoints_bkd_pixter< I >::update().

10.129.3.6 template<typename I> void mln::dpoints_bkd_pixter< I >::update () [inline]

Force this iterator to update its location to take into account that its center point may have moved.

References mln::dpoints_bkd_pixter< I >::is_valid().

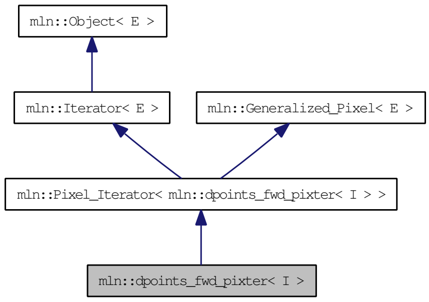
Referenced by mln::dpoints_bkd_pixter< I >::start().

10.130 mln::dpoints_fwd_pixter< I > Class Template Reference

A generic forward iterator on the pixels of a dpoint-based window or neighborhood.

`#include <dpoints_pixter.hh>`

Inheritance diagram for mln::dpoints_fwd_pixter< I >:



Public Member Functions

- const I::value & center_val () const

  The value around which this iterator moves.

- template<typename Dps, typename Pref>
  dpoints_fwd_pixter (const Generalized_Pixel< Pref > &pxl_ref, const Dps &dps)

  Constructor (using a generalized pixel).

- template<typename Dps, typename Pref>
  dpoints_fwd_pixter (I &image, const Dps &dps, const Pref &p_ref)

  Constructor (using an image).

- void next ()

  Go to the next element.

  - void invalidate ()

    Invalidate the iterator.

  - bool is_valid () const

    Test the iterator validity.

  - void start ()

    Manipulation.

  - void update ()

    Force this iterator to update its location to take into account that its center point may have moved.

10.130.1 Detailed Description

template<typename I> class mln::dpoints_fwd_pixter< I >

A generic forward iterator on the pixels of a dpoint-based window or neighborhood.

Parameter `I` is the image type.

10.130.2 Constructor & Destructor Documentation

10.130.2.1 template<typename I> template<typename Dps, typename Pref> mln::dpoints_fwd_pixter< I >::dpoints_fwd_pixter (I & *image*, const Dps & *dps*, const Pref & *p_ref*) `[inline]`

Constructor (using an image).

Parameters:

← ***image*** The image to iterate over.

← ***dps*** An object (neighborhood or window) that can provide a set of delta-points.

← ***p_ref*** Center (resp. reference) point of the neighborhood (resp. window).

10.130.2.2 template<typename I> template<typename Dps, typename Pref> mln::dpoints_fwd_pixter< I >::dpoints_fwd_pixter (const Generalized_Pixel< Pref > & *pxl_ref*, const Dps & *dps*) `[inline]`

Constructor (using a generalized pixel).

Parameters:

← ***pxl_ref*** Center (generalized) pixel to iterate around.

← ***dps*** An object (neighborhood or window) that can provide a set of delta-points.

10.130.3 Member Function Documentation

10.130.3.1 template<typename I> const I::value & mln::dpoints_fwd_pixter< I >::center_val () const `[inline]`

The value around which this iterator moves.

10.130.3.2 template<typename I> void mln::dpoints_fwd_pixter< I >::invalidate () `[inline]`

Invalidate the iterator.

10.130.3.3 template<typename I> bool mln::dpoints_fwd_pixter< I >::is_valid () const `[inline]`

Test the iterator validity.

Referenced by mln::dpoints_fwd_pixter< I >::update().

10.130.3.4 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.130.3.5 template<typename I> void mln::dpoints_fwd_pixter< I >::start () [inline]

Manipulation.

Start an iteration.

References mln::dpoints_fwd_pixter< I >::update().

10.130.3.6 template<typename I> void mln::dpoints_fwd_pixter< I >::update () [inline]

Force this iterator to update its location to take into account that its center point may have moved.

References mln::dpoints_fwd_pixter< I >::is_valid().

Referenced by mln::dpoints_fwd_pixter< I >::start().

10.131 mln::dpsites_bkd_piter< V > Class Template Reference

A generic backward iterator on points of windows and of neighborhoods.

`#include <dpsites_piter.hh>`

Inherits mln::internal::site_relative_iterator_base< V, mln::dpsites_bkd_piter< V > >.

Public Member Functions

- dpsites_bkd_piter ()

  Constructor without argument.

- template< typename P>
  dpsites_bkd_piter (const V &v, const P &c)

  Constructor.

- void next ()

  Go to the next element.

10.131.1 Detailed Description

template< typename V> class mln::dpsites_bkd_piter< V >

A generic backward iterator on points of windows and of neighborhoods.

The parameter `V` is the type of std::vector enclosing structure.

10.131.2 Constructor & Destructor Documentation

10.131.2.1 template< typename V> template< typename P> mln::dpsites_bkd_piter< V >::dpsites_bkd_piter (const V & *v*, const P & *c*) `[inline]`

Constructor.

Parameters:

← ***v*** Object that can provide an array of delta-points.

← ***c*** Center point to iterate around.

10.131.2.2 template< typename V> mln::dpsites_bkd_piter< V >::dpsites_bkd_piter () `[inline]`

Constructor without argument.

10.131.3 Member Function Documentation

10.131.3.1 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.132 mln::dpsites_fwd_piter< V > Class Template Reference

A generic forward iterator on points of windows and of neighborhoods.

`#include <dpsites_piter.hh>`

Inherits mln::internal::site_relative_iterator_base< V, mln::dpsites_fwd_piter< V > >.

Public Member Functions

- dpsites_fwd_piter ()

  Constructor without argument.

- template<typename P>
  dpsites_fwd_piter (const V &v, const P &c)

  Constructor.

- void next ()

  Go to the next element.

10.132.1 Detailed Description

template<typename V> class mln::dpsites_fwd_piter< V >

A generic forward iterator on points of windows and of neighborhoods.

The parameter `V` is the type of std::vector enclosing structure.

10.132.2 Constructor & Destructor Documentation

10.132.2.1 template<typename V> template<typename P> mln::dpsites_fwd_piter< V >::dpsites_fwd_piter (const V & *v*, const P & *c*) `[inline]`

Constructor.

Parameters:

← ***v*** Object that can provide an array of delta-points.

← ***c*** Center point to iterate around.

10.132.2.2 template<typename V> mln::dpsites_fwd_piter< V >::dpsites_fwd_piter () `[inline]`

Constructor without argument.

10.132.3 Member Function Documentation

10.132.3.1 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.133 mln::Edge< E > Struct Template Reference

edge category flag type.

```
#include <edge.hh>
```

10.133.1 Detailed Description

template<typename E> struct mln::Edge< E >

edge category flag type.

10.134 mln::edge_image< P, V, G > Class Template Reference

Image based on graph edges.

`#include <edge_image.hh>`

Inherits mln::pw::internal::image_base< mln::fun::i2v::array< V >, mln::p_edges< G, mln::internal::efsite_selector< P, G >::mln::fun::i2v::array >, mln::edge_image< P, V, G > >.

Public Types

- typedef graph_elt_neighborhood< G, p_edges< G, site_function_t > > edge_nbh_t

  Neighborhood type.

- typedef graph_elt_window< G, p_edges< G, site_function_t > > edge_win_t

  Edge Window type.

- typedef G graph_t

  The type of the underlying graph.

- typedef edge_nbh_t nbh_t

  Default Neighborhood type.

- typedef internal::efsite_selector< P, G >::site_function_t site_function_t

  Function mapping graph elements to sites.

- typedef edge_image< tag::psite_< P >, tag::value_< V >, tag::graph_< G > > skeleton

  Skeleton type.

- typedef edge_win_t win_t

  Default Window type.

Public Member Functions

- edge_image ()

  Constructors.

- rvalue operator() (unsigned e_id) const

  Value accessors/operators overloads.

10.134.1 Detailed Description

template<typename P, typename V, typename G = util::graph> class mln::edge_image< P, V, G >

Image based on graph edges.

10.134.2 Member Typedef Documentation

10.134.2.1 template<typename P, typename V, typename G = util::graph> typedef graph_elt_neighborhood<G,p_edges<G,site_function_t> > mln::edge_image< P, V, G >::edge_nbh_t

Neighborhood type.

10.134.2.2 template<typename P, typename V, typename G = util::graph> typedef graph_elt_window<G,p_edges<G,site_function_t> > mln::edge_image< P, V, G >::edge_win_t

Edge Window type.

10.134.2.3 template<typename P, typename V, typename G = util::graph> typedef G mln::edge_image< P, V, G >::graph_t

The type of the underlying graph.

10.134.2.4 template<typename P, typename V, typename G = util::graph> typedef edge_nbh_t mln::edge_image< P, V, G >::nbh_t

Default Neighborhood type.

10.134.2.5 template<typename P, typename V, typename G = util::graph> typedef internal::efsite_selector<P,G>::site_function_t mln::edge_image< P, V, G >::site_function_t

Function mapping graph elements to sites.

10.134.2.6 template<typename P, typename V, typename G = util::graph> typedef edge_image< tag::psite_<P>, tag::value_<V>, tag::graph_<G> > mln::edge_image< P, V, G >::skeleton

Skeleton type.

10.134.2.7 template<typename P, typename V, typename G = util::graph> typedef edge_win_t mln::edge_image< P, V, G >::win_t

Default Window type.

10.134.3 Constructor & Destructor Documentation

10.134.3.1 template<typename P, typename V, typename G> mln::edge_image< P, V, G >::edge_image () [inline]

Constructors.

10.134.4 Member Function Documentation

10.134.4.1 template<typename P, typename V, typename G> edge_image< P, V, G >::rvalue mln::edge_image< P, V, G >::operator() (unsigned *e_id*) const [inline]

Value accessors/operators overloads.

10.135 mln::extended< I > Struct Template Reference

Makes an image become restricted by a point set.

`#include <extended.hh>`

Inherits mln::internal::image_domain_morpher< I, mln::box< I::site >, mln::extended< I > >.

Public Types

- typedef tag::image_< I > skeleton

    Skeleton.

- typedef I::value value

    Value type.

Public Member Functions

- const box< typename I::site > & domain () const

    Give the definition domain.

- extended (I &ima, const box< typename I::site > &b)

    Constructor.

- extended ()

    Constructor without argument.

10.135.1 Detailed Description

template<typename I> struct mln::extended< I >

Makes an image become restricted by a point set.

10.135.2 Member Typedef Documentation

10.135.2.1 template<typename I> typedef tag::image_<I> mln::extended< I >::skeleton

Skeleton.

10.135.2.2 template<typename I> typedef I ::value mln::extended< I >::value

Value type.

10.135.3 Constructor & Destructor Documentation

10.135.3.1 template<typename I> mln::extended< I >::extended () [inline]

Constructor without argument.

10.135.3.2 template<typename I> mln::extended< I >::extended (I & *ima*, const box< typename I::site > & *b*) [inline]

Constructor.

10.135.4 Member Function Documentation

10.135.4.1 template<typename I> const box< typename I::site > & mln::extended< I >::domain () const [inline]

Give the definition domain.

10.136 mln::extension_fun< I, F > Class Template Reference

Extends the domain of an image with a function.

`#include <extension_fun.hh>`

Inherits mln::internal::image_identity< I, I::domain_t, mln::extension_fun< I, F > >.

Public Types

- typedef I::value rvalue

  Return type of read-only access.

- typedef extension_fun< tag::image_< I >, tag::function_< F > > skeleton

  Skeleton.

- typedef I::value value

  Image value type.

Public Member Functions

- const F & extension () const

  Give the extension function.

- extension_fun (I &ima, const F &fun)

  Constructor from an image `ima` *and a function* `fun`.

- extension_fun ()

  Constructor without argument.

- template<typename P>
  bool has (const P &p) const

  Test if `p` *is valid.*

- internal::morpher_lvalue_< I >::ret operator() (const typename I::psite &p)

  Read-write access to the image value located at site `p`.

- I::value operator() (const typename I::psite &p) const

  Read-only access to the image value located at site `p`*;.*

10.136.1 Detailed Description

template<typename I, typename F> class mln::extension_fun< I, F >

Extends the domain of an image with a function.

10.136.2 Member Typedef Documentation

10.136.2.1 template<typename I, typename F> typedef I ::value mln::extension_fun< I, F >::rvalue

Return type of read-only access.

10.136.2.2 template<typename I, typename F> typedef extension_fun< tag::image_<I>, tag::function_<F> > mln::extension_fun< I, F >::skeleton

Skeleton.

10.136.2.3 template<typename I, typename F> typedef I ::value mln::extension_fun< I, F >::value

Image value type.

10.136.3 Constructor & Destructor Documentation

10.136.3.1 template<typename I, typename F> mln::extension_fun< I, F >::extension_fun () `[inline]`

Constructor without argument.

10.136.3.2 template<typename I, typename F> mln::extension_fun< I, F >::extension_fun (I & *ima*, const F & *fun*) `[inline]`

Constructor from an image `ima` and a function `fun`.

10.136.4 Member Function Documentation

10.136.4.1 template<typename I, typename F> const F & mln::extension_fun< I, F >::extension () const `[inline]`

Give the extension function.

10.136.4.2 template<typename I, typename F> template<typename P> bool mln::extension_fun< I, F >::has (const P & *p*) const `[inline]`

Test if `p` is valid.

It returns always true, assuming that the function is valid for any `p`.

10.136.4.3 template<typename I, typename F> internal::morpher_lvalue_< I >::ret mln::extension_fun< I, F >::operator() (const typename I::psite & *p*) `[inline]`

Read-write access to the image value located at site `p`.

10.136.4.4 template<typename I, typename F> I::value mln::extension_fun< I, F >::operator() (const typename I::psite & *p*) const [inline]

Read-only access to the image value located at site p;.

10.137 mln::extension_ima< I, J > Class Template Reference

Extends the domain of an image with an image.

`#include <extension_ima.hh>`

Inherits mln::internal::image_identity< I, I::domain_t, mln::extension_ima< I, J > >.

Public Types

- typedef I::value rvalue

  Return type of read-only access.

- typedef extension_ima< tag::image_< I >, tag::ext_< J > > skeleton

  Skeleton.

- typedef I::value value

  Image value type.

Public Member Functions

- const J & extension () const

  Read-only access to the extension domain (image).

- extension_ima (I &ima, const J &ext)

  Constructor from an image `ima` *and a function* `ext`.

- extension_ima ()

  Constructor without argument.

- template<typename P>
  bool has (const P &p) const

  Test if `p` *is valid.*

- internal::morpher_lvalue_< I >::ret operator() (const typename I::psite &p)

  Read-write access to the image value located at site `p`.

- I::value operator() (const typename I::psite &p) const

  Read-only access to the image value located at site `p`;.

10.137.1 Detailed Description

template<typename I, typename J> class mln::extension_ima< I, J >

Extends the domain of an image with an image.

10.137.2 Member Typedef Documentation

10.137.2.1 template<typename I, typename J> typedef I ::value mln::extension_ima< I, J >::rvalue

Return type of read-only access.

10.137.2.2 template<typename I, typename J> typedef extension_ima< tag::image_<I>, tag::ext_<J> > mln::extension_ima< I, J >::skeleton

Skeleton.

10.137.2.3 template<typename I, typename J> typedef I ::value mln::extension_ima< I, J >::value

Image value type.

10.137.3 Constructor & Destructor Documentation

10.137.3.1 template<typename I, typename J> mln::extension_ima< I, J >::extension_ima () `[inline]`

Constructor without argument.

10.137.3.2 template<typename I, typename J> mln::extension_ima< I, J >::extension_ima (I & *ima*, const J & *ext*) `[inline]`

Constructor from an image `ima` and a function `ext`.

10.137.4 Member Function Documentation

10.137.4.1 template<typename I, typename J> const J & mln::extension_ima< I, J >::extension () const `[inline]`

Read-only access to the extension domain (image).

10.137.4.2 template<typename I, typename J> template<typename P> bool mln::extension_ima< I, J >::has (const P & *p*) const `[inline]`

Test if `p` is valid.

Referenced by mln::extension_ima< I, J >::operator()().

10.137.4.3 template<typename I, typename J> internal::morpher_lvalue_< I >::ret mln::extension_ima< I, J >::operator() (const typename I::psite & *p*) `[inline]`

Read-write access to the image value located at site `p`.

References mln::extension_ima< I, J >::has().

10.137.4.4 template<typename I, typename J> I::value mln::extension_ima< I, J >::operator() (const typename I::psite & *p*) const [inline]

Read-only access to the image value located at site `p`;.

References mln::extension_ima< I, J >::has().

10.138 mln::extension_val< I > Class Template Reference

Extends the domain of an image with a value.

`#include <extension_val.hh>`

Inherits mln::internal::image_identity< I, I::domain_t, mln::extension_val< I > >.

Public Types

- typedef I::value rvalue

  Return type of read-only access.
- typedef extension_val< tag::image_< I > > skeleton

  Skeleton.
- typedef I::value value

  Image value type.

Public Member Functions

- void change_extension (const typename I::value &val)

  Change the value of the extension domain.
- const I::value & extension () const

  Read-only access to the value of the extension domain.
- extension_val (I &ima, const typename I::value &val)

  Constructor from an image `ima` *and a value* `val`*.*
- extension_val ()

  Constructor without argument.
- template<typename P>
  bool has (const P &p) const

  Test if `p` *is valid. It returns always true.*
- internal::morpher_lvalue_< I >::ret operator() (const typename I::psite &p)

  Read-write access to the image value located at site `p`*.*
- I::value operator() (const typename I::psite &p) const

  Read-only access to the image value located at site `p`*;.*

10.138.1 Detailed Description

template<typename I> class mln::extension_val< I >

Extends the domain of an image with a value.

10.138.2 Member Typedef Documentation

10.138.2.1 template<typename I> typedef I ::value mln::extension_val< I >::rvalue

Return type of read-only access.

10.138.2.2 template<typename I> typedef extension_val< tag::image_<I> > mln::extension_val< I >::skeleton

Skeleton.

10.138.2.3 template<typename I> typedef I ::value mln::extension_val< I >::value

Image value type.

10.138.3 Constructor & Destructor Documentation

10.138.3.1 template<typename I> mln::extension_val< I >::extension_val () [inline]

Constructor without argument.

10.138.3.2 template<typename I> mln::extension_val< I >::extension_val (I & *ima*, const typename I::value & *val*) [inline]

Constructor from an image `ima` and a value `val`.

10.138.4 Member Function Documentation

10.138.4.1 template<typename I> void mln::extension_val< I >::change_extension (const typename I::value & *val*) [inline]

Change the value of the extension domain.

10.138.4.2 template<typename I> const I::value & mln::extension_val< I >::extension () const [inline]

Read-only access to the value of the extension domain.

10.138.4.3 template<typename I> template<typename P> bool mln::extension_val< I >::has (const P & *p*) const [inline]

Test if `p` is valid. It returns always true.

10.138.4.4 template<typename I> internal::morpher_lvalue_< I >::ret mln::extension_val< I >::operator() (const typename I::psite & *p*) [inline]

Read-write access to the image value located at site `p`.

10.138.4.5 template<typename I> I::value mln::extension_val< I >::operator() (const typename I::psite & *p*) const [inline]

Read-only access to the image value located at site p;.

10.139 mln::faces_psite< N, D, P > Class Template Reference

Point site associated to a mln::p_faces.

`#include <faces_psite.hh>`

Inherits mln::internal::pseudo_site_base_< const P &, mln::faces_psite< N, D, P > >.

Public Member Functions

- void change_target (const target &new_target)
  Set the target site_set.
- const target & site_set () const
  Site set manipulators.

- topo::n_face< N, D > face () const
  Face handle manipulators.
- unsigned face_id () const
  Return the id of the face of this psite.
- unsigned n () const
  Return the dimension of the face of this psite.

- faces_psite (const p_faces< N, D, P > &pf, const topo::n_face< N, D > &face)
- faces_psite ()
  Construction and assignment.

- void invalidate ()
  Invalidate this psite.
- bool is_valid () const
  Psite manipulators.

10.139.1 Detailed Description

template<unsigned N, unsigned D, typename P> class mln::faces_psite< N, D, P >

Point site associated to a mln::p_faces.

Template Parameters:

N The dimension of the face associated to this psite.

D The dimension of the complex this psite belongs to.

P The type of point associated to this psite.

10.139.2 Constructor & Destructor Documentation

10.139.2.1 template<unsigned N, unsigned D, typename P> mln::faces_psite< N, D, P >::faces_psite () [inline]

Construction and assignment.

References mln::faces_psite< N, D, P >::invalidate().

10.139.2.2 template<unsigned N, unsigned D, typename P> mln::faces_psite< N, D, P >::faces_psite (const p_faces< N, D, P > & *pf*, const topo::n_face< N, D > & *face*) [inline]

Precondition:

pf.cplx() == face.cplx().

10.139.3 Member Function Documentation

10.139.3.1 template<unsigned N, unsigned D, typename P> void mln::faces_psite< N, D, P >::change_target (const target & *new_target*) [inline]

Set the target site_set.

References mln::p_faces< N, D, P >::cplx(), and mln::faces_psite< N, D, P >::invalidate().

10.139.3.2 template<unsigned N, unsigned D, typename P> topo::n_face< N, D > mln::faces_psite< N, D, P >::face () const [inline]

Face handle manipulators.

Return the face handle of this point site.

Referenced by mln::operator!=(), and mln::operator==().

10.139.3.3 template<unsigned N, unsigned D, typename P> unsigned mln::faces_psite< N, D, P >::face_id () const [inline]

Return the id of the face of this psite.

10.139.3.4 template<unsigned N, unsigned D, typename P> void mln::faces_psite< N, D, P >::invalidate () [inline]

Invalidate this psite.

Referenced by mln::faces_psite< N, D, P >::change_target(), and mln::faces_psite< N, D, P >::faces_psite().

10.139.3.5 template<unsigned N, unsigned D, typename P> bool mln::faces_psite< N, D, P >::is_valid () const [inline]

Psite manipulators.

Is this psite valid?

10.139.3.6 template<unsigned N, unsigned D, typename P> unsigned mln::faces_psite< N, D, P >::n () const [inline]

Return the dimension of the face of this psite.

10.139.3.7 template<unsigned N, unsigned D, typename P> const p_faces< N, D, P > & mln::faces_psite< N, D, P >::site_set () const [inline]

Site set manipulators.

Return the p_faces this site is built on. (shortcut for *target()).

Precondition:

Member face_ is valid.

Referenced by mln::operator!=(), and mln::operator==().

10.140 mln::flat_image< T, S > Struct Template Reference

Image with a single value.

`#include <flat_image.hh>`

Inherits mln::internal::image_primary< T, S, mln::flat_image< T, S > >.

Public Types

- typedef T & lvalue

  Return type of read-write access.

- typedef const T & rvalue

  Return type of read-only access.

- typedef flat_image< tag::value_< T >, tag::domain_< S > > skeleton

  Skeleton.

- typedef T value

  Value associated type.

Public Member Functions

- const S & domain () const

  Give the definition domain.

- flat_image (const T &val, const S &pset)

  Constructor.

- flat_image ()

  Constructor without argument.

- bool has (const typename S::psite &p) const

  Test if `p` *is valid: always return true.*

- T & operator() (const typename S::psite &p)

  Read-write access to the image value located at point `p`.

- const T & operator() (const typename S::psite &p) const

  Read-only access to the image value located at point `p`.

10.140.1 Detailed Description

template<typename T, typename S> struct mln::flat_image< T, S >

Image with a single value.

10.140.2 Member Typedef Documentation

10.140.2.1 template<typename T, typename S> typedef T& mln::flat_image< T, S >::lvalue

Return type of read-write access.

10.140.2.2 template<typename T, typename S> typedef const T& mln::flat_image< T, S >::rvalue

Return type of read-only access.

10.140.2.3 template<typename T, typename S> typedef flat_image< tag::value_<T>, tag::domain_<S> > mln::flat_image< T, S >::skeleton

Skeleton.

10.140.2.4 template<typename T, typename S> typedef T mln::flat_image< T, S >::value

Value associated type.

10.140.3 Constructor & Destructor Documentation

10.140.3.1 template<typename T, typename S> mln::flat_image< T, S >::flat_image () [inline]

Constructor without argument.

10.140.3.2 template<typename T, typename S> mln::flat_image< T, S >::flat_image (const T & *val*, const S & *pset*) [inline]

Constructor.

10.140.4 Member Function Documentation

10.140.4.1 template<typename T, typename S> const S & mln::flat_image< T, S >::domain () const [inline]

Give the definition domain.

10.140.4.2 template<typename T, typename S> bool mln::flat_image< T, S >::has (const typename S::psite & *p*) const [inline]

Test if `p` is valid: always return true.

10.140.4.3 template<typename T, typename S> T & mln::flat_image< T, S >::operator() (const typename S::psite & *p*) [inline]

Read-write access to the image value located at point `p`.

10.140.4.4 template<typename T, typename S> const T & mln::flat_image< T, S >::operator() (const typename S::psite & *p*) const [inline]

Read-only access to the image value located at point p.

10.141 mln::fun::from_accu< A > Struct Template Reference

Wrap an accumulator into a function.

```
#include <from_accu.hh>
```

Inherits mln::fun::unary_param< mln::fun::from_accu< A >, A * >.

10.141.1 Detailed Description

template< typename A > struct mln::fun::from_accu< A >

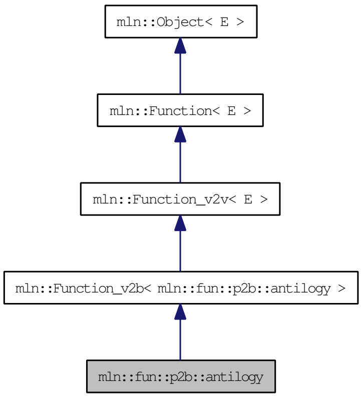
Wrap an accumulator into a function.

10.142 mln::fun::p2b::antilogy Struct Reference

A p2b function always returning `false`.

`#include <antilogy.hh>`

Inheritance diagram for mln::fun::p2b::antilogy:



10.142.1 Detailed Description

A p2b function always returning `false`.

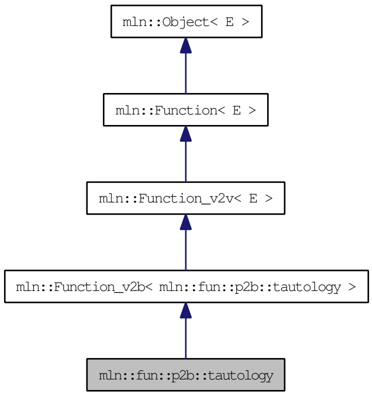
A simpler name would be 'false', but this is not a valid C++ identifier, as `false` is a keyword of the language.

10.143 mln::fun::p2b::tautology Struct Reference

A p2b function always returning `true`.

`#include <tautology.hh>`

Inheritance diagram for mln::fun::p2b::tautology:



10.143.1 Detailed Description

A p2b function always returning `true`.

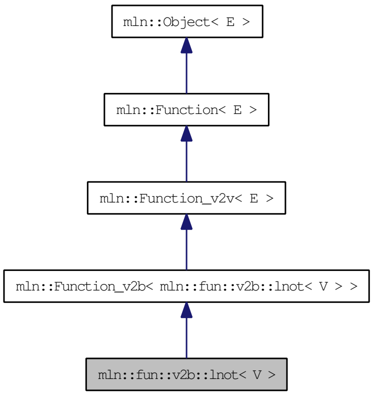
A simpler name would be 'true', but this is not a valid C++ identifier, as `true` is a keyword of the language.

10.144 mln::fun::v2b::lnot< V > Struct Template Reference

Functor computing logical-not on a value.

`#include <lnot.hh>`

Inheritance diagram for mln::fun::v2b::lnot< V >:



10.144.1 Detailed Description

template<typename V> struct mln::fun::v2b::lnot< V >

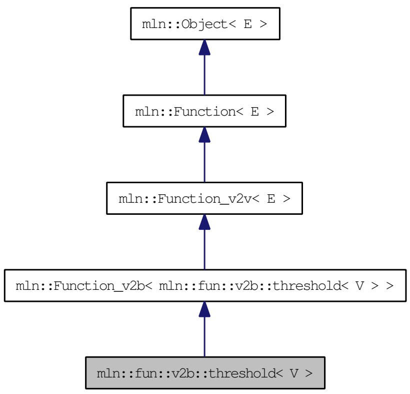
Functor computing logical-not on a value.

10.145 mln::fun::v2b::threshold< V > Struct Template Reference

Threshold function.

`#include <threshold.hh>`

Inheritance diagram for mln::fun::v2b::threshold< V >:



10.145.1 Detailed Description

template<typename V> struct mln::fun::v2b::threshold< V >

Threshold function.

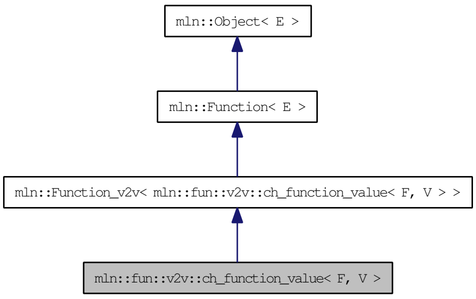
f(v) = (v >= threshold).

10.146 mln::fun::v2v::ch_function_value< F, V > Class Template Reference

Wrap a function v2v and convert its result to another type.

`#include <ch_function_value.hh>`

Inheritance diagram for mln::fun::v2v::ch_function_value< F, V >:



10.146.1 Detailed Description

template<typename F, typename V> class mln::fun::v2v::ch_function_value< F, V >

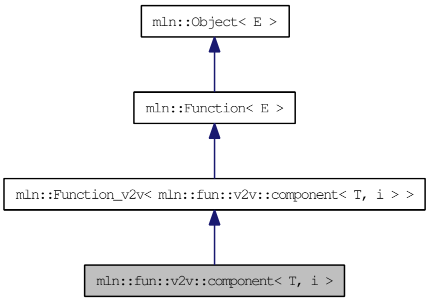
Wrap a function v2v and convert its result to another type.

10.147 mln::fun::v2v::component< T, i > Struct Template Reference

Functor that accesses the i-th component of a value.

`#include <component.hh>`

Inheritance diagram for mln::fun::v2v::component< T, i >:



10.147.1 Detailed Description

template<typename T, unsigned i> struct mln::fun::v2v::component< T, i >

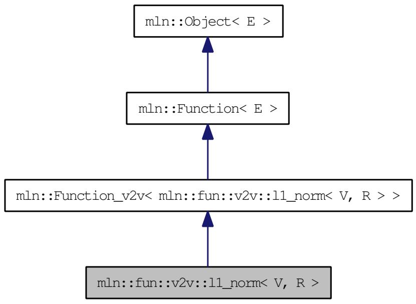
Functor that accesses the i-th component of a value.

10.148 mln::fun::v2v::l1_norm< V, R > Struct Template Reference

L1-norm.

`#include <norm.hh>`

Inheritance diagram for mln::fun::v2v::l1_norm< V, R >:



10.148.1 Detailed Description

template<typename V, typename R> struct mln::fun::v2v::l1_norm< V, R >

L1-norm.

`V` is the type of input values; `R` is the result type.

See also:

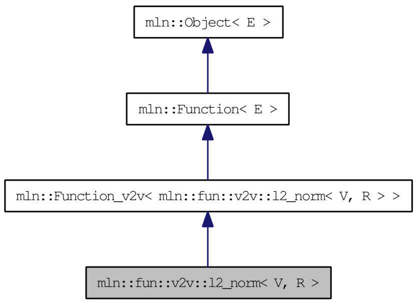
mln::norm::l1.

10.149 mln::fun::v2v::l2_norm< V, R > Struct Template Reference

L2-norm.

`#include <norm.hh>`

Inheritance diagram for mln::fun::v2v::l2_norm< V, R >:



10.149.1 Detailed Description

template<typename V, typename R> struct mln::fun::v2v::l2_norm< V, R >

L2-norm.

`V` is the type of input values; `R` is the result type.

See also:

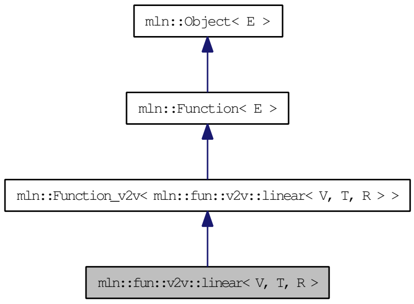
mln::norm::l2.

10.150 mln::fun::v2v::linear< V, T, R > Struct Template Reference

Linear function. f(v) = a ∗ v + b. `V` is the type of input values; `T` is the type used to compute the result; `R` is the result type.

`#include <linear.hh>`

Inheritance diagram for mln::fun::v2v::linear< V, T, R >:



10.150.1 Detailed Description

template<typename V, typename T = V, typename R = T> struct mln::fun::v2v::linear< V, T, R >

Linear function. f(v) = a ∗ v + b. `V` is the type of input values; `T` is the type used to compute the result; `R` is the result type.

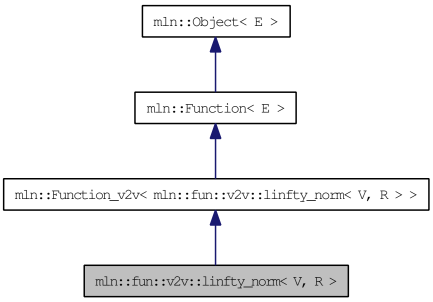
By defaut, `T` is `V` and `R` is `T`.

10.151 mln::fun::v2v::linfty_norm< V, R > Struct Template Reference

L-infty norm.

`#include <norm.hh>`

Inheritance diagram for mln::fun::v2v::linfty_norm< V, R >:



10.151.1 Detailed Description

template<typename V, typename R> struct mln::fun::v2v::linfty_norm< V, R >

L-infty norm.

`V` is the type of input values; `R` is the result type.

See also:

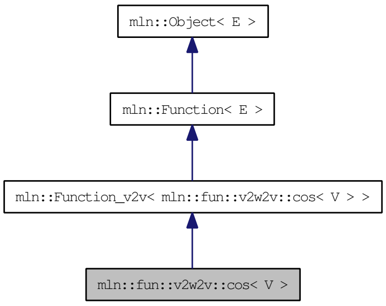
mln::norm::linfty.

10.152 mln::fun::v2w2v::cos< V > Struct Template Reference

Cosinus bijective functor.

`#include <cos.hh>`

Inheritance diagram for mln::fun::v2w2v::cos< V >:



10.152.1 Detailed Description

template<typename V> struct mln::fun::v2w2v::cos< V >

Cosinus bijective functor.

`V` is the type of input values and the result type.

See also:

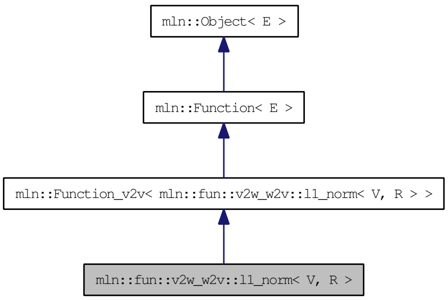
mln::math::cos.

10.153 mln::fun::v2w_w2v::l1_norm< V, R > Struct Template Reference

L1-norm.

`#include <norm.hh>`

Inheritance diagram for mln::fun::v2w_w2v::l1_norm< V, R >:



10.153.1 Detailed Description

template<typename V, typename R> struct mln::fun::v2w_w2v::l1_norm< V, R >

L1-norm.

`V` is the type of input values; `R` is the result type.

See also:

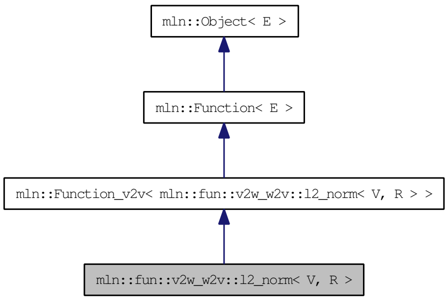
mln::norm::l1.

10.154 mln::fun::v2w_w2v::l2_norm< V, R > Struct Template Reference

L2-norm.

`#include <norm.hh>`

Inheritance diagram for mln::fun::v2w_w2v::l2_norm< V, R >:



10.154.1 Detailed Description

template<typename V, typename R> struct mln::fun::v2w_w2v::l2_norm< V, R >

L2-norm.

`V` is the type of input values; `R` is the result type.

See also:

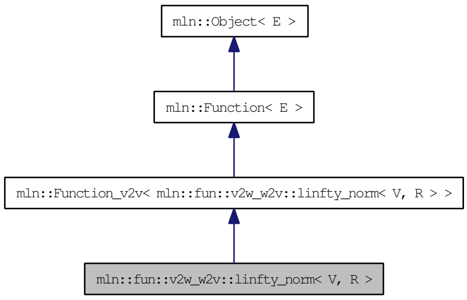
mln::norm::l2.

10.155 mln::fun::v2w_w2v::linfty_norm< V, R > Struct Template Reference

L-infty norm.

`#include <norm.hh>`

Inheritance diagram for mln::fun::v2w_w2v::linfty_norm< V, R >:



10.155.1 Detailed Description

template<typename V, typename R> struct mln::fun::v2w_w2v::linfty_norm< V, R >

L-infty norm.

`V` is the type of input values; `R` is the result type.

See also:

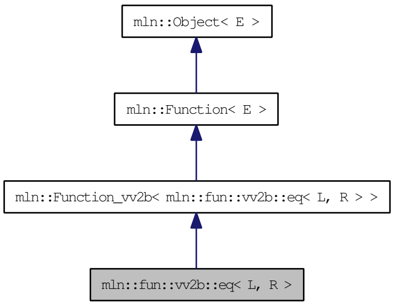
mln::norm::linfty.

10.156 mln::fun::vv2b::eq< L, R > Struct Template Reference

Functor computing equal between two values.

`#include <eq.hh>`

Inheritance diagram for mln::fun::vv2b::eq< L, R >:



10.156.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2b::eq< L, R >

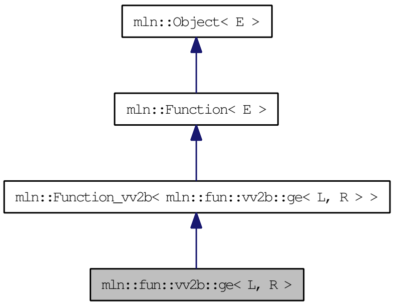
Functor computing equal between two values.

10.157 mln::fun::vv2b::ge< L, R > Struct Template Reference

Functor computing "greater or equal than" between two values.

`#include <ge.hh>`

Inheritance diagram for mln::fun::vv2b::ge< L, R >:



10.157.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2b::ge< L, R >

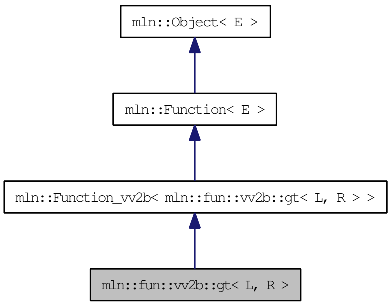
Functor computing "greater or equal than" between two values.

10.158 mln::fun::vv2b::gt< L, R > Struct Template Reference

Functor computing "greater than" between two values.

`#include <gt.hh>`

Inheritance diagram for mln::fun::vv2b::gt< L, R >:



10.158.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2b::gt< L, R >

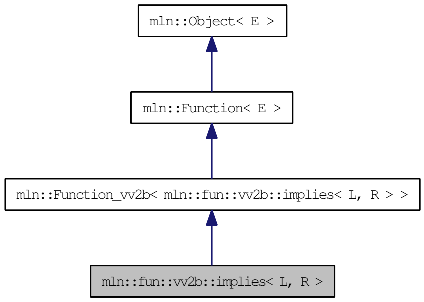
Functor computing "greater than" between two values.

10.159 mln::fun::vv2b::implies< L, R > Struct Template Reference

Functor computing logical-implies between two values.

`#include <implies.hh>`

Inheritance diagram for mln::fun::vv2b::implies< L, R >:



10.159.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2b::implies< L, R >

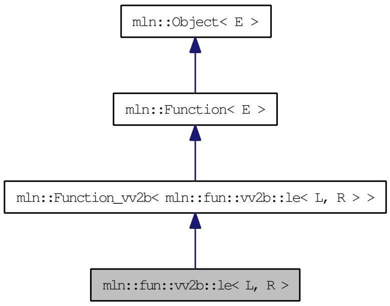
Functor computing logical-implies between two values.

10.160 mln::fun::vv2b::le< L, R > Struct Template Reference

Functor computing "lower or equal than" between two values.

`#include <le.hh>`

Inheritance diagram for mln::fun::vv2b::le< L, R >:



10.160.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2b::le< L, R >

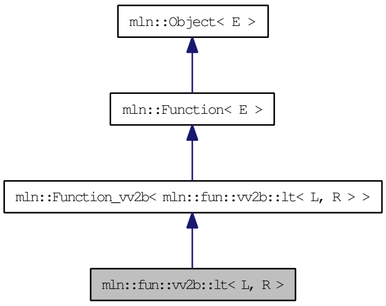
Functor computing "lower or equal than" between two values.

10.161 mln::fun::vv2b::lt< L, R > Struct Template Reference

Functor computing "lower than" between two values.

`#include <lt.hh>`

Inheritance diagram for mln::fun::vv2b::lt< L, R >:



10.161.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2b::lt< L, R >

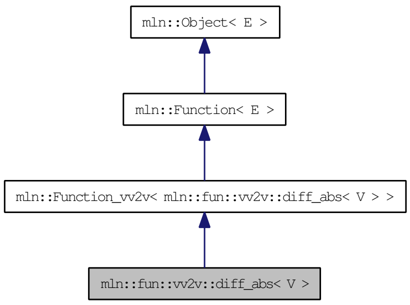
Functor computing "lower than" between two values.

10.162 mln::fun::vv2v::diff_abs< V > Struct Template Reference

A functor computing the diff_absimum of two values.

`#include <diff_abs.hh>`

Inheritance diagram for mln::fun::vv2v::diff_abs< V >:



10.162.1 Detailed Description

template<typename V> struct mln::fun::vv2v::diff_abs< V >

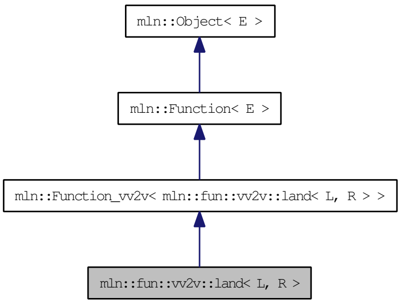
A functor computing the diff_absimum of two values.

10.163 mln::fun::vv2v::land< L, R > Struct Template Reference

Functor computing logical-and between two values.

`#include <land.hh>`

Inheritance diagram for mln::fun::vv2v::land< L, R >:



10.163.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2v::land< L, R >

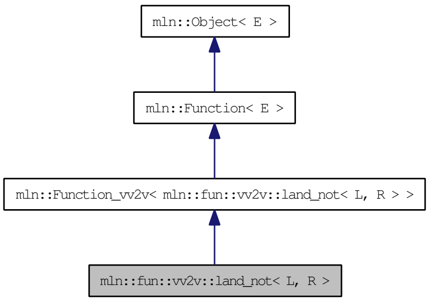
Functor computing logical-and between two values.

10.164 mln::fun::vv2v::land_not< L, R > Struct Template Reference

Functor computing logical and-not between two values.

`#include <land_not.hh>`

Inheritance diagram for mln::fun::vv2v::land_not< L, R >:



10.164.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2v::land_not< L, R >

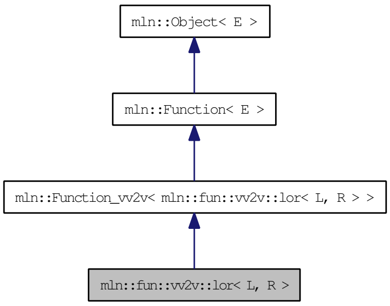
Functor computing logical and-not between two values.

10.165 mln::fun::vv2v::lor< L, R > Struct Template Reference

Functor computing logical-or between two values.

`#include <lor.hh>`

Inheritance diagram for mln::fun::vv2v::lor< L, R >:



10.165.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2v::lor< L, R >

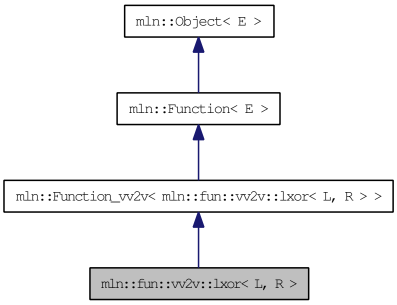
Functor computing logical-or between two values.

10.166 mln::fun::vv2v::lxor< L, R > Struct Template Reference

Functor computing logical-xor between two values.

`#include <lxor.hh>`

Inheritance diagram for mln::fun::vv2v::lxor< L, R >:



10.166.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2v::lxor< L, R >

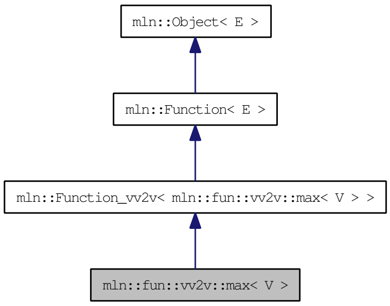
Functor computing logical-xor between two values.

10.167 mln::fun::vv2v::max< V > Struct Template Reference

A functor computing the maximum of two values.

`#include <max.hh>`

Inheritance diagram for mln::fun::vv2v::max< V >:



10.167.1 Detailed Description

template<typename V> struct mln::fun::vv2v::max< V >

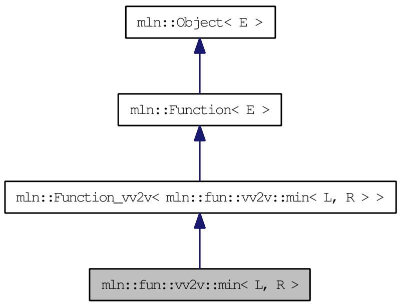
A functor computing the maximum of two values.

10.168 mln::fun::vv2v::min< L, R > Struct Template Reference

A functor computing the minimum of two values.

`#include <min.hh>`

Inheritance diagram for mln::fun::vv2v::min< L, R >:



10.168.1 Detailed Description

template<typename L, typename R = L> struct mln::fun::vv2v::min< L, R >

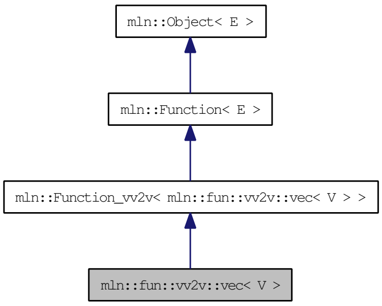
A functor computing the minimum of two values.

10.169 mln::fun::vv2v::vec< V > Struct Template Reference

A functor computing the vecimum of two values.

`#include <vec.hh>`

Inheritance diagram for mln::fun::vv2v::vec< V >:



10.169.1 Detailed Description

template<typename V> struct mln::fun::vv2v::vec< V >

A functor computing the vecimum of two values.

10.170 mln::fun::x2p::closest_point< P > Struct Template Reference

FIXME: doxygen + concept checking.

```
#include <closest_point.hh>
```

10.170.1 Detailed Description

template<typename P> struct mln::fun::x2p::closest_point< P >

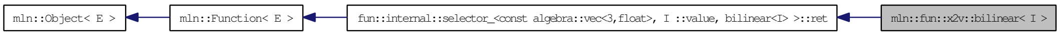
FIXME: doxygen + concept checking.

10.171 mln::fun::x2v::bilinear< I > Struct Template Reference

Represent a bilinear interolation of values from an underlying image.

`#include <bilinear.hh>`

Inheritance diagram for mln::fun::x2v::bilinear< I >:



Public Member Functions

- template<typename T>
  I::value operator() (const algebra::vec< 3, T > &v) const

  Bilinear filtering on 3d images. Work on slices.
- template<typename T>
  I::value operator() (const algebra::vec< 2, T > &v) const

  Bilinear filtering on 2d images.

10.171.1 Detailed Description

template<typename I> struct mln::fun::x2v::bilinear< I >

Represent a bilinear interolation of values from an underlying image.

10.171.2 Member Function Documentation

10.171.2.1 template<typename I> template<typename T> I::value mln::fun::x2v::bilinear< I >::operator() (const algebra::vec< 3, T > & *v*) const `[inline]`

Bilinear filtering on 3d images. Work on slices.

10.171.2.2 template<typename I> template<typename T> I::value mln::fun::x2v::bilinear< I >::operator() (const algebra::vec< 2, T > & *v*) const `[inline]`

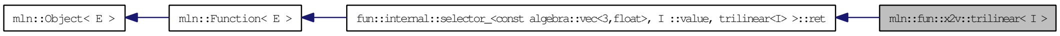
Bilinear filtering on 2d images.

10.172 mln::fun::x2v::trilinear< I > Struct Template Reference

Represent a trilinear interolation of values from an underlying image.

`#include <trilinear.hh>`

Inheritance diagram for mln::fun::x2v::trilinear< I >:



10.172.1 Detailed Description

template<typename I> struct mln::fun::x2v::trilinear< I >

Represent a trilinear interolation of values from an underlying image.

10.173 mln::fun::x2x::composed< T2, T1 > Struct Template Reference

Represent a composition of two transformations.

`#include <composed.hh>`

Public Member Functions

- composed (const T2 &f, const T1 &g)

  Constructor with the two transformation to be composed.

- composed ()

  Constructor without argument.

10.173.1 Detailed Description

template<typename T2, typename T1> struct mln::fun::x2x::composed< T2, T1 >

Represent a composition of two transformations.

10.173.2 Constructor & Destructor Documentation

10.173.2.1 template<typename T2, typename T1> mln::fun::x2x::composed< T2, T1 >::composed () [inline]

Constructor without argument.

10.173.2.2 template<typename T2, typename T1> mln::fun::x2x::composed< T2, T1 >::composed (const T2 & *f*, const T1 & *g*) [inline]

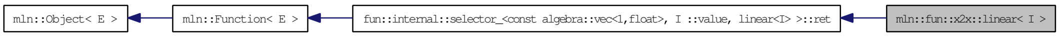
Constructor with the two transformation to be composed.

10.174 mln::fun::x2x::linear< I > Struct Template Reference

Represent a linear interolation of values from an underlying image.

```
#include <linear.hh>
```

Inheritance diagram for mln::fun::x2x::linear< I >:



Public Member Functions

- linear (const I &ima)

  Constructor with the underlying image.

- template<typename C>
  I::value operator() (const algebra::vec< 1, C > &v) const

  Return the interpolated value in the underlying image at the given 'point' v.

Public Attributes

- const I & ima

  Underlying image.

10.174.1 Detailed Description

template<typename I> struct mln::fun::x2x::linear< I >

Represent a linear interolation of values from an underlying image.

10.174.2 Constructor & Destructor Documentation

10.174.2.1 template<typename I> mln::fun::x2x::linear< I >::linear (const I & *ima*) [inline]

Constructor with the underlying image.

10.174.3 Member Function Documentation

10.174.3.1 template<typename I> template<typename C> I::value mln::fun::x2x::linear< I >::operator() (const algebra::vec< 1, C > & *v*) const [inline]

Return the interpolated value in the underlying image at the given 'point' v.

10.174.4 Member Data Documentation

10.174.4.1 template<typename I> const I& mln::fun::x2x::linear< I >::ima

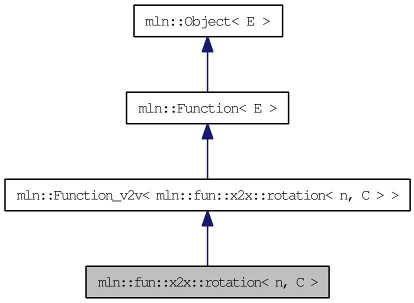
Underlying image.

10.175 mln::fun::x2x::rotation< n, C > Struct Template Reference

Represent a rotation function.

```
#include <rotation.hh>
```

Inheritance diagram for mln::fun::x2x::rotation< n, C >:



Public Types

- typedef rotation< n, C > invert

    Type of the inverse function.

Public Member Functions

- invert inv () const

    Return the invere function.

- algebra::vec< n, C > operator() (const algebra::vec< n, C > &v) const

    Perform the rotation of the given vector.

- rotation (const algebra::h_mat< n, C > &m)

    Constructor with h_mat.

- rotation (const algebra::quat &q)

    Constructor with quaternion.

- rotation (C alpha, const algebra::vec< n, C > &axis)

    Constructor with radian alpha and a facultative direction (rotation axis).

- rotation ()

    Constructor without argument.

- void set_alpha (C alpha)

    Set a new grade alpha.

- void set_axis (const algebra::vec< n, C > &axis)

    Set a new rotation axis.

10.175.1 Detailed Description

template<unsigned n, typename C> struct mln::fun::x2x::rotation< n, C >

Represent a rotation function.

10.175.2 Member Typedef Documentation

10.175.2.1 template<unsigned n, typename C> typedef rotation<n,C> mln::fun::x2x::rotation< n, C >::invert

Type of the inverse function.

10.175.3 Constructor & Destructor Documentation

10.175.3.1 template<unsigned n, typename C> mln::fun::x2x::rotation< n, C >::rotation () `[inline]`

Constructor without argument.

10.175.3.2 template<unsigned n, typename C> mln::fun::x2x::rotation< n, C >::rotation (C *alpha*, const algebra::vec< n, C > & *axis*) `[inline]`

Constructor with radian alpha and a facultative direction (rotation axis).

10.175.3.3 template<unsigned n, typename C> mln::fun::x2x::rotation< n, C >::rotation (const algebra::quat & *q*) `[inline]`

Constructor with quaternion.

References mln::make::h_mat().

10.175.3.4 template<unsigned n, typename C> mln::fun::x2x::rotation< n, C >::rotation (const algebra::h_mat< n, C > & *m*) `[inline]`

Constructor with h_mat.

10.175.4 Member Function Documentation

10.175.4.1 template<unsigned n, typename C> rotation< n, C > mln::fun::x2x::rotation< n, C >::inv () const `[inline]`

Return the invere function.

10.175.4.2 template<unsigned n, typename C> algebra::vec< n, C > mln::fun::x2x::rotation< n, C >::operator() (const algebra::vec< n, C > & *v*) const `[inline]`

Perform the rotation of the given vector.

10.175.4.3 template<unsigned n, typename C> void mln::fun::x2x::rotation< n, C >::set_alpha (C *alpha*) [inline]

Set a new grade alpha.

10.175.4.4 template<unsigned n, typename C> void mln::fun::x2x::rotation< n, C >::set_axis (const algebra::vec< n, C > & *axis*) [inline]

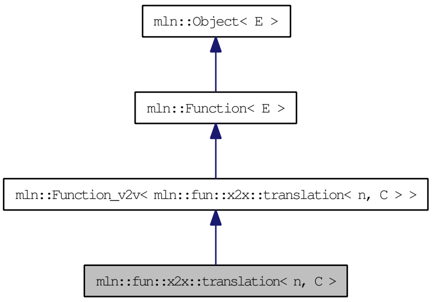
Set a new rotation axis.

10.176 mln::fun::x2x::translation< n, C > Struct Template Reference

Translation function-object.

`#include <translation.hh>`

Inheritance diagram for mln::fun::x2x::translation< n, C >:



Public Types

- typedef translation< n, C > invert

  Type of the inverse function.

Public Member Functions

- invert inv () const

  Return the inverse function.

- algebra::vec< n, C > operator() (const algebra::vec< n, C > &v) const

  Perform the translation of the given vector.

- void set_t (const algebra::vec< n, C > &t)

  Set a net translation vector.

- const algebra::vec< n, C > & t () const

  Return the translation vector.

- translation (const algebra::vec< n, C > &t)

  Constructor with the translation vector.

- translation ()

  Constructor without argument.

10.176.1 Detailed Description

template<unsigned n, typename C> struct mln::fun::x2x::translation< n, C >

Translation function-object.

10.176.2 Member Typedef Documentation

10.176.2.1 template<unsigned n, typename C> typedef translation<n,C> mln::fun::x2x::translation< n, C >::invert

Type of the inverse function.

10.176.3 Constructor & Destructor Documentation

10.176.3.1 template<unsigned n, typename C> mln::fun::x2x::translation< n, C >::translation () [inline]

Constructor without argument.

10.176.3.2 template<unsigned n, typename C> mln::fun::x2x::translation< n, C >::translation (const algebra::vec< n, C > & *t*) [inline]

Constructor with the translation vector.

10.176.4 Member Function Documentation

10.176.4.1 template<unsigned n, typename C> translation< n, C > mln::fun::x2x::translation< n, C >::inv () const [inline]

Return the inverse function.

10.176.4.2 template<unsigned n, typename C> algebra::vec< n, C > mln::fun::x2x::translation< n, C >::operator() (const algebra::vec< n, C > & *v*) const [inline]

Perform the translation of the given vector.

10.176.4.3 template<unsigned n, typename C> void mln::fun::x2x::translation< n, C >::set_t (const algebra::vec< n, C > & *t*) [inline]

Set a net translation vector.

10.176.4.4 template<unsigned n, typename C> const algebra::vec< n, C > & mln::fun::x2x::translation< n, C >::t () const [inline]

Return the translation vector.

10.177 mln::fun_image< F, I > Struct Template Reference

Image read through a function.

`#include <fun_image.hh>`

Inherits mln::internal::image_value_morpher< I, F::result, mln::fun_image< F, I > >.

Public Types

- typedef F::result lvalue

  Return type of read-write access.

- typedef F::result rvalue

  Return type of read-only access.

- typedef fun_image< tag::value_< typename F::result >, tag::image_< I > > skeleton

  Skeleton.

- typedef F::result value

  Value associated type.

Public Member Functions

- fun_image (const Image< I > &ima)

  Constructor.

- fun_image (const Function_v2v< F > &f, const Image< I > &ima)

  Constructor.

- fun_image ()

  Constructor.

- F::result operator() (const typename I::psite &p)

  Mutable access is for reading only.

- F::result operator() (const typename I::psite &p) const

  Read-only access of pixel value at point site `p`.

10.177.1 Detailed Description

template<typename F, typename I> struct mln::fun_image< F, I >

Image read through a function.

10.177.2 Member Typedef Documentation

10.177.2.1 template<typename F, typename I> typedef F ::result mln::fun_image< F, I >::lvalue

Return type of read-write access.

10.177.2.2 template<typename F, typename I> typedef F ::result mln::fun_image< F, I >::rvalue

Return type of read-only access.

10.177.2.3 template<typename F, typename I> typedef fun_image< tag::value_<typename F ::result>, tag::image_<I> > mln::fun_image< F, I >::skeleton

Skeleton.

10.177.2.4 template<typename F, typename I> typedef F ::result mln::fun_image< F, I >::value

Value associated type.

10.177.3 Constructor & Destructor Documentation

10.177.3.1 template<typename F, typename I> mln::fun_image< F, I >::fun_image () [inline]

Constructor.

10.177.3.2 template<typename F, typename I> mln::fun_image< F, I >::fun_image (const Function_v2v< F > & *f*, const Image< I > & *ima*) [inline]

Constructor.

10.177.3.3 template<typename F, typename I> mln::fun_image< F, I >::fun_image (const Image< I > & *ima*) [inline]

Constructor.

10.177.4 Member Function Documentation

10.177.4.1 template<typename F, typename I> F::result mln::fun_image< F, I >::operator() (const typename I::psite & *p*) [inline]

Mutable access is for reading only.

10.177.4.2 template<typename F, typename I> F::result mln::fun_image< F, I >::operator() (const typename I::psite & *p*) const [inline]

Read-only access of pixel value at point site `p`.

10.178 mln::Function< E > Struct Template Reference

Base class for implementation of function-objects.

`#include <function.hh>`

Inherits mln::Object< E >.

Inherited by mln::Function_v2v< function< meta::blue< mln::value::rgb::mln::value::rgb< n > > > >, mln::Function_v2v< function< meta::green< mln::value::rgb::mln::value::rgb< n > > > >, mln::Function_v2v< function< meta::hue< mln::value::hsi_::mln::value::hsi_< H, S, I > > > >, mln::Function_v2v< function< meta::hue< mln::value::hsl_::mln::value::hsl_< H, S, L > > > >, mln::Function_v2v< function< meta::inty< mln::value::hsi_::mln::value::hsi_< H, S, I > > > >, mln::Function_v2v< function< meta::lum< mln::value::hsl_::mln::value::hsl_< H, S, I > > > >, mln::Function_v2v< function< meta::red< mln::value::rgb::mln::value::rgb< n > > > >, mln::Function_v2v< function< meta::sat< mln::value::hsi_::mln::value::hsi_< H, S, I > > > >, mln::Function_v2v< function< meta::sat< mln::value::hsl_::mln::value::hsl_< H, S, L > > > >, mln::Function_v2v< E >, mln::Function_vv2b< E >, and mln::Function_vv2v< E >.

Protected Member Functions

- Function ()

  An operator() has to be provided.

10.178.1 Detailed Description

template<typename E> struct mln::Function< E >

Base class for implementation of function-objects.

The parameter *E* is the exact type.

10.178.2 Constructor & Destructor Documentation

10.178.2.1 template<typename E> mln::Function< E >::Function () `[inline, protected]`

An operator() has to be provided.

Its signature depends on the particular function-object one considers.

10.179 mln::Function< void > Struct Template Reference

Function category flag type.

`#include <function.hh>`

10.179.1 Detailed Description

template<> struct mln::Function< void >

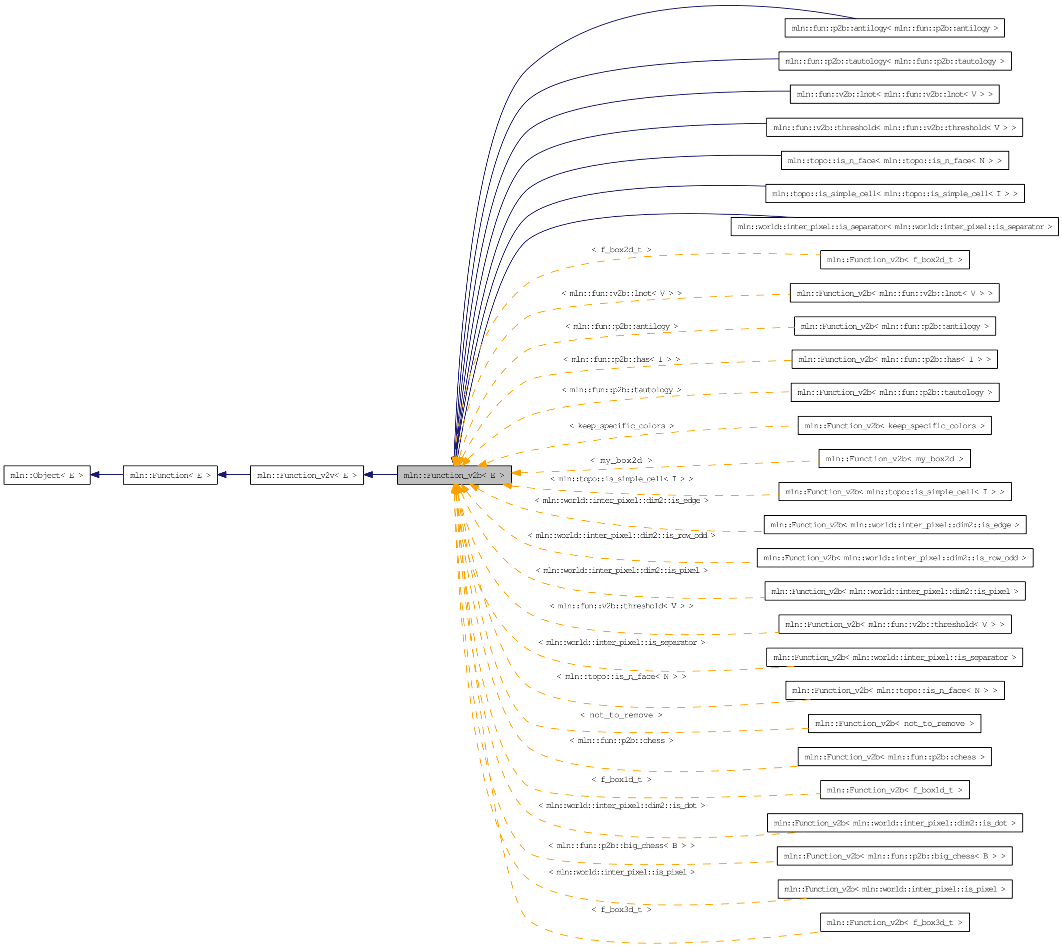
Function category flag type.

10.180 mln::Function_v2b< E > Struct Template Reference

Base class for implementation of function-objects from a value to a Boolean.

`#include <function.hh>`

Inheritance diagram for mln::Function_v2b< E >:



10.180.1 Detailed Description

template<typename E> struct mln::Function_v2b< E >

Base class for implementation of function-objects from a value to a Boolean.

The parameter *E* is the exact type.

10.181 mln::Function_v2v< E > Struct Template Reference

Base class for implementation of function-objects from value to value.

```
#include <function.hh>
```

Inherits mln::Function< E >.

Inherited by mln::edge_to_color< I, V >, mln::fun::C< R(*)(A) >, mln::fun::cast_p2v_expr_< V, F >, mln::fun::i2v::all_to< T >, mln::fun::i2v::value_at_index< T >, mln::fun::i2v::value_at_index< bool >, mln::fun::p2p::fold< P, dir_0, dir_1, dir_2 >, mln::fun::p2p::mirror< B >, mln::fun::p2p::translation_t< P >, mln::fun::p2v::iota, mln::fun::spe::impl::binary_impl< false, Fun, T1, T2 >, mln::fun::spe::impl::binary_impl< true, Fun, T1, T2 >, mln::fun::spe::impl::unary_impl< false, false, Fun, T >, mln::fun::spe::impl::unary_impl< true, false, Fun, T >, mln::fun::stat::mahalanobis< V >, mln::fun::v2i::index_of_value< T >, mln::fun::v2i::index_of_value< bool >, mln::fun::v2v::abs< V >, mln::fun::v2v::cast< V >, mln::fun::v2v::ch_function_value< F, V >, mln::fun::v2v::component< T, i >, mln::fun::v2v::convert< V >, mln::fun::v2v::dec< T >, mln::fun::v2v::enc< V >, mln::fun::v2v::f_hsi_to_rgb_< T_rgb >, mln::fun::v2v::f_hsl_to_rgb_< T_rgb >, mln::fun::v2v::f_rgb_to_hsi_< T_hsi >, mln::fun::v2v::f_rgb_to_hsl_< T_hsl >, mln::fun::v2v::id< T >, mln::fun::v2v::inc< T >, mln::fun::v2v::l1_norm< V, R >, mln::fun::v2v::l2_norm< V, R >, mln::fun::v2v::linear< V, T, R >, mln::fun::v2v::linear_sat< V, T, R >, mln::fun::v2v::linfty_norm< V, R >, mln::fun::v2v::projection< P, dir >, mln::fun::v2v::saturate< V >, mln::fun::v2v::wrap< L >, mln::fun::v2w2v::cos< V >, mln::fun::v2w_w2v::l1_norm< V, R >, mln::fun::v2w_w2v::l2_norm< V, R >, mln::fun::v2w_w2v::linfty_norm< V, R >, mln::fun::x2v::bilinear< I >, mln::fun::x2v::l1_norm< V >, mln::fun::x2v::trilinear< I >, mln::fun::x2x::internal::helper_composed_< T2, T1, E, false >, mln::fun::x2x::internal::helper_composed_< T2, T1, E, true >, mln::fun::x2x::linear< I >, mln::fun::x2x::nneighbor< I >, mln::fun::x2x::rotation< n, C >, mln::fun::x2x::translation< n, C >, mln::function< meta::blue< value::rgb< n > > >, mln::function< meta::green< value::rgb< n > > >, mln::function< meta::hue< value::hsi_< H, S, I > > >, mln::function< meta::hue< value::hsl_< H, S, L > > >, mln::function< meta::inty< value::hsi_< H, S, I > > >, mln::function< meta::lum< value::hsl_< H, S, I > > >, mln::function< meta::red< value::rgb< n > > >, mln::function< meta::sat< value::hsi_< H, S, I > > >, mln::function< meta::sat< value::hsl_< H, S, L > > >, mln::Function_v2b< E > [virtual], mln::histo::point_from_value< T >, mln::math::round< R >, mln::math::round_sat_< R >, mln::my_ext, mln::pw::var_< V >, mln::ref_data, mln::saturate_rgb8, mln::to8bits, mln::tofloat01, mln::util::internal::id2element< G, Elt >, my::sqrt, test< T >, to8bits, to8bits, to8bits, to8bits, to8bits, and viota_t< S >.

10.181.1 Detailed Description

template<typename E> struct mln::Function_v2v< E >

Base class for implementation of function-objects from value to value.

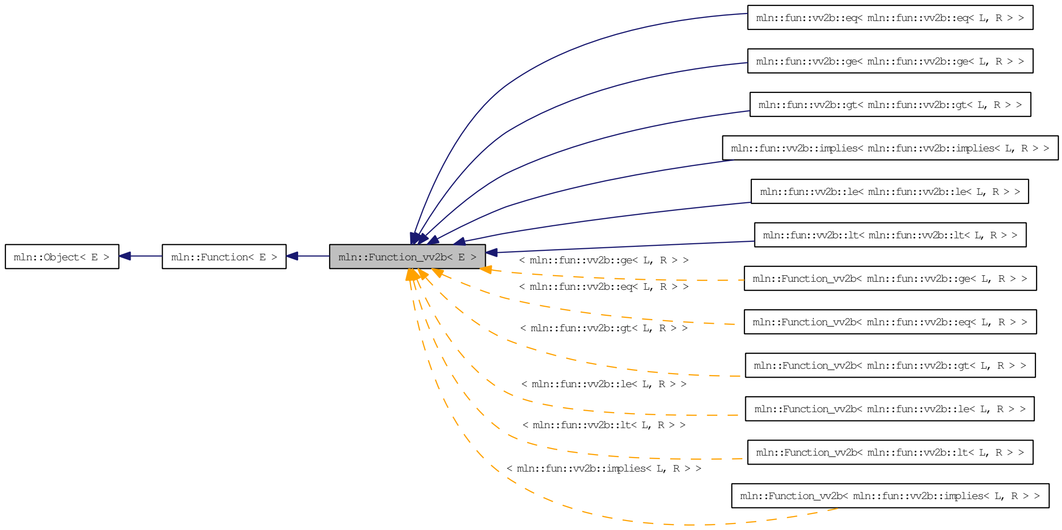
The parameter *E* is the exact type.

10.182 mln::Function_vv2b< E > Struct Template Reference

Base class for implementation of function-objects from a couple of values to a Boolean.

`#include <function.hh>`

Inheritance diagram for mln::Function_vv2b< E >:



10.182.1 Detailed Description

template<typename E> struct mln::Function_vv2b< E >

Base class for implementation of function-objects from a couple of values to a Boolean.

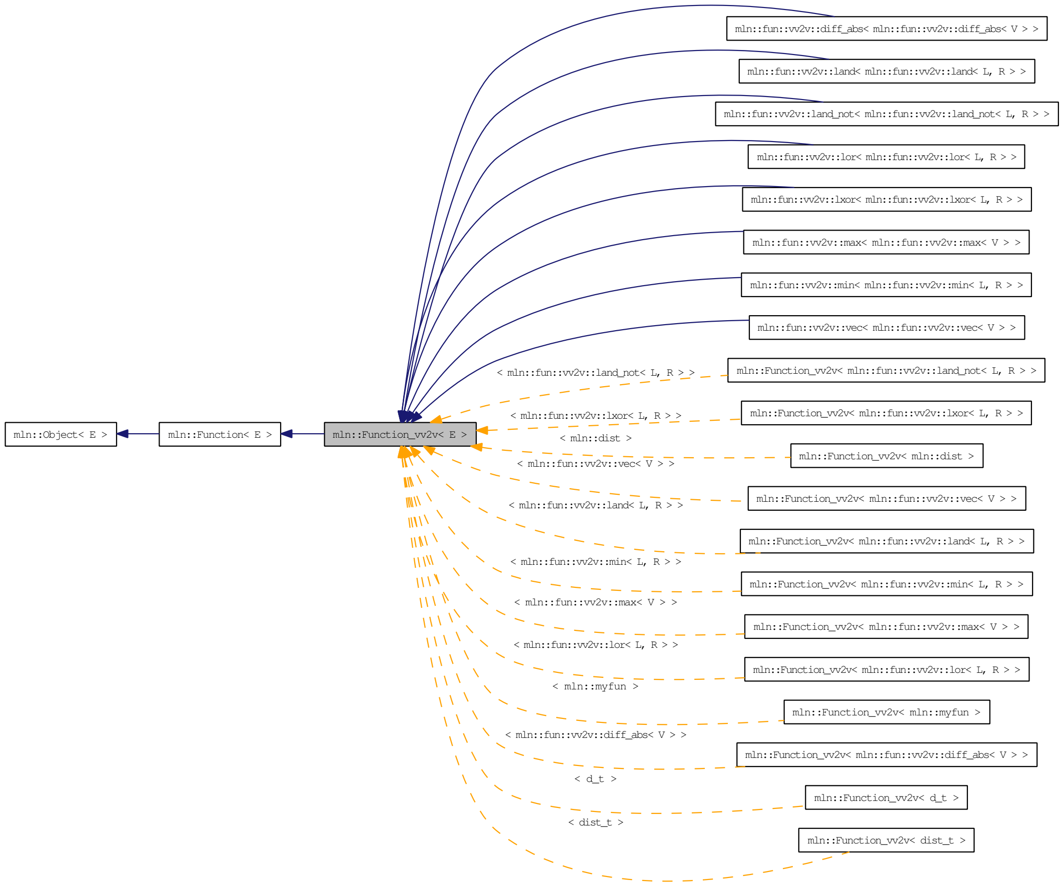
The parameter *E* is the exact type.

10.183 mln::Function_vv2v< E > Struct Template Reference

Base class for implementation of function-objects from a couple of values to a value.

`#include <function.hh>`

Inheritance diagram for mln::Function_vv2v< E >:



10.183.1 Detailed Description

template<typename E> struct mln::Function_vv2v< E >

Base class for implementation of function-objects from a couple of values to a value.

The parameter *E* is the exact type.

10.184 mln::fwd_pixter1d< I > Class Template Reference

Forward pixel iterator on a 1-D image with border.

`#include <pixter1d.hh>`

Inherits mln::internal::forward_pixel_iterator_base_< I, mln::fwd_pixter1d< I > >.

Public Types

- typedef I image

    Image type.

Public Member Functions

- fwd_pixter1d (I &image)

    Constructor.

- void next ()

    Go to the next element.

10.184.1 Detailed Description

template<typename I> class mln::fwd_pixter1d< I >

Forward pixel iterator on a 1-D image with border.

10.184.2 Member Typedef Documentation

10.184.2.1 template<typename I> typedef I mln::fwd_pixter1d< I >::image

Image type.

10.184.3 Constructor & Destructor Documentation

10.184.3.1 template<typename I> mln::fwd_pixter1d< I >::fwd_pixter1d (I & *image*) `[inline]`

Constructor.

Parameters:

← ***image*** The image this pixel iterator is bound to.

10.184.4 Member Function Documentation

10.184.4.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.185 mln::fwd_pixter2d< I > Class Template Reference

Forward pixel iterator on a 2-D image with border.

`#include <pixter2d.hh>`

Inherits mln::internal::forward_pixel_iterator_base_< I, mln::fwd_pixter2d< I > >.

Public Types

- typedef I image

  Image type.

Public Member Functions

- fwd_pixter2d (I &image)

  Constructor.

- void next ()

  Go to the next element.

10.185.1 Detailed Description

template<typename I> class mln::fwd_pixter2d< I >

Forward pixel iterator on a 2-D image with border.

10.185.2 Member Typedef Documentation

10.185.2.1 template<typename I> typedef I mln::fwd_pixter2d< I >::image

Image type.

10.185.3 Constructor & Destructor Documentation

10.185.3.1 template<typename I> mln::fwd_pixter2d< I >::fwd_pixter2d (I & *image*) `[inline]`

Constructor.

Parameters:

← ***image*** The image this pixel iterator is bound to.

10.185.4 Member Function Documentation

10.185.4.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.186 mln::fwd_pixter3d< I > Class Template Reference

Forward pixel iterator on a 3-D image with border.

`#include <pixter3d.hh>`

Inherits mln::internal::forward_pixel_iterator_base_< I, mln::fwd_pixter3d< I > >.

Public Types

- typedef I image

  Image type.

Public Member Functions

- fwd_pixter3d (I &image)

  Constructor.

- void next ()

  Go to the next element.

10.186.1 Detailed Description

template<typename I> class mln::fwd_pixter3d< I >

Forward pixel iterator on a 3-D image with border.

10.186.2 Member Typedef Documentation

10.186.2.1 template<typename I> typedef I mln::fwd_pixter3d< I >::image

Image type.

10.186.3 Constructor & Destructor Documentation

10.186.3.1 template<typename I> mln::fwd_pixter3d< I >::fwd_pixter3d (I & *image*) `[inline]`

Constructor.

Parameters:

← ***image*** The image this pixel iterator is bound to.

10.186.4 Member Function Documentation

10.186.4.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

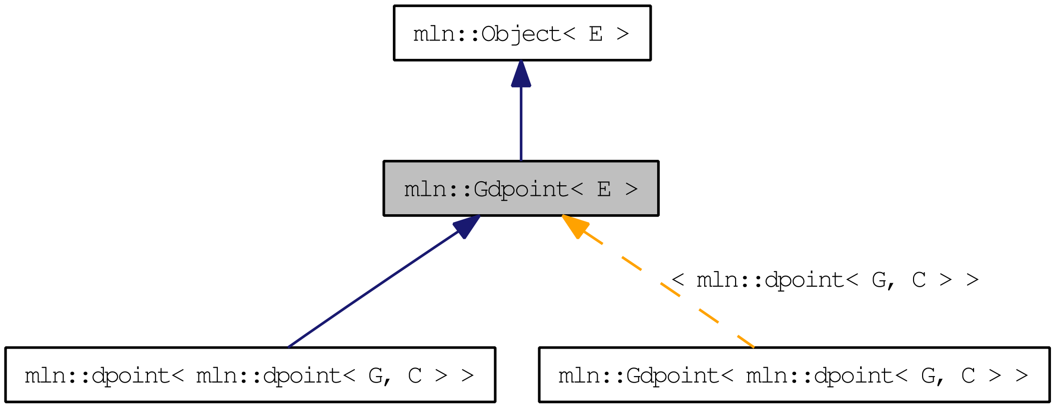
The iterator is valid.

10.187 mln::Gdpoint< E > Struct Template Reference

FIXME: Doc!

`#include <gdpoint.hh>`

Inheritance diagram for mln::Gdpoint< E >:



10.187.1 Detailed Description

template<typename E> struct mln::Gdpoint< E >

FIXME: Doc!

10.188 mln::Gdpoint< void > Struct Template Reference

Delta point site category flag type.

`#include <gdpoint.hh>`

10.188.1 Detailed Description

template<> struct mln::Gdpoint< void >

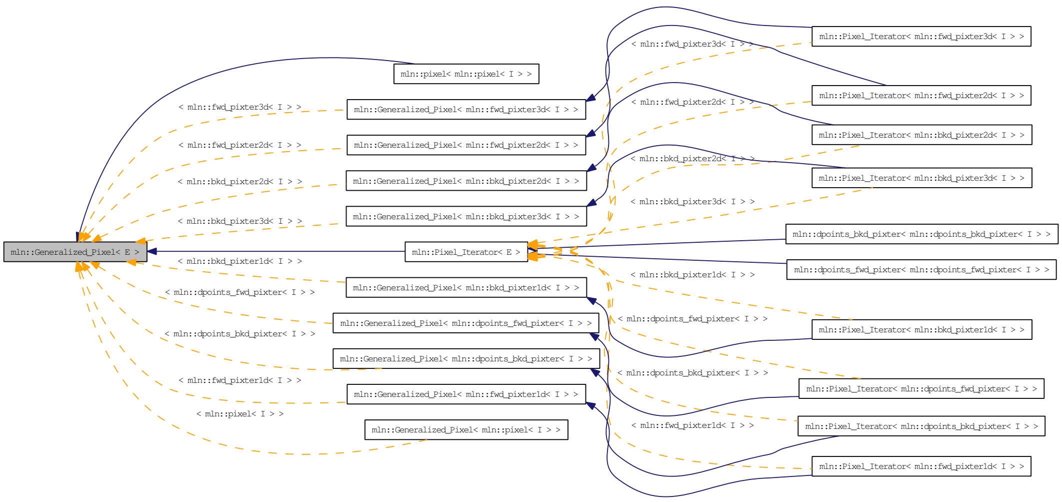
Delta point site category flag type.

10.189 mln::Generalized_Pixel< E > Struct Template Reference

Base class for implementation classes that are pixels or that have the behavior of pixels.

`#include <generalized_pixel.hh>`

Inheritance diagram for mln::Generalized_Pixel< E >:



10.189.1 Detailed Description

template<typename E> struct mln::Generalized_Pixel< E >

Base class for implementation classes that are pixels or that have the behavior of pixels.

Warning:

This class does *not* derive from mln::Object; it is for use as a parallel hierarchy.

See also:

mln::doc::Generalized_Pixel for a complete documentation of this class contents.

10.190 mln::geom::complex_geometry< D, P > Class Template Reference

A functor returning the sites of the faces of a complex where the locations of each 0-face is stored.

`#include <complex_geometry.hh>`

Public Member Functions

- unsigned add_location (const P &p)

  Populate the set of locations.

- complex_geometry ()

  Build a complex geometry object.

- site operator() (const mln::topo::face< D > &f) const

  Retrieve the site associated to f.

10.190.1 Detailed Description

template<unsigned D, typename P> class mln::geom::complex_geometry< D, P >

A functor returning the sites of the faces of a complex where the locations of each 0-face is stored.

Faces of higher dimensions are computed.

Template Parameters:

D The dimension of the complex.

P The type of the location of a 0-face.

Locations of 0-face are usually points (hence the `P` above), but can possibly be any (default-constructible) values.

The functor returns a std::vector of locations: 0-faces are singletons, 1-faces are (usually) pairs, faces of higher dimensions are arrays of locations.

Note that for consistency reasons w.r.t. the return type of operator(), returned sites are always *arrays* of locations attached to 0-faces; hence the returned singletons (of locations) for 0-faces.

10.190.2 Constructor & Destructor Documentation

10.190.2.1 template<unsigned D, typename P> mln::geom::complex_geometry< D, P >::complex_geometry () `[inline]`

Build a complex geometry object.

10.190.3 Member Function Documentation

10.190.3.1 template<unsigned D, typename P> unsigned mln::geom::complex_geometry< D, P >::add_location (const P & *p*) [inline]

Populate the set of locations.

Append a new location *p*. Return the index of the newly created location (which should semantically match the id of the corresonding 0-face in the complex).

10.190.3.2 template<unsigned D, typename P> util::multi_site< P > mln::geom::complex_-geometry< D, P >::operator() (const mln::topo::face< D > & *f*) const [inline]

Retrieve the site associated to *f*.

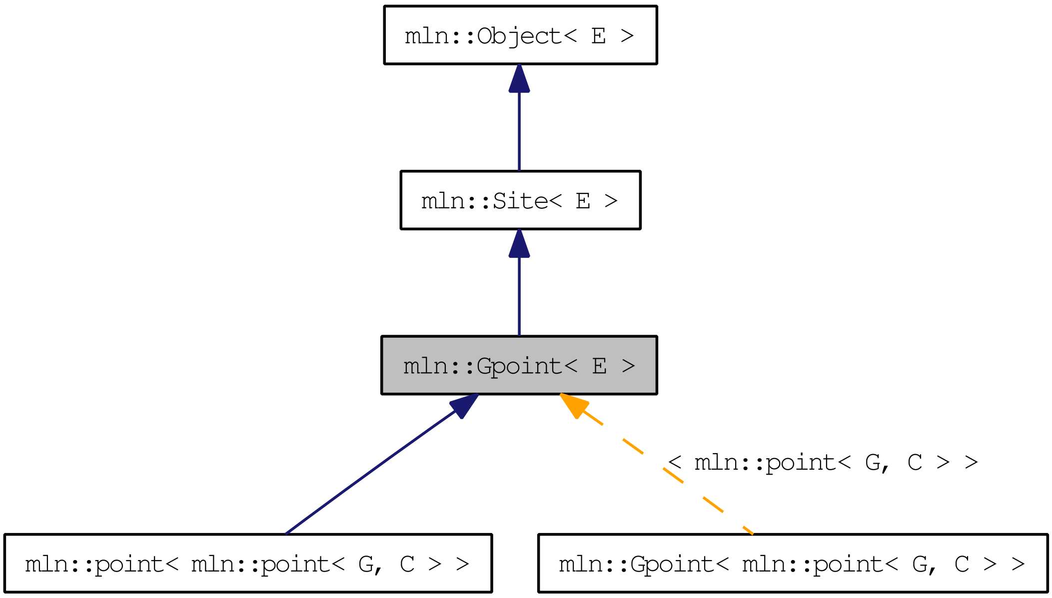
References mln::topo::face< D >::face_id(), and mln::topo::face< D >::n().

10.191 mln::Gpoint< E > Struct Template Reference

Base class for implementation of point classes.

`#include <gpoint.hh>`

Inheritance diagram for mln::Gpoint< E >:



Related Functions

(Note that these are not member functions.)

- template<typename P, typename D>
  P operator+ (const Gpoint< P > &p, const Gdpoint< D > &dp)
  Add a delta-point `rhs` *to a grid point* `lhs`.
- template<typename P, typename D>
  P & operator+= (Gpoint< P > &p, const Gdpoint< D > &dp)
  Shift a point `by` *a delta-point* `dp`.
- template<typename L, typename R>
  L::delta operator- (const Gpoint< L > &lhs, const Gpoint< R > &rhs)
  Difference between a couple of grid point `lhs` *and* `rhs`.
- template<typename P, typename D>
  P & operator-= (Gpoint< P > &p, const Gdpoint< D > &dp)
  Shift a point `by` *the negate of a delta-point* `dp`.
- template<typename P, typename D>
  P operator/ (const Gpoint< P > &p, const value::scalar_< D > &dp)
  Divise a point `by` *a scalar* `s`.

- template<typename P>
  std::ostream & operator<< (std::ostream &ostr, const Gpoint< P > &p)

  Print a grid point `p` *into the output stream* `ostr`.

- template<typename L, typename R>
  bool operator== (const Gpoint< L > &lhs, const Gpoint< R > &rhs)

  Equality comparison between a couple of grid point `lhs` *and* `rhs`.

10.191.1 Detailed Description

template<typename E> struct mln::Gpoint< E >

Base class for implementation of point classes.

A point is an element of a space.

For instance, mln::point2d is the type of elements defined on the discrete square grid of the 2D plane.

10.191.2 Friends And Related Function Documentation

10.191.2.1 template<typename P, typename D> P operator+ (const Gpoint< P > & *p*, const Gdpoint< D > & *dp*) `[related]`

Add a delta-point `rhs` to a grid point `lhs`.

Parameters:

← ***p*** A grid point.

← ***dp*** A delta-point.

The type of `dp` has to compatible with the type of `p`.

Returns:

A point (temporary object).

See also:

mln::Gdpoint

10.191.2.2 template<typename P, typename D> P & operator+= (Gpoint< P > & *p*, const Gdpoint< D > & *dp*) `[related]`

Shift a point `by` a delta-point `dp`.

Parameters:

↔ ***p*** The targeted point.

← ***dp*** A delta-point.

Returns:

A reference to the point `p` once translated by `dp`.

Precondition:

The type of `dp` has to be compatible with the type of `p`.

10.191.2.3 template<typename L, typename R> L::delta operator- (const Gpoint< L > & *lhs*, const Gpoint< R > & *rhs*) [related]

Difference between a couple of grid point `lhs` and `rhs`.

Parameters:

← ***lhs*** A first grid point.

← ***rhs*** A second grid point.

Warning:

There is no type promotion in Milena so the client has to make sure that both points are defined with the same type of coordinates.

Precondition:

Both `lhs` and `rhs` have to be defined on the same topology and with the same type of coordinates; otherwise this test does not compile.

Postcondition:

The result, `dp`, is such as `lhs` == `rhs` + `dp`.

Returns:

A delta point (temporary object).

See also:

mln::Gdpoint

10.191.2.4 template<typename P, typename D> P & operator-= (Gpoint< P > & *p*, const Gdpoint< D > & *dp*) [related]

Shift a point `by` the negate of a delta-point `dp`.

Parameters:

↔ ***p*** The targeted point.

← ***dp*** A delta-point.

Returns:

A reference to the point `p` once translated by - `dp`.

Precondition:

The type of `dp` has to be compatible with the type of `p`.

10.191.2.5 template<typename P, typename D> P operator/ (const Gpoint< P > & *p*, const value::scalar_< D > & *dp*) [related]

Divise a point by a scalar s.

Parameters:

↔ ***p*** The targeted point.

← ***dp*** A scalar.

Returns:

A reference to the point p once divised by s.

10.191.2.6 template<typename P> std::ostream & operator<< (std::ostream & *ostr*, const Gpoint< P > & *p*) [related]

Print a grid point p into the output stream ostr.

Parameters:

↔ ***ostr*** An output stream.

← ***p*** A grid point.

Returns:

The modified output stream ostr.

References mln::debug::format().

10.191.2.7 template<typename L, typename R> bool operator== (const Gpoint< L > & *lhs*, const Gpoint< R > & *rhs*) [related]

Equality comparison between a couple of grid point lhs and rhs.

Parameters:

← ***lhs*** A first grid point.

← ***rhs*** A second grid point.

Precondition:

Both lhs and rhs have to be defined on the same topology; otherwise this test does not compile.

Returns:

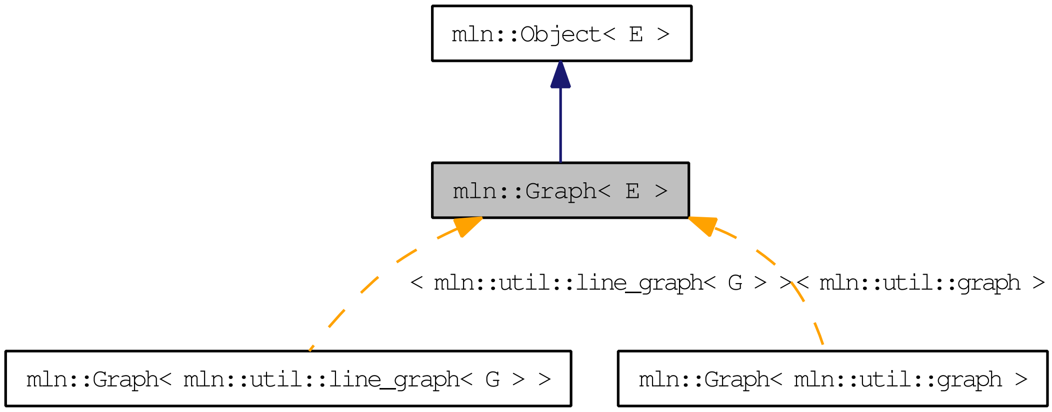
True if both grid points have the same coordinates, otherwise false.

10.192 mln::Graph< E > Struct Template Reference

Base class for implementation of graph classes.

`#include <graph.hh>`

Inheritance diagram for mln::Graph< E >:



10.192.1 Detailed Description

template<typename E> struct mln::Graph< E >

Base class for implementation of graph classes.

See also:

mln::doc::Graph for a complete documentation of this class contents.

10.193 mln::graph::attribute::card_t Struct Reference

Compute the cardinality of every component in a graph.

`#include <card.hh>`

Public Types

- typedef util::array< unsigned > result

  Type of the computed value.

10.193.1 Detailed Description

Compute the cardinality of every component in a graph.

Returns:

An array with the cardinality for each component. Components are labeled from 0.

10.193.2 Member Typedef Documentation

10.193.2.1 typedef util::array<unsigned> mln::graph::attribute::card_t::result

Type of the computed value.

10.194 mln::graph::attribute::representative_t Struct Reference

Compute the representative vertex of every component in a graph.

`#include <representative.hh>`

Public Types

- typedef util::array< unsigned > result

  Type of the computed value.

10.194.1 Detailed Description

Compute the representative vertex of every component in a graph.

Returns:

An array with the representative for each component. Components are labeled from 0.

10.194.2 Member Typedef Documentation

10.194.2.1 typedef util::array<unsigned> mln::graph::attribute::representative_t::result

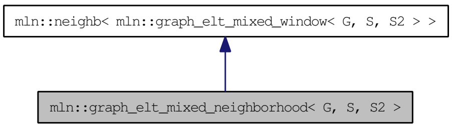
Type of the computed value.

10.195 mln::graph_elt_mixed_neighborhood< G, S, S2 > Struct Template Reference

Elementary neighborhood on graph class.

#include <graph_elt_mixed_neighborhood.hh>

Inheritance diagram for mln::graph_elt_mixed_neighborhood< G, S, S2 >:



Public Types

- typedef neighb_bkd_niter< W > bkd_niter

  Backward site iterator associated type.

- typedef neighb_fwd_niter< W > fwd_niter

  Forward site iterator associated type.

- typedef fwd_niter niter

  Site iterator associated type.

10.195.1 Detailed Description

template<typename G, typename S, typename S2> struct mln::graph_elt_mixed_neighborhood< G, S, S2 >

Elementary neighborhood on graph class.

Template Parameters:

G is a graph type.
S is a site set type.
S2 is the site set type of the neighbors.

10.195.2 Member Typedef Documentation

10.195.2.1 template<typename W> typedef neighb_bkd_niter<W> mln::neighb< W >::bkd_niter [inherited]

Backward site iterator associated type.

10.195.2.2 template<typename W> typedef neighb_fwd_niter<W> mln::neighb< W >::fwd_niter [inherited]

Forward site iterator associated type.

10.195.2.3 template<typename W> typedef fwd_niter mln::neighb< W >::niter [inherited]

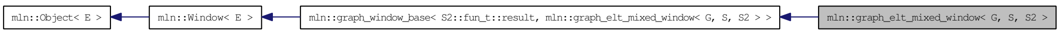
Site iterator associated type.

10.196 mln::graph_elt_mixed_window< G, S, S2 > Class Template Reference

Elementary window on graph class.

`#include <graph_elt_mixed_window.hh>`

Inheritance diagram for mln::graph_elt_mixed_window< G, S, S2 >:



Public Types

- typedef graph_window_piter< target, self_, nbh_bkd_iter_ > bkd_qiter
  Site_Iterator type to browse the psites of the window w.r.t.
- typedef S::psite center_t
  Type of the window center element.
- typedef graph_window_piter< target, self_, nbh_fwd_iter_ > fwd_qiter
  Site_Iterator type to browse the psites of the window w.r.t.
- typedef target::graph_element graph_element
  Type of the graph element pointed by this iterator.
- typedef target::psite psite
  The type of psite corresponding to the window.
- typedef fwd_qiter qiter
  The default qiter type.
- typedef super_::target target
  Associated types.
- typedef P site
  Associated types.

Public Member Functions

- bool is_valid () const
  Return true by default.
- unsigned delta () const
  Return the maximum coordinate gap between the window center and a window point.
- bool is_centered () const
  Is the window centered?
- bool is_empty () const

Interface of the concept Window.

- bool is_symmetric () const

  Is the window symmetric?

- self_ & sym ()

  Apply a central symmetry to the target window.

10.196.1 Detailed Description

template<typename G, typename S, typename S2> class mln::graph_elt_mixed_window< G, S, S2 >

Elementary window on graph class.

`G` is the graph type. `S` is an image site set from where the center is extracted. `S2` is an image site set from where the neighbors are extracted.

10.196.2 Member Typedef Documentation

10.196.2.1 template<typename G, typename S, typename S2> typedef graph_window_-piter<target,self_,nbh_bkd_iter_> mln::graph_elt_mixed_window< G, S, S2 >::bkd_qiter

Site_Iterator type to browse the psites of the window w.r.t.

the reverse ordering of vertices.

10.196.2.2 template<typename G, typename S, typename S2> typedef S ::psite mln::graph_elt_mixed_window< G, S, S2 >::center_t

Type of the window center element.

10.196.2.3 template<typename G, typename S, typename S2> typedef graph_window_-piter<target,self_,nbh_fwd_iter_> mln::graph_elt_mixed_window< G, S, S2 >::fwd_qiter

Site_Iterator type to browse the psites of the window w.r.t.

the ordering of vertices.

10.196.2.4 template<typename G, typename S, typename S2> typedef target ::graph_element mln::graph_elt_mixed_window< G, S, S2 >::graph_element

Type of the graph element pointed by this iterator.

10.196.2.5 template<typename G, typename S, typename S2> typedef target ::psite mln::graph_elt_mixed_window< G, S, S2 >::psite

The type of psite corresponding to the window.

10.196.2.6 template<typename G, typename S, typename S2> typedef fwd_qiter mln::graph_elt_mixed_window< G, S, S2 >::qiter

The default qiter type.

10.196.2.7 template<typename P, typename E> typedef P mln::graph_window_base< P, E >::site [inherited]

Associated types.

The type of site corresponding to the window.

10.196.2.8 template<typename G, typename S, typename S2> typedef super_::target mln::graph_elt_mixed_window< G, S, S2 >::target

Associated types.

10.196.3 Member Function Documentation

10.196.3.1 template<typename P, typename E> unsigned mln::graph_window_base< P, E >::delta () const [inline, inherited]

Return the maximum coordinate gap between the window center and a window point.

10.196.3.2 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_centered () const [inline, inherited]

Is the window centered?

10.196.3.3 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_empty () const [inline, inherited]

Interface of the concept Window.

Is the window is empty?

10.196.3.4 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_symmetric () const [inline, inherited]

Is the window symmetric?

10.196.3.5 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_valid () const [inline, inherited]

Return true by default.

Reimplemented in mln::graph_elt_window_if< G, S, I >.

10.196.3.6 template<typename P, typename E> graph_window_base< P, E > & mln::graph_window_base< P, E >::sym () [inline, inherited]

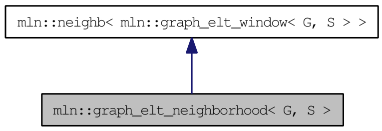
Apply a central symmetry to the target window.

10.197 mln::graph_elt_neighborhood< G, S > Struct Template Reference

Elementary neighborhood on graph class.

`#include <graph_elt_neighborhood.hh>`

Inheritance diagram for mln::graph_elt_neighborhood< G, S >:



Public Types

- typedef neighb_bkd_niter< W > bkd_niter

  Backward site iterator associated type.

- typedef neighb_fwd_niter< W > fwd_niter

  Forward site iterator associated type.

- typedef fwd_niter niter

  Site iterator associated type.

10.197.1 Detailed Description

template<typename G, typename S> struct mln::graph_elt_neighborhood< G, S >

Elementary neighborhood on graph class.

Template Parameters:

G is a graph type.

S is a site set type.

10.197.2 Member Typedef Documentation

10.197.2.1 template<typename W> typedef neighb_bkd_niter<W> mln::neighb< W >::bkd_niter [inherited]

Backward site iterator associated type.

10.197.2.2 template<typename W> typedef neighb_fwd_niter<W> mln::neighb< W >::fwd_niter [inherited]

Forward site iterator associated type.

10.197.2.3 template<typename W> typedef fwd_niter mln::neighb< W >::niter [inherited]

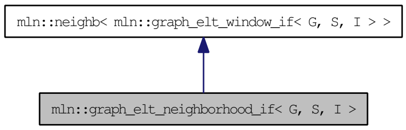
Site iterator associated type.

10.198 mln::graph_elt_neighborhood_if< G, S, I > Struct Template Reference

Elementary neighborhood_if on graph class.

`#include <graph_elt_neighborhood_if.hh>`

Inheritance diagram for mln::graph_elt_neighborhood_if< G, S, I >:



Public Types

- typedef neighb_bkd_niter< W > bkd_niter

  Backward site iterator associated type.

- typedef neighb_fwd_niter< W > fwd_niter

  Forward site iterator associated type.

- typedef fwd_niter niter

  Site iterator associated type.

Public Member Functions

- graph_elt_neighborhood_if (const Image< I > &mask)
- graph_elt_neighborhood_if ()

  Constructors @{ Construct an invalid neighborhood.

- const I & mask () const

  @}

10.198.1 Detailed Description

template<typename G, typename S, typename I> struct mln::graph_elt_neighborhood_if< G, S, I >

Elementary neighborhood_if on graph class.

10.198.2 Member Typedef Documentation

10.198.2.1 template<typename W> typedef neighb_bkd_niter<W> mln::neighb< W >::bkd_niter [inherited]

Backward site iterator associated type.

10.198.2.2 template<typename W> typedef neighb_fwd_niter<W> mln::neighb< W >::fwd_niter [inherited]

Forward site iterator associated type.

10.198.2.3 template<typename W> typedef fwd_niter mln::neighb< W >::niter [inherited]

Site iterator associated type.

10.198.3 Constructor & Destructor Documentation

10.198.3.1 template<typename G, typename S, typename I> mln::graph_elt_neighborhood_if< G, S, I >::graph_elt_neighborhood_if () [inline]

Constructors @{ Construct an invalid neighborhood.

10.198.3.2 template<typename G, typename S, typename I> mln::graph_elt_neighborhood_if< G, S, I >::graph_elt_neighborhood_if (const Image< I > & *mask*) [inline]

Parameters:

← ***mask*** A graph image of Boolean.

10.198.4 Member Function Documentation

10.198.4.1 template<typename G, typename S, typename I> const I & mln::graph_elt_neighborhood_if< G, S, I >::mask () const [inline]

@}

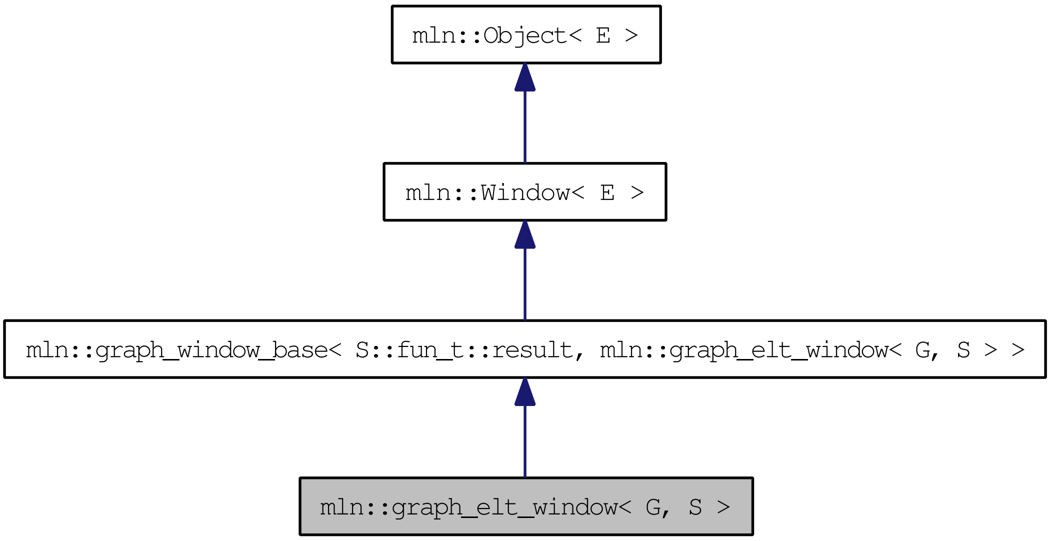
Return the graph image used as mask.

10.199 mln::graph_elt_window< G, S > Class Template Reference

Elementary window on graph class.

`#include <graph_elt_window.hh>`

Inheritance diagram for mln::graph_elt_window< G, S >:



Public Types

- typedef graph_window_piter< S, self_, nbh_bkd_iter_ > bkd_qiter
  Site_Iterator type to browse the psites of the window w.r.t.
- typedef S::psite center_t
  Type of the window center element.
- typedef graph_window_piter< S, self_, nbh_fwd_iter_ > fwd_qiter
  Site_Iterator type to browse the psites of the window w.r.t.
- typedef S::graph_element graph_element
  Type of the graph element pointed by this iterator.
- typedef S::psite psite
  The type of psite corresponding to the window.
- typedef fwd_qiter qiter
  The default qiter type.
- typedef S target
  Associated types.
- typedef P site
  Associated types.

Public Member Functions

- bool is_valid () const
  Return true by default.

- unsigned delta () const
  Return the maximum coordinate gap between the window center and a window point.
- bool is_centered () const
  Is the window centered?
- bool is_empty () const
  Interface of the concept Window.
- bool is_symmetric () const
  Is the window symmetric?
- self_ & sym ()
  Apply a central symmetry to the target window.

10.199.1 Detailed Description

template<typename G, typename S> class mln::graph_elt_window< G, S >

Elementary window on graph class.

`G` is the graph type. `S` is an image site set from where the center is extracted. `S2` is an image site set from where the neighbors are extracted.

10.199.2 Member Typedef Documentation

10.199.2.1 template<typename G, typename S> typedef graph_window_-piter<S,self_,nbh_bkd_iter_> mln::graph_elt_window< G, S >::bkd_qiter

Site_Iterator type to browse the psites of the window w.r.t.

the reverse ordering of vertices.

10.199.2.2 template<typename G, typename S> typedef S ::psite mln::graph_elt_window< G, S >::center_t

Type of the window center element.

10.199.2.3 template<typename G, typename S> typedef graph_window_-piter<S,self_,nbh_fwd_iter_> mln::graph_elt_window< G, S >::fwd_qiter

Site_Iterator type to browse the psites of the window w.r.t.

the ordering of vertices.

10.199.2.4 template<typename G, typename S> typedef S ::graph_element mln::graph_elt_window< G, S >::graph_element

Type of the graph element pointed by this iterator.

10.199.2.5 template<typename G, typename S> typedef S ::psite mln::graph_elt_window< G, S >::psite

The type of psite corresponding to the window.

10.199.2.6 template<typename G, typename S> typedef fwd_qiter mln::graph_elt_window< G, S >::qiter

The default qiter type.

10.199.2.7 template<typename P, typename E> typedef P mln::graph_window_base< P, E >::site [inherited]

Associated types.

The type of site corresponding to the window.

10.199.2.8 template<typename G, typename S> typedef S mln::graph_elt_window< G, S >::target

Associated types.

10.199.3 Member Function Documentation

10.199.3.1 template<typename P, typename E> unsigned mln::graph_window_base< P, E >::delta () const [inline, inherited]

Return the maximum coordinate gap between the window center and a window point.

10.199.3.2 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_centered () const [inline, inherited]

Is the window centered?

10.199.3.3 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_empty () const [inline, inherited]

Interface of the concept Window.

Is the window is empty?

10.199.3.4 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_symmetric () const [inline, inherited]

Is the window symmetric?

10.199.3.5 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_valid () const [inline, inherited]

Return true by default.

Reimplemented in mln::graph_elt_window_if< G, S, I >.

10.199.3.6 template<typename P, typename E> graph_window_base< P, E > & mln::graph_window_base< P, E >::sym () [inline, inherited]

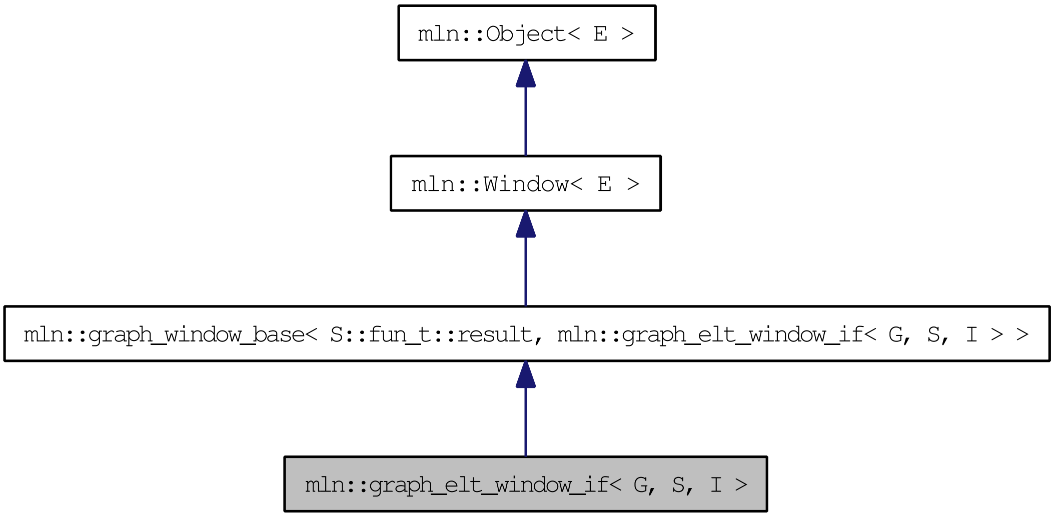
Apply a central symmetry to the target window.

10.200 mln::graph_elt_window_if< G, S, I > Class Template Reference

Custom window on graph class.

```
#include <graph_elt_window_if.hh>
```

Inheritance diagram for mln::graph_elt_window_if< G, S, I >:



Public Types

- typedef I mask_t

    The type of the image used as mask.

- typedef graph_window_if_piter< target, self_, nbh_bkd_iter_ > bkd_qiter

    Site_Iterator type to browse the psites of the window w.r.t.

- typedef graph_window_if_piter< target, self_, nbh_fwd_iter_ > fwd_qiter

    Site_Iterator type to browse the psites of the window w.r.t.

- typedef target::psite psite

    The type of psite corresponding to the window.

- typedef fwd_qiter qiter

    The default qiter type.

- typedef S target

    @}

- typedef P site

    Associated types.

Public Member Functions

- void change_mask (const Image< I > &mask)

  Change mask image.

- graph_elt_window_if (const Image< I > &mask)
- graph_elt_window_if ()

  Constructor.

- bool is_valid () const

  Return true by default.

- const I & mask () const

  Return the graph image used as mask.

  - unsigned delta () const

    Return the maximum coordinate gap between the window center and a window point.

  - bool is_centered () const

    Is the window centered?

  - bool is_empty () const

    Interface of the concept Window.

  - bool is_symmetric () const

    Is the window symmetric?

  - self_ & sym ()

    Apply a central symmetry to the target window.

10.200.1 Detailed Description

template<typename G, typename S, typename I> class mln::graph_elt_window_if< G, S, I >

Custom window on graph class.

It is defined thanks to a mask.

`G` is the graph type. `S` is the image site set. `I` is the graph image the type used as mask.

10.200.2 Member Typedef Documentation

10.200.2.1 template<typename G, typename S, typename I> typedef graph_window_-if_piter<target,self_,nbh_bkd_iter_> mln::graph_elt_window_if< G, S, I >::bkd_qiter

Site_Iterator type to browse the psites of the window w.r.t.

the reverse ordering of vertices.

10.200.2.2 template<typename G, typename S, typename I> typedef graph_window_-if_piter<target,self_,nbh_fwd_iter_> mln::graph_elt_window_if< G, S, I >::fwd_qiter

Site_Iterator type to browse the psites of the window w.r.t.

the ordering of vertices.

10.200.2.3 template<typename G, typename S, typename I> typedef I mln::graph_elt_window_if< G, S, I >::mask_t

The type of the image used as mask.

10.200.2.4 template<typename G, typename S, typename I> typedef target ::psite mln::graph_elt_window_if< G, S, I >::psite

The type of psite corresponding to the window.

10.200.2.5 template<typename G, typename S, typename I> typedef fwd_qiter mln::graph_elt_window_if< G, S, I >::qiter

The default qiter type.

10.200.2.6 template<typename P, typename E> typedef P mln::graph_window_base< P, E >::site [inherited]

Associated types.

The type of site corresponding to the window.

10.200.2.7 template<typename G, typename S, typename I> typedef S mln::graph_elt_window_if< G, S, I >::target

@}

Associated types. The image domain on which this window iterates on.

10.200.3 Constructor & Destructor Documentation

10.200.3.1 template<typename G, typename S, typename I> mln::graph_elt_window_if< G, S, I >::graph_elt_window_if () [inline]

Constructor.

@{ Default. Construct an invalid window.

10.200.3.2 template<typename G, typename S, typename I> mln::graph_elt_window_if< G, S, I >::graph_elt_window_if (const Image< I > & *mask*) [inline]

Parameters:

← ***mask*** A graph image of bool.

See also:

vertex_image, edge_image.

10.200.4 Member Function Documentation

10.200.4.1 template<typename G, typename S, typename I> void mln::graph_elt_window_if< G, S, I >::change_mask (const Image< I > & *mask*) [inline]

Change mask image.

References mln::graph_elt_window_if< G, S, I >::is_valid().

10.200.4.2 template<typename P, typename E> unsigned mln::graph_window_base< P, E >::delta () const [inline, inherited]

Return the maximum coordinate gap between the window center and a window point.

10.200.4.3 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_centered () const [inline, inherited]

Is the window centered?

10.200.4.4 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_empty () const [inline, inherited]

Interface of the concept Window.

Is the window is empty?

10.200.4.5 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_symmetric () const [inline, inherited]

Is the window symmetric?

10.200.4.6 template<typename G, typename S, typename I> bool mln::graph_elt_window_if< G, S, I >::is_valid () const [inline]

Return true by default.

Reimplemented from mln::graph_window_base< P, E >.

Referenced by mln::graph_elt_window_if< G, S, I >::change_mask().

10.200.4.7 template<typename G, typename S, typename I> const I & mln::graph_elt_window_if< G, S, I >::mask () const [inline]

Return the graph image used as mask.

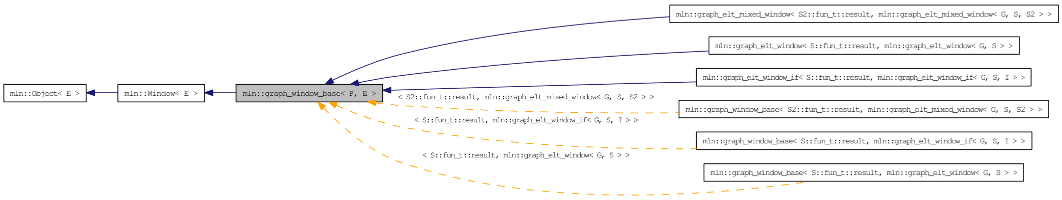
10.200.4.8 template<typename P, typename E> graph_window_base< P, E > & mln::graph_window_base< P, E >::sym () [inline, inherited]

Apply a central symmetry to the target window.

10.201 mln::graph_window_base< P, E > Class Template Reference

`#include <graph_window_base.hh>`

Inheritance diagram for mln::graph_window_base< P, E >:



Public Types

- typedef P site

  Associated types.

Public Member Functions

- bool is_valid () const

  Return true by default.

- unsigned delta () const

  Return the maximum coordinate gap between the window center and a window point.

- bool is_centered () const

  Is the window centered?

- bool is_empty () const

  Interface of the concept Window.

- bool is_symmetric () const

  Is the window symmetric?

- self_ & sym ()

  Apply a central symmetry to the target window.

10.201.1 Detailed Description

template<typename P, typename E> class mln::graph_window_base< P, E >

Template Parameters:

P Site type.

10.201.2 Member Typedef Documentation

10.201.2.1 template<typename P, typename E> typedef P mln::graph_window_base< P, E >::site

Associated types.

The type of site corresponding to the window.

10.201.3 Member Function Documentation

10.201.3.1 template<typename P, typename E> unsigned mln::graph_window_base< P, E >::delta () const [inline]

Return the maximum coordinate gap between the window center and a window point.

10.201.3.2 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_centered () const [inline]

Is the window centered?

10.201.3.3 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_empty () const [inline]

Interface of the concept Window.

Is the window is empty?

10.201.3.4 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_symmetric () const [inline]

Is the window symmetric?

10.201.3.5 template<typename P, typename E> bool mln::graph_window_base< P, E >::is_valid () const [inline]

Return true by default.

Reimplemented in mln::graph_elt_window_if< G, S, I >.

10.201.3.6 template<typename P, typename E> graph_window_base< P, E > & mln::graph_window_base< P, E >::sym () [inline]

Apply a central symmetry to the target window.

10.202 mln::graph_window_if_piter< S, W, I > Class Template Reference

Forward iterator on line graph window.

`#include <graph_window_if_piter.hh>`

Inherits mln::internal::site_relative_iterator_base< W, mln::graph_window_if_piter< S, W, I > >, and mln::internal::is_masked_impl_selector< S, W::mask_t::domain_t, mln::graph_window_if_piter< S, W, I > >.

Public Types

- typedef S::fun_t::result P

  Associated types.

Public Member Functions

- void next ()

  Go to the next element.

- const S::graph_element & element () const

  Return the graph element pointed by this iterator.

- unsigned id () const

  Return the graph element id.

- graph_window_if_piter ()

  Construction.

10.202.1 Detailed Description

template<typename S, typename W, typename I> class mln::graph_window_if_piter< S, W, I >

Forward iterator on line graph window.

10.202.2 Member Typedef Documentation

10.202.2.1 template<typename S, typename W, typename I> typedef S::fun_t ::result mln::graph_window_if_piter< S, W, I >::P

Associated types.

10.202.3 Constructor & Destructor Documentation

10.202.3.1 template<typename S, typename W, typename I> mln::graph_window_if_piter< S, W, I >::graph_window_if_piter () [inline]

Construction.

10.202.4 Member Function Documentation

10.202.4.1 template<typename S, typename W, typename I> const S::graph_element & mln::graph_window_if_piter< S, W, I >::element () const [inline]

Return the graph element pointed by this iterator.

10.202.4.2 template<typename S, typename W, typename I> unsigned mln::graph_window_if_piter< S, W, I >::id () const [inline]

Return the graph element id.

FIXME: we do not want to have this member since there is an automatic conversion to the graph element. C++ does not seem to use this conversion operator.

10.202.4.3 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.203 mln::graph_window_piter< S, W, I > Class Template Reference

Forward iterator on line graph window.

`#include <graph_window_piter.hh>`

Inherits mln::internal::site_relative_iterator_base< W, mln::graph_window_piter< S, W, I >, W::center_t >, and mln::internal::impl_selector< W::center_t, W::psite, mln::graph_window_piter< S, W, I > >.

Public Types

- typedef W::center_t center_t
  Type of the window center.
- typedef W::graph_element graph_element
  Type of the graph element pointed by this iterator.
- typedef S::fun_t::result P
  Associated types
  Type of the window elements.

Public Member Functions

- void change_target_site_set (const S &s)
  Change the target site set.
- void next ()
  Go to the next element.
- const S & target_site_set () const
  Return the target site set.

- const graph_element & element () const
  Return the graph element pointed by this iterator.
- unsigned id () const
  Return the graph element id.

- template<typename Pref>
  graph_window_piter (const Window< W > &win, const Site_Set< S > &target_site_set, const Pref &p_ref)
  To be used in case center and neighbors sites do not have the same type and do not belong to the same site set.
- template<typename Pref>
  graph_window_piter (const Window< W > &win, const Pref &p_ref)
  To be used in case the center and neighbor sites have the same type and belong to the same site set.

- graph_window_piter ()
  Construction.

10.203.1 Detailed Description

template<typename S, typename W, typename I> class mln::graph_window_piter< S, W, I >

Forward iterator on line graph window.

Template Parameters:

S is the site set type.

W is the window type.

I is the underlying iterator type.

10.203.2 Member Typedef Documentation

10.203.2.1 template<typename S, typename W, typename I> typedef W::center_t mln::graph_window_piter< S, W, I >::center_t

Type of the window center.

10.203.2.2 template<typename S, typename W, typename I> typedef W::graph_element mln::graph_window_piter< S, W, I >::graph_element

Type of the graph element pointed by this iterator.

10.203.2.3 template<typename S, typename W, typename I> typedef S::fun_t ::result mln::graph_window_piter< S, W, I >::P

Associated types

Type of the window elements.

10.203.3 Constructor & Destructor Documentation

10.203.3.1 template<typename S, typename W, typename I> mln::graph_window_piter< S, W, I >::graph_window_piter () `[inline]`

Construction.

10.203.3.2 template<typename S, typename W, typename I> template<typename Pref> mln::graph_window_piter< S, W, I >::graph_window_piter (const Window< W > & *win*, const Pref & *p_ref*) `[inline]`

To be used in case the center and neighbor sites have the same type and belong to the same site set.

Parameters:

win The underlying window.

p_ref Window center.

10.203.3.3 template<typename S, typename W, typename I> template<typename Pref> mln::graph_window_piter< S, W, I >::graph_window_piter (const Window< W > & *win*, const Site_Set< S > & *target_site_set*, const Pref & *p_ref*) [inline]

To be used in case center and neighbors sites do not have the same type and do not belong to the same site set.

Parameters:

win The underlying window.

target_site_set Site set in which neighbor sites are extracted.

p_ref Window center.

10.203.4 Member Function Documentation

10.203.4.1 template<typename S, typename W, typename I> void mln::graph_window_piter< S, W, I >::change_target_site_set (const S & *s*) [inline]

Change the target site set.

Window elements different from the center come from the target site set.

10.203.4.2 template<typename S, typename W, typename I> const graph_window_piter< S, W, I >::graph_element & mln::graph_window_piter< S, W, I >::element () const [inline]

Return the graph element pointed by this iterator.

10.203.4.3 template<typename S, typename W, typename I> unsigned mln::graph_window_piter< S, W, I >::id () const [inline]

Return the graph element id.

FIXME: we do not want to have this member since there is an automatic conversion to the graph element. C++ does not seem to use this conversion operator.

10.203.4.4 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.203.4.5 template<typename S, typename W, typename I> const S & mln::graph_window_piter< S, W, I >::target_site_set () const [inline]

Return the target site set.

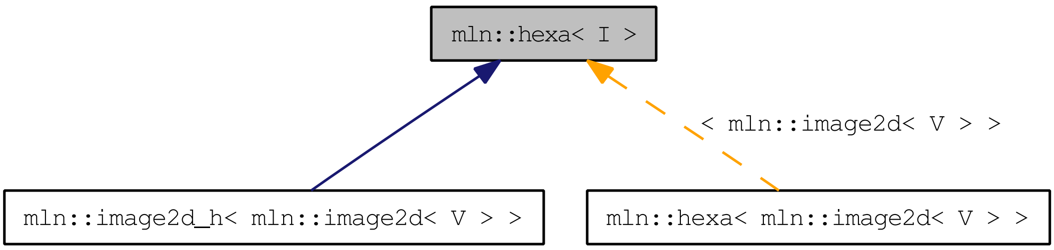
Window elements different from the center come from the target site set.

10.204 mln::hexa< I > Struct Template Reference

hexagonal image class.

#include <hexa.hh>

Inheritance diagram for mln::hexa< I >:



Public Types

- typedef hexa_bkd_piter_< box2d > bkd_piter

  FIXME : should it be in box2d_h? Backward Site_Iterator associated type.

- typedef hexa_fwd_piter_< box2d > fwd_piter

  FIXME : should it be in box2d_h? Forward Site_Iterator associated type.

- typedef I::lvalue lvalue

  Lvalue associated type.

- typedef point2d_h psite

  Point site type.

- typedef I::rvalue rvalue

  Return type of read-only access.

- typedef hexa< tag::image_< I > > skeleton

  Skeleton.

- typedef I::value value

  Value associated type.

Public Member Functions

- const box2d_h & domain () const

  Give the definition domain.

- bool has (const psite &p) const

  Test if p *belongs to the image domain.*

- hexa (I &ima)

Constructor with an base image.

- hexa ()

  Constructor without argument.

- lvalue operator() (const point2d_h &p)

  Read-write access of pixel value at hexa point site `p`.

- rvalue operator() (const point2d_h &p) const

  Read-only access of pixel value at hexa point site `p`.

10.204.1 Detailed Description

template<typename I> struct mln::hexa< I >

hexagonal image class.

The parameter `I` is the type of the base image. This image class which handles hexagonal grid.

Ex : 1 3 5 7 9 11 0 2 4 6 8 10 ——————- 0 XX| | | | | | |XX ——————— 2 XX| | | | | | |XX ——————— 4 XX| | | | | | |XX ——————— 6 XX| | | | | | |XX ——————— 8 XX| | | | | | |XX ——————-

10.204.2 Member Typedef Documentation

10.204.2.1 template<typename I> typedef hexa_bkd_piter_<box2d> mln::hexa< I >::bkd_piter

FIXME : should it be in box2d_h? Backward Site_Iterator associated type.

10.204.2.2 template<typename I> typedef hexa_fwd_piter_<box2d> mln::hexa< I >::fwd_piter

FIXME : should it be in box2d_h? Forward Site_Iterator associated type.

10.204.2.3 template<typename I> typedef I ::lvalue mln::hexa< I >::lvalue

Lvalue associated type.

10.204.2.4 template<typename I> typedef point2d_h mln::hexa< I >::psite

Point site type.

Reimplemented in mln::image2d_h< V >.

10.204.2.5 template<typename I> typedef I ::rvalue mln::hexa< I >::rvalue

Return type of read-only access.

10.204.2.6 template<typename I> typedef hexa< tag::image_<I> > mln::hexa< I >::skeleton

Skeleton.

10.204.2.7 template<typename I> typedef I ::value mln::hexa< I >::value

Value associated type.

10.204.3 Constructor & Destructor Documentation

10.204.3.1 template<typename I> mln::hexa< I >::hexa () `[inline]`

Constructor without argument.

10.204.3.2 template<typename I> mln::hexa< I >::hexa (I & *ima*) `[inline]`

Constructor with an base image.

10.204.4 Member Function Documentation

10.204.4.1 template<typename I> const box2d_h & mln::hexa< I >::domain () const `[inline]`

Give the definition domain.

10.204.4.2 template<typename I> bool mln::hexa< I >::has (const psite & *p*) const `[inline]`

Test if `p` belongs to the image domain.

Referenced by mln::hexa< I >::operator()().

10.204.4.3 template<typename I> hexa< I >::lvalue mln::hexa< I >::operator() (const point2d_h & *p*) `[inline]`

Read-write access of pixel value at hexa point site `p`.

References mln::hexa< I >::has().

10.204.4.4 template<typename I> hexa< I >::rvalue mln::hexa< I >::operator() (const point2d_h & *p*) const `[inline]`

Read-only access of pixel value at hexa point site `p`.

References mln::hexa< I >::has().

10.205 mln::histo::array< T > Struct Template Reference

Generic histogram class over a value set with type T.

`#include <array.hh>`

10.205.1 Detailed Description

template<typename T> struct mln::histo::array< T >

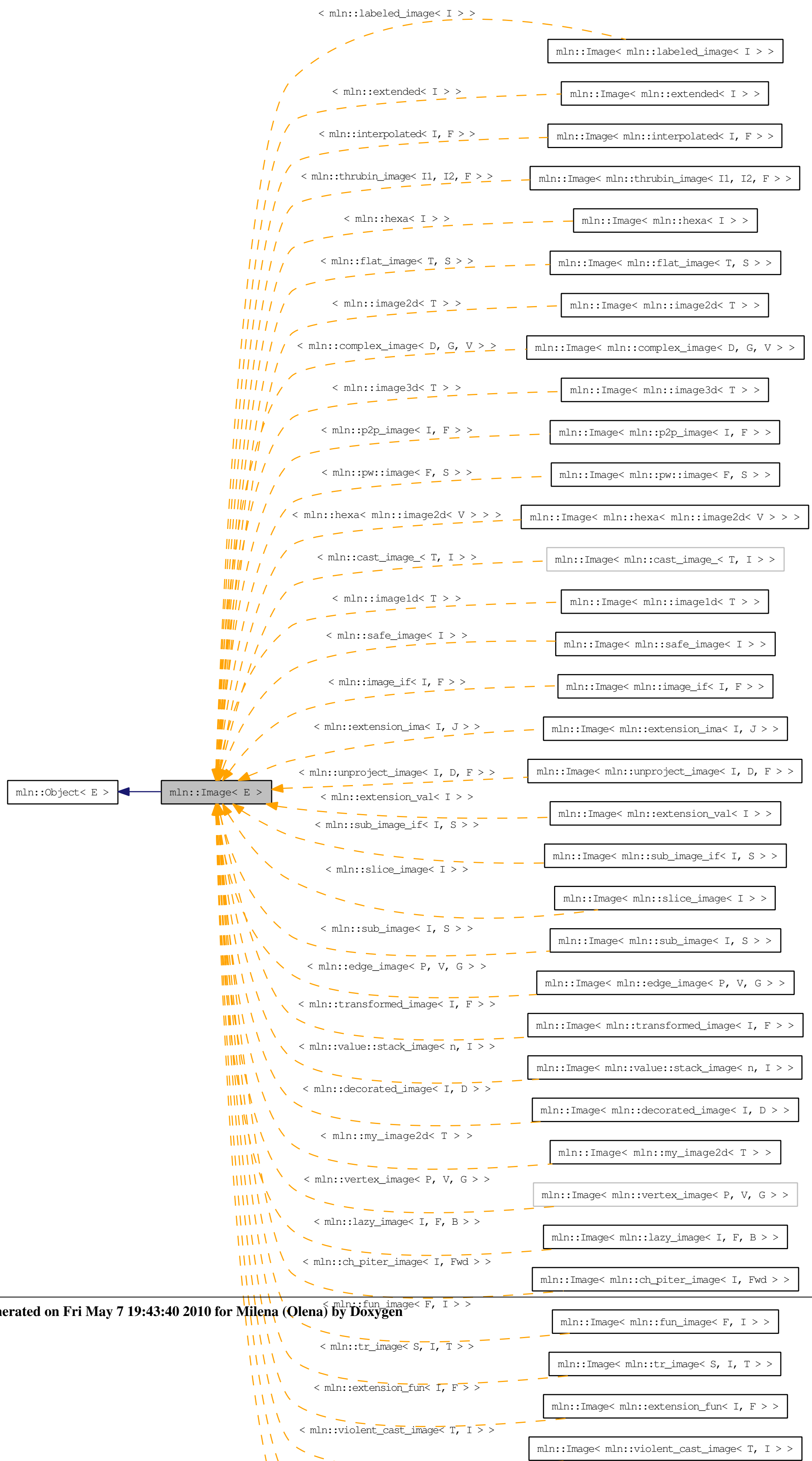
Generic histogram class over a value set with type T.

10.206 mln::Image< E > Struct Template Reference

Base class for implementation of image classes.

`#include <image.hh>`

Inheritance diagram for mln::Image< E >:



10.206.1 Detailed Description

template<typename E> struct mln::Image< E >

Base class for implementation of image classes.

See also:

mln::doc::Image for a complete documentation of this class contents.

10.207 mln::image1d< T > Struct Template Reference

Basic 1D image class.

`#include <image1d.hh>`

Inherits mln::internal::image_primary< T, mln::box, mln::image1d< T > >.

Package Types

- typedef T & lvalue

  Return type of read-write access.

- typedef const T & rvalue

  Return type of read-only access.

- typedef image1d< tag::value_< T > > skeleton

  Skeleton.

- typedef T value

  Value associated type.

Package Functions

- const box1d & bbox () const

  Give the bounding box domain.

- unsigned border () const

  Give the border thickness.

- T ∗ buffer ()

  Give a hook to the value buffer.

- const T ∗ buffer () const

  Give a hook to the value buffer.

- int delta_index (const dpoint1d &dp) const

  Give the offset corresponding to the delta-point `dp`.

- const box1d & domain () const

  Give the definition domain.

- T & element (unsigned i)

  Read-write access to the `i-th` *image value (including the border).*

- const T & element (unsigned i) const

  Read-only access to the `i-th` *image value (including the border).*

- bool has (const point1d &p) const

Test if `p` *is valid.*

- image1d (const box1d &b, unsigned bdr=border::thickness)

  Constructor with a box and the border thickness.

- image1d (unsigned ninds, unsigned bdr=border::thickness)

  Constructor with the number of indices and the border thickness.

- image1d ()

  Constructor without argument.

- unsigned nelements () const

  Give the number of cells (points including border ones).

- unsigned ninds () const

  Give the number of indexes.

- T & operator() (const point1d &p)

  Read-write access to the image value located at point `p`*.*

- const T & operator() (const point1d &p) const

  Read-only access to the image value located at point `p`*.*

- point1d point_at_index (unsigned i) const

  Give the point corresponding to the offset `o`*.*

10.207.1 Detailed Description

template<typename T> struct mln::image1d< T >

Basic 1D image class.

The parameter `T` is the type of pixel values. This image class stores data in memory and has a virtual border with constant thickness before and after data.

10.207.2 Member Typedef Documentation

10.207.2.1 template<typename T> typedef T& mln::image1d< T >::lvalue `[package]`

Return type of read-write access.

10.207.2.2 template<typename T> typedef const T& mln::image1d< T >::rvalue `[package]`

Return type of read-only access.

10.207.2.3 template<typename T> typedef image1d< tag::value_<T> > mln::image1d< T >::skeleton `[package]`

Skeleton.

10.207.2.4 template<typename T> typedef T mln::image1d< T >::value [package]

Value associated type.

10.207.3 Constructor & Destructor Documentation

10.207.3.1 template<typename T> mln::image1d< T >::image1d () [inline, package]

Constructor without argument.

10.207.3.2 template<typename T> mln::image1d< T >::image1d (unsigned *ninds*, unsigned *bdr* = border::thickness) [inline, package]

Constructor with the number of indices and the border thickness.

References mln::make::box1d().

10.207.3.3 template<typename T> mln::image1d< T >::image1d (const box1d & *b*, unsigned *bdr* = border::thickness) [inline, package]

Constructor with a box and the border thickness.

10.207.4 Member Function Documentation

10.207.4.1 template<typename T> const box1d & mln::image1d< T >::bbox () const [inline, package]

Give the bounding box domain.

10.207.4.2 template<typename T> unsigned mln::image1d< T >::border () const [inline, package]

Give the border thickness.

10.207.4.3 template<typename T> T * mln::image1d< T >::buffer () [inline, package]

Give a hook to the value buffer.

10.207.4.4 template<typename T> const T * mln::image1d< T >::buffer () const [inline, package]

Give a hook to the value buffer.

10.207.4.5 template<typename T> int mln::image1d< T >::delta_index (const dpoint1d & *dp*) const [inline, package]

Give the offset corresponding to the delta-point `dp`.

10.207.4.6 template<typename T> const box1d & mln::image1d< T >::domain () const [inline, package]

Give the definition domain.

10.207.4.7 template<typename T> T & mln::image1d< T >::element (unsigned *i*) [inline, package]

Read-write access to the `i-th` image value (including the border).

References mln::image1d< T >::nelements().

10.207.4.8 template<typename T> const T & mln::image1d< T >::element (unsigned *i*) const [inline, package]

Read-only access to the `i-th` image value (including the border).

References mln::image1d< T >::nelements().

10.207.4.9 template<typename T> bool mln::image1d< T >::has (const point1d & *p*) const [inline, package]

Test if `p` is valid.

Referenced by mln::image1d< T >::operator()().

10.207.4.10 template<typename T> unsigned mln::image1d< T >::nelements () const [inline, package]

Give the number of cells (points including border ones).

Referenced by mln::image1d< T >::element(), and mln::image1d< T >::point_at_index().

10.207.4.11 template<typename T> unsigned mln::image1d< T >::ninds () const [inline, package]

Give the number of indexes.

10.207.4.12 template<typename T> T & mln::image1d< T >::operator() (const point1d & *p*) [inline, package]

Read-write access to the image value located at point `p`.

References mln::image1d< T >::has().

10.207.4.13 template<typename T> const T & mln::image1d< T >::operator() (const point1d & *p*) const [inline, package]

Read-only access to the image value located at point `p`.

References mln::image1d< T >::has().

10.207.4.14 template<typename T> point1d mln::image1d< T >::point_at_index (unsigned *i*) const `[inline, package]`

Give the point corresponding to the offset `o`.

References mln::image1d< T >::nelements().

10.208 mln::image2d< T > Class Template Reference

Basic 2D image class.

`#include <image2d.hh>`

Inherits mln::internal::image_primary< T, mln::box, mln::image2d< T > >.

Public Types

- typedef T & lvalue

  Return type of read-write access.

- typedef const T & rvalue

  Return type of read-only access.

- typedef image2d< tag::value_< T > > skeleton

  Skeleton.

- typedef T value

  Value associated type.

Public Member Functions

- const box2d & bbox () const

  Give the bounding box domain.

- unsigned border () const

  Give the border thickness.

- T ∗ buffer ()

  Give a hook to the value buffer.

- const T ∗ buffer () const

  Give a hook to the value buffer.

- int delta_index (const dpoint2d &dp) const

  Give the delta-index corresponding to the delta-point `dp`.

- const box2d & domain () const

  Give the definition domain.

- T & element (unsigned i)

  Read-write access to the image value located at index `i`.

- const T & element (unsigned i) const

  Read-only access to the image value located at index `i`.

- bool has (const point2d &p) const

Test if `p` *is valid.*

- image2d (const box2d &b, unsigned bdr=border::thickness)

  Constructor with a box and the border thickness (default is 3).

- image2d (int nrows, int ncols, unsigned bdr=border::thickness)

  Constructor with the numbers of rows and columns and the border thickness.

- image2d ()

  Constructor without argument.

- unsigned ncols () const

  Give the number of columns.

- unsigned nelements () const

  Give the number of elements (points including border ones).

- unsigned nrows () const

  Give the number of rows.

- T & operator() (const point2d &p)

  Read-write access to the image value located at point `p`.

- const T & operator() (const point2d &p) const

  Read-only access to the image value located at point `p`.

- point2d point_at_index (unsigned i) const

  Give the point corresponding to the index `i`.

10.208.1 Detailed Description

template<typename T> class mln::image2d< T >

Basic 2D image class.

The parameter `T` is the type of pixel values. This image class stores data in memory and has a virtual border with constant thickness around data.

10.208.2 Member Typedef Documentation

10.208.2.1 template<typename T> typedef T& mln::image2d< T >::lvalue

Return type of read-write access.

10.208.2.2 template<typename T> typedef const T& mln::image2d< T >::rvalue

Return type of read-only access.

10.208.2.3 template<typename T> typedef image2d< tag::value_<T> > mln::image2d< T >::skeleton

Skeleton.

10.208.2.4 template<typename T> typedef T mln::image2d< T >::value

Value associated type.

10.208.3 Constructor & Destructor Documentation

10.208.3.1 template<typename T> mln::image2d< T >::image2d () `[inline]`

Constructor without argument.

10.208.3.2 template<typename T> mln::image2d< T >::image2d (int *nrows*, int *ncols*, unsigned *bdr* = `border::thickness`) `[inline]`

Constructor with the numbers of rows and columns and the border thickness.

References mln::make::box2d().

10.208.3.3 template<typename T> mln::image2d< T >::image2d (const box2d & *b*, unsigned *bdr* = `border::thickness`) `[inline]`

Constructor with a box and the border thickness (default is 3).

10.208.4 Member Function Documentation

10.208.4.1 template<typename T> const box2d & mln::image2d< T >::bbox () const `[inline]`

Give the bounding box domain.

10.208.4.2 template<typename T> unsigned mln::image2d< T >::border () const `[inline]`

Give the border thickness.

10.208.4.3 template<typename T> T * mln::image2d< T >::buffer () `[inline]`

Give a hook to the value buffer.

10.208.4.4 template<typename T> const T * mln::image2d< T >::buffer () const `[inline]`

Give a hook to the value buffer.

10.208.4.5 template<typename T> int mln::image2d< T >::delta_index (const dpoint2d & *dp*) const [inline]

Give the delta-index corresponding to the delta-point dp.

10.208.4.6 template<typename T> const box2d & mln::image2d< T >::domain () const [inline]

Give the definition domain.

Referenced by mln::morpho::line_gradient(), mln::make_debug_graph_image(), and mln::io::txt::save().

10.208.4.7 template<typename T> T & mln::image2d< T >::element (unsigned *i*) [inline]

Read-write access to the image value located at index i.

References mln::image2d< T >::nelements().

10.208.4.8 template<typename T> const T & mln::image2d< T >::element (unsigned *i*) const [inline]

Read-only access to the image value located at index i.

References mln::image2d< T >::nelements().

10.208.4.9 template<typename T> bool mln::image2d< T >::has (const point2d & *p*) const [inline]

Test if p is valid.

Referenced by mln::image2d< T >::operator()(), and mln::debug::put_word().

10.208.4.10 template<typename T> unsigned mln::image2d< T >::ncols () const [inline]

Give the number of columns.

10.208.4.11 template<typename T> unsigned mln::image2d< T >::nelements () const [inline]

Give the number of elements (points including border ones).

Referenced by mln::image2d< T >::element(), and mln::image2d< T >::point_at_index().

10.208.4.12 template<typename T> unsigned mln::image2d< T >::nrows () const [inline]

Give the number of rows.

10.208.4.13 template<typename T> T & mln::image2d< T >::operator() (const point2d & *p*) [inline]

Read-write access to the image value located at point p.

References mln::image2d< T >::has().

10.208.4.14 template<typename T> const T & mln::image2d< T >::operator() (const point2d & *p*) const [inline]

Read-only access to the image value located at point `p`.

References mln::image2d< T >::has().

10.208.4.15 template<typename T> point2d mln::image2d< T >::point_at_index (unsigned *i*) const [inline]

Give the point corresponding to the index `i`.

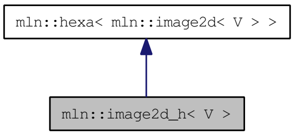
References mln::image2d< T >::nelements().

10.209 mln::image2d_h< V > Struct Template Reference

2d image based on an hexagonal mesh.

`#include <image2d_h.hh>`

Inheritance diagram for mln::image2d_h< V >:



Public Types

- typedef hexa_bkd_piter_< box2d > bkd_piter

  FIXME : should it be in box2d_h? Backward Site_Iterator associated type.

- typedef hexa_fwd_piter_< box2d > fwd_piter

  FIXME : should it be in box2d_h? Forward Site_Iterator associated type.

- typedef I::lvalue lvalue

  Lvalue associated type.

- typedef point2d_h psite

  Point site type.

- typedef I::rvalue rvalue

  Return type of read-only access.

- typedef hexa< tag::image_< I > > skeleton

  Skeleton.

- typedef I::value value

  Value associated type.

Public Member Functions

- const box2d_h & domain () const

  Give the definition domain.

- bool has (const psite &p) const

  Test if p *belongs to the image domain.*

- image2d_h (int nrows, int ncols, unsigned bdr=border::thickness)

  Constructor with the numbers of rows and columns border thickness.

- lvalue operator() (const point2d_h &p)

Read-write access of pixel value at hexa point site p.

- rvalue operator() (const point2d_h &p) const

  Read-only access of pixel value at hexa point site p.

10.209.1 Detailed Description

template<typename V> struct mln::image2d_h< V >

2d image based on an hexagonal mesh.

10.209.2 Member Typedef Documentation

10.209.2.1 template<typename I> typedef hexa_bkd_piter_<box2d> mln::hexa< I >::bkd_piter [inherited]

FIXME : should it be in box2d_h? Backward Site_Iterator associated type.

10.209.2.2 template<typename I> typedef hexa_fwd_piter_<box2d> mln::hexa< I >::fwd_piter [inherited]

FIXME : should it be in box2d_h? Forward Site_Iterator associated type.

10.209.2.3 template<typename I> typedef I ::lvalue mln::hexa< I >::lvalue [inherited]

Lvalue associated type.

10.209.2.4 template<typename V> typedef point2d_h mln::image2d_h< V >::psite

Point site type.

Reimplemented from mln::hexa< I >.

10.209.2.5 template<typename I> typedef I ::rvalue mln::hexa< I >::rvalue [inherited]

Return type of read-only access.

10.209.2.6 template<typename I> typedef hexa< tag::image_<I> > mln::hexa< I >::skeleton [inherited]

Skeleton.

10.209.2.7 template<typename I> typedef I ::value mln::hexa< I >::value [inherited]

Value associated type.

10.209.3 Constructor & Destructor Documentation

10.209.3.1 template<typename V> mln::image2d_h< V >::image2d_h (int *nrows*, int *ncols*, unsigned *bdr* = `border::thickness`) `[inline]`

Constructor with the numbers of rows and columns border thickness.

image2d_h(3,6) will build this hexa image :

1 3 5 0 2 4 ———— 0| x x x | 2| x x x | 4| x x x

10.209.4 Member Function Documentation

10.209.4.1 template<typename I> const box2d_h & mln::hexa< I >::domain () const `[inline, inherited]`

Give the definition domain.

10.209.4.2 template<typename I> bool mln::hexa< I >::has (const psite & *p*) const `[inline, inherited]`

Test if `p` belongs to the image domain.

Referenced by mln::hexa< I >::operator()().

10.209.4.3 template<typename I> hexa< I >::lvalue mln::hexa< I >::operator() (const point2d_h & *p*) `[inline, inherited]`

Read-write access of pixel value at hexa point site `p`.

References mln::hexa< I >::has().

10.209.4.4 template<typename I> hexa< I >::rvalue mln::hexa< I >::operator() (const point2d_h & *p*) const `[inline, inherited]`

Read-only access of pixel value at hexa point site `p`.

References mln::hexa< I >::has().

10.210 mln::image3d< T > Struct Template Reference

Basic 3D image class.

`#include <image3d.hh>`

Inherits mln::internal::image_primary< T, mln::box, mln::image3d< T > >.

Package Types

- typedef T & lvalue

  Return type of read-write access.

- typedef const T & rvalue

  Return type of read-only access.

- typedef image3d< tag::value_< T > > skeleton

  Skeleton.

- typedef T value

  Value associated type.

Package Functions

- const box3d & bbox () const

  Give the bounding box domain.

- unsigned border () const

  Give the border thickness.

- T ∗ buffer ()

  Give a hook to the value buffer.

- const T ∗ buffer () const

  Give a hook to the value buffer.

- int delta_index (const dpoint3d &dp) const

  Fast Image method.

- const box3d & domain () const

  Give the definition domain.

- T & element (unsigned i)

  Read-write access to the image value located at index `i`.

- const T & element (unsigned i) const

  Read-only access to the image value located at index `i`.

- bool has (const point3d &p) const

Test if p *is valid.*

- image3d (int nslis, int nrows, int ncols, unsigned bdr=border::thickness)

  Constructor with the numbers of indexes and the border thickness.

- image3d (const box3d &b, unsigned bdr=border::thickness)

  Constructor with a box and the border thickness (default is 3).

- image3d ()

  Constructor without argument.

- unsigned ncols () const

  Give the number of columns.

- unsigned nelements () const

  Give the number of cells (points including border ones).

- unsigned nrows () const

  Give the number of rows.

- unsigned nslices () const

  Give the number of slices.

- T & operator() (const point3d &p)

  Read-write access to the image value located at point p.

- const T & operator() (const point3d &p) const

  Read-only access to the image value located at point p.

- point3d point_at_index (unsigned o) const

  Give the point corresponding to the offset o.

10.210.1 Detailed Description

template<typename T> struct mln::image3d< T >

Basic 3D image class.

The parameter T is the type of pixel values. This image class stores data in memory and has a virtual border with constant thickness around data.

10.210.2 Member Typedef Documentation

10.210.2.1 template<typename T> typedef T& mln::image3d< T >::lvalue [package]

Return type of read-write access.

10.210.2.2 template<typename T> typedef const T& mln::image3d< T >::rvalue [package]

Return type of read-only access.

10.210.2.3 template<typename T> typedef image3d< tag::value_<T> > mln::image3d< T >::skeleton [package]

Skeleton.

10.210.2.4 template<typename T> typedef T mln::image3d< T >::value [package]

Value associated type.

10.210.3 Constructor & Destructor Documentation

10.210.3.1 template<typename T> mln::image3d< T >::image3d () [inline, package]

Constructor without argument.

10.210.3.2 template<typename T> mln::image3d< T >::image3d (const box3d & *b*, unsigned *bdr* = border::thickness) [inline, package]

Constructor with a box and the border thickness (default is 3).

10.210.3.3 template<typename T> mln::image3d< T >::image3d (int *nslis*, int *nrows*, int *ncols*, unsigned *bdr* = border::thickness) [inline, package]

Constructor with the numbers of indexes and the border thickness.

References mln::make::box3d().

10.210.4 Member Function Documentation

10.210.4.1 template<typename T> const box3d & mln::image3d< T >::bbox () const [inline, package]

Give the bounding box domain.

10.210.4.2 template<typename T> unsigned mln::image3d< T >::border () const [inline, package]

Give the border thickness.

10.210.4.3 template<typename T> T * mln::image3d< T >::buffer () [inline, package]

Give a hook to the value buffer.

10.210.4.4 template<typename T> const T * mln::image3d< T >::buffer () const [inline, package]

Give a hook to the value buffer.

10.210.4.5 template<typename T> int mln::image3d< T >::delta_index (const dpoint3d & *dp*) const [inline, package]

Fast Image method.

Give the offset corresponding to the delta-point `dp`.

10.210.4.6 template<typename T> const box3d & mln::image3d< T >::domain () const [inline, package]

Give the definition domain.

10.210.4.7 template<typename T> T & mln::image3d< T >::element (unsigned *i*) [inline, package]

Read-write access to the image value located at index `i`.

References mln::image3d< T >::nelements().

10.210.4.8 template<typename T> const T & mln::image3d< T >::element (unsigned *i*) const [inline, package]

Read-only access to the image value located at index `i`.

References mln::image3d< T >::nelements().

10.210.4.9 template<typename T> bool mln::image3d< T >::has (const point3d & *p*) const [inline, package]

Test if `p` is valid.

Referenced by mln::image3d< T >::operator()().

10.210.4.10 template<typename T> unsigned mln::image3d< T >::ncols () const [inline, package]

Give the number of columns.

10.210.4.11 template<typename T> unsigned mln::image3d< T >::nelements () const [inline, package]

Give the number of cells (points including border ones).

Referenced by mln::image3d< T >::element(), and mln::image3d< T >::point_at_index().

10.210.4.12 template<typename T> unsigned mln::image3d< T >::nrows () const [inline, package]

Give the number of rows.

10.210.4.13 template<typename T> unsigned mln::image3d< T >::nslices () const [inline, package]

Give the number of slices.

10.210.4.14 template<typename T> T & mln::image3d< T >::operator() (const point3d & *p*) [inline, package]

Read-write access to the image value located at point `p`.

References mln::image3d< T >::has().

10.210.4.15 template<typename T> const T & mln::image3d< T >::operator() (const point3d & *p*) const [inline, package]

Read-only access to the image value located at point `p`.

References mln::image3d< T >::has().

10.210.4.16 template<typename T> point3d mln::image3d< T >::point_at_index (unsigned *o*) const [inline, package]

Give the point corresponding to the offset `o`.

References mln::image3d< T >::nelements().

10.211 mln::image_if< I, F > Struct Template Reference

Image which domain is restricted by a function 'site -> Boolean'.

`#include <image_if.hh>`

Inherits mln::internal::image_domain_morpher< I, mln::p_if< I::domain_t, F >, mln::image_if< I, F > >.

Public Types

- typedef image_if< tag::image_< I >, tag::function_< F > > skeleton

  Skeleton.

Public Member Functions

- const p_if< typename I::domain_t, F > & domain () const

  Give the definition domain.

- image_if (I &ima, const F &f)

  Constructor from an image `ima` *and a predicate* `f`*.*

- image_if ()

  Constructor without argument.

- operator image_if< const I, F > () const

  Const promotion via conversion.

10.211.1 Detailed Description

template<typename I, typename F> struct mln::image_if< I, F >

Image which domain is restricted by a function 'site -> Boolean'.

10.211.2 Member Typedef Documentation

10.211.2.1 template<typename I, typename F> typedef image_if< tag::image_<I>, tag::function_<F> > mln::image_if< I, F >::skeleton

Skeleton.

10.211.3 Constructor & Destructor Documentation

10.211.3.1 template<typename I, typename F> mln::image_if< I, F >::image_if () [inline]

Constructor without argument.

10.211.3.2 template< typename I, typename F > mln::image_if< I, F >::image_if (I & *ima*, const F & *f*) [inline]

Constructor from an image ima and a predicate f.

10.211.4 Member Function Documentation

10.211.4.1 template< typename I, typename F > const p_if< typename I::domain_t, F > & mln::image_if< I, F >::domain () const [inline]

Give the definition domain.

10.211.4.2 template< typename I, typename F > mln::image_if< I, F >::operator image_if< const I, F > () const [inline]

Const promotion via conversion.

10.212 mln::interpolated< I, F > Struct Template Reference

Makes the underlying image being accessed with floating coordinates.

`#include <interpolated.hh>`

Inherits mln::internal::image_identity< I, I::domain_t, mln::interpolated< I, F > >.

Public Types

- typedef I::lvalue lvalue
  Return type of read-write access.
- typedef I::psite psite
  Point_Site associated type.
- typedef I::rvalue rvalue
  Return type of read-only access.
- typedef interpolated< tag::image_< I >, F > skeleton
  Skeleton.
- typedef I::value value
  Value associated type.

Public Member Functions

- bool has (const mln::algebra::vec< I::psite::dim, float > &v) const
  Test if a pixel value is accessible at `v`*.*
- interpolated (I &ima)
  Constructors.
- bool is_valid () const
  Test if this image has been initialized.

10.212.1 Detailed Description

template<typename I, template< class > class F> struct mln::interpolated< I, F >

Makes the underlying image being accessed with floating coordinates.

10.212.2 Member Typedef Documentation

10.212.2.1 template<typename I, template< class > class F> typedef I ::lvalue mln::interpolated< I, F >::lvalue

Return type of read-write access.

10.212.2.2 template<typename I, template< class > class F> typedef I ::psite mln::interpolated< I, F >::psite

Point_Site associated type.

10.212.2.3 template<typename I, template< class > class F> typedef I ::rvalue mln::interpolated< I, F >::rvalue

Return type of read-only access.

10.212.2.4 template<typename I, template< class > class F> typedef interpolated< tag::image_<I>, F > mln::interpolated< I, F >::skeleton

Skeleton.

10.212.2.5 template<typename I, template< class > class F> typedef I ::value mln::interpolated< I, F >::value

Value associated type.

10.212.3 Constructor & Destructor Documentation

10.212.3.1 template<typename I, template< class > class F> mln::interpolated< I, F >::interpolated (I & *ima*) `[inline]`

Constructors.

FIXME: don't we want a 'const' here?

10.212.4 Member Function Documentation

10.212.4.1 template<typename I, template< class > class F> bool mln::interpolated< I, F >::has (const mln::algebra::vec< I::psite::dim, float > & *v*) const `[inline]`

Test if a pixel value is accessible at `v`.

10.212.4.2 template<typename I, template< class > class F> bool mln::interpolated< I, F >::is_valid () const `[inline]`

Test if this image has been initialized.

10.213 mln::io::fld::fld_header Struct Reference

Define the header structure of an AVS field data file.

```
#include <header.hh>
```

10.213.1 Detailed Description

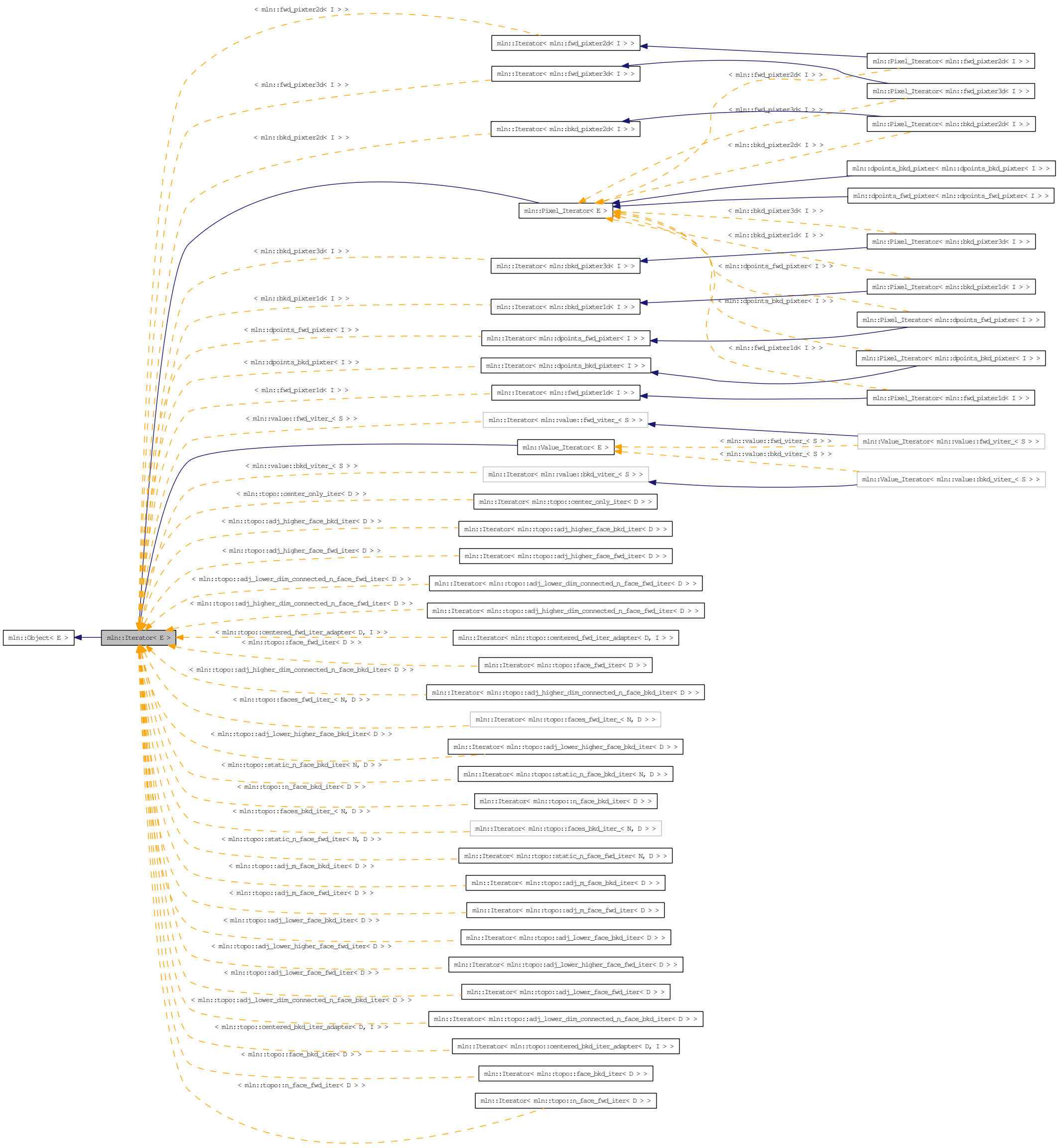
Define the header structure of an AVS field data file.

10.214 mln::Iterator< E > Struct Template Reference

Base class for implementation classes that are iterators.

`#include <iterator.hh>`

Inheritance diagram for mln::Iterator< E >:



Public Member Functions

- void next ()

  Go to the next element.

10.214.1 Detailed Description

template<typename E> struct mln::Iterator< E >

Base class for implementation classes that are iterators.

See also:

mln::doc::Iterator for a complete documentation of this class contents.

10.214.2 Member Function Documentation

10.214.2.1 template<typename E> void mln::Iterator< E >::next () [inline]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

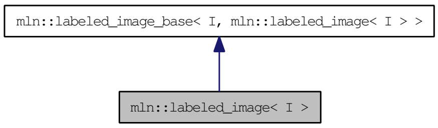
The iterator is valid.

10.215 mln::labeled_image< I > Class Template Reference

Morpher providing an improved interface for labeled image.

`#include <labeled_image.hh>`

Inheritance diagram for mln::labeled_image< I >:



Public Types

- typedef accu::shape::bbox< typename I::psite >::result bbox_t

    Type of the bounding component bounding boxes.

- typedef labeled_image< tag::image_< I > > skeleton

    Skeleton.

Public Member Functions

- const bbox_t & bbox (const typename I::value &label) const

    Return the bounding box of the component `label`.

- const util::array< bbox_t > & bboxes () const

    Return the component bounding boxes.

- I::value nlabels () const

    Return the number of labels;.

- p_if< mln_box(I), fun::eq_v2b_expr_< pw::value_< I >, pw::cst_< typename I::value > > > subdomain (const typename I::value &label) const

    Return the domain of the component with label `label`.

    - labeled_image (const I &ima, const typename I::value &nlabels, const util::array< mln_box(I)> &bboxes)

        Constructor from an image `ima`*, the number of labels* `nlabels` *and the object bounding boxes.*

    - labeled_image (const I &ima, const typename I::value &nlabels)

        Constructor from an image `ima` *and the number of labels* `nlabels`.

    - labeled_image ()

        Constructors
        Constructor without argument.

- template<typename F>
  void relabel (const Function_v2b< F > &f)

  Labels may be removed.

- template<typename F>
  void relabel (const Function_v2v< F > &f)

  Relabel according to a function.

Protected Member Functions

- void update_data (const fun::i2v::array< typename I::value > &relabel_fun)

  Update bounding boxes information.

10.215.1 Detailed Description

template<typename I> class mln::labeled_image< I >

Morpher providing an improved interface for labeled image.

Template Parameters:

I The label image type.

This image type allows to access every site set at a given label.

This image type guaranties that labels are contiguous (from 1 to n).

10.215.2 Member Typedef Documentation

10.215.2.1 template<typename I, typename E> typedef accu::shape::bbox<typename I ::psite>::result mln::labeled_image_base< I, E >::bbox_t [inherited]

Type of the bounding component bounding boxes.

10.215.2.2 template<typename I> typedef labeled_image< tag::image_<I> > mln::labeled_image< I >::skeleton

Skeleton.

10.215.3 Constructor & Destructor Documentation

10.215.3.1 template<typename I> mln::labeled_image< I >::labeled_image () [inline]

Constructors

Constructor without argument.

10.215.3.2 template<typename I> mln::labeled_image< I >::labeled_image (const I & *ima*, const typename I::value & *nlabels*) [inline]

Constructor from an image `ima` and the number of labels `nlabels`.

10.215.3.3 template<typename I> mln::labeled_image< I >::labeled_image (const I & *ima*, const typename I::value & *nlabels*, const util::array< mln_box(I)> & *bboxes*) [inline]

Constructor from an image `ima`, the number of labels `nlabels` and the object bounding boxes.

References mln::labeled_image_base< I, E >::bboxes(), and mln::data::compute().

10.215.4 Member Function Documentation

10.215.4.1 template<typename I, typename E> const labeled_image_base< I, E >::bbox_t & mln::labeled_image_base< I, E >::bbox (const typename I::value & *label*) const [inline, inherited]

Return the bounding box of the component `label`.

Referenced by mln::labeled_image_base< I, E >::subdomain().

10.215.4.2 template<typename I, typename E> const util::array< typename labeled_image_base< I, E >::bbox_t > & mln::labeled_image_base< I, E >::bboxes () const [inline, inherited]

Return the component bounding boxes.

Referenced by mln::labeled_image< I >::labeled_image().

10.215.4.3 template<typename I, typename E> I::value mln::labeled_image_base< I, E >::nlabels () const [inline, inherited]

Return the number of labels;.

10.215.4.4 template<typename I, typename E> template<typename F> void mln::labeled_image_base< I, E >::relabel (const Function_v2b< F > & *f*) [inline, inherited]

Labels may be removed.

This overload make sure the labeling is still contiguous.

References mln::labeling::relabel_inplace(), mln::make::relabelfun(), and mln::labeled_image_base< I, E >::update_data().

10.215.4.5 template<typename I, typename E> template<typename F> void mln::labeled_image_base< I, E >::relabel (const Function_v2v< F > & *f*) [inline, inherited]

Relabel according to a function.

Merge or delete labels according to the given function. This method ensures that the labeling remains contiguous.

References mln::labeling::relabel_inplace(), mln::make::relabelfun(), and mln::labeled_image_base< I, E >::update_data().

10.215.4.6 template<typename I, typename E> p_if< mln_box(I), fun::eq_v2b_expr_< pw::value_< I >, pw::cst_< typename I::value > > > mln::labeled_image_base< I, E >::subdomain (const typename I::value & *label*) const [inline, inherited]

Return the domain of the component with label `label`.

References mln::labeled_image_base< I, E >::bbox().

10.215.4.7 template<typename I, typename E> void mln::labeled_image_base< I, E >::update_data (const fun::i2v::array< typename I::value > & *relabel_fun*) [inline, protected, inherited]

Update bounding boxes information.

References mln::util::array< T >::size().

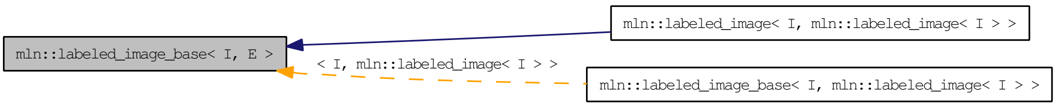
Referenced by mln::labeled_image_base< I, E >::relabel().

10.216 mln::labeled_image_base< I, E > Class Template Reference

Base class Morpher providing an improved interface for labeled image.

`#include <labeled_image_base.hh>`

Inheritance diagram for mln::labeled_image_base< I, E >:



Public Types

- typedef accu::shape::bbox< typename I::psite >::result bbox_t

  Type of the bounding component bounding boxes.

Public Member Functions

- const bbox_t & bbox (const typename I::value &label) const

  Return the bounding box of the component `label`.

- const util::array< bbox_t > & bboxes () const

  Return the component bounding boxes.

- I::value nlabels () const

  Return the number of labels;.

- p_if< mln_box(I), fun::eq_v2b_expr_< pw::value_< I >, pw::cst_< typename I::value > > > subdomain (const typename I::value &label) const

  Return the domain of the component with label `label`.

  - labeled_image_base ()

    Constructors
    Constructor without argument.

  - template<typename F>
    void relabel (const Function_v2b< F > &f)

    Labels may be removed.

  - template<typename F>
    void relabel (const Function_v2v< F > &f)

    Relabel according to a function.

Protected Member Functions

- void update_data (const fun::i2v::array< typename I::value > &relabel_fun)
  Update bounding boxes information.

10.216.1 Detailed Description

template<typename I, typename E> class mln::labeled_image_base< I, E >

Base class Morpher providing an improved interface for labeled image.

Template Parameters:

I The label image type.

This image type allows to access every site set at a given label.

This image type guaranties that labels are contiguous (from 1 to n).

10.216.2 Member Typedef Documentation

10.216.2.1 template<typename I, typename E> typedef accu::shape::bbox<typename I ::psite>::result mln::labeled_image_base< I, E >::bbox_t

Type of the bounding component bounding boxes.

10.216.3 Constructor & Destructor Documentation

10.216.3.1 template<typename I, typename E> mln::labeled_image_base< I, E >::labeled_image_base () [inline]

Constructors

Constructor without argument.

10.216.4 Member Function Documentation

10.216.4.1 template<typename I, typename E> const labeled_image_base< I, E >::bbox_t & mln::labeled_image_base< I, E >::bbox (const typename I::value & *label*) const [inline]

Return the bounding box of the component `label`.

Referenced by mln::labeled_image_base< I, E >::subdomain().

10.216.4.2 template<typename I, typename E> const util::array< typename labeled_image_base< I, E >::bbox_t > & mln::labeled_image_base< I, E >::bboxes () const [inline]

Return the component bounding boxes.

Referenced by mln::labeled_image< I >::labeled_image().

10.216.4.3 template<typename I, typename E> I::value mln::labeled_image_base< I, E >::nlabels () const [inline]

Return the number of labels;.

10.216.4.4 template<typename I, typename E> template<typename F> void mln::labeled_image_base< I, E >::relabel (const Function_v2b< F > & *f*) [inline]

Labels may be removed.

This overload make sure the labeling is still contiguous.

References mln::labeling::relabel_inplace(), mln::make::relabelfun(), and mln::labeled_image_base< I, E >::update_data().

10.216.4.5 template<typename I, typename E> template<typename F> void mln::labeled_image_base< I, E >::relabel (const Function_v2v< F > & *f*) [inline]

Relabel according to a function.

Merge or delete labels according to the given function. This method ensures that the labeling remains contiguous.

References mln::labeling::relabel_inplace(), mln::make::relabelfun(), and mln::labeled_image_base< I, E >::update_data().

10.216.4.6 template<typename I, typename E> p_if< mln_box(I), fun::eq_v2b_expr_< pw::value_< I >, pw::cst_< typename I::value > > > mln::labeled_image_base< I, E >::subdomain (const typename I::value & *label*) const [inline]

Return the domain of the component with label `label`.

References mln::labeled_image_base< I, E >::bbox().

10.216.4.7 template<typename I, typename E> void mln::labeled_image_base< I, E >::update_data (const fun::i2v::array< typename I::value > & *relabel_fun*) [inline, protected]

Update bounding boxes information.

References mln::util::array< T >::size().

Referenced by mln::labeled_image_base< I, E >::relabel().

10.217 mln::lazy_image< I, F, B > Struct Template Reference

Image values are computed on the fly.

`#include <lazy_image.hh>`

Inherits mln::internal::image_identity< mln::trait::ch_value< I, F::result >::ret, I::domain_t, mln::lazy_image< I, F, B > >.

Public Types

- typedef F::result lvalue

  Return type of read-write access.

- typedef F::result rvalue

  Return type of read access.

- typedef lazy_image< tag::image_< I >, F, B > skeleton

  Skeleton.

Public Member Functions

- const box< typename I::psite > & domain () const

  Return domain of lazyd_image.

- bool has (const typename I::psite &) const

  Test if a pixel value is accessible at `p`.

- lazy_image (const F &fun, const B &box)

  Constructors.

- lazy_image ()

  Constructors.

- lvalue operator() (const typename I::psite &p)

  Read and "write if possible" access of pixel value at point site `p`.

- rvalue operator() (const typename I::psite &p) const

  Read-only access of pixel value at point site `p`.

- F::result operator() (const typename F::input &x)

  Read and "write if possible" access of pixel value at F::input `x`.

- F::result operator() (const typename F::input &x) const

  Read-only access of pixel value at F::input `x`.

10.217.1 Detailed Description

template<typename I, typename F, typename B> struct mln::lazy_image< I, F, B >

Image values are computed on the fly.

The parameter `I` is the type of image. The parameter `F` is the type of function. The parameter `B` is the type of box.

This image class tage a functor `fun` and a box `box`. Access to ima(p) where `p` include `box` return fun(b) lazily.

10.217.2 Member Typedef Documentation

10.217.2.1 template<typename I, typename F, typename B> typedef F ::result mln::lazy_image< I, F, B >::lvalue

Return type of read-write access.

10.217.2.2 template<typename I, typename F, typename B> typedef F ::result mln::lazy_image< I, F, B >::rvalue

Return type of read access.

10.217.2.3 template<typename I, typename F, typename B> typedef lazy_image< tag::image_<I>, F, B > mln::lazy_image< I, F, B >::skeleton

Skeleton.

10.217.3 Constructor & Destructor Documentation

10.217.3.1 template<typename I, typename F, typename B> mln::lazy_image< I, F, B >::lazy_image ()

Constructors.

10.217.3.2 template<typename I, typename F, typename B> mln::lazy_image< I, F, B >::lazy_image (const F & *fun*, const B & *box*) `[inline]`

Constructors.

10.217.4 Member Function Documentation

10.217.4.1 template<typename I, typename F, typename B> const box< typename I::psite > & mln::lazy_image< I, F, B >::domain () const `[inline]`

Return domain of lazyd_image.

10.217.4.2 template<typename I, typename F, typename B> bool mln::lazy_image< I, F, B >::has (const typename I::psite & *p*) const [inline]

Test if a pixel value is accessible at p.

10.217.4.3 template<typename I, typename F, typename B> lazy_image< I, F, B >::lvalue mln::lazy_image< I, F, B >::operator() (const typename I::psite & *p*) [inline]

Read and "write if possible" access of pixel value at point site p.

10.217.4.4 template<typename I, typename F, typename B> lazy_image< I, F, B >::rvalue mln::lazy_image< I, F, B >::operator() (const typename I::psite & *p*) const [inline]

Read-only access of pixel value at point site p.

10.217.4.5 template<typename I, typename F, typename B> F::result mln::lazy_image< I, F, B >::operator() (const typename F::input & *x*) [inline]

Read and "write if possible" access of pixel value at F::input x.

10.217.4.6 template<typename I, typename F, typename B> F::result mln::lazy_image< I, F, B >::operator() (const typename F::input & *x*) const [inline]

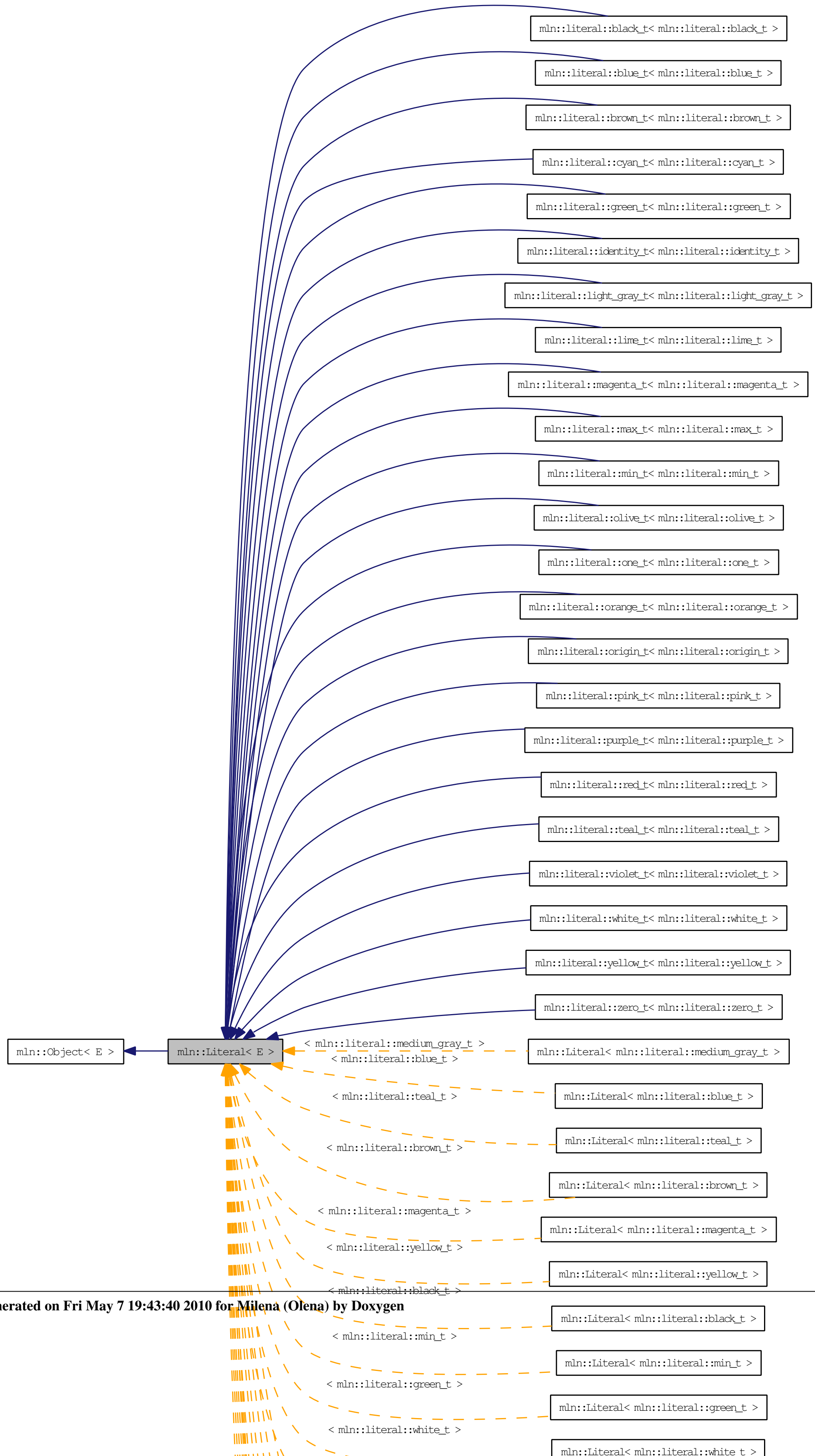
Read-only access of pixel value at F::input x.

10.218 mln::Literal< E > Struct Template Reference

Base class for implementation classes of literals.

```
#include <literal.hh>
```

Inheritance diagram for mln::Literal< E >:



10.218.1 Detailed Description

template<typename E> struct mln::Literal< E >

Base class for implementation classes of literals.

See also:

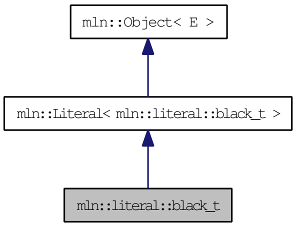
mln::doc::Literal for a complete documentation of this class contents.

10.219 mln::literal::black_t Struct Reference

Type of literal black.

`#include <black.hh>`

Inheritance diagram for mln::literal::black_t:



10.219.1 Detailed Description

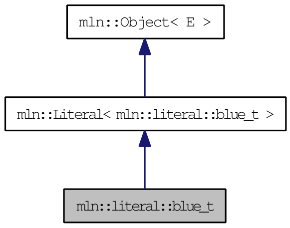
Type of literal black.

10.220 mln::literal::blue_t Struct Reference

Type of literal blue.

`#include <colors.hh>`

Inheritance diagram for mln::literal::blue_t:



10.220.1 Detailed Description

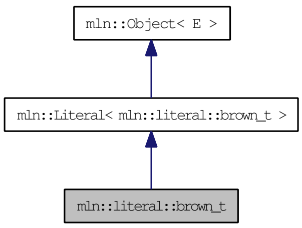
Type of literal blue.

10.221 mln::literal::brown_t Struct Reference

Type of literal brown.

`#include <colors.hh>`

Inheritance diagram for mln::literal::brown_t:



10.221.1 Detailed Description

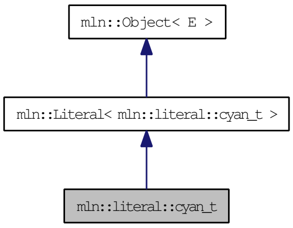
Type of literal brown.

10.222 mln::literal::cyan_t Struct Reference

Type of literal cyan.

`#include <colors.hh>`

Inheritance diagram for mln::literal::cyan_t:



10.222.1 Detailed Description

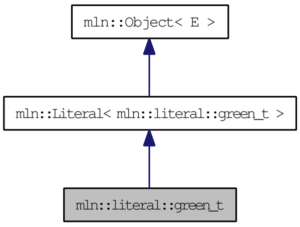
Type of literal cyan.

10.223 mln::literal::green_t Struct Reference

Type of literal green.

`#include <colors.hh>`

Inheritance diagram for mln::literal::green_t:



10.223.1 Detailed Description

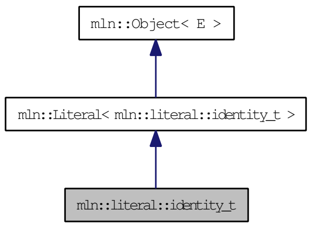
Type of literal green.

10.224 mln::literal::identity_t Struct Reference

Type of literal identity.

`#include <identity.hh>`

Inheritance diagram for mln::literal::identity_t:



10.224.1 Detailed Description

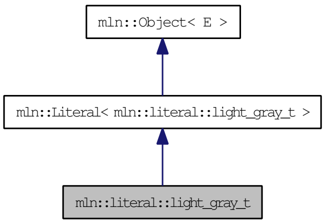
Type of literal identity.

10.225 mln::literal::light_gray_t Struct Reference

Type of literal grays.

`#include <grays.hh>`

Inheritance diagram for mln::literal::light_gray_t:



10.225.1 Detailed Description

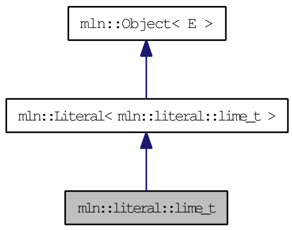
Type of literal grays.

10.226 mln::literal::lime_t Struct Reference

Type of literal lime.

```
#include <colors.hh>
```

Inheritance diagram for mln::literal::lime_t:



10.226.1 Detailed Description

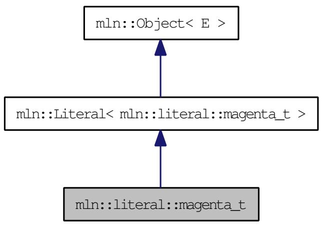
Type of literal lime.

10.227 mln::literal::magenta_t Struct Reference

Type of literal magenta.

`#include <colors.hh>`

Inheritance diagram for mln::literal::magenta_t:



10.227.1 Detailed Description

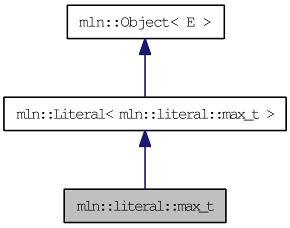
Type of literal magenta.

10.228 mln::literal::max_t Struct Reference

Type of literal max.

`#include <max.hh>`

Inheritance diagram for mln::literal::max_t:



10.228.1 Detailed Description

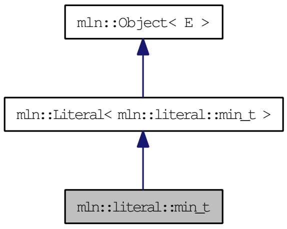
Type of literal max.

10.229 mln::literal::min_t Struct Reference

Type of literal min.

`#include <min.hh>`

Inheritance diagram for mln::literal::min_t:



10.229.1 Detailed Description

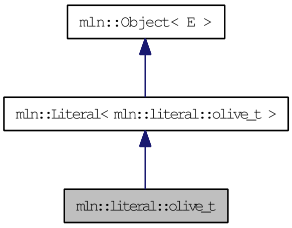
Type of literal min.

10.230 mln::literal::olive_t Struct Reference

Type of literal olive.

`#include <colors.hh>`

Inheritance diagram for mln::literal::olive_t:



10.230.1 Detailed Description

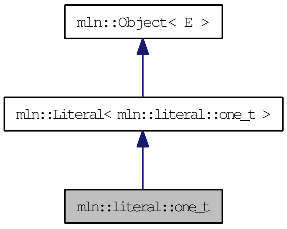
Type of literal olive.

10.231 mln::literal::one_t Struct Reference

Type of literal one.

`#include <one.hh>`

Inheritance diagram for mln::literal::one_t:



10.231.1 Detailed Description

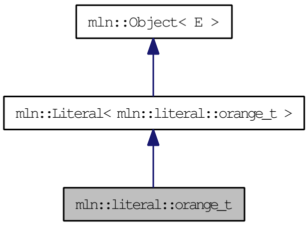
Type of literal one.

10.232 mln::literal::orange_t Struct Reference

Type of literal orange.

`#include <colors.hh>`

Inheritance diagram for mln::literal::orange_t:



10.232.1 Detailed Description

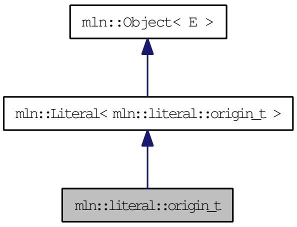
Type of literal orange.

10.233 mln::literal::origin_t Struct Reference

Type of literal origin.

`#include <origin.hh>`

Inheritance diagram for mln::literal::origin_t:



10.233.1 Detailed Description

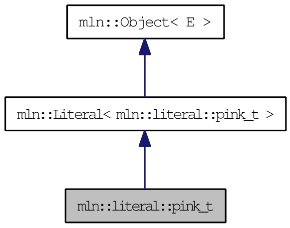
Type of literal origin.

10.234 mln::literal::pink_t Struct Reference

Type of literal pink.

`#include <colors.hh>`

Inheritance diagram for mln::literal::pink_t:



10.234.1 Detailed Description

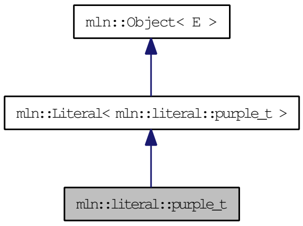
Type of literal pink.

10.235 mln::literal::purple_t Struct Reference

Type of literal purple.

`#include <colors.hh>`

Inheritance diagram for mln::literal::purple_t:



10.235.1 Detailed Description

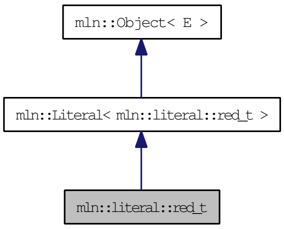
Type of literal purple.

10.236 mln::literal::red_t Struct Reference

Type of literal red.

`#include <colors.hh>`

Inheritance diagram for mln::literal::red_t:



10.236.1 Detailed Description

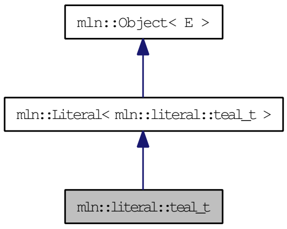
Type of literal red.

10.237 mln::literal::teal_t Struct Reference

Type of literal teal.

`#include <colors.hh>`

Inheritance diagram for mln::literal::teal_t:



10.237.1 Detailed Description

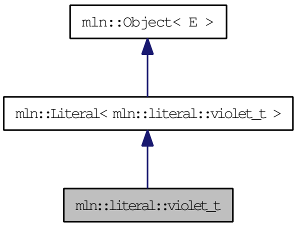
Type of literal teal.

10.238 mln::literal::violet_t Struct Reference

Type of literal violet.

`#include <colors.hh>`

Inheritance diagram for mln::literal::violet_t:



10.238.1 Detailed Description

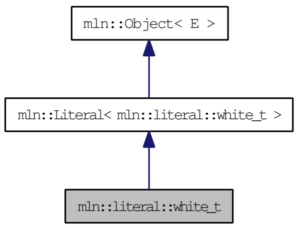
Type of literal violet.

10.239 mln::literal::white_t Struct Reference

Type of literal white.

`#include <white.hh>`

Inheritance diagram for mln::literal::white_t:



10.239.1 Detailed Description

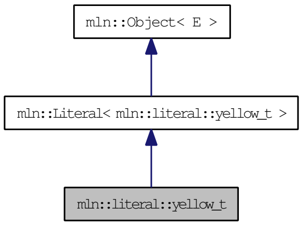
Type of literal white.

10.240 mln::literal::yellow_t Struct Reference

Type of literal yellow.

`#include <colors.hh>`

Inheritance diagram for mln::literal::yellow_t:



10.240.1 Detailed Description

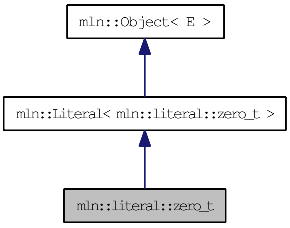
Type of literal yellow.

10.241 mln::literal::zero_t Struct Reference

Type of literal zero.

`#include <zero.hh>`

Inheritance diagram for mln::literal::zero_t:



10.241.1 Detailed Description

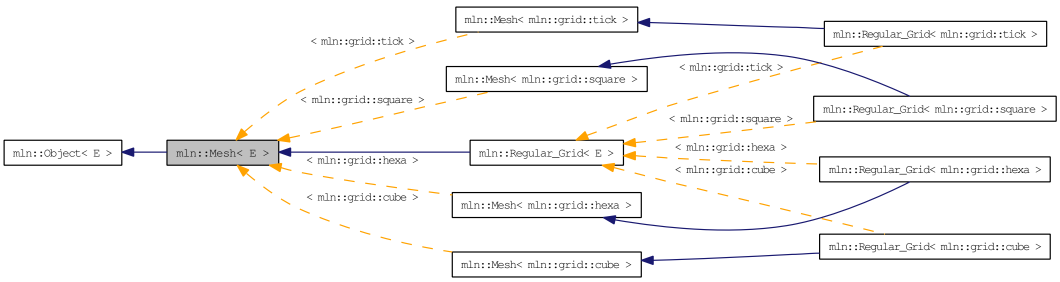
Type of literal zero.

10.242 mln::Mesh< E > Struct Template Reference

Base class for implementation classes of meshes.

`#include <mesh.hh>`

Inheritance diagram for mln::Mesh< E >:



10.242.1 Detailed Description

template<typename E> struct mln::Mesh< E >

Base class for implementation classes of meshes.

See also:

mln::doc::Mesh for a complete documentation of this class contents.

10.243 mln::Meta_Accumulator< E > Struct Template Reference

Base class for implementation of meta accumulators.

`#include <meta_accumulator.hh>`

Inherits mln::Object< E >.

Inherited by mln::accu::meta::center, mln::accu::meta::count_adjacent_vertices, mln::accu::meta::count_labels, mln::accu::meta::count_value, mln::accu::meta::histo, mln::accu::meta::label_used, mln::accu::meta::logic::land, mln::accu::meta::logic::land_basic, mln::accu::meta::logic::lor, mln::accu::meta::logic::lor_basic, mln::accu::meta::maj_h, mln::accu::meta::math::count, mln::accu::meta::math::inf, mln::accu::meta::math::sum, mln::accu::meta::math::sup, mln::accu::meta::max_site, mln::accu::meta::nil, mln::accu::meta::p< mA >, mln::accu::meta::pair< A1, A2 >, mln::accu::meta::rms, mln::accu::meta::shape::bbox, mln::accu::meta::shape::height, mln::accu::meta::shape::volume, mln::accu::meta::stat::max, mln::accu::meta::stat::max_h, mln::accu::meta::stat::mean, mln::accu::meta::stat::median_alt< T >, mln::accu::meta::stat::median_h, mln::accu::meta::stat::min, mln::accu::meta::stat::min_h, mln::accu::meta::stat::rank, mln::accu::meta::stat::rank_high_quant, mln::accu::meta::tuple< n, >, mln::accu::meta::val< mA >, and mln::accu::stat::meta::deviation.

10.243.1 Detailed Description

template<typename E> struct mln::Meta_Accumulator< E >

Base class for implementation of meta accumulators.

The parameter *E* is the exact type.

See also:

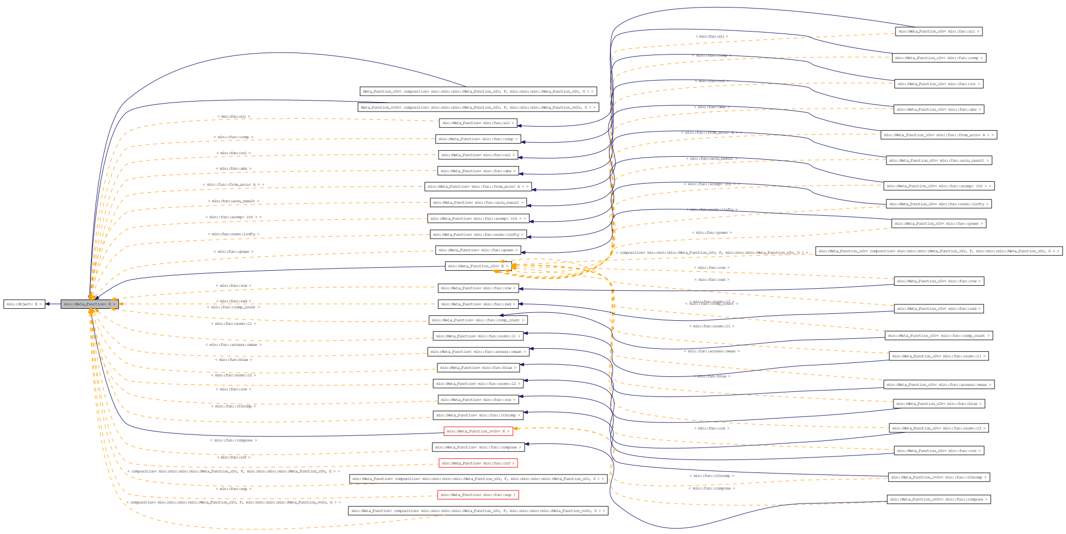
mln::doc::Meta_Accumulator for a complete documentation of this class contents.

10.244 mln::Meta_Function< E > Struct Template Reference

Base class for implementation of meta functions.

```
#include <meta_function.hh>
```

Inheritance diagram for mln::Meta_Function< E >:



10.244.1 Detailed Description

template<typename E> struct mln::Meta_Function< E >

Base class for implementation of meta functions.

The parameter *E* is the exact type.

See also:

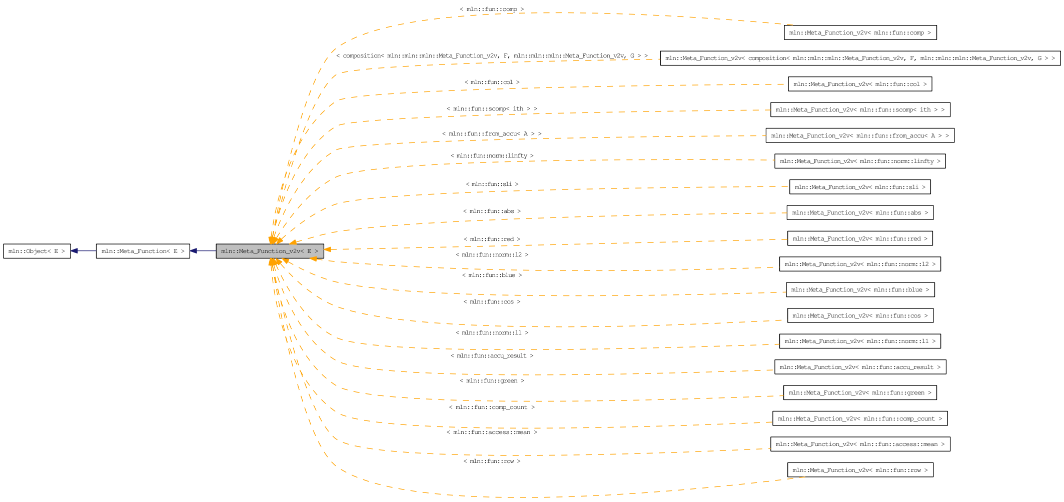
mln::doc::Meta_Function for a complete documentation of this class contents.

10.245 mln::Meta_Function_v2v< E > Struct Template Reference

Base class for implementation of function-objects from value to value.

```
#include <meta_function.hh>
```

Inheritance diagram for mln::Meta_Function_v2v< E >:



10.245.1 Detailed Description

template<typename E> struct mln::Meta_Function_v2v< E >

Base class for implementation of function-objects from value to value.

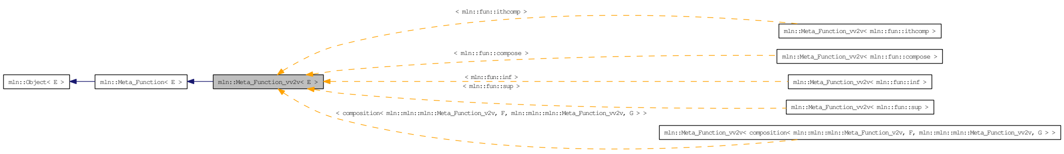
The parameter *E* is the exact type.

10.246 mln::Meta_Function_vv2v< E > Struct Template Reference

Base class for implementation of function-objects from value to value.

```
#include <meta_function.hh>
```

Inheritance diagram for mln::Meta_Function_vv2v< E >:



10.246.1 Detailed Description

template<typename E> struct mln::Meta_Function_vv2v< E >

Base class for implementation of function-objects from value to value.

The parameter *E* is the exact type.

10.247 mln::metal::ands< E1, E2, E3, E4, E5, E6, E7, E8 > Struct Template Reference

Ands type.

```
#include <ands.hh>
```

10.247.1 Detailed Description

template<typename E1, typename E2, typename E3, typename E4 = true_, typename E5 = true_, typename E6 = true_, typename E7 = true_, typename E8 = true_> struct mln::metal::ands< E1, E2, E3, E4, E5, E6, E7, E8 >

Ands type.

10.248 mln::metal::converts_to< T, U > Struct Template Reference

"converts-to" check.

`#include <converts_to.hh>`

Inherited by mln::metal::converts_to< T *, U * >.

10.248.1 Detailed Description

template<typename T, typename U> struct mln::metal::converts_to< T, U >

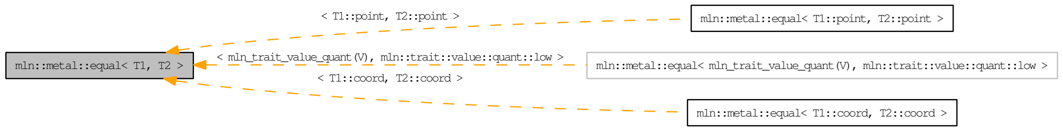
"converts-to" check.

10.249 mln::metal::equal< T1, T2 > Struct Template Reference

Definition of a static 'equal' test.

`#include <equal.hh>`

Inheritance diagram for mln::metal::equal< T1, T2 >:



10.249.1 Detailed Description

template<typename T1, typename T2> struct mln::metal::equal< T1, T2 >

Definition of a static 'equal' test.

Check whether type T1 is exactly type T2.

10.250 mln::metal::goes_to< T, U > Struct Template Reference

"goes-to" check.

```
#include <goes_to.hh>
```

10.250.1 Detailed Description

template<typename T, typename U> struct mln::metal::goes_to< T, U >

"goes-to" check.

FIXME: Doc!

10.251 mln::metal::is< T, U > Struct Template Reference

"is" check.

```
#include <is.hh>
```

10.251.1 Detailed Description

template<typename T, typename U> struct mln::metal::is< T, U >

"is" check.

Check whether T inherits from U.

10.252 mln::metal::is_a< T, M > Struct Template Reference

"is_a" check.

`#include <is_a.hh>`

10.252.1 Detailed Description

template<typename T, template< class > class M> struct mln::metal::is_a< T, M >

"is_a" check.

Check whether T inherits from _CONCEPT_ M.

10.253 mln::metal::is_not< T, U > Struct Template Reference

"is_not" check.

```
#include <is_not.hh>
```

10.253.1 Detailed Description

template<typename T, typename U> struct mln::metal::is_not< T, U >

"is_not" check.

FIXME: Doc!

10.254 mln::metal::is_not_a< T, M > Struct Template Reference

"is_not_a" static Boolean expression.

`#include <is_not_a.hh>`

10.254.1 Detailed Description

template<typename T, template< class > class M> struct mln::metal::is_not_a< T, M >

"is_not_a" static Boolean expression.

10.255 mln::mixed_neighb< W > Class Template Reference

Adapter class from window to neighborhood.

`#include <mixed_neighb.hh>`

Inherits mln::internal::neighb_base< W, mln::mixed_neighb< W > >, and mlc_is_aW.

Public Types

- typedef mixed_neighb_bkd_niter< W > bkd_niter

  Backward site iterator associated type.

- typedef mixed_neighb_fwd_niter< W > fwd_niter

  Forward site iterator associated type.

- typedef fwd_niter niter

  Site iterator associated type.

Public Member Functions

- mixed_neighb (const W &win)

  Constructor from a window `win`.

- mixed_neighb ()

  Constructor without argument.

10.255.1 Detailed Description

template<typename W> class mln::mixed_neighb< W >

Adapter class from window to neighborhood.

10.255.2 Member Typedef Documentation

10.255.2.1 template<typename W> typedef mixed_neighb_bkd_niter<W> mln::mixed_neighb< W >::bkd_niter

Backward site iterator associated type.

10.255.2.2 template<typename W> typedef mixed_neighb_fwd_niter<W> mln::mixed_neighb< W >::fwd_niter

Forward site iterator associated type.

10.255.2.3 template<typename W> typedef fwd_niter mln::mixed_neighb< W >::niter

Site iterator associated type.

10.255.3 Constructor & Destructor Documentation

10.255.3.1 template<typename W> mln::mixed_neighb< W >::mixed_neighb () [inline]

Constructor without argument.

10.255.3.2 template<typename W> mln::mixed_neighb< W >::mixed_neighb (const W & *win*) [inline]

Constructor from a window `win`.

10.256 mln::morpho::attribute::card< I > Class Template Reference

Cardinality accumulator class.

`#include <card.hh>`

Inherits mln::accu::internal::base< unsigned, mln::morpho::attribute::card< I > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- unsigned to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.256.1 Detailed Description

template<typename I> class mln::morpho::attribute::card< I >

Cardinality accumulator class.

10.256.2 Member Function Documentation

10.256.2.1 template<typename I> void mln::morpho::attribute::card< I >::init () `[inline]`

Manipulators.

10.256.2.2 template<typename I> bool mln::morpho::attribute::card< I >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

10.256.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.256.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.256.2.5 template<typename I> unsigned mln::morpho::attribute::card< I >::to_result () const [inline]

Get the value of the accumulator.

10.257 mln::morpho::attribute::count_adjacent_vertices< I > Struct Template Reference

Count_Adjacent_Vertices accumulator class.

`#include <count_adjacent_vertices.hh>`

Inherits mln::accu::internal::base< unsigned, mln::morpho::attribute::count_adjacent_vertices< I > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- unsigned to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.257.1 Detailed Description

template<typename I> struct mln::morpho::attribute::count_adjacent_vertices< I >

Count_Adjacent_Vertices accumulator class.

The parameter `I` is the image type on which the accumulator of pixels is built.

10.257.2 Member Function Documentation

10.257.2.1 template<typename I> void mln::morpho::attribute::count_adjacent_vertices< I >::init () [inline]

Manipulators.

10.257.2.2 template<typename I> bool mln::morpho::attribute::count_adjacent_vertices< I >::is_valid () const [inline]

Check whether this accu is able to return a result.

10.257.2.3 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.257.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.257.2.5 template<typename I> unsigned mln::morpho::attribute::count_adjacent_vertices< I >::to_result () const [inline]

Get the value of the accumulator.

10.258 mln::morpho::attribute::height< I > Struct Template Reference

Height accumulator class.

`#include <height.hh>`

Inherits mln::accu::internal::base< unsigned, mln::morpho::attribute::height< I > >.

Public Member Functions

- unsigned base_level () const
  Get base & current level of the accumulator.
- bool is_valid () const
  Check whether this accu is able to return a result.
- template<typename T>
  void take_as_init (const T &t)
  Take as initialization the value `t`.
- template<typename T>
  void take_n_times (unsigned n, const T &t)
  Take `n` *times the value* `t`.
- unsigned to_result () const
  Get the value of the accumulator.

  - void init ()
    Manipulators.

10.258.1 Detailed Description

template<typename I> struct mln::morpho::attribute::height< I >

Height accumulator class.

The parameter `I` is the image type on which the accumulator of pixels is built.

10.258.2 Member Function Documentation

10.258.2.1 template<typename I> unsigned mln::morpho::attribute::height< I >::base_level () const [inline]

Get base & current level of the accumulator.

10.258.2.2 template<typename I> void mln::morpho::attribute::height< I >::init () [inline]

Manipulators.

10.258.2.3 template<typename I> bool mln::morpho::attribute::height< I >::is_valid () const `[inline]`

Check whether this accu is able to return a result.

Always true here.

Referenced by mln::morpho::attribute::height< I >::to_result().

10.258.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) `[inline, inherited]`

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.258.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) `[inline, inherited]`

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.258.2.6 template<typename I> unsigned mln::morpho::attribute::height< I >::to_result () const `[inline]`

Get the value of the accumulator.

References mln::morpho::attribute::height< I >::is_valid().

10.259 mln::morpho::attribute::sharpness< I > Struct Template Reference

Sharpness accumulator class.

`#include <sharpness.hh>`

Inherits mln::accu::internal::base< double, mln::morpho::attribute::sharpness< I > >.

Public Member Functions

- unsigned area () const

  Give the area of the component.

- unsigned height () const

  Give the height.

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`*.*

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`*.*

- double to_result () const

  Get the value of the accumulator.

- unsigned volume () const

  Give the volume of the component.

  - void init ()

    Manipulators.

10.259.1 Detailed Description

template<typename I> struct mln::morpho::attribute::sharpness< I >

Sharpness accumulator class.

The parameter `I` is the image type on which the accumulator of pixels is built.

10.259.2 Member Function Documentation

10.259.2.1 template<typename I> unsigned mln::morpho::attribute::sharpness< I >::area () const [inline]

Give the area of the component.

10.259.2.2 template<typename I> unsigned mln::morpho::attribute::sharpness< I >::height () const [inline]

Give the height.

10.259.2.3 template<typename I> void mln::morpho::attribute::sharpness< I >::init () [inline]

Manipulators.

10.259.2.4 template<typename I> bool mln::morpho::attribute::sharpness< I >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.259.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.259.2.6 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.259.2.7 template<typename I> double mln::morpho::attribute::sharpness< I >::to_result () const [inline]

Get the value of the accumulator.

10.259.2.8 template<typename I> unsigned mln::morpho::attribute::sharpness< I >::volume () const [inline]

Give the volume of the component.

10.260 mln::morpho::attribute::sum< I, S > Class Template Reference

Suminality accumulator class.

`#include <sum.hh>`

Inherits mln::accu::internal::base< S, mln::morpho::attribute::sum< I, S > >.

Public Member Functions

- bool is_valid () const

  Check whether this accu is able to return a result.

- void set_value (const argument &v)

  Set the return value of the accumalator.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` times the value `t`.

- S to_result () const

  Get the value of the accumulator.

- void untake (const argument &v)

  Untake a value from the accumulator.

  - void init ()

    Manipulators.

10.260.1 Detailed Description

template<typename I, typename S = typename mln::value::props< typename I ::value >::sum> class mln::morpho::attribute::sum< I, S >

Suminality accumulator class.

10.260.2 Member Function Documentation

10.260.2.1 template<typename I, typename S> void mln::morpho::attribute::sum< I, S >::init () [inline]

Manipulators.

References mln::literal::zero.

10.260.2.2 template<typename I, typename S> bool mln::morpho::attribute::sum< I, S >::is_valid () const [inline]

Check whether this accu is able to return a result.

Return always true.

10.260.2.3 template<typename I, typename S> void mln::morpho::attribute::sum< I, S >::set_value (const argument & *v*) [inline]

Set the return value of the accumalator.

10.260.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.260.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.260.2.6 template<typename I, typename S> S mln::morpho::attribute::sum< I, S >::to_result () const [inline]

Get the value of the accumulator.

10.260.2.7 template<typename I, typename S> void mln::morpho::attribute::sum< I, S >::untake (const argument & *v*) [inline]

Untake a value from the accumulator.

10.261 mln::morpho::attribute::volume< I > Struct Template Reference

Volume accumulator class.

`#include <volume.hh>`

Inherits mln::accu::internal::base< unsigned, mln::morpho::attribute::volume< I > >.

Public Member Functions

- unsigned area () const

  Give the area.

- bool is_valid () const

  Check whether this accu is able to return a result.

- template<typename T>
  void take_as_init (const T &t)

  Take as initialization the value `t`.

- template<typename T>
  void take_n_times (unsigned n, const T &t)

  Take `n` *times the value* `t`.

- unsigned to_result () const

  Get the value of the accumulator.

  - void init ()

    Manipulators.

10.261.1 Detailed Description

template<typename I> struct mln::morpho::attribute::volume< I >

Volume accumulator class.

The parameter `I` is the image type on which the accumulator of pixels is built.

10.261.2 Member Function Documentation

10.261.2.1 template<typename I> unsigned mln::morpho::attribute::volume< I >::area () const `[inline]`

Give the area.

10.261.2.2 template<typename I> void mln::morpho::attribute::volume< I >::init () [inline]

Manipulators.

10.261.2.3 template<typename I> bool mln::morpho::attribute::volume< I >::is_valid () const [inline]

Check whether this accu is able to return a result.

Always true here.

10.261.2.4 template<typename E> template<typename T> void mln::Accumulator< E >::take_as_init (const T & *t*) [inline, inherited]

Take as initialization the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

Reimplemented in mln::accu::stat::variance< T, S, R >.

References mln::mln_exact().

10.261.2.5 template<typename E> template<typename T> void mln::Accumulator< E >::take_n_times (unsigned *n*, const T & *t*) [inline, inherited]

Take `n` times the value `t`.

Dev note: this is a final method; override if needed by take_as_init_ (ending with '_').

References mln::mln_exact().

10.261.2.6 template<typename I> unsigned mln::morpho::attribute::volume< I >::to_result () const [inline]

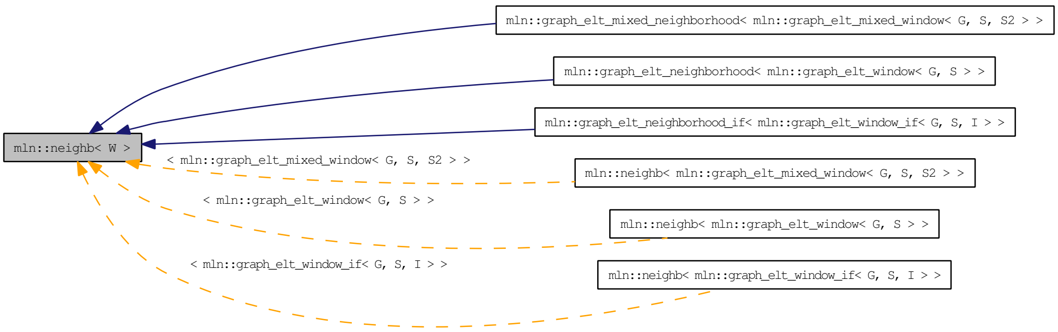
Get the value of the accumulator.

10.262 mln::neighb< W > Class Template Reference

Adapter class from window to neighborhood.

`#include <neighb.hh>`

Inheritance diagram for mln::neighb< W >:



Public Types

- typedef neighb_bkd_niter< W > bkd_niter

  Backward site iterator associated type.

- typedef neighb_fwd_niter< W > fwd_niter

  Forward site iterator associated type.

- typedef fwd_niter niter

  Site iterator associated type.

Public Member Functions

- neighb (const W &win)

  Constructor from a window `win`.

- neighb ()

  Constructor without argument.

10.262.1 Detailed Description

template<typename W> class mln::neighb< W >

Adapter class from window to neighborhood.

10.262.2 Member Typedef Documentation

10.262.2.1 template<typename W> typedef neighb_bkd_niter<W> mln::neighb< W >::bkd_niter

Backward site iterator associated type.

10.262.2.2 template<typename W> typedef neighb_fwd_niter<W> mln::neighb< W >::fwd_niter

Forward site iterator associated type.

10.262.2.3 template<typename W> typedef fwd_niter mln::neighb< W >::niter

Site iterator associated type.

10.262.3 Constructor & Destructor Documentation

10.262.3.1 template<typename W> mln::neighb< W >::neighb () [inline]

Constructor without argument.

10.262.3.2 template<typename W> mln::neighb< W >::neighb (const W & *win*) [inline]

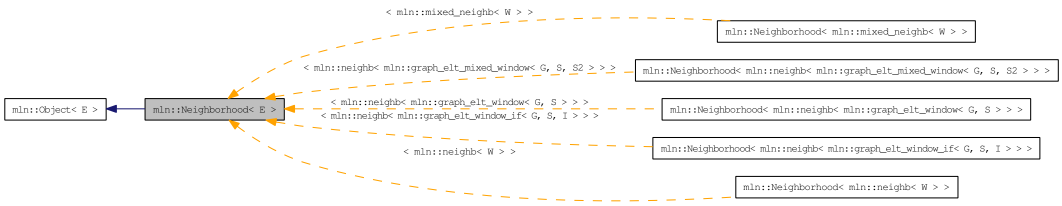
Constructor from a window `win`.

10.263 mln::Neighborhood< E > Struct Template Reference

Base class for implementation classes that are neighborhoods.

`#include <neighborhood.hh>`

Inheritance diagram for mln::Neighborhood< E >:



10.263.1 Detailed Description

template<typename E> struct mln::Neighborhood< E >

Base class for implementation classes that are neighborhoods.

See also:

mln::doc::Neighborhood for a complete documentation of this class contents.

10.264 mln::Neighborhood< void > Struct Template Reference

Neighborhood category flag type.

```
#include <neighborhood.hh>
```

10.264.1 Detailed Description

template<> struct mln::Neighborhood< void >

Neighborhood category flag type.

10.265 mln::Object< E > Struct Template Reference

Base class for almost every class defined in Milena.

```
#include <object.hh>
```

Inherited by mln::Function< function< meta::blue< mln::value::mln::value::rgb::mln::value::mln::value::rgb< n > > > > >, mln::Function< function< meta::green< mln::value::mln::value::rgb::mln::value::mln::value::rgb< n > > > > >, mln::Function< function< meta::hue< mln::value::mln::value::hsi_::mln::value::mln::value::hsi_< H, S, I > > > >, mln::Function< function< meta::hue< mln::value::mln::value::hsl_::mln::value::mln::value::hsl_< H, S, L > > > > >, mln::Function< function< meta::inty< mln::value::mln::value::hsi_::mln::value::mln::value::hsi_< H, S, I > > > > >, mln::Function< function< meta::lum< mln::value::mln::value::hsl_::mln::value::mln::value::hsl_< H, S, I > > > > >, mln::Function< function< meta::red< mln::value::mln::value::rgb::mln::value::mln::value::rgb< n > > > > >, mln::Function< function< meta::sat< mln::value::mln::value::hsi_::mln::value::mln::value::hsi_< H, S, I > > > > >, mln::Function< function< meta::sat< mln::value::mln::value::hsl_::mln::value::mln::value::hsl_< H, S, L > > > > >, mln::algebra::mat< d+1, d+1, T >, mln::Meta_Function< composition< mln::mln::mln::mln::Meta_Function_v2v, F, mln::mln::mln::mln::Meta_Function_v2v, G > >, mln::Meta_Function< composition< mln::mln::mln::mln::Meta_Function_v2v, F, mln::mln::mln::mln::Meta_Function_vv2v, G > >, mln::algebra::internal::vec_base_< n, T >, mln::algebra::internal::vec_base_< 1, T >, mln::algebra::internal::vec_base_< 2, T >, mln::algebra::internal::vec_base_< 3, T >, mln::algebra::internal::vec_base_< 4, T >, mln::algebra::mat< n, m, T >, mln::Base< E >, mln::Browsing< E >, mln::Delta_Point_Site< E >, mln::Function< E >, mln::Gdpoint< E >, mln::Graph< E >, mln::Image< E >, mln::io::off::internal::off_loader< I, E >, mln::io::off::internal::off_saver< I, E >, mln::Iterator< E >, mln::Literal< E >, mln::Mesh< E >, mln::Meta_Accumulator< E >, mln::Meta_Function< E >, mln::metal::array1d< T, Size >, mln::metal::array2d< T, r, c >, mln::metal::array3d< T, s, r, c >, mln::metal::internal::vec_base_< n, T >, mln::metal::internal::vec_base_< 1, T >, mln::metal::internal::vec_base_< 2, T >, mln::metal::internal::vec_base_< 3, T >, mln::metal::internal::vec_base_< 4, T >, mln::metal::mat< n, m, T >, mln::Neighborhood< E >, mln::pixel< I >, mln::Point_Site< E >, mln::Proxy< E >, mln::Site< E >, mln::Site_Set< E >, mln::util::couple< T, U >, mln::util::eat, mln::util::fibonacci_heap< P, T >, mln::util::ignore, mln::util::lemmings_< I >, mln::util::multi_site< P >, mln::util::nil, mln::util::ord_pair< T >, mln::util::site_pair< P >, mln::util::soft_heap< T, R >, mln::util::yes, mln::Value< E >, mln::value::HSL< E >, mln::value::interval_< T >, mln::Value_Set< E >, mln::Weighted_Window< E >, mln::Window< E >, test< T >, and mln::algebra::internal::vec_base_< n, C >.

10.265.1 Detailed Description

template< typename E > struct mln::Object< E >

Base class for almost every class defined in Milena.

The parameter *E* is the exact type.

10.266 mln::p2p_image< I, F > Struct Template Reference

FIXME: Doc!

`#include <p2p_image.hh>`

Inherits mln::internal::image_domain_morpher< I, I::domain_t, mln::p2p_image< I, F > >.

Public Types

- typedef p2p_image< tag::image_< I >, tag::function_< F > > skeleton

  Skeleton.

Public Member Functions

- const I::domain_t & domain () const

  Give the definition domain.

- const F & fun () const

  Give the p2p function.

- internal::morpher_lvalue_< I >::ret operator() (const typename I::psite &p)

  Read-write access to the image value located at point `p`.

- I::rvalue operator() (const typename I::psite &p) const

  Read-only access to the image value located at point `p`.

- p2p_image (I &ima, const F &f)

  Constructor from an image `ima` *and a predicate* `f`.

- p2p_image ()

  Constructor without argument.

10.266.1 Detailed Description

template<typename I, typename F> struct mln::p2p_image< I, F >

FIXME: Doc!

10.266.2 Member Typedef Documentation

10.266.2.1 template<typename I, typename F> typedef p2p_image< tag::image_<I>, tag::function_<F> > mln::p2p_image< I, F >::skeleton

Skeleton.

10.266.3 Constructor & Destructor Documentation

10.266.3.1 template<typename I, typename F> mln::p2p_image< I, F >::p2p_image () [inline]

Constructor without argument.

10.266.3.2 template<typename I, typename F> mln::p2p_image< I, F >::p2p_image (I & *ima*, const F & *f*) [inline]

Constructor from an image `ima` and a predicate `f`.

10.266.4 Member Function Documentation

10.266.4.1 template<typename I, typename F> const I::domain_t & mln::p2p_image< I, F >::domain () const [inline]

Give the definition domain.

10.266.4.2 template<typename I, typename F> const F & mln::p2p_image< I, F >::fun () const [inline]

Give the p2p function.

10.266.4.3 template<typename I, typename F> internal::morpher_lvalue_< I >::ret mln::p2p_image< I, F >::operator() (const typename I::psite & *p*) [inline]

Read-write access to the image value located at point `p`.

10.266.4.4 template<typename I, typename F> I::rvalue mln::p2p_image< I, F >::operator() (const typename I::psite & *p*) const [inline]

Read-only access to the image value located at point `p`.

10.267 mln::p_array< P > Class Template Reference

Multi-set of sites.

`#include <p_array.hh>`

Inherits mln::internal::site_set_base_< P, mln::p_array< P > >.

Public Types

- typedef p_indexed_bkd_piter< self_ > bkd_piter

  Backward Site_Iterator associated type.

- typedef P element

  Element associated type.

- typedef p_indexed_fwd_piter< self_ > fwd_piter

  Forward Site_Iterator associated type.

- typedef P i_element

  Insertion element associated type.

- typedef fwd_piter piter

  Site_Iterator associated type.

- typedef p_indexed_psite< self_ > psite

  Psite associated type.

Public Member Functions

- p_array< P > & append (const p_array< P > &other)

  Append an array `other` *of points.*

- p_array< P > & append (const P &p)

  Append a point `p`.

- void change (const psite &p, const P &new_p)

  Change site `p` *into* `new_p`.

- void clear ()

  Clear this set.

- bool has (const util::index &i) const

  Test is index `i` *belongs to this site set.*

- bool has (const psite &p) const

  Test is `p` *belongs to this site set.*

- void insert (const P &p)

Insert a point `p` *(equivalent as 'append').*

- bool is_valid () const

  Test this set validity so returns always true.

- std::size_t memory_size () const

  Return the size of this site set in memory.

- unsigned nsites () const

  Give the number of sites.

- const P & operator[ ] (const util::index &i) const

  Return the i-th element.

- P & operator[ ] (unsigned i)

  Return the `i-th` *site (mutable).*

- const P & operator[ ] (unsigned i) const

  Return the `i-th` *site (constant).*

- p_array (const std::vector< P > &vect)

  Constructor from a vector `vect`.

- p_array ()

  Constructor.

- void reserve (size_type n)

  Reserve `n` *cells.*

- void resize (size_t size)

  Update the size of this array.

- const std::vector< P > & std_vector () const

  Return the corresponding std::vector of points.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.267.1 Detailed Description

template<typename P> class mln::p_array< P >

Multi-set of sites.

Site set class based on std::vector.

10.267.2 Member Typedef Documentation

10.267.2.1 template<typename P> typedef p_indexed_bkd_piter<self_> mln::p_array< P >::bkd_piter

Backward Site_Iterator associated type.

10.267.2.2 template<typename P> typedef P mln::p_array< P >::element

Element associated type.

10.267.2.3 template<typename P> typedef p_indexed_fwd_piter<self_> mln::p_array< P >::fwd_piter

Forward Site_Iterator associated type.

10.267.2.4 template<typename P> typedef P mln::p_array< P >::i_element

Insertion element associated type.

10.267.2.5 template<typename P> typedef fwd_piter mln::p_array< P >::piter

Site_Iterator associated type.

10.267.2.6 template<typename P> typedef p_indexed_psite<self_> mln::p_array< P >::psite

Psite associated type.

10.267.3 Constructor & Destructor Documentation

10.267.3.1 template<typename P> mln::p_array< P >::p_array () [inline]

Constructor.

10.267.3.2 template<typename P> mln::p_array< P >::p_array (const std::vector< P > & *vect*) [inline]

Constructor from a vector `vect`.

10.267.4 Member Function Documentation

10.267.4.1 template<typename P> p_array< P > & mln::p_array< P >::append (const p_array< P > & *other*) [inline]

Append an array `other` of points.

References mln::p_array< P >::std_vector().

10.267.4.2 template<typename P> p_array< P > & mln::p_array< P >::append (const P & *p*) [inline]

Append a point `p`.

Referenced by mln::convert::to_p_array().

10.267.4.3 template<typename P> void mln::p_array< P >::change (const psite & *p*, const P & *new_p*) [inline]

Change site `p` into `new_p`.

References mln::p_array< P >::has(), and mln::p_indexed_psite< S >::index().

10.267.4.4 template<typename P> void mln::p_array< P >::clear () [inline]

Clear this set.

10.267.4.5 template<typename P> bool mln::p_array< P >::has (const util::index & *i*) const `[inline]`

Test is index `i` belongs to this site set.

References mln::p_array< P >::nsites().

10.267.4.6 template<typename P> bool mln::p_array< P >::has (const psite & *p*) const `[inline]`

Test is `p` belongs to this site set.

References mln::p_indexed_psite< S >::index().

Referenced by mln::p_array< P >::change(), and mln::p_array< P >::operator[ ]().

10.267.4.7 template<typename P> void mln::p_array< P >::insert (const P & *p*) `[inline]`

Insert a point `p` (equivalent as 'append').

10.267.4.8 template<typename P> bool mln::p_array< P >::is_valid () const `[inline]`

Test this set validity so returns always true.

10.267.4.9 template<typename P> std::size_t mln::p_array< P >::memory_size () const `[inline]`

Return the size of this site set in memory.

References mln::p_array< P >::nsites().

10.267.4.10 template<typename P> unsigned mln::p_array< P >::nsites () const `[inline]`

Give the number of sites.

Referenced by mln::registration::get_rot(), mln::p_array< P >::has(), mln::p_array< P >::memory_size(), and mln::p_array< P >::operator[ ]().

10.267.4.11]

template<typename P> const P & **mln::p_array**< P >::operator[ ] (const util::index & *i*) const `[inline]`

Return the i-th element.

References mln::p_array< P >::has().

10.267.4.12]

template<typename P> P & **mln::p_array**< P >::operator[ ] (unsigned *i*) `[inline]`

Return the `i-th` site (mutable).

References mln::p_array< P >::nsites().

10.267.4.13]

template<typename P> const P & **mln::p_array**< P >::operator[ ] (unsigned *i*) const [inline]

Return the i-th site (constant).

References mln::p_array< P >::nsites().

10.267.4.14 template<typename P> void mln::p_array< P >::reserve (size_type *n*) [inline]

Reserve n cells.

Referenced by mln::convert::to_p_array().

10.267.4.15 template<typename P> void mln::p_array< P >::resize (size_t *size*) [inline]

Update the size of this array.

10.267.4.16 template<typename P> const std::vector< P > & mln::p_array< P >::std_vector () const [inline]

Return the corresponding std::vector of points.

Referenced by mln::p_array< P >::append().

10.267.5 Friends And Related Function Documentation

10.267.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of lhs and rhs.

10.267.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.267.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets lhs and rhs.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.267.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.267.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.267.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.267.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.267.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Union of a couple of point sets.

10.267.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

Give the unique set of `s`.

10.268 mln::p_centered< W > Class Template Reference

Site set corresponding to a window centered on a site.

`#include <p_centered.hh>`

Inherits mln::internal::site_set_base_< W::psite, mln::p_centered< W > >, and mlc_is_aW.

Public Types

- typedef p_centered_piter< W > bkd_piter

  Backward Site_Iterator associated type.

- typedef psite element

  Element associated type.

- typedef p_centered_piter< W > fwd_piter

  Forward Site_Iterator associated type.

- typedef fwd_piter piter

  Site_Iterator associated type.

- typedef W::psite psite

  Psite associated type.

- typedef W::site site

  Site associated type.

Public Member Functions

- const W::psite & center () const

  Give the center of this site set.

- template<typename P>
  bool has (const P &p) const

  Test if `p` *belongs to the box.*

- bool is_valid () const

  Test if this site set is initialized.

- std::size_t memory_size () const

  Return the size of this site set in memory.

- p_centered (const W &win, const typename W::psite &c)

  Constructor from a window `win` *and a center* `c`*.*

- p_centered ()

  Constructor without argument.

- const W & window () const

    Give the window this site set is defined upon.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

    Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

    Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

    Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

    Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

    Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

    Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

    Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

    Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

    Give the unique set of `s`.

10.268.1 Detailed Description

template<typename W> class mln::p_centered< W >

Site set corresponding to a window centered on a site.

10.268.2 Member Typedef Documentation

10.268.2.1 template<typename W> typedef p_centered_piter<W> mln::p_centered< W >::bkd_piter

Backward Site_Iterator associated type.

10.268.2.2 template<typename W> typedef psite mln::p_centered< W >::element

Element associated type.

10.268.2.3 template<typename W> typedef p_centered_piter<W> mln::p_centered< W >::fwd_piter

Forward Site_Iterator associated type.

10.268.2.4 template<typename W> typedef fwd_piter mln::p_centered< W >::piter

Site_Iterator associated type.

10.268.2.5 template<typename W> typedef W ::psite mln::p_centered< W >::psite

Psite associated type.

10.268.2.6 template<typename W> typedef W ::site mln::p_centered< W >::site

Site associated type.

10.268.3 Constructor & Destructor Documentation

10.268.3.1 template<typename W> mln::p_centered< W >::p_centered () `[inline]`

Constructor without argument.

10.268.3.2 template<typename W> mln::p_centered< W >::p_centered (const W & *win*, const typename W::psite & *c*) `[inline]`

Constructor from a window `win` and a center `c`.

References mln::p_centered< W >::is_valid().

10.268.4 Member Function Documentation

10.268.4.1 template<typename W> const W::psite & mln::p_centered< W >::center () const `[inline]`

Give the center of this site set.

10.268.4.2 template<typename W> template<typename P> bool mln::p_centered< W >::has (const P & *p*) const [inline]

Test if p belongs to the box.

References mln::p_centered< W >::is_valid().

10.268.4.3 template<typename W> bool mln::p_centered< W >::is_valid () const [inline]

Test if this site set is initialized.

Referenced by mln::p_centered< W >::has(), and mln::p_centered< W >::p_centered().

10.268.4.4 template<typename W> std::size_t mln::p_centered< W >::memory_size () const [inline]

Return the size of this site set in memory.

10.268.4.5 template<typename W> const W & mln::p_centered< W >::window () const [inline]

Give the window this site set is defined upon.

10.268.5 Friends And Related Function Documentation

10.268.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of lhs and rhs.

10.268.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.268.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets lhs and rhs.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.268.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set set into the output stream ostr.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.268.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.268.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.268.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.268.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.268.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) `[related, inherited]`

Give the unique set of `s`.

10.269 mln::p_complex< D, G > Class Template Reference

A complex psite set based on the N-faces of a complex of dimension `D` (a `D-complex`).

`#include <p_complex.hh>`

Inherits mln::internal::site_set_base_< mln::complex_psite< D, G >, mln::p_complex< D, G > >.

Public Types

- typedef p_complex_bkd_piter_< D, G > bkd_piter
  Backward Site_Iterator associated type.
- typedef super_::site element
  Associated types.
- typedef p_complex_fwd_piter_< D, G > fwd_piter
  Forward Site_Iterator associated type.
- typedef fwd_piter piter
  Site_Iterator associated type.
- typedef complex_psite< D, G > psite
  Point_Site associated type.

Public Member Functions

- bool has (const psite &p) const
  Does this site set has p*?*
- bool is_valid () const
  Is this site set valid?
- unsigned nfaces () const
  Return the number of faces in the complex.
- unsigned nfaces_of_dim (unsigned n) const
  Return the number of n-faces *in the complex.*
- unsigned nsites () const
  Return The number of sites of the set, i.e., the number of faces.
- p_complex (const topo::complex< D > &cplx, const G &geom)
  Construct a complex psite set from a complex.

- topo::complex< D > & cplx ()
  Return the complex associated to the p_complex domain (mutable version).
- topo::complex< D > & cplx () const
  Accessors.

- const G & geom () const
  Return the geometry of the complex.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Set theoretic difference of `lhs` *and* `rhs`.
- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Intersection between a couple of point sets.
- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Strict inclusion test between site sets `lhs` *and* `rhs`.
- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)
  Print a site set `set` *into the output stream* `ostr`.
- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Inclusion test between site sets `lhs` *and* `rhs`.
- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Equality test between site sets `lhs` *and* `rhs`.
- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Set theoretic symmetrical difference of `lhs` *and* `rhs`.
- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Union of a couple of point sets.
- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)
  Give the unique set of `s`.

10.269.1 Detailed Description

template<unsigned D, typename G> class mln::p_complex< D, G >

A complex psite set based on the N-faces of a complex of dimension `D` (a `D-complex`).

Template Parameters:

D The dimension of the complex.

G A function object type, associating localization information (geometry) to each face of the complex.

See also:

mln::geom::complex_geometry. A complex psite set based on the N-faces of a complex.

10.269.2 Member Typedef Documentation

10.269.2.1 template<unsigned D, typename G> typedef p_complex_bkd_piter_<D, G> mln::p_complex< D, G >::bkd_piter

Backward Site_Iterator associated type.

10.269.2.2 template<unsigned D, typename G> typedef super_ ::site mln::p_complex< D, G >::element

Associated types.

Element associated type.

10.269.2.3 template<unsigned D, typename G> typedef p_complex_fwd_piter_<D, G> mln::p_complex< D, G >::fwd_piter

Forward Site_Iterator associated type.

10.269.2.4 template<unsigned D, typename G> typedef fwd_piter mln::p_complex< D, G >::piter

Site_Iterator associated type.

10.269.2.5 template<unsigned D, typename G> typedef complex_psite<D, G> mln::p_complex< D, G >::psite

Point_Site associated type.

10.269.3 Constructor & Destructor Documentation

10.269.3.1 template<unsigned D, typename G> mln::p_complex< D, G >::p_complex (const topo::complex< D > & *cplx*, const G & *geom*) [inline]

Construct a complex psite set from a complex.

Parameters:

cplx The complex upon which the complex psite set is built.

geom FIXME

10.269.4 Member Function Documentation

10.269.4.1 template<unsigned D, typename G> topo::complex< D > & mln::p_complex< D, G >::cplx () [inline]

Return the complex associated to the p_complex domain (mutable version).

References mln::p_complex< D, G >::is_valid().

10.269.4.2 template<unsigned D, typename G> topo::complex< D > & mln::p_complex< D, G >::cplx () const [inline]

Accessors.

Return the complex associated to the p_complex domain (const version)

References mln::p_complex< D, G >::is_valid().

Referenced by mln::complex_psite< D, G >::change_target(), mln::complex_psite< D, G >::complex_-psite(), and mln::operator==().

10.269.4.3 template<unsigned D, typename G> const G & mln::p_complex< D, G >::geom () const [inline]

Return the geometry of the complex.

10.269.4.4 template<unsigned D, typename G> bool mln::p_complex< D, G >::has (const psite & *p*) const [inline]

Does this site set has *p*?

References mln::complex_psite< D, G >::is_valid(), mln::p_complex< D, G >::is_valid(), and mln::complex_psite< D, G >::site_set().

10.269.4.5 template<unsigned D, typename G> bool mln::p_complex< D, G >::is_valid () const [inline]

Is this site set valid?

Referenced by mln::p_complex< D, G >::cplx(), and mln::p_complex< D, G >::has().

10.269.4.6 template<unsigned D, typename G> unsigned mln::p_complex< D, G >::nfaces () const [inline]

Return the number of faces in the complex.

Referenced by mln::p_complex< D, G >::nsites().

10.269.4.7 template<unsigned D, typename G> unsigned mln::p_complex< D, G >::nfaces_of_dim (unsigned *n*) const [inline]

Return the number of *n-faces* in the complex.

10.269.4.8 template<unsigned D, typename G> unsigned mln::p_complex< D, G >::nsites () const [inline]

Return The number of sites of the set, i.e., the number of *faces*.

(Required by the mln::Site_Set concept, since the property trait::site_set::nsites::known of this site set is set to 'known'.)

References mln::p_complex< D, G >::nfaces().

10.269.5 Friends And Related Function Documentation

10.269.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.269.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.269.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.269.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.269.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.269.5.6 template< typename Sl, typename Sr > bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.269.5.7 template< typename Sl, typename Sr > p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.269.5.8 template< typename Sl, typename Sr > p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Union of a couple of point sets.

10.269.5.9 template< typename S > p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

Give the unique set of `s`.

10.270 mln::p_edges< G, F > Class Template Reference

Site set mapping graph edges and image sites.

`#include <p_edges.hh>`

Inherits mln::internal::site_set_base_< F::result, mln::p_edges< G, F > >.

Public Types

- typedef util::edge< G > edge
  Type of graph edge.
- typedef F fun_t
  Function associated type.
- typedef util::edge< G > graph_element
  Type of graph element this site set focuses on.
- typedef G graph_t
  Graph associated type.

  - typedef p_graph_piter< self_, mln_edge_bkd_iter(G) > bkd_piter
    Backward Site_Iterator associated type.
  - typedef super_::site element
    Associated types.
  - typedef p_graph_piter< self_, mln_edge_fwd_iter(G) > fwd_piter
    Forward Site_Iterator associated type.
  - typedef fwd_piter piter
    Site_Iterator associated type.
  - typedef p_edges_psite< G, F > psite
    Point_Site associated type.

Public Member Functions

- template<typename G2>
  bool has (const util::edge< G2 > &e) const
  Does this site set has edge e*?*
- bool has (const psite &p) const
  Does this site set has site p*?*
- void invalidate ()
  Invalidate this site set.
- bool is_valid () const

Is this site set valid?

- std::size_t memory_size () const

  Does this site set has vertex_id*? FIXME: causes ambiguities while calling has(mln::neighb_fwd_niter<>); bool has(unsigned vertex_id) const;.*

- unsigned nedges () const

  Return The number of edges in the graph.

- unsigned nsites () const

  Return The number of points (sites) of the set, i.e., the number of edges.

- const F & function () const

  Return the mapping function.

- const G & graph () const

  Accessors.

- template<typename F2>
  p_edges (const Graph< G > &gr, const Function< F2 > &f)

  Construct a graph edge psite set from a graph and a function.

- p_edges (const Graph< G > &gr, const Function< F > &f)

  Construct a graph edge psite set from a graph and a function.

- p_edges (const Graph< G > &gr)

  Construct a graph edge psite set from a graph.

- p_edges ()

  Constructors
  Default constructor.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)
  Print a site set `set` *into the output stream* `ostr`.
- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Inclusion test between site sets `lhs` *and* `rhs`.
- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Equality test between site sets `lhs` *and* `rhs`.
- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Set theoretic symmetrical difference of `lhs` *and* `rhs`.
- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Union of a couple of point sets.
- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)
  Give the unique set of `s`.

10.270.1 Detailed Description

template<typename G, typename F = util::internal::id2element<G,util::edge<G> >> class mln::p_edges< G, F >

Site set mapping graph edges and image sites.

10.270.2 Member Typedef Documentation

10.270.2.1 template<typename G, typename F = util::internal::id2element<G,util::edge<G> >> typedef p_graph_piter< self_, mln_edge_bkd_iter(G) > mln::p_edges< G, F >::bkd_piter

Backward Site_Iterator associated type.

10.270.2.2 template<typename G, typename F = util::internal::id2element<G,util::edge<G> >> typedef util::edge<G> mln::p_edges< G, F >::edge

Type of graph edge.

10.270.2.3 template<typename G, typename F = util::internal::id2element<G,util::edge<G> >> typedef super_ ::site mln::p_edges< G, F >::element

Associated types.

Element associated type.

10.270.2.4 template< typename G, typename F = util::internal::id2element< G,util::edge< G> >> typedef F mln::p_edges< G, F >::fun_t

Function associated type.

10.270.2.5 template< typename G, typename F = util::internal::id2element< G,util::edge< G> >> typedef p_graph_piter< self_, mln_edge_fwd_iter(G) > mln::p_edges< G, F >::fwd_piter

Forward Site_Iterator associated type.

10.270.2.6 template< typename G, typename F = util::internal::id2element< G,util::edge< G> >> typedef util::edge< G> mln::p_edges< G, F >::graph_element

Type of graph element this site set focuses on.

10.270.2.7 template< typename G, typename F = util::internal::id2element< G,util::edge< G> >> typedef G mln::p_edges< G, F >::graph_t

Graph associated type.

10.270.2.8 template< typename G, typename F = util::internal::id2element< G,util::edge< G> >> typedef fwd_piter mln::p_edges< G, F >::piter

Site_Iterator associated type.

10.270.2.9 template< typename G, typename F = util::internal::id2element< G,util::edge< G> >> typedef p_edges_psite< G, F> mln::p_edges< G, F >::psite

Point_Site associated type.

10.270.3 Constructor & Destructor Documentation

10.270.3.1 template< typename G, typename F> mln::p_edges< G, F >::p_edges () `[inline]`

Constructors

Default constructor.

10.270.3.2 template< typename G, typename F> mln::p_edges< G, F >::p_edges (const Graph< G > & *gr*) `[inline]`

Construct a graph edge psite set from a graph.

Parameters:

gr The graph upon which the graph edge psite set is built.

References mln::p_edges< G, F >::is_valid().

10.270.3.3 template<typename G, typename F> mln::p_edges< G, F >::p_edges (const Graph< G > & *gr*, const Function< F > & *f*) [inline]

Construct a graph edge psite set from a graph and a function.

Parameters:

gr The graph upon which the graph edge psite set is built.

f the function mapping edges and sites.

References mln::p_edges< G, F >::is_valid().

10.270.3.4 template<typename G, typename F> template<typename F2> mln::p_edges< G, F >::p_edges (const Graph< G > & *gr*, const Function< F2 > & *f*) [inline]

Construct a graph edge psite set from a graph and a function.

Parameters:

gr The graph upon which the graph edge psite set is built.

f the function mapping edges and sites. It must be convertible towards the function type `F`.

References mln::p_edges< G, F >::is_valid().

10.270.4 Member Function Documentation

10.270.4.1 template<typename G, typename F> const F & mln::p_edges< G, F >::function () const [inline]

Return the mapping function.

10.270.4.2 template<typename G, typename F> const G & mln::p_edges< G, F >::graph () const [inline]

Accessors.

Return the graph associated to this site set

References mln::p_edges< G, F >::is_valid().

Referenced by mln::operator==().

10.270.4.3 template<typename G, typename F> template<typename G2> bool mln::p_edges< G, F >::has (const util::edge< G2 > & *e*) const [inline]

Does this site set has edge *e*?

References mln::util::edge< G >::graph(), mln::util::edge< G >::is_valid(), and mln::p_edges< G, F >::is_valid().

10.270.4.4 template<typename G, typename F> bool mln::p_edges< G, F >::has (const psite & *p*) const [inline]

Does this site set has site *p*?

References mln::p_edges< G, F >::is_valid().

10.270.4.5 template<typename G, typename F> void mln::p_edges< G, F >::invalidate () [inline]

Invalidate this site set.

10.270.4.6 template<typename G, typename F> bool mln::p_edges< G, F >::is_valid () const [inline]

Is this site set valid?

Referenced by mln::p_edges< G, F >::graph(), mln::p_edges< G, F >::has(), and mln::p_edges< G, F >::p_edges().

10.270.4.7 template<typename G, typename F> std::size_t mln::p_edges< G, F >::memory_size () const [inline]

Does this site set has *vertex_id*? FIXME: causes ambiguities while calling has(mln::neighb_fwd_niter<>); bool has(unsigned vertex_id) const;.

10.270.4.8 template<typename G, typename F> unsigned mln::p_edges< G, F >::nedges () const [inline]

Return The number of edges in the graph.

Referenced by mln::p_edges< G, F >::nsites().

10.270.4.9 template<typename G, typename F> unsigned mln::p_edges< G, F >::nsites () const [inline]

Return The number of points (sites) of the set, i.e., the number of *edges*.

References mln::p_edges< G, F >::nedges().

10.270.5 Friends And Related Function Documentation

10.270.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.270.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.270.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.270.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) `[related, inherited]`

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.270.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.270.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.270.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.270.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Union of a couple of point sets.

10.270.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

Give the unique set of `s`.

10.271 mln::p_faces< N, D, P > Struct Template Reference

A complex psite set based on a the N-faces of a complex of dimension D (a D-complex).

`#include <p_faces.hh>`

Inherits mln::internal::site_set_base_< mln::faces_psite< N, D, P >, mln::p_faces< N, D, P > >.

Package Types

- typedef p_faces_bkd_piter_< N, D, P > bkd_piter
  Backward Site_Iterator associated type.
- typedef super_::site element
  Associated types.
- typedef p_faces_fwd_piter_< N, D, P > fwd_piter
  Forward Site_Iterator associated type.
- typedef fwd_piter piter
  Site_Iterator associated type.
- typedef faces_psite< N, D, P > psite
  Point_Site associated type.

Package Functions

- bool is_valid () const
  Is this site set valid?
- unsigned nfaces () const
  Return The number of faces in the complex.
- unsigned nsites () const
  Return The number of sites of the set, i.e., the number of faces.
- p_faces (const p_complex< D, P > &pc)
  Construct a faces psite set from an mln::p_complex.
- p_faces (const topo::complex< D > &cplx)
  Construct a faces psite set from an mln::complex.

- topo::complex< D > & cplx ()
  Return the complex associated to the p_faces domain (mutable version).
- topo::complex< D > & cplx () const
  Accessors.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.271.1 Detailed Description

template<unsigned N, unsigned D, typename P> struct mln::p_faces< N, D, P >

A complex psite set based on a the N-faces of a complex of dimension D (a D-complex).

10.271.2 Member Typedef Documentation

10.271.2.1 template<unsigned N, unsigned D, typename P> typedef p_faces_bkd_piter_<N, D, P> mln::p_faces< N, D, P >::bkd_piter [package]

Backward Site_Iterator associated type.

10.271.2.2 template<unsigned N, unsigned D, typename P> typedef super_ ::site mln::p_faces< N, D, P >::element [package]

Associated types.

Element associated type.

10.271.2.3 template<unsigned N, unsigned D, typename P> typedef p_faces_fwd_piter_<N, D, P> mln::p_faces< N, D, P >::fwd_piter [package]

Forward Site_Iterator associated type.

10.271.2.4 template<unsigned N, unsigned D, typename P> typedef fwd_piter mln::p_faces< N, D, P >::piter [package]

Site_Iterator associated type.

10.271.2.5 template<unsigned N, unsigned D, typename P> typedef faces_psite<N, D, P> mln::p_faces< N, D, P >::psite [package]

Point_Site associated type.

10.271.3 Constructor & Destructor Documentation

10.271.3.1 template<unsigned N, unsigned D, typename P> mln::p_faces< N, D, P >::p_faces (const topo::complex< D > & *cplx*) [inline, package]

Construct a faces psite set from an mln::complex.

Parameters:

cplx The complex upon which the complex psite set is built.

10.271.3.2 template<unsigned N, unsigned D, typename P> mln::p_faces< N, D, P >::p_faces (const p_complex< D, P > & *pc*) [inline, package]

Construct a faces psite set from an mln::p_complex.

Parameters:

pc The complex upon which the complex psite set is built.

10.271.4 Member Function Documentation

10.271.4.1 template< unsigned N, unsigned D, typename P> topo::complex< D > & mln::p_faces< N, D, P >::cplx () [inline, package]

Return the complex associated to the p_faces domain (mutable version).

References mln::p_faces< N, D, P >::is_valid().

10.271.4.2 template< unsigned N, unsigned D, typename P> topo::complex< D > & mln::p_faces< N, D, P >::cplx () const [inline, package]

Accessors.

Return the complex associated to the p_faces domain (const version).

References mln::p_faces< N, D, P >::is_valid().

Referenced by mln::faces_psite< N, D, P >::change_target(), and mln::operator==().

10.271.4.3 template< unsigned N, unsigned D, typename P> bool mln::p_faces< N, D, P >::is_valid () const [inline, package]

Is this site set valid?

Referenced by mln::p_faces< N, D, P >::cplx().

10.271.4.4 template< unsigned N, unsigned D, typename P> unsigned mln::p_faces< N, D, P >::nfaces () const [inline, package]

Return The number of faces in the complex.

Referenced by mln::p_faces< N, D, P >::nsites().

10.271.4.5 template< unsigned N, unsigned D, typename P> unsigned mln::p_faces< N, D, P >::nsites () const [inline, package]

Return The number of sites of the set, i.e., the number of *faces*.

(Required by the mln::Site_Set concept, since the property trait::site_set::nsites::known of this site set is set to 'known'.)

References mln::p_faces< N, D, P >::nfaces().

10.271.5 Friends And Related Function Documentation

10.271.5.1 template< typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.271.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Intersection between a couple of point sets.

10.271.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.271.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) `[related, inherited]`

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.271.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.271.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.271.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.271.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.271.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) `[related, inherited]`

Give the unique set of `s`.

10.272 mln::p_graph_piter< S, I > Class Template Reference

Generic iterator on point sites of a mln::S.

`#include <p_graph_piter.hh>`

Inherits mln::internal::site_set_iterator_base< S, mln::p_graph_piter< S, I > >.

Public Member Functions

- const S::graph_t & graph () const

  Return the graph associated to the target S.

- unsigned id () const

  Return the graph element id.

- mln_q_subject (iter) element()

  Return the underlying graph element.

- void next ()

  Go to the next element.

- p_graph_piter ()

  Constructors.

10.272.1 Detailed Description

template<typename S, typename I> class mln::p_graph_piter< S, I >

Generic iterator on point sites of a mln::S.

10.272.2 Constructor & Destructor Documentation

10.272.2.1 template<typename S, typename I> mln::p_graph_piter< S, I >::p_graph_piter () `[inline]`

Constructors.

10.272.3 Member Function Documentation

10.272.3.1 template<typename S, typename I> const S::graph_t & mln::p_graph_piter< S, I >::graph () const `[inline]`

Return the graph associated to the target S.

10.272.3.2 template<typename S, typename I> unsigned mln::p_graph_piter< S, I >::id () const [inline]

Return the graph element id.

10.272.3.3 template<typename S, typename I> mln::p_graph_piter< S, I >::mln_q_subject (iter)

Return the underlying graph element.

10.272.3.4 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.273 mln::p_if< S, F > Class Template Reference

Site set restricted w.r.t.

`#include <p_if.hh>`

Inherits mln::internal::site_set_base_< S::psite, mln::p_if< S, F > >.

Public Types

- typedef p_if_piter_< typename S::bkd_piter, S, F > bkd_piter
  Backward Site_Iterator associated type.
- typedef S::element element
  Element associated type.
- typedef p_if_piter_< typename S::fwd_piter, S, F > fwd_piter
  Forward Site_Iterator associated type.
- typedef fwd_piter piter
  Site_Iterator associated type.
- typedef S::psite psite
  Psite associated type.

Public Member Functions

- bool has (const psite &p) const
  Test if `p` *belongs to the subset.*
- bool is_valid () const
  Test if this site set is valid.
- std::size_t memory_size () const
  Return the size of this site set in memory.
- const S & overset () const
  Give the primary overset.
- p_if ()
  Constructor without argument.
- p_if (const S &s, const F &f)
  Constructor with a site set `s` *and a predicate* `f`*.*
- bool pred (const psite &p) const
  Test predicate on point site `p`*.*
- const F & predicate () const
  Give the predicate function.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.273.1 Detailed Description

template<typename S, typename F> class mln::p_if< S, F >

Site set restricted w.r.t.

a predicate.

Parameter `S` is a site set type; parameter F is a function from point to Boolean.

10.273.2 Member Typedef Documentation

10.273.2.1 template<typename S, typename F> typedef p_if_piter_<typename S ::bkd_piter, S, F> mln::p_if< S, F >::bkd_piter

Backward Site_Iterator associated type.

10.273.2.2 template<typename S, typename F> typedef S ::element mln::p_if< S, F >::element

Element associated type.

10.273.2.3 template<typename S, typename F> typedef p_if_piter_<typename S ::fwd_piter, S, F> mln::p_if< S, F >::fwd_piter

Forward Site_Iterator associated type.

10.273.2.4 template<typename S, typename F> typedef fwd_piter mln::p_if< S, F >::piter

Site_Iterator associated type.

10.273.2.5 template<typename S, typename F> typedef S ::psite mln::p_if< S, F >::psite

Psite associated type.

10.273.3 Constructor & Destructor Documentation

10.273.3.1 template<typename S, typename F> mln::p_if< S, F >::p_if (const S & *s*, const F & *f*) `[inline]`

Constructor with a site set `s` and a predicate `f`.

10.273.3.2 template<typename S, typename F> mln::p_if< S, F >::p_if () `[inline]`

Constructor without argument.

10.273.4 Member Function Documentation

10.273.4.1 template<typename S, typename F> bool mln::p_if< S, F >::has (const psite & *p*) const `[inline]`

Test if `p` belongs to the subset.

References mln::p_if< S, F >::has().

Referenced by mln::p_if< S, F >::has().

10.273.4.2 template<typename S, typename F> bool mln::p_if< S, F >::is_valid () const [inline]

Test if this site set is valid.

10.273.4.3 template<typename S, typename F> std::size_t mln::p_if< S, F >::memory_size () const [inline]

Return the size of this site set in memory.

10.273.4.4 template<typename S, typename F> const S & mln::p_if< S, F >::overset () const [inline]

Give the primary overset.

10.273.4.5 template<typename S, typename F> bool mln::p_if< S, F >::pred (const psite & *p*) const [inline]

Test predicate on point site `p`.

10.273.4.6 template<typename S, typename F> const F & mln::p_if< S, F >::predicate () const [inline]

Give the predicate function.

10.273.5 Friends And Related Function Documentation

10.273.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.273.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.273.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.273.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.273.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.273.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.273.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.273.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Union of a couple of point sets.

10.273.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

Give the unique set of `s`.

10.274 mln::p_image< I > Class Template Reference

Site set based on an image of Booleans.

`#include <p_image.hh>`

Inherits mln::internal::site_set_base_< I::psite, mln::p_image< I > >.

Public Types

- typedef S::bkd_piter bkd_piter

  Backward Site_Iterator associated type.
- typedef I::psite element

  Element associated type.
- typedef S::fwd_piter fwd_piter

  Forward Site_Iterator associated type.
- typedef psite i_element

  Insertion element associated type.
- typedef S::piter piter

  Site_Iterator associated type.
- typedef I::psite psite

  Psite associated type.
- typedef psite r_element

  Removal element associated type.
- typedef internal::p_image_site_set< I >::ret S

  Equivalent site_set type.

Public Member Functions

- void clear ()

  Clear this set.
- bool has (const psite &) const

  Test is the psite `p` *belongs to this site set.*
- void insert (const psite &p)

  Insert a site `p`*.*
- bool is_valid () const

  Test if this site set is valid, i.e., initialized.
- std::size_t memory_size () const

Return the size of this site set in memory.

- unsigned nsites () const

  Give the number of sites.

- operator typename internal::p_image_site_set< I >::ret () const

  Conversion towards the equivalent site set.

- p_image (const I &ima)

  Constructor.

- p_image ()

  Constructor without argument.

- void remove (const psite &p)

  Remove a site `p`*.*

- void toggle (const psite &p)

  Change the status in/out of a site `p`*.*

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`*.*

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`*.*

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Set theoretic symmetrical difference of `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)
  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)
  Give the unique set of `s`*.*

10.274.1 Detailed Description

template<typename I> class mln::p_image< I >

Site set based on an image of Booleans.

10.274.2 Member Typedef Documentation

10.274.2.1 template<typename I> typedef S ::bkd_piter mln::p_image< I >::bkd_piter

Backward Site_Iterator associated type.

10.274.2.2 template<typename I> typedef I ::psite mln::p_image< I >::element

Element associated type.

10.274.2.3 template<typename I> typedef S ::fwd_piter mln::p_image< I >::fwd_piter

Forward Site_Iterator associated type.

10.274.2.4 template<typename I> typedef psite mln::p_image< I >::i_element

Insertion element associated type.

10.274.2.5 template<typename I> typedef S ::piter mln::p_image< I >::piter

Site_Iterator associated type.

10.274.2.6 template<typename I> typedef I ::psite mln::p_image< I >::psite

Psite associated type.

10.274.2.7 template<typename I> typedef psite mln::p_image< I >::r_element

Removal element associated type.

10.274.2.8 template<typename I> typedef internal::p_image_site_set<I>::ret mln::p_image< I >::S

Equivalent site_set type.

10.274.3 Constructor & Destructor Documentation

10.274.3.1 template<typename I> mln::p_image< I >::p_image () [inline]

Constructor without argument.

10.274.3.2 template<typename I> mln::p_image< I >::p_image (const I & *ima*) [inline]

Constructor.

References mln::p_image< I >::clear().

10.274.4 Member Function Documentation

10.274.4.1 template<typename I> void mln::p_image< I >::clear () [inline]

Clear this set.

References mln::data::fill_with_value(), and mln::p_image< I >::is_valid().

Referenced by mln::p_image< I >::p_image().

10.274.4.2 template<typename I> bool mln::p_image< I >::has (const psite & *p*) const [inline]

Test is the psite `p` belongs to this site set.

References mln::p_image< I >::is_valid().

10.274.4.3 template<typename I> void mln::p_image< I >::insert (const psite & *p*) [inline]

Insert a site `p`.

References mln::p_image< I >::is_valid().

10.274.4.4 template<typename I> bool mln::p_image< I >::is_valid () const [inline]

Test if this site set is valid, i.e., initialized.

Referenced by mln::p_image< I >::clear(), mln::p_image< I >::has(), mln::p_image< I >::insert(), mln::p_image< I >::memory_size(), mln::p_image< I >::remove(), and mln::p_image< I >::toggle().

10.274.4.5 template<typename I> std::size_t mln::p_image< I >::memory_size () const [inline]

Return the size of this site set in memory.

References mln::p_image< I >::is_valid().

10.274.4.6 template<typename I> unsigned mln::p_image< I >::nsites () const [inline]

Give the number of sites.

10.274.4.7 template<typename I> mln::p_image< I >::operator typename internal::p_image_site_set< I >::ret () const [inline]

Conversion towards the equivalent site set.

10.274.4.8 template<typename I> void mln::p_image< I >::remove (const psite & *p*) [inline]

Remove a site `p`.

References mln::p_image< I >::is_valid().

10.274.4.9 template<typename I> void mln::p_image< I >::toggle (const psite & *p*) [inline]

Change the status in/out of a site `p`.

References mln::p_image< I >::is_valid().

10.274.5 Friends And Related Function Documentation

10.274.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.274.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.274.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.274.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.274.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.274.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.274.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.274.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Union of a couple of point sets.

10.274.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

Give the unique set of `s`.

10.275 mln::p_indexed_bkd_piter< S > Class Template Reference

Backward iterator on sites of an indexed site set.

`#include <p_array.hh>`

Inherits mln::internal::site_set_iterator_base< S, mln::p_indexed_bkd_piter< S > >.

Public Member Functions

- int index () const

  Return the current index.

- void next ()

  Go to the next element.

- p_indexed_bkd_piter (const S &s)

  Constructor.

- p_indexed_bkd_piter ()

  Constructor with no argument.

10.275.1 Detailed Description

template<typename S> class mln::p_indexed_bkd_piter< S >

Backward iterator on sites of an indexed site set.

10.275.2 Constructor & Destructor Documentation

10.275.2.1 template<typename S> mln::p_indexed_bkd_piter< S >::p_indexed_bkd_piter () `[inline]`

Constructor with no argument.

10.275.2.2 template<typename S> mln::p_indexed_bkd_piter< S >::p_indexed_bkd_piter (const S & *s*) `[inline]`

Constructor.

10.275.3 Member Function Documentation

10.275.3.1 template<typename S> int mln::p_indexed_bkd_piter< S >::index () const `[inline]`

Return the current index.

10.275.3.2 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.276 mln::p_indexed_fwd_piter< S > Class Template Reference

Forward iterator on sites of an indexed site set.

`#include <p_array.hh>`

Inherits mln::internal::site_set_iterator_base< S, mln::p_indexed_fwd_piter< S > >.

Public Member Functions

- int index () const

  Return the current index.

- void next ()

  Go to the next element.

- p_indexed_fwd_piter (const S &s)

  Constructor.

- p_indexed_fwd_piter ()

  Constructor with no argument.

10.276.1 Detailed Description

template<typename S> class mln::p_indexed_fwd_piter< S >

Forward iterator on sites of an indexed site set.

10.276.2 Constructor & Destructor Documentation

10.276.2.1 template<typename S> mln::p_indexed_fwd_piter< S >::p_indexed_fwd_piter () [inline]

Constructor with no argument.

10.276.2.2 template<typename S> mln::p_indexed_fwd_piter< S >::p_indexed_fwd_piter (const S & *s*) [inline]

Constructor.

10.276.3 Member Function Documentation

10.276.3.1 template<typename S> int mln::p_indexed_fwd_piter< S >::index () const [inline]

Return the current index.

10.276.3.2 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.277 mln::p_indexed_psite< S > Class Template Reference

Psite class for indexed site sets such as p_array.

`#include <p_array.hh>`

Inherits mln::internal::pseudo_site_base_< const S::element &, mln::p_indexed_psite< S > >.

10.277.1 Detailed Description

template<typename S> class mln::p_indexed_psite< S >

Psite class for indexed site sets such as p_array.

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10.278 mln::p_key< K, P > Class Template Reference

Priority queue class.

`#include <p_key.hh>`

Inherits mln::internal::site_set_base_< P, mln::p_key< K, P > >.

Public Types

- typedef p_double_piter< self_, mln_bkd_eiter(util::set< K >), typename p_set< P >::bkd_piter > bkd_piter

  Backward Site_Iterator associated type.

- typedef P element

  Element associated type.

- typedef p_double_piter< self_, mln_fwd_eiter(util::set< K >), typename p_set< P >::fwd_piter > fwd_piter

  Forward Site_Iterator associated type.

- typedef std::pair< K, P > i_element

  Insertion element associated type.

- typedef fwd_piter piter

  Site_Iterator associated type.

- typedef p_double_psite< self_, p_set< P > > psite

  Psite associated type.

- typedef P r_element

  Removal element associated type.

Public Member Functions

- void change_key (const K &k, const K &new_k)

  Change the key `k` *into a new value* `new_k`.

- template<typename F>
  void change_keys (const Function_v2v< F > &f)

  Change the keys by applying the function `f`.

- void clear ()

  Clear this site set.

- bool exists_key (const K &key) const

  Test if the `priority` *exists.*

- bool has (const P &p) const

Test is the psite p *belongs to this site set.*

- bool has (const psite &) const

  Test is the psite p *belongs to this site set.*

- void insert (const K &k, const P &p)

  Insert a pair (key k*, site* p*).*

- void insert (const i_element &k_p)

  Insert a pair k_p *(key k, site p).*

- bool is_valid () const

  Test this set validity so returns always true.

- const K & key (const P &p) const

  Give the key associated with site p*.*

- const util::set< K > & keys () const

  Give the set of keys.

- std::size_t memory_size () const

  Return the size of this site set in memory.

- unsigned nsites () const

  Give the number of sites.

- const p_set< P > & operator() (const K &key) const

  Give the queue with the priority priority*.*

- p_key ()

  Constructor.

- void remove (const P &p)

  Remove a site p*.*

- void remove_key (const K &k)

  Remove all sites with key k*.*

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of lhs *and* rhs*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template< typename Sl, typename Sr >
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`*.*

- template< typename S >
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`*.*

- template< typename Sl, typename Sr >
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`*.*

- template< typename Sl, typename Sr >
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`*.*

- template< typename Sl, typename Sr >
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`*.*

- template< typename Sl, typename Sr >
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template< typename S >
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`*.*

10.278.1 Detailed Description

template< typename K, typename P > class mln::p_key< K, P >

Priority queue class.

10.278.2 Member Typedef Documentation

10.278.2.1 template< typename K, typename P > typedef p_double_piter<self_, mln_bkd_eiter(util::set<K>), typename p_set<P>::bkd_piter> mln::p_key< K, P >::bkd_piter

Backward Site_Iterator associated type.

10.278.2.2 template< typename K, typename P > typedef P mln::p_key< K, P >::element

Element associated type.

10.278.2.3 template<typename K, typename P> typedef p_double_piter<self_, mln_fwd_eiter(util::set<K>), typename p_set<P>::fwd_piter> mln::p_key< K, P >::fwd_piter

Forward Site_Iterator associated type.

10.278.2.4 template<typename K, typename P> typedef std::pair<K,P> mln::p_key< K, P >::i_element

Insertion element associated type.

10.278.2.5 template<typename K, typename P> typedef fwd_piter mln::p_key< K, P >::piter

Site_Iterator associated type.

10.278.2.6 template<typename K, typename P> typedef p_double_psite< self_, p_set<P> > mln::p_key< K, P >::psite

Psite associated type.

10.278.2.7 template<typename K, typename P> typedef P mln::p_key< K, P >::r_element

Removal element associated type.

10.278.3 Constructor & Destructor Documentation

10.278.3.1 template<typename K, typename P> mln::p_key< K, P >::p_key () `[inline]`

Constructor.

10.278.4 Member Function Documentation

10.278.4.1 template<typename K, typename P> void mln::p_key< K, P >::change_key (const K & *k*, const K & *new_k*) `[inline]`

Change the key `k` into a new value `new_k`.

References mln::p_set< P >::nsites().

10.278.4.2 template<typename K, typename P> template<typename F> void mln::p_key< K, P >::change_keys (const Function_v2v< F > & *f*) `[inline]`

Change the keys by applying the function `f`.

References mln::util::set< T >::insert().

10.278.4.3 template<typename K, typename P> void mln::p_key< K, P >::clear () `[inline]`

Clear this site set.

10.278.4.4 template<typename K, typename P> bool mln::p_key< K, P >::exists_key (const K & *key*) const [inline]

Test if the `priority` exists.

Referenced by mln::p_key< K, P >::operator()().

10.278.4.5 template<typename K, typename P> bool mln::p_key< K, P >::has (const P & *p*) const [inline]

Test is the psite `p` belongs to this site set.

10.278.4.6 template<typename K, typename P> bool mln::p_key< K, P >::has (const psite &) const [inline]

Test is the psite `p` belongs to this site set.

Referenced by mln::p_key< K, P >::insert().

10.278.4.7 template<typename K, typename P> void mln::p_key< K, P >::insert (const K & *k*, const P & *p*) [inline]

Insert a pair (key `k`, site `p`).

References mln::p_key< K, P >::has().

10.278.4.8 template<typename K, typename P> void mln::p_key< K, P >::insert (const i_element & *k_p*) [inline]

Insert a pair `k_p` (key k, site p).

10.278.4.9 template<typename K, typename P> bool mln::p_key< K, P >::is_valid () const [inline]

Test this set validity so returns always true.

10.278.4.10 template<typename K, typename P> const K & mln::p_key< K, P >::key (const P & *p*) const [inline]

Give the key associated with site `p`.

10.278.4.11 template<typename K, typename P> const util::set< K > & mln::p_key< K, P >::keys () const [inline]

Give the set of keys.

10.278.4.12 template<typename K, typename P> std::size_t mln::p_key< K, P >::memory_size () const [inline]

Return the size of this site set in memory.

10.278.4.13 template<typename K, typename P> unsigned mln::p_key< K, P >::nsites () const [inline]

Give the number of sites.

10.278.4.14 template<typename K, typename P> const p_set< P > & mln::p_key< K, P >::operator() (const K & *key*) const [inline]

Give the queue with the priority `priority`.

This method always works: if the priority is not in this set, an empty queue is returned.

References mln::p_key< K, P >::exists_key().

10.278.4.15 template<typename K, typename P> void mln::p_key< K, P >::remove (const P & *p*) [inline]

Remove a site `p`.

10.278.4.16 template<typename K, typename P> void mln::p_key< K, P >::remove_key (const K & *k*) [inline]

Remove all sites with key `k`.

References mln::p_set< P >::nsites().

10.278.5 Friends And Related Function Documentation

10.278.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.278.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.278.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.278.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.278.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.278.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.278.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.278.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Union of a couple of point sets.

10.278.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

Give the unique set of `s`.

10.279 mln::p_line2d Class Reference

2D discrete line of points.

`#include <p_line2d.hh>`

Inherits mln::internal::site_set_base_< mln::point, mln::p_line2d >.

Public Types

- typedef p_indexed_bkd_piter< self_ > bkd_piter
  Backward Site_Iterator associated type.
- typedef point2d element
  Element associated type.
- typedef p_indexed_fwd_piter< self_ > fwd_piter
  Forward Site_Iterator associated type.
- typedef p_indexed_fwd_piter< self_ > piter
  Site_Iterator associated type.
- typedef p_indexed_psite< self_ > psite
  Psite associated type.
- typedef const box2d & q_box
  Box (qualified) associated type.

Public Member Functions

- const box2d & bbox () const
  Give the exact bounding box.
- const point2d & begin () const
  Give the point that begins the line.
- const point2d & end () const
  Give the point that ends the line.
- bool has (const util::index &i) const
  Test if index `i` belongs to this point set.
- bool has (const psite &p) const
  Test if `p` belongs to this point set.
- bool is_valid () const
  Test if this line is valid, i.e., initialized.
- std::size_t memory_size () const

Return the size of this site set in memory.

- unsigned nsites () const

  Give the number of points.

- const point2d & operator[ ] (unsigned i) const

  Return the `i-th` *point of the line.*

- p_line2d (const point2d &beg, const point2d &end, bool is_end_excluded=false)

  Constructor from point `beg` *to point* `end`*.*

- p_line2d ()

  Constructor without argument.

- const std::vector< point2d > & std_vector () const

  Return the corresponding std::vector of points.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`*.*

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`*.*

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.279.1 Detailed Description

2D discrete line of points.

It is based on p_array.

10.279.2 Member Typedef Documentation

10.279.2.1 typedef p_indexed_bkd_piter<self_> mln::p_line2d::bkd_piter

Backward Site_Iterator associated type.

10.279.2.2 typedef point2d mln::p_line2d::element

Element associated type.

10.279.2.3 typedef p_indexed_fwd_piter<self_> mln::p_line2d::fwd_piter

Forward Site_Iterator associated type.

10.279.2.4 typedef p_indexed_fwd_piter<self_> mln::p_line2d::piter

Site_Iterator associated type.

10.279.2.5 typedef p_indexed_psite<self_> mln::p_line2d::psite

Psite associated type.

10.279.2.6 typedef const box2d& mln::p_line2d::q_box

Box (qualified) associated type.

10.279.3 Constructor & Destructor Documentation

10.279.3.1 mln::p_line2d::p_line2d () `[inline]`

Constructor without argument.

References is_valid().

10.279.3.2 mln::p_line2d::p_line2d (const point2d & *beg*, const point2d & *end*, bool *is_end_excluded* = false) [inline]

Constructor from point `beg` to point `end`.

References is_valid().

10.279.4 Member Function Documentation

10.279.4.1 const box2d & mln::p_line2d::bbox () const [inline]

Give the exact bounding box.

References is_valid().

10.279.4.2 const point2d & mln::p_line2d::begin () const [inline]

Give the point that begins the line.

References is_valid().

Referenced by mln::debug::draw_graph().

10.279.4.3 const point2d & mln::p_line2d::end () const [inline]

Give the point that ends the line.

References is_valid(), and nsites().

Referenced by mln::debug::draw_graph().

10.279.4.4 bool mln::p_line2d::has (const util::index & *i*) const [inline]

Test if index `i` belongs to this point set.

References nsites().

10.279.4.5 bool mln::p_line2d::has (const psite & *p*) const [inline]

Test if `p` belongs to this point set.

References mln::p_indexed_psite< S >::index().

10.279.4.6 bool mln::p_line2d::is_valid () const [inline]

Test if this line is valid, i.e., initialized.

References mln::implies().

Referenced by bbox(), begin(), end(), and p_line2d().

10.279.4.7 std::size_t mln::p_line2d::memory_size () const [inline]

Return the size of this site set in memory.

10.279.4.8 unsigned mln::p_line2d::nsites () const [inline]

Give the number of points.

Referenced by end(), has(), and operator[ ]().

10.279.4.9]

const **point2d** & mln::p_line2d::operator[ ] (unsigned *i*) const [inline]

Return the `i-th` point of the line.

References nsites().

10.279.4.10 const std::vector< point2d > & mln::p_line2d::std_vector () const [inline]

Return the corresponding std::vector of points.

10.279.5 Friends And Related Function Documentation

10.279.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.279.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.279.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.279.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.279.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.279.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.279.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.279.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.279.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) `[related, inherited]`

Give the unique set of `s`.

10.280 mln::p_mutable_array_of< S > Class Template Reference

p_mutable_array_of is a mutable array of site sets.

`#include <p_mutable_array_of.hh>`

Inherits mln::internal::site_set_base_< S::site, mln::p_mutable_array_of< S > >.

Public Types

- typedef p_double_piter< self_, mln_bkd_eiter(array_), typename S::bkd_piter > bkd_piter
  Backward Site_Iterator associated type.
- typedef S element
  Element associated type.
- typedef p_double_piter< self_, mln_fwd_eiter(array_), typename S::fwd_piter > fwd_piter
  Forward Site_Iterator associated type.
- typedef S i_element
  Insertion element associated type.
- typedef fwd_piter piter
  Site_Iterator associated type.
- typedef p_double_psite< self_, element > psite
  Psite associated type.

Public Member Functions

- void clear ()
  Clear this set.
- bool has (const psite &p) const
  Test if `p` *belongs to this point set.*
- void insert (const S &s)
  Insert a site set `s`*.*
- bool is_valid () const
  Test this set validity so returns always true.
- std::size_t memory_size () const
  Return the size of this site set in memory.
- unsigned nelements () const
  Give the number of elements (site sets) of this composite.
- S & operator[ ] (unsigned i)

Return the `i-th` *site set (mutable version).*

- const S & operator[ ] (unsigned i) const

  Return the `i-th` *site set (const version).*

- p_mutable_array_of ()

  Constructor without arguments.

- void reserve (unsigned n)

  Reserve memory for `n` *elements.*

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.280.1 Detailed Description

template<typename S> class mln::p_mutable_array_of< S >

p_mutable_array_of is a mutable array of site sets.

Parameter `S` is the type of the contained site sets.

10.280.2 Member Typedef Documentation

10.280.2.1 template<typename S> typedef p_double_piter<self_, mln_bkd_eiter(array_), typename S ::bkd_piter> mln::p_mutable_array_of< S >::bkd_piter

Backward Site_Iterator associated type.

10.280.2.2 template<typename S> typedef S mln::p_mutable_array_of< S >::element

Element associated type.

10.280.2.3 template<typename S> typedef p_double_piter<self_, mln_fwd_eiter(array_), typename S ::fwd_piter> mln::p_mutable_array_of< S >::fwd_piter

Forward Site_Iterator associated type.

10.280.2.4 template<typename S> typedef S mln::p_mutable_array_of< S >::i_element

Insertion element associated type.

10.280.2.5 template<typename S> typedef fwd_piter mln::p_mutable_array_of< S >::piter

Site_Iterator associated type.

10.280.2.6 template<typename S> typedef p_double_psite<self_, element> mln::p_mutable_array_of< S >::psite

Psite associated type.

10.280.3 Constructor & Destructor Documentation

10.280.3.1 template<typename S> mln::p_mutable_array_of< S >::p_mutable_array_of () `[inline]`

Constructor without arguments.

10.280.4 Member Function Documentation

10.280.4.1 template<typename S> void mln::p_mutable_array_of< S >::clear () [inline]

Clear this set.

10.280.4.2 template<typename S> bool mln::p_mutable_array_of< S >::has (const psite & *p*) const [inline]

Test if `p` belongs to this point set.

10.280.4.3 template<typename S> void mln::p_mutable_array_of< S >::insert (const S & *s*) [inline]

Insert a site set `s`.

Precondition:

`s` is valid.

10.280.4.4 template<typename S> bool mln::p_mutable_array_of< S >::is_valid () const [inline]

Test this set validity so returns always true.

10.280.4.5 template<typename S> std::size_t mln::p_mutable_array_of< S >::memory_size () const [inline]

Return the size of this site set in memory.

10.280.4.6 template<typename S> unsigned mln::p_mutable_array_of< S >::nelements () const [inline]

Give the number of elements (site sets) of this composite.

10.280.4.7]

template<typename S> S & **mln::p_mutable_array_of**< S >::operator[ ] (unsigned *i*) [inline]

Return the `i-th` site set (mutable version).

10.280.4.8]

template<typename S> const S & **mln::p_mutable_array_of**< S >::operator[ ] (unsigned *i*) const [inline]

Return the `i-th` site set (const version).

10.280.4.9 template<typename S> void mln::p_mutable_array_of< S >::reserve (unsigned *n*) [inline]

Reserve memory for n elements.

10.280.5 Friends And Related Function Documentation

10.280.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of lhs and rhs.

10.280.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.280.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets lhs and rhs.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.280.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set set into the output stream ostr.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream ostr.

10.280.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Inclusion test between site sets lhs and rhs.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.280.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.280.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.280.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.280.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) `[related, inherited]`

Give the unique set of `s`.

10.281 mln::p_n_faces_bkd_piter< D, P > Class Template Reference

Backward iterator on the n-faces sites of an mln::p_complex<D, P>.

`#include <p_n_faces_piter.hh>`

Inherits mln::internal::p_complex_piter_base_< mln::topo::n_face_bkd_iter< D >, mln::p_complex< D, P >, P, mln::p_n_faces_bkd_piter< D, P > >.

Public Member Functions

- void next ()
  Go to the next element.

- unsigned n () const
  Accessors.

- p_n_faces_bkd_piter ()
  Construction and assignment.

10.281.1 Detailed Description

template<unsigned D, typename P> class mln::p_n_faces_bkd_piter< D, P >

Backward iterator on the n-faces sites of an mln::p_complex<D, P>.

10.281.2 Constructor & Destructor Documentation

10.281.2.1 template<unsigned D, typename P> mln::p_n_faces_bkd_piter< D, P >::p_n_faces_bkd_piter () [inline]

Construction and assignment.

10.281.3 Member Function Documentation

10.281.3.1 template<unsigned D, typename P> unsigned mln::p_n_faces_bkd_piter< D, P >::n () const [inline]

Accessors.

Shortcuts to face_'s accessors.

10.281.3.2 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.282 mln::p_n_faces_fwd_piter< D, P > Class Template Reference

Forward iterator on the n-faces sites of an mln::p_complex<D, P>.

`#include <p_n_faces_piter.hh>`

Inherits mln::internal::p_complex_piter_base_< mln::topo::n_face_fwd_iter< D >, mln::p_complex< D, P >, P, mln::p_n_faces_fwd_piter< D, P > >.

Public Member Functions

- void next ()

  Go to the next element.

- unsigned n () const

  Accessors.

- p_n_faces_fwd_piter ()

  Construction and assignment.

10.282.1 Detailed Description

template<unsigned D, typename P> class mln::p_n_faces_fwd_piter< D, P >

Forward iterator on the n-faces sites of an mln::p_complex<D, P>.

10.282.2 Constructor & Destructor Documentation

10.282.2.1 template<unsigned D, typename P> mln::p_n_faces_fwd_piter< D, P >::p_n_faces_fwd_piter () [inline]

Construction and assignment.

10.282.3 Member Function Documentation

10.282.3.1 template<unsigned D, typename P> unsigned mln::p_n_faces_fwd_piter< D, P >::n () const [inline]

Accessors.

Shortcuts to face_'s accessors.

10.282.3.2 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.283 mln::p_priority< P, Q > Class Template Reference

Priority queue.

`#include <p_priority.hh>`

Inherits mln::internal::site_set_base_< Q::site, mln::p_priority< P, Q > >.

Public Types

- typedef p_double_piter< self_, mln_fwd_eiter(util::set< P >), typename Q::bkd_piter > bkd_-piter

  Backward Site_Iterator associated type.

- typedef Q::element element

  Element associated type.

- typedef p_double_piter< self_, mln_bkd_eiter(util::set< P >), typename Q::fwd_piter > fwd_-piter

  Forward Site_Iterator associated type.

- typedef std::pair< P, element > i_element

  Insertion element associated type.

- typedef fwd_piter piter

  Site_Iterator associated type.

- typedef p_double_psite< self_, Q > psite

  Psite associated type.

Public Member Functions

- void clear ()

  Clear the queue.

- bool exists_priority (const P &priority) const

  Test if the `priority` exists.

- const Q::element & front () const

  Give an element with highest priority.

- bool has (const psite &) const

  Test is the psite `p` belongs to this site set.

- const P highest_priority () const

  Give the highest priority.

- void insert (const p_priority< P, Q > &other)

  Insert elements from another priority queue.

- void insert (const i_element &p_e)

  Insert a pair `p_e` *(priority p, element e).*

- bool is_valid () const

  Test this set validity so returns always true.

- const P lowest_priority () const

  Give the lowest priority.

- std::size_t memory_size () const

  Return the size of this site set in memory.

- unsigned nsites () const

  Give the number of sites.

- const Q & operator() (const P &priority) const

  Give the queue with the priority `priority`.

- p_priority ()

  Constructor.

- void pop ()

  Pop (remove) from the queue an element with highest priority.

- Q::element pop_front ()

  Return an element with highest priority and remove it from the set.

- const util::set< P > & priorities () const

  Give the set of priorities.

- void push (const P &priority, const element &e)

  Push in the queue with `priority` *the element* `e`.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.283.1 Detailed Description

template<typename P, typename Q> class mln::p_priority< P, Q >

Priority queue.

The parameter `P` is the type of the priorities (for instance unsigned).

The parameter `Q` is a type of queue (for instance p_queue<point2d>).

10.283.2 Member Typedef Documentation

10.283.2.1 template<typename P, typename Q> typedef p_double_piter< self_, mln_fwd_eiter(util::set<P>), typename Q ::bkd_piter > mln::p_priority< P, Q >::bkd_piter

Backward Site_Iterator associated type.

10.283.2.2 template<typename P, typename Q> typedef Q ::element mln::p_priority< P, Q >::element

Element associated type.

10.283.2.3 template<typename P, typename Q> typedef p_double_piter< self_, mln_bkd_eiter(util::set<P>), typename Q ::fwd_piter > mln::p_priority< P, Q >::fwd_piter

Forward Site_Iterator associated type.

10.283.2.4 template<typename P, typename Q> typedef std::pair<P, element> mln::p_priority< P, Q >::i_element

Insertion element associated type.

10.283.2.5 template<typename P, typename Q> typedef fwd_piter mln::p_priority< P, Q >::piter

Site_Iterator associated type.

10.283.2.6 template<typename P, typename Q> typedef p_double_psite<self_, Q> mln::p_priority< P, Q >::psite

Psite associated type.

10.283.3 Constructor & Destructor Documentation

10.283.3.1 template<typename P, typename Q> mln::p_priority< P, Q >::p_priority () `[inline]`

Constructor.

10.283.4 Member Function Documentation

10.283.4.1 template<typename P, typename Q> void mln::p_priority< P, Q >::clear () `[inline]`

Clear the queue.

10.283.4.2 template<typename P, typename Q> bool mln::p_priority< P, Q >::exists_priority (const P & *priority*) const `[inline]`

Test if the `priority` exists.

Referenced by mln::p_priority< P, Q >::operator()().

10.283.4.3 template<typename P, typename Q> const Q::element & mln::p_priority< P, Q >::front () const `[inline]`

Give an element with highest priority.

If several elements have this priority, the least recently inserted is chosen.

Precondition:

! is_empty()

References mln::p_priority< P, Q >::highest_priority().

Referenced by mln::morpho::meyer_wst(), mln::p_priority< P, Q >::pop_front(), and mln::morpho::watershed::topological().

10.283.4.4 template<typename P, typename Q> bool mln::p_priority< P, Q >::has (const psite &) const [inline]

Test is the psite `p` belongs to this site set.

10.283.4.5 template<typename P, typename Q> const P mln::p_priority< P, Q >::highest_priority () const [inline]

Give the highest priority.

Precondition:

! is_empty()

Referenced by mln::p_priority< P, Q >::front(), and mln::p_priority< P, Q >::pop().

10.283.4.6 template<typename P, typename Q> void mln::p_priority< P, Q >::insert (const p_priority< P, Q > & *other*) [inline]

Insert elements from another priority queue.

10.283.4.7 template<typename P, typename Q> void mln::p_priority< P, Q >::insert (const i_element & *p_e*) [inline]

Insert a pair `p_e` (priority p, element e).

References mln::p_priority< P, Q >::push().

10.283.4.8 template<typename P, typename Q> bool mln::p_priority< P, Q >::is_valid () const [inline]

Test this set validity so returns always true.

10.283.4.9 template<typename P, typename Q> const P mln::p_priority< P, Q >::lowest_priority () const [inline]

Give the lowest priority.

Precondition:

! is_empty()

10.283.4.10 template<typename P, typename Q> std::size_t mln::p_priority< P, Q >::memory_size () const [inline]

Return the size of this site set in memory.

10.283.4.11 template<typename P, typename Q> unsigned mln::p_priority< P, Q >::nsites () const [inline]

Give the number of sites.

Referenced by mln::p_priority< P, Q >::operator()().

10.283.4.12 template<typename P, typename Q> const Q & mln::p_priority< P, Q >::operator() (const P & *priority*) const [inline]

Give the queue with the priority `priority`.

This method always works: if the priority is not in this set, an empty queue is returned.

References mln::p_priority< P, Q >::exists_priority(), and mln::p_priority< P, Q >::nsites().

10.283.4.13 template<typename P, typename Q> void mln::p_priority< P, Q >::pop () [inline]

Pop (remove) from the queue an element with highest priority.

If several elements have this priority, the least recently inserted is chosen.

Precondition:

! is_empty()

References mln::p_priority< P, Q >::highest_priority().

Referenced by mln::morpho::meyer_wst(), mln::p_priority< P, Q >::pop_front(), and mln::morpho::watershed::topological().

10.283.4.14 template<typename P, typename Q> Q::element mln::p_priority< P, Q >::pop_front () [inline]

Return an element with highest priority and remove it from the set.

If several elements have this priority, the least recently inserted is chosen.

Precondition:

! is_empty()

References mln::p_priority< P, Q >::front(), and mln::p_priority< P, Q >::pop().

Referenced by mln::geom::impl::seeds2tiling_roundness().

10.283.4.15 template<typename P, typename Q> const util::set< P > & mln::p_priority< P, Q >::priorities () const [inline]

Give the set of priorities.

10.283.4.16 template<typename P, typename Q> void mln::p_priority< P, Q >::push (const P & *priority*, const element & *e*) [inline]

Push in the queue with `priority` the element `e`.

Referenced by mln::p_priority< P, Q >::insert(), mln::morpho::meyer_wst(), mln::geom::impl::seeds2tiling_roundness(), and mln::morpho::watershed::topological().

10.283.5 Friends And Related Function Documentation

10.283.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.283.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.283.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.283.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.283.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.283.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.283.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.283.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Union of a couple of point sets.

10.283.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

Give the unique set of `s`.

10.284 mln::p_queue< P > Class Template Reference

Queue of sites (based on std::deque).

`#include <p_queue.hh>`

Inherits mln::internal::site_set_base_< P, mln::p_queue< P > >.

Public Types

- typedef p_indexed_bkd_piter< self_ > bkd_piter

  Backward Site_Iterator associated type.

- typedef P element

  Element associated type.

- typedef p_indexed_fwd_piter< self_ > fwd_piter

  Forward Site_Iterator associated type.

- typedef P i_element

  Insertion element associated type.

- typedef fwd_piter piter

  Site_Iterator associated type.

- typedef p_indexed_psite< self_ > psite

  Psite associated type.

Public Member Functions

- void clear ()

  Clear the queue.

- const P & front () const

  Give the front site `p` of the queue; `p` is the least recently inserted site.

- bool has (const util::index &i) const

  Test if index `i` belongs to this site set.

- bool has (const psite &p) const

  Test if `p` belongs to this site set.

- void insert (const P &p)

  Insert a site `p` (equivalent as 'push').

- bool is_valid () const

  This set is always valid so it returns true.

- std::size_t memory_size () const

Return the size of this site set in memory.

- unsigned nsites () const

  Give the number of sites.

- const P & operator[ ] (unsigned i) const

  Return the `i-th` *site.*

- p_queue ()

  Constructor without argument.

- void pop ()

  Pop (remove) the front site `p` *from the queue;* `p` *is the least recently inserted site.*

- P pop_front ()

  Pop (remove) the front site `p` *from the queue;* `p` *is the least recently inserted site and give the front site* `p` *of the queue;* `p` *is the least recently inserted site.*

- void push (const P &p)

  Push a site `p` *in the queue.*

- const std::deque< P > & std_deque () const

  Return the corresponding std::deque of sites.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`*.*

10.284.1 Detailed Description

template<typename P> class mln::p_queue< P >

Queue of sites (based on std::deque).

The parameter `P` shall be a site or pseudo-site type.

10.284.2 Member Typedef Documentation

10.284.2.1 template<typename P> typedef p_indexed_bkd_piter<self_> mln::p_queue< P >::bkd_piter

Backward Site_Iterator associated type.

10.284.2.2 template<typename P> typedef P mln::p_queue< P >::element

Element associated type.

10.284.2.3 template<typename P> typedef p_indexed_fwd_piter<self_> mln::p_queue< P >::fwd_piter

Forward Site_Iterator associated type.

10.284.2.4 template<typename P> typedef P mln::p_queue< P >::i_element

Insertion element associated type.

10.284.2.5 template<typename P> typedef fwd_piter mln::p_queue< P >::piter

Site_Iterator associated type.

10.284.2.6 template<typename P> typedef p_indexed_psite<self_> mln::p_queue< P >::psite

Psite associated type.

10.284.3 Constructor & Destructor Documentation

10.284.3.1 template<typename P> mln::p_queue< P >::p_queue () [inline]

Constructor without argument.

10.284.4 Member Function Documentation

10.284.4.1 template<typename P> void mln::p_queue< P >::clear () [inline]

Clear the queue.

10.284.4.2 template<typename P> const P & mln::p_queue< P >::front () const [inline]

Give the front site `p` of the queue; `p` is the least recently inserted site.

Referenced by mln::p_queue< P >::pop_front(), and mln::geom::impl::seeds2tiling().

10.284.4.3 template<typename P> bool mln::p_queue< P >::has (const util::index & *i*) const [inline]

Test if index `i` belongs to this site set.

References mln::p_queue< P >::nsites().

10.284.4.4 template<typename P> bool mln::p_queue< P >::has (const psite & *p*) const [inline]

Test if `p` belongs to this site set.

References mln::p_indexed_psite< S >::index(), and mln::p_queue< P >::nsites().

10.284.4.5 template<typename P> void mln::p_queue< P >::insert (const P & *p*) [inline]

Insert a site `p` (equivalent as 'push').

References mln::p_queue< P >::push().

10.284.4.6 template<typename P> bool mln::p_queue< P >::is_valid () const [inline]

This set is always valid so it returns true.

10.284.4.7 template<typename P> std::size_t mln::p_queue< P >::memory_size () const [inline]

Return the size of this site set in memory.

References mln::p_queue< P >::nsites().

10.284.4.8 template<typename P> unsigned mln::p_queue< P >::nsites () const [inline]

Give the number of sites.

Referenced by mln::p_queue< P >::has(), mln::p_queue< P >::memory_size(), and mln::p_queue< P >::operator[ ]().

10.284.4.9]

template<typename P> const P & **mln::p_queue**< P >::operator[ ] (unsigned *i*) const [inline]

Return the `i-th` site.

References mln::p_queue< P >::nsites().

10.284.4.10 template<typename P> void mln::p_queue< P >::pop () [inline]

Pop (remove) the front site `p` from the queue; `p` is the least recently inserted site.

Referenced by mln::p_queue< P >::pop_front(), and mln::geom::impl::seeds2tiling().

10.284.4.11 template<typename P> P mln::p_queue< P >::pop_front () [inline]

Pop (remove) the front site `p` from the queue; `p` is the least recently inserted site and give the front site `p` of the queue; `p` is the least recently inserted site.

References mln::p_queue< P >::front(), and mln::p_queue< P >::pop().

10.284.4.12 template<typename P> void mln::p_queue< P >::push (const P & *p*) [inline]

Push a site `p` in the queue.

Referenced by mln::p_queue< P >::insert(), and mln::geom::impl::seeds2tiling().

10.284.4.13 template<typename P> const std::deque< P > & mln::p_queue< P >::std_deque () const [inline]

Return the corresponding std::deque of sites.

10.284.5 Friends And Related Function Documentation

10.284.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.284.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Intersection between a couple of point sets.

10.284.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.284.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) `[related, inherited]`

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.284.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.284.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.284.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.284.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.284.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) `[related, inherited]`

Give the unique set of `s`.

10.285 mln::p_queue_fast< P > Class Template Reference

Queue of sites class (based on p_array.

`#include <p_queue_fast.hh>`

Inherits mln::internal::site_set_base_< P, mln::p_queue_fast< P > >.

Public Types

- typedef p_indexed_bkd_piter< self_ > bkd_piter

  Backward Site_Iterator associated type.

- typedef P element

  Element associated type.

- typedef p_indexed_fwd_piter< self_ > fwd_piter

  Forward Site_Iterator associated type.

- typedef P i_element

  Insertion element associated type.

- typedef fwd_piter piter

  Site_Iterator associated type.

- typedef p_indexed_psite< self_ > psite

  Psite associated type.

Public Member Functions

- void clear ()

  Clear the queue.

- bool compute_has (const P &p) const

  Test if `p` *belongs to this site set.*

- bool empty () const

  Test if the queue is empty.

- const P & front () const

  Give the front site `p` *of the queue;* `p` *is the least recently inserted site.*

- bool has (const util::index &i) const

  Test if index `i` *belongs to this site set.*

- bool has (const psite &p) const

  Test if `p` *belongs to this site set.*

- void insert (const P &p)

Insert a site `p` *(equivalent as 'push').*

- bool is_valid () const

  This set is always valid so it returns true.

- std::size_t memory_size () const

  Return the size of this site set in memory.

- unsigned nsites () const

  Give the number of sites.

- const P & operator[ ] (unsigned i) const

  Return the `i-th` *site.*

- p_queue_fast ()

  Constructor without argument.

- void pop ()

  Pop (remove) the front site `p` *from the queue;* `p` *is the least recently inserted site.*

- const P & pop_front ()

  Pop (remove) the front site `p` *from the queue;* `p` *is the least recently inserted site and give the front site* `p` *of the queue;* `p` *is the least recently inserted site.*

- void purge ()

  Purge the queue to save (free) some memory.

- void push (const P &p)

  Push a site `p` *in the queue.*

- void reserve (typename p_array< P >::size_type n)

  Reserve `n` *cells.*

- const std::vector< P > & std_vector () const

  Return the corresponding std::vector of sites.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.285.1 Detailed Description

template<typename P> class mln::p_queue_fast< P >

Queue of sites class (based on p_array.

).

This container is efficient; FIXME: explain...

The parameter `P` shall be a site or pseudo-site type.

10.285.2 Member Typedef Documentation

10.285.2.1 template<typename P> typedef p_indexed_bkd_piter<self_> mln::p_queue_fast< P >::bkd_piter

Backward Site_Iterator associated type.

10.285.2.2 template<typename P> typedef P mln::p_queue_fast< P >::element

Element associated type.

10.285.2.3 template<typename P> typedef p_indexed_fwd_piter<self_> mln::p_queue_fast< P >::fwd_piter

Forward Site_Iterator associated type.

10.285.2.4 template<typename P> typedef P mln::p_queue_fast< P >::i_element

Insertion element associated type.

10.285.2.5 template<typename P> typedef fwd_piter mln::p_queue_fast< P >::piter

Site_Iterator associated type.

10.285.2.6 template<typename P> typedef p_indexed_psite<self_> mln::p_queue_fast< P >::psite

Psite associated type.

10.285.3 Constructor & Destructor Documentation

10.285.3.1 template<typename P> mln::p_queue_fast< P >::p_queue_fast () `[inline]`

Constructor without argument.

10.285.4 Member Function Documentation

10.285.4.1 template<typename P> void mln::p_queue_fast< P >::clear () `[inline]`

Clear the queue.

10.285.4.2 template<typename P> bool mln::p_queue_fast< P >::compute_has (const P & *p*) const `[inline]`

Test if `p` belongs to this site set.

10.285.4.3 template<typename P> bool mln::p_queue_fast< P >::empty () const `[inline]`

Test if the queue is empty.

10.285.4.4 template<typename P> const P & mln::p_queue_fast< P >::front () const `[inline]`

Give the front site `p` of the queue; `p` is the least recently inserted site.

Referenced by mln::p_queue_fast< P >::pop_front().

10.285.4.5 template<typename P> bool mln::p_queue_fast< P >::has (const util::index & *i*) const [inline]

Test if index `i` belongs to this site set.

References mln::p_queue_fast< P >::nsites().

10.285.4.6 template<typename P> bool mln::p_queue_fast< P >::has (const psite & *p*) const [inline]

Test if `p` belongs to this site set.

References mln::p_indexed_psite< S >::index(), and mln::p_queue_fast< P >::nsites().

10.285.4.7 template<typename P> void mln::p_queue_fast< P >::insert (const P & *p*) [inline]

Insert a site `p` (equivalent as 'push').

References mln::p_queue_fast< P >::push().

10.285.4.8 template<typename P> bool mln::p_queue_fast< P >::is_valid () const [inline]

This set is always valid so it returns true.

10.285.4.9 template<typename P> std::size_t mln::p_queue_fast< P >::memory_size () const [inline]

Return the size of this site set in memory.

10.285.4.10 template<typename P> unsigned mln::p_queue_fast< P >::nsites () const [inline]

Give the number of sites.

Referenced by mln::p_queue_fast< P >::has(), and mln::p_queue_fast< P >::operator[ ]().

10.285.4.11]

template<typename P> const P & **mln::p_queue_fast**< P >::operator[ ] (unsigned *i*) const [inline]

Return the `i-th` site.

References mln::p_queue_fast< P >::nsites().

10.285.4.12 template<typename P> void mln::p_queue_fast< P >::pop () [inline]

Pop (remove) the front site `p` from the queue; `p` is the least recently inserted site.

Referenced by mln::p_queue_fast< P >::pop_front().

10.285.4.13 template< typename P > const P & mln::p_queue_fast< P >::pop_front () [inline]

Pop (remove) the front site p from the queue; p is the least recently inserted site and give the front site p of the queue; p is the least recently inserted site.

References mln::p_queue_fast< P >::front(), and mln::p_queue_fast< P >::pop().

10.285.4.14 template< typename P > void mln::p_queue_fast< P >::purge () [inline]

Purge the queue to save (free) some memory.

10.285.4.15 template< typename P > void mln::p_queue_fast< P >::push (const P & *p*) [inline]

Push a site p in the queue.

Referenced by mln::p_queue_fast< P >::insert().

10.285.4.16 template< typename P > void mln::p_queue_fast< P >::reserve (typename p_array< P >::size_type *n*) [inline]

Reserve n cells.

10.285.4.17 template< typename P > const std::vector< P > & mln::p_queue_fast< P >::std_vector () const [inline]

Return the corresponding std::vector of sites.

10.285.5 Friends And Related Function Documentation

10.285.5.1 template< typename Sl, typename Sr > p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of lhs and rhs.

10.285.5.2 template< typename Sl, typename Sr > p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.285.5.3 template< typename Sl, typename Sr > bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets lhs and rhs.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.285.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.285.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.285.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.285.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.285.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Union of a couple of point sets.

10.285.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

Give the unique set of `s`.

10.286 mln::p_run< P > Class Template Reference

Point set class in run.

`#include <p_run.hh>`

Inherits mln::internal::site_set_base_< P, mln::p_run< P > >.

Public Types

- typedef p_run_bkd_piter_< P > bkd_piter

  Backward Site_Iterator associated type.

- typedef P element

  Element associated type.

- typedef p_run_fwd_piter_< P > fwd_piter

  Forward Site_Iterator associated type.

- typedef fwd_piter piter

  Site_Iterator associated type.

- typedef p_run_psite< P > psite

  Psite associated type.

- typedef mln::box< P > q_box

  Box associated type.

Public Member Functions

- mln::box< P > bbox () const

  Give the exact bounding box.

- P end () const

  Return (compute) the ending point.

- bool has (const P &p) const

  Test if `p` belongs to this point set.

- bool has (const psite &p) const

  Test if `p` belongs to this point set.

- bool has_index (unsigned short i) const

  Test if index `i` belongs to this point set.

- void init (const P &start, unsigned short len)

  Set the starting point.

- bool is_valid () const

Test if this run is valid, i.e., with length > 0.

- unsigned short length () const

  Give the length of the run.

- std::size_t memory_size () const

  Return the size of this site set in memory.

- unsigned nsites () const

  Give the number of sites.

- P operator[ ] (unsigned short i) const

  Return the `i-th` *point.*

- p_run (const P &start, const P &end)

  Constructor.

- p_run (const P &start, unsigned short len)

  Constructor.

- p_run ()

  Constructor without argument.

- const P & start () const

  Return the starting point.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.286.1 Detailed Description

template<typename P> class mln::p_run< P >

Point set class in run.

This is a mathematical set of points (not a multi-set). The parameter `P` shall be a Point type.

10.286.2 Member Typedef Documentation

10.286.2.1 template<typename P> typedef p_run_bkd_piter_<P> mln::p_run< P >::bkd_piter

Backward Site_Iterator associated type.

10.286.2.2 template<typename P> typedef P mln::p_run< P >::element

Element associated type.

10.286.2.3 template<typename P> typedef p_run_fwd_piter_<P> mln::p_run< P >::fwd_piter

Forward Site_Iterator associated type.

10.286.2.4 template<typename P> typedef fwd_piter mln::p_run< P >::piter

Site_Iterator associated type.

10.286.2.5 template<typename P> typedef p_run_psite<P> mln::p_run< P >::psite

Psite associated type.

10.286.2.6 template<typename P> typedef mln::box<P> mln::p_run< P >::q_box

Box associated type.

10.286.3 Constructor & Destructor Documentation

10.286.3.1 template<typename P> mln::p_run< P >::p_run () [inline]

Constructor without argument.

10.286.3.2 template<typename P> mln::p_run< P >::p_run (const P & *start*, unsigned short *len*) [inline]

Constructor.

References mln::p_run< P >::init().

10.286.3.3 template<typename P> mln::p_run< P >::p_run (const P & *start*, const P & *end*) [inline]

Constructor.

10.286.4 Member Function Documentation

10.286.4.1 template<typename P> mln::box< P > mln::p_run< P >::bbox () const [inline]

Give the exact bounding box.

References mln::p_run< P >::end().

10.286.4.2 template<typename P> P mln::p_run< P >::end () const [inline]

Return (compute) the ending point.

References mln::point< G, C >::last_coord().

Referenced by mln::p_run< P >::bbox().

10.286.4.3 template<typename P> bool mln::p_run< P >::has (const P & *p*) const [inline]

Test if `p` belongs to this point set.

References mln::p_run< P >::is_valid().

10.286.4.4 template<typename P> bool mln::p_run< P >::has (const psite & *p*) const [inline]

Test if `p` belongs to this point set.

10.286.4.5 template< typename P > bool mln::p_run< P >::has_index (unsigned short *i*) const [inline]

Test if index `i` belongs to this point set.

10.286.4.6 template< typename P > void mln::p_run< P >::init (const P & *start*, unsigned short *len*) [inline]

Set the starting point.

Referenced by mln::p_run< P >::p_run().

10.286.4.7 template< typename P > bool mln::p_run< P >::is_valid () const [inline]

Test if this run is valid, i.e., with length > 0.

Referenced by mln::p_run< P >::has(), mln::p_run< P >::length(), mln::p_run< P >::nsites(), and mln::p_run< P >::operator[ ]().

10.286.4.8 template< typename P > unsigned short mln::p_run< P >::length () const [inline]

Give the length of the run.

References mln::p_run< P >::is_valid().

10.286.4.9 template< typename P > std::size_t mln::p_run< P >::memory_size () const [inline]

Return the size of this site set in memory.

10.286.4.10 template< typename P > unsigned mln::p_run< P >::nsites () const [inline]

Give the number of sites.

References mln::p_run< P >::is_valid().

10.286.4.11]

template< typename P > P **mln::p_run**< P >::operator[ ] (unsigned short *i*) const [inline]

Return the `i-th` point.

References mln::p_run< P >::is_valid(), and mln::point< G, C >::last_coord().

10.286.4.12 template< typename P > const P & mln::p_run< P >::start () const [inline]

Return the starting point.

10.286.5 Friends And Related Function Documentation

10.286.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic difference of `lhs` and `rhs`.

10.286.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Intersection between a couple of point sets.

10.286.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.286.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) `[related, inherited]`

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.286.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.286.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.286.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.286.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.286.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) `[related, inherited]`

Give the unique set of `s`.

10.287 mln::p_set< P > Class Template Reference

Mathematical set of sites (based on util::set).

`#include <p_set.hh>`

Inherits mln::internal::site_set_base_< P, mln::p_set< P > >.

Public Types

- typedef p_indexed_bkd_piter< self_ > bkd_piter
  Backward Site_Iterator associated type.
- typedef P element
  Element associated type.
- typedef p_indexed_fwd_piter< self_ > fwd_piter
  Forward Site_Iterator associated type.
- typedef P i_element
  Insertion element associated type.
- typedef fwd_piter piter
  Site_Iterator associated type.
- typedef p_indexed_psite< self_ > psite
  Psite associated type.
- typedef P r_element
  Removal element associated type.

Public Member Functions

- void clear ()
  Clear this set.
- bool has (const util::index &i) const
  Test if index `i` belongs to this point set.
- bool has (const P &p) const
  Test if `p` belongs to this point set.
- bool has (const psite &p) const
  Test if psite `p` belongs to this point set.
- void insert (const P &p)
  Insert a site `p`.
- bool is_valid () const

Test this set validity so returns always true.

- std::size_t memory_size () const

  Return the size of this site set in memory.

- unsigned nsites () const

  Give the number of sites.

- const P & operator[ ] (unsigned i) const

  Return the `i-th` *site.*

- p_set ()

  Constructor.

- void remove (const P &p)

  Remove a site `p`.

- const std::vector< P > & std_vector () const

  Return the corresponding std::vector of sites.

- const util::set< P > & util_set () const

  Return the corresponding util::set of sites.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.287.1 Detailed Description

template<typename P> class mln::p_set< P >

Mathematical set of sites (based on util::set).

This is a mathematical set of sites (not a multi-set).

The parameter `P` shall be a site or pseudo-site type.

10.287.2 Member Typedef Documentation

10.287.2.1 template<typename P> typedef p_indexed_bkd_piter<self_> mln::p_set< P >::bkd_piter

Backward Site_Iterator associated type.

10.287.2.2 template<typename P> typedef P mln::p_set< P >::element

Element associated type.

10.287.2.3 template<typename P> typedef p_indexed_fwd_piter<self_> mln::p_set< P >::fwd_piter

Forward Site_Iterator associated type.

10.287.2.4 template<typename P> typedef P mln::p_set< P >::i_element

Insertion element associated type.

10.287.2.5 template<typename P> typedef fwd_piter mln::p_set< P >::piter

Site_Iterator associated type.

10.287.2.6 template<typename P> typedef p_indexed_psite<self_> mln::p_set< P >::psite

Psite associated type.

10.287.2.7 template<typename P> typedef P mln::p_set< P >::r_element

Removal element associated type.

10.287.3 Constructor & Destructor Documentation

10.287.3.1 template<typename P> mln::p_set< P >::p_set () [inline]

Constructor.

10.287.4 Member Function Documentation

10.287.4.1 template<typename P> void mln::p_set< P >::clear () [inline]

Clear this set.

10.287.4.2 template<typename P> bool mln::p_set< P >::has (const util::index & *i*) const [inline]

Test if index `i` belongs to this point set.

References mln::p_set< P >::nsites().

10.287.4.3 template<typename P> bool mln::p_set< P >::has (const P & *p*) const [inline]

Test if `p` belongs to this point set.

10.287.4.4 template<typename P> bool mln::p_set< P >::has (const psite & *p*) const [inline]

Test if psite `p` belongs to this point set.

References mln::p_indexed_psite< S >::index().

10.287.4.5 template<typename P> void mln::p_set< P >::insert (const P & *p*) [inline]

Insert a site `p`.

Referenced by mln::convert::to_p_set().

10.287.4.6 template<typename P> bool mln::p_set< P >::is_valid () const [inline]

Test this set validity so returns always true.

10.287.4.7 template<typename P> std::size_t mln::p_set< P >::memory_size () const [inline]

Return the size of this site set in memory.

10.287.4.8 template<typename P> unsigned mln::p_set< P >::nsites () const [inline]

Give the number of sites.

Referenced by mln::p_key< K, P >::change_key(), mln::p_set< P >::has(), mln::p_set< P >::operator[ ](), and mln::p_key< K, P >::remove_key().

10.287.4.9]

template<typename P> const P & **mln::p_set**< P >::operator[ ] (unsigned *i*) const [inline]

Return the `i-th` site.

References mln::p_set< P >::nsites().

10.287.4.10 template<typename P> void mln::p_set< P >::remove (const P & *p*) [inline]

Remove a site `p`.

10.287.4.11 template<typename P> const std::vector< P > & mln::p_set< P >::std_vector () const [inline]

Return the corresponding std::vector of sites.

10.287.4.12 template<typename P> const util::set< P > & mln::p_set< P >::util_set () const [inline]

Return the corresponding util::set of sites.

10.287.5 Friends And Related Function Documentation

10.287.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.287.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.287.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.287.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) `[related, inherited]`

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.287.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.287.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.287.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.287.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.287.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

Give the unique set of s.

10.288 mln::p_set_of< S > Class Template Reference

p_set_of is a set of site sets.

`#include <p_set_of.hh>`

Inherits mln::internal::site_set_base_< S::site, mln::p_set_of< S > >, and site_set_impl< S >.

Public Types

- typedef p_double_piter< self_, mln_bkd_eiter(set_), typename S::bkd_piter > bkd_piter
  Backward Site_Iterator associated type.
- typedef S element
  Element associated type.
- typedef p_double_piter< self_, mln_fwd_eiter(set_), typename S::fwd_piter > fwd_piter
  Forward Site_Iterator associated type.
- typedef S i_element
  Insertion element associated type.
- typedef fwd_piter piter
  Site_Iterator associated type.
- typedef p_double_psite< self_, element > psite
  Psite associated type.

Public Member Functions

- void clear ()
  Clear this set.
- bool has (const psite &p) const
  Test if `p` *belongs to this point set.*
- void insert (const S &s)
  Insert a site set `s`*.*
- bool is_valid () const
  Test if this set of runs is valid.
- std::size_t memory_size () const
  Return the size of this site set in memory.
- unsigned nelements () const
  Give the number of elements (site sets) of this composite.
- const S & operator[ ] (unsigned i) const

Return the i-th *site set.*

- p_set_of ()

  Constructor without arguments.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of lhs *and* rhs*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets lhs *and* rhs*.*

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set set *into the output stream* ostr*.*

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets lhs *and* rhs*.*

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets lhs *and* rhs*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of lhs *and* rhs*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of s*.*

10.288.1 Detailed Description

template<typename S> class mln::p_set_of< S >

p_set_of is a set of site sets.

Parameter `S` is the type of the contained site sets.

10.288.2 Member Typedef Documentation

10.288.2.1 template<typename S> typedef p_double_piter<self_, mln_bkd_eiter(set_), typename S ::bkd_piter> mln::p_set_of< S >::bkd_piter

Backward Site_Iterator associated type.

10.288.2.2 template<typename S> typedef S mln::p_set_of< S >::element

Element associated type.

10.288.2.3 template<typename S> typedef p_double_piter<self_, mln_fwd_eiter(set_), typename S ::fwd_piter> mln::p_set_of< S >::fwd_piter

Forward Site_Iterator associated type.

10.288.2.4 template<typename S> typedef S mln::p_set_of< S >::i_element

Insertion element associated type.

10.288.2.5 template<typename S> typedef fwd_piter mln::p_set_of< S >::piter

Site_Iterator associated type.

10.288.2.6 template<typename S> typedef p_double_psite<self_, element> mln::p_set_of< S >::psite

Psite associated type.

10.288.3 Constructor & Destructor Documentation

10.288.3.1 template<typename S> mln::p_set_of< S >::p_set_of () `[inline]`

Constructor without arguments.

10.288.4 Member Function Documentation

10.288.4.1 template<typename S> void mln::p_set_of< S >::clear () `[inline]`

Clear this set.

10.288.4.2 template<typename S> bool mln::p_set_of< S >::has (const psite & *p*) const `[inline]`

Test if `p` belongs to this point set.

10.288.4.3 template<typename S> void mln::p_set_of< S >::insert (const S & *s*) `[inline]`

Insert a site set `s`.

10.288.4.4 template<typename S> bool mln::p_set_of< S >::is_valid () const `[inline]`

Test if this set of runs is valid.

10.288.4.5 template<typename S> std::size_t mln::p_set_of< S >::memory_size () const `[inline]`

Return the size of this site set in memory.

10.288.4.6 template<typename S> unsigned mln::p_set_of< S >::nelements () const `[inline]`

Give the number of elements (site sets) of this composite.

10.288.4.7]

template<typename S> const S & **mln::p_set_of**< S >::operator[ ] (unsigned *i*) const `[inline]`

Return the `i-th` site set.

10.288.5 Friends And Related Function Documentation

10.288.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic difference of `lhs` and `rhs`.

10.288.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Intersection between a couple of point sets.

10.288.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.288.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) `[related, inherited]`

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.288.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.288.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.288.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.288.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.288.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) `[related, inherited]`

Give the unique set of `s`.

10.289 mln::p_transformed< S, F > Class Template Reference

Site set transformed through a function.

`#include <p_transformed.hh>`

Inherits mln::internal::site_set_base_< S::psite, mln::p_transformed< S, F > >.

Public Types

- typedef p_transformed_piter< typename S::bkd_piter, S, F > bkd_piter

  Backward Site_Iterator associated type.

- typedef S::element element

  Element associated type.

- typedef p_transformed_piter< typename S::fwd_piter, S, F > fwd_piter

  Forward Site_Iterator associated type.

- typedef fwd_piter piter

  Site_Iterator associated type.

- typedef S::psite psite

  Psite associated type.

Public Member Functions

- const F & function () const

  Return the transformation function.

- bool has (const psite &p) const

  Test if `p` *belongs to the subset.*

- bool is_valid () const

  Test if this site set is valid.

- std::size_t memory_size () const

  Return the size of this site set in memory.

- p_transformed ()

  Constructor without argument.

- p_transformed (const S &s, const F &f)

  Constructor with a site set `s` *and a predicate* `f`.

- const S & primary_set () const

  Return the primary set.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.289.1 Detailed Description

template<typename S, typename F> class mln::p_transformed< S, F >

Site set transformed through a function.

Parameter `S` is a site set type; parameter F is a function from site to site.

10.289.2 Member Typedef Documentation

10.289.2.1 template<typename S, typename F> typedef p_transformed_piter<typename S ::bkd_piter, S, F> mln::p_transformed< S, F >::bkd_piter

Backward Site_Iterator associated type.

10.289.2.2 template<typename S, typename F> typedef S ::element mln::p_transformed< S, F >::element

Element associated type.

10.289.2.3 template<typename S, typename F> typedef p_transformed_piter<typename S ::fwd_piter, S, F> mln::p_transformed< S, F >::fwd_piter

Forward Site_Iterator associated type.

10.289.2.4 template<typename S, typename F> typedef fwd_piter mln::p_transformed< S, F >::piter

Site_Iterator associated type.

10.289.2.5 template<typename S, typename F> typedef S ::psite mln::p_transformed< S, F >::psite

Psite associated type.

10.289.3 Constructor & Destructor Documentation

10.289.3.1 template<typename S, typename F> mln::p_transformed< S, F >::p_transformed (const S & *s*, const F & *f*) `[inline]`

Constructor with a site set `s` and a predicate `f`.

10.289.3.2 template<typename S, typename F> mln::p_transformed< S, F >::p_transformed () `[inline]`

Constructor without argument.

10.289.4 Member Function Documentation

10.289.4.1 template<typename S, typename F> const F & mln::p_transformed< S, F >::function () const `[inline]`

Return the transformation function.

10.289.4.2 template<typename S, typename F> bool mln::p_transformed< S, F >::has (const psite & *p*) const [inline]

Test if p belongs to the subset.

10.289.4.3 template<typename S, typename F> bool mln::p_transformed< S, F >::is_valid () const [inline]

Test if this site set is valid.

10.289.4.4 template<typename S, typename F> std::size_t mln::p_transformed< S, F >::memory_size () const [inline]

Return the size of this site set in memory.

10.289.4.5 template<typename S, typename F> const S & mln::p_transformed< S, F >::primary_set () const [inline]

Return the primary set.

Referenced by mln::p_transformed_piter< Pi, S, F >::change_target().

10.289.5 Friends And Related Function Documentation

10.289.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of lhs and rhs.

10.289.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.289.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets lhs and rhs.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.289.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set set into the output stream ostr.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.289.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.289.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.289.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.289.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.289.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) `[related, inherited]`

Give the unique set of `s`.

10.290 mln::p_transformed_piter< Pi, S, F > Struct Template Reference

Iterator on p_transformed<S,F>.

`#include <p_transformed_piter.hh>`

Inherits mln::internal::site_set_iterator_base< mln::p_transformed< S, F >, mln::p_transformed_piter< Pi, S, F > >.

Public Member Functions

- void change_target (const p_transformed< S, F > &s)

  Change the set site targeted by this iterator.

- void next ()

  Go to the next element.

- p_transformed_piter (const p_transformed< S, F > &s)

  Constructor from a site set.

- p_transformed_piter ()

  Constructor without argument.

10.290.1 Detailed Description

template<typename Pi, typename S, typename F> struct mln::p_transformed_piter< Pi, S, F >

Iterator on p_transformed<S,F>.

Parameter `S` is a site set type; parameter F is a function from point to Boolean.

See also:

mln::p_transformed

10.290.2 Constructor & Destructor Documentation

10.290.2.1 template<typename Pi, typename S, typename F> mln::p_transformed_piter< Pi, S, F >::p_transformed_piter () `[inline]`

Constructor without argument.

10.290.2.2 template<typename Pi, typename S, typename F> mln::p_transformed_piter< Pi, S, F >::p_transformed_piter (const p_transformed< S, F > & *s*) `[inline]`

Constructor from a site set.

References mln::p_transformed_piter< Pi, S, F >::change_target().

10.290.3 Member Function Documentation

10.290.3.1 template<typename Pi, typename S, typename F> void mln::p_transformed_piter< Pi, S, F >::change_target (const p_transformed< S, F > & *s*) [inline]

Change the set site targeted by this iterator.

References mln::p_transformed< S, F >::primary_set().

Referenced by mln::p_transformed_piter< Pi, S, F >::p_transformed_piter().

10.290.3.2 template<typename E> void mln::Site_Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.291 mln::p_vaccess< V, S > Class Template Reference

Site set in which sites are grouped by their associated value.

`#include <p_vaccess.hh>`

Inherits mln::internal::site_set_base_< S::site, mln::p_vaccess< V, S > >, and site_set_impl< S >.

Public Types

- typedef p_double_piter< self_, typename vset::bkd_viter, typename S::bkd_piter > bkd_piter
  Backward Site_Iterator associated type.
- typedef S::element element
  Element associated type.
- typedef p_double_piter< self_, typename vset::fwd_viter, typename S::fwd_piter > fwd_piter
  Forward Site_Iterator associated type.
- typedef std::pair< V, element > i_element
  Insertion element associated type.
- typedef fwd_piter piter
  Site_Iterator associated type.
- typedef S pset
  Inner site set associated type.
- typedef p_double_psite< self_, S > psite
  Psite associated type.
- typedef V value
  Value associated type.
- typedef mln::value::set< V > vset
  Value_Set associated type.

Public Member Functions

- bool has (const V &v, const typename S::psite &p) const
  Test if the couple (value `v`*, psite* `p`*) belongs to this site set.*
- bool has (const psite &p) const
  Test if `p` *belongs to this site set.*
- void insert (const V &v, const element &e)
  Insert `e` *at value* `v`*.*
- void insert (const i_element &v_e)

Insert a pair `v_e` *(value v, element e).*

- bool is_valid () const

  Test if this site set is valid.

- std::size_t memory_size () const

  Return the size of this site set in memory.

- const S & operator() (const V &v) const

  Return the site set at value `v`*.*

- p_vaccess ()

  Constructor.

- const mln::value::set< V > & values () const

  Give the set of values.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`*.*

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`*.*

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.291.1 Detailed Description

template<typename V, typename S> class mln::p_vaccess< V, S >

Site set in which sites are grouped by their associated value.

10.291.2 Member Typedef Documentation

10.291.2.1 template<typename V, typename S> typedef p_double_piter<self_, typename vset ::bkd_viter, typename S ::bkd_piter> mln::p_vaccess< V, S >::bkd_piter

Backward Site_Iterator associated type.

10.291.2.2 template<typename V, typename S> typedef S ::element mln::p_vaccess< V, S >::element

Element associated type.

10.291.2.3 template<typename V, typename S> typedef p_double_piter<self_, typename vset ::fwd_viter, typename S ::fwd_piter> mln::p_vaccess< V, S >::fwd_piter

Forward Site_Iterator associated type.

10.291.2.4 template<typename V, typename S> typedef std::pair<V, element> mln::p_vaccess< V, S >::i_element

Insertion element associated type.

10.291.2.5 template<typename V, typename S> typedef fwd_piter mln::p_vaccess< V, S >::piter

Site_Iterator associated type.

10.291.2.6 template<typename V, typename S> typedef S mln::p_vaccess< V, S >::pset

Inner site set associated type.

10.291.2.7 template<typename V, typename S> typedef p_double_psite<self_, S> mln::p_vaccess< V, S >::psite

Psite associated type.

10.291.2.8 template<typename V, typename S> typedef V mln::p_vaccess< V, S >::value

Value associated type.

10.291.2.9 template<typename V, typename S> typedef mln::value::set<V> mln::p_vaccess< V, S >::vset

Value_Set associated type.

10.291.3 Constructor & Destructor Documentation

10.291.3.1 template<typename V, typename S> mln::p_vaccess< V, S >::p_vaccess () `[inline]`

Constructor.

10.291.4 Member Function Documentation

10.291.4.1 template<typename V, typename S> bool mln::p_vaccess< V, S >::has (const V & *v*, const typename S::psite & *p*) const `[inline]`

Test if the couple (value `v`, psite `p`) belongs to this site set.

10.291.4.2 template<typename V, typename S> bool mln::p_vaccess< V, S >::has (const psite & *p*) const `[inline]`

Test if `p` belongs to this site set.

10.291.4.3 template<typename V, typename S> void mln::p_vaccess< V, S >::insert (const V & *v*, const element & *e*) `[inline]`

Insert `e` at value `v`.

10.291.4.4 template<typename V, typename S> void mln::p_vaccess< V, S >::insert (const i_element & *v_e*) `[inline]`

Insert a pair `v_e` (value v, element e).

10.291.4.5 template<typename V, typename S> bool mln::p_vaccess< V, S >::is_valid () const `[inline]`

Test if this site set is valid.

10.291.4.6 template<typename V, typename S> std::size_t mln::p_vaccess< V, S >::memory_size () const [inline]

Return the size of this site set in memory.

10.291.4.7 template<typename V, typename S> const S & mln::p_vaccess< V, S >::operator() (const V & *v*) const [inline]

Return the site set at value `v`.

10.291.4.8 template<typename V, typename S> const mln::value::set< V > & mln::p_vaccess< V, S >::values () const [inline]

Give the set of values.

10.291.5 Friends And Related Function Documentation

10.291.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.291.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.291.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.291.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.291.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.291.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.291.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.291.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related, inherited]`

Union of a couple of point sets.

10.291.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) `[related, inherited]`

Give the unique set of `s`.

10.292 mln::p_vertices< G, F > Class Template Reference

Site set based mapping graph vertices to sites.

`#include <p_vertices.hh>`

Inherits mln::internal::site_set_base_< F::result, mln::p_vertices< G, F > >.

Public Types

- typedef F fun_t
  Function associated type.
- typedef util::vertex< G > graph_element
  Type of graph element this site set focuses on.
- typedef G graph_t
  Graph associated type.
- typedef util::vertex< G > vertex
  Type of graph vertex.

  - typedef p_graph_piter< self_, mln_vertex_bkd_iter(G) > bkd_piter
    Backward Site_Iterator associated type.
  - typedef super_::site element
    Associated types.
  - typedef p_graph_piter< self_, mln_vertex_fwd_iter(G) > fwd_piter
    Forward Site_Iterator associated type.
  - typedef fwd_piter piter
    Site_Iterator associated type.
  - typedef p_vertices_psite< G, F > psite
    Point_Site associated type.

Public Member Functions

- template<typename G2>
  bool has (const util::vertex< G2 > &v) const
  Does this site set has v*?*
- bool has (const psite &p) const
  Does this site set has p*?*
- void invalidate ()
  Invalidate this site set.
- bool is_valid () const

Test this site set validity.

- std::size_t memory_size () const

  Does this site set has vertex_id*? FIXME: causes ambiguities while calling has(mln::neighb_fwd_niter<>); bool has(unsigned vertex_id) const;.*

- unsigned nsites () const

  Return The number of points (sites) of the set, i.e., the number of vertices*.*

- unsigned nvertices () const

  Return The number of vertices in the graph.

- template<typename F2>
  p_vertices (const p_vertices< G, F2 > &other)

  Copy constructor.

- template<typename F2>
  p_vertices (const Graph< G > &gr, const Function< F2 > &f)

  Construct a graph psite set from a graph of points.

- p_vertices (const Graph< G > &gr, const Function< F > &f)

  Construct a graph psite set from a graph of points.

- p_vertices (const Graph< G > &gr)

  Construct a graph psite set from a graph of points.

- p_vertices ()

  Constructor without argument.

  - const F & function () const

    Return the association function.

  - const G & graph () const

    Accessors.

  - F::result operator() (const psite &p) const

    Return the value associated to an element of this site set.

Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.292.1 Detailed Description

template<typename G, typename F = util::internal::id2element<G,util::vertex<G> >> class mln::p_vertices< G, F >

Site set based mapping graph vertices to sites.

10.292.2 Member Typedef Documentation

10.292.2.1 template<typename G, typename F = util::internal::id2element<G,util::vertex<G> >> typedef p_graph_piter< self_, mln_vertex_bkd_iter(G) > mln::p_vertices< G, F >::bkd_piter

Backward Site_Iterator associated type.

10.292.2.2 template<typename G, typename F = util::internal::id2element<G,util::vertex<G> >> typedef super_ ::site mln::p_vertices< G, F >::element

Associated types.

Element associated type.

10.292.2.3 template<typename G, typename F = util::internal::id2element<G,util::vertex<G> >> typedef F mln::p_vertices< G, F >::fun_t

Function associated type.

10.292.2.4 template<typename G, typename F = util::internal::id2element<G,util::vertex<G> >> typedef p_graph_piter< self_, mln_vertex_fwd_iter(G) > mln::p_vertices< G, F >::fwd_piter

Forward Site_Iterator associated type.

10.292.2.5 template<typename G, typename F = util::internal::id2element<G,util::vertex<G> >> typedef util::vertex<G> mln::p_vertices< G, F >::graph_element

Type of graph element this site set focuses on.

10.292.2.6 template<typename G, typename F = util::internal::id2element<G,util::vertex<G> >> typedef G mln::p_vertices< G, F >::graph_t

Graph associated type.

10.292.2.7 template<typename G, typename F = util::internal::id2element<G,util::vertex<G> >> typedef fwd_piter mln::p_vertices< G, F >::piter

Site_Iterator associated type.

10.292.2.8 template<typename G, typename F = util::internal::id2element<G,util::vertex<G> >> typedef p_vertices_psite<G,F> mln::p_vertices< G, F >::psite

Point_Site associated type.

10.292.2.9 template<typename G, typename F = util::internal::id2element<G,util::vertex<G> >> typedef util::vertex<G> mln::p_vertices< G, F >::vertex

Type of graph vertex.

10.292.3 Constructor & Destructor Documentation

10.292.3.1 template<typename G, typename F> mln::p_vertices< G, F >::p_vertices () [inline]

Constructor without argument.

10.292.3.2 template<typename G, typename F> mln::p_vertices< G, F >::p_vertices (const Graph< G > & *gr*) [inline]

Construct a graph psite set from a graph of points.

Parameters:

gr The graph upon which the graph psite set is built. The identity function is used.

References mln::p_vertices< G, F >::is_valid().

10.292.3.3 template<typename G, typename F> mln::p_vertices< G, F >::p_vertices (const Graph< G > & *gr*, const Function< F > & *f*) [inline]

Construct a graph psite set from a graph of points.

Parameters:

gr The graph upon which the graph psite set is built.

f the function which maps a vertex to a site.

References mln::p_vertices< G, F >::is_valid().

10.292.3.4 template<typename G, typename F> template<typename F2> mln::p_vertices< G, F >::p_vertices (const Graph< G > & *gr*, const Function< F2 > & *f*) [inline]

Construct a graph psite set from a graph of points.

Parameters:

gr The graph upon which the graph psite set is built.

f the function which maps a vertex to a site. It must be convertible to the function type `F`.

References mln::p_vertices< G, F >::is_valid().

10.292.3.5 template<typename G, typename F> template<typename F2> mln::p_vertices< G, F >::p_vertices (const p_vertices< G, F2 > & *other*) [inline]

Copy constructor.

References mln::p_vertices< G, F >::function(), mln::p_vertices< G, F >::graph(), and mln::p_vertices< G, F >::is_valid().

10.292.4 Member Function Documentation

10.292.4.1 template<typename G, typename F> const F & mln::p_vertices< G, F >::function () const [inline]

Return the association function.

Referenced by mln::p_vertices< G, F >::p_vertices().

10.292.4.2 template<typename G, typename F> const G & mln::p_vertices< G, F >::graph () const [inline]

Accessors.

Return the graph associated to this site set (const version)

References mln::p_vertices< G, F >::is_valid().

Referenced by mln::debug::draw_graph(), mln::operator==(), and mln::p_vertices< G, F >::p_vertices().

10.292.4.3 template<typename G, typename F> template<typename G2> bool mln::p_vertices< G, F >::has (const util::vertex< G2 > & *v*) const [inline]

Does this site set has *v*?

References mln::util::vertex< G >::graph(), mln::util::vertex< G >::is_valid(), and mln::p_vertices< G, F >::is_valid().

10.292.4.4 template<typename G, typename F> bool mln::p_vertices< G, F >::has (const psite & *p*) const [inline]

Does this site set has *p*?

References mln::p_vertices< G, F >::is_valid().

10.292.4.5 template<typename G, typename F> void mln::p_vertices< G, F >::invalidate () [inline]

Invalidate this site set.

10.292.4.6 template<typename G, typename F> bool mln::p_vertices< G, F >::is_valid () const [inline]

Test this site set validity.

Referenced by mln::p_vertices< G, F >::graph(), mln::p_vertices< G, F >::has(), and mln::p_vertices< G, F >::p_vertices().

10.292.4.7 template<typename G, typename F> std::size_t mln::p_vertices< G, F >::memory_size () const [inline]

Does this site set has *vertex_id*? FIXME: causes ambiguities while calling has(mln::neighb_fwd_niter<>); bool has(unsigned vertex_id) const;.

10.292.4.8 template<typename G, typename F> unsigned mln::p_vertices< G, F >::nsites () const [inline]

Return The number of points (sites) of the set, i.e., the number of *vertices*.

Required by the mln::Point_Set concept.

References mln::p_vertices< G, F >::nvertices().

10.292.4.9 template<typename G, typename F> unsigned mln::p_vertices< G, F >::nvertices () const [inline]

Return The number of vertices in the graph.

Referenced by mln::p_vertices< G, F >::nsites().

10.292.4.10 template<typename G, typename F> F::result mln::p_vertices< G, F >::operator() (const psite & *p*) const [inline]

Return the value associated to an element of this site set.

10.292.5 Friends And Related Function Documentation

10.292.5.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic difference of `lhs` and `rhs`.

10.292.5.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Intersection between a couple of point sets.

10.292.5.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.292.5.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) [related, inherited]

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.292.5.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Inclusion test between site sets lhs and rhs.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.292.5.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Equality test between site sets lhs and rhs.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.292.5.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Set theoretic symmetrical difference of lhs and rhs.

10.292.5.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related, inherited]

Union of a couple of point sets.

10.292.5.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related, inherited]

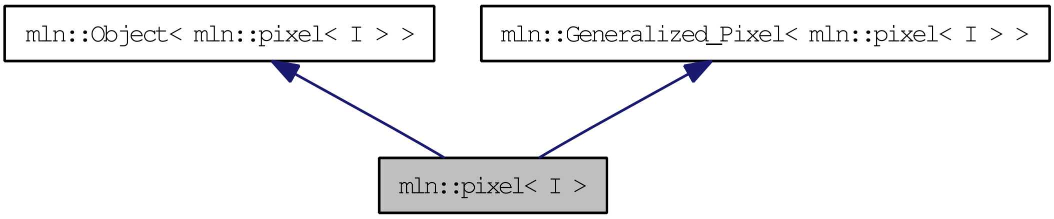
Give the unique set of s.

10.293 mln::pixel< I > Struct Template Reference

Generic pixel class.

`#include <pixel.hh>`

Inheritance diagram for mln::pixel< I >:



Public Member Functions

- void change_to (const typename I::psite &p)

  Change the pixel to the one at point `p`.

- bool is_valid () const

  Test if this pixel is valid.

- pixel (I &image, const typename I::psite &p)

  Constructor.

- pixel (I &image)

  Constructor.

10.293.1 Detailed Description

template<typename I> struct mln::pixel< I >

Generic pixel class.

The parameter is `I` the type of the image it belongs to.

10.293.2 Constructor & Destructor Documentation

10.293.2.1 template<typename I> mln::pixel< I >::pixel (I & *image*) `[inline]`

Constructor.

10.293.2.2 template<typename I> mln::pixel< I >::pixel (I & *image*, const typename I::psite & *p*) `[inline]`

Constructor.

References mln::pixel< I >::change_to().

10.293.3 Member Function Documentation

10.293.3.1 template<typename I> void mln::pixel< I >::change_to (const typename I::psite & *p*) [inline]

Change the pixel to the one at point `p`.

Referenced by mln::pixel< I >::pixel().

10.293.3.2 template<typename I> bool mln::pixel< I >::is_valid () const [inline]

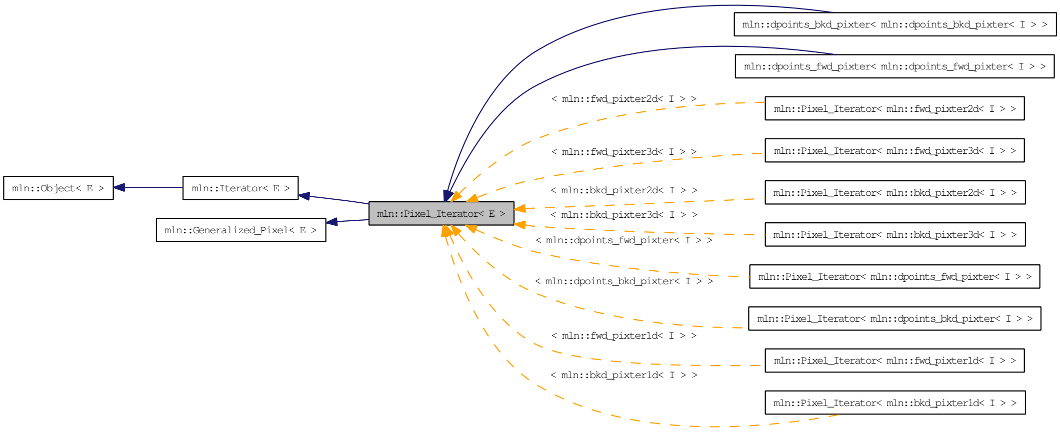
Test if this pixel is valid.

10.294 mln::Pixel_Iterator< E > Struct Template Reference

Base class for the implementation of pixel iterator classes.

```
#include <pixel_iterator.hh>
```

Inheritance diagram for mln::Pixel_Iterator< E >:



Public Member Functions

- void next ()

    Go to the next element.

10.294.1 Detailed Description

template<typename E> struct mln::Pixel_Iterator< E >

Base class for the implementation of pixel iterator classes.

An iterator on pixels is an iterator that is bound to a particular image and that browses over a set of image pixels.

See also:

mln::doc::Pixel_Iterator for a complete documentation of this class contents.

10.294.2 Member Function Documentation

10.294.2.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.295 mln::plain< I > Class Template Reference

Prevents an image from sharing its data.

`#include <plain.hh>`

Inherits mln::internal::image_identity< I, I::domain_t, mln::plain< I > >.

Public Types

- typedef plain< tag::image_< I > > skeleton

  Skeleton.

Public Member Functions

- operator I () const

  Conversion into an image with type `I`.

- plain< I > & operator= (const I &ima)

  Assignment operator from an image `ima`.

- plain< I > & operator= (const plain< I > &rhs)

  Assignment operator.

- plain (const I &ima)

  Copy constructor from an image `ima`.

- plain (const plain< I > &rhs)

  Copy constructor.

- plain ()

  Constructor without argument.

10.295.1 Detailed Description

template<typename I> class mln::plain< I >

Prevents an image from sharing its data.

While assigned to another image, its data is duplicated.

10.295.2 Member Typedef Documentation

10.295.2.1 template<typename I> typedef plain< tag::image_<I> > mln::plain< I >::skeleton

Skeleton.

10.295.3 Constructor & Destructor Documentation

10.295.3.1 template<typename I> mln::plain< I >::plain () [inline]

Constructor without argument.

10.295.3.2 template<typename I> mln::plain< I >::plain (const plain< I > & *rhs*) [inline]

Copy constructor.

10.295.3.3 template<typename I> mln::plain< I >::plain (const I & *ima*) [inline]

Copy constructor from an image `ima`.

10.295.4 Member Function Documentation

10.295.4.1 template<typename I> mln::plain< I >::operator I () const [inline]

Conversion into an image with type `I`.

References mln::duplicate().

10.295.4.2 template<typename I> plain< I > & mln::plain< I >::operator= (const I & *ima*) [inline]

Assignment operator from an image `ima`.

10.295.4.3 template<typename I> plain< I > & mln::plain< I >::operator= (const plain< I > & *rhs*) [inline]

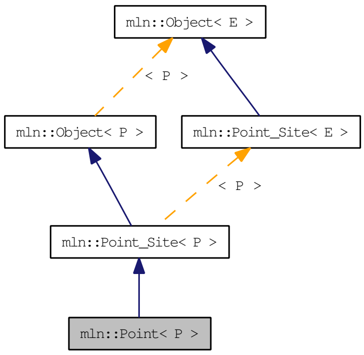
Assignment operator.

10.296 mln::Point< P > Struct Template Reference

Base class for implementation of point classes.

`#include <point.hh>`

Inheritance diagram for mln::Point< P >:



Public Types

- typedef P point

  The associated point type is itself.

Public Member Functions

- const P & to_point () const

  It is a Point so it returns itself.

Related Functions

(Note that these are not member functions.)

- template<typename P, typename D>
  P & operator+= (Point< P > &p, const Dpoint< D > &dp)

  Shift a point `by` *a delta-point* `dp`.

- template<typename P, typename D>
  P & operator-= (Point< P > &p, const Dpoint< D > &dp)

  Shift a point `by` *the negate of a delta-point* `dp`.

- template<typename P, typename D>
  P & operator/ (Point< P > &p, const value::Scalar< D > &dp)

  Divise a point `by` *a scalar* `s`.

10.296.1 Detailed Description

template<typename P> struct mln::Point< P >

Base class for implementation of point classes.

A point is an element of a space.

For instance, mln::point2d is the type of elements defined on the discrete square grid of the 2D plane.

10.296.2 Member Typedef Documentation

10.296.2.1 template<typename P> typedef P mln::Point< P >::point

The associated point type is itself.

10.296.3 Member Function Documentation

10.296.3.1 template<typename P> const P & mln::Point< P >::to_point () const `[inline]`

It is a Point so it returns itself.

10.296.4 Friends And Related Function Documentation

10.296.4.1 template<typename P, typename D> P & operator+= (Point< P > & *p*, const Dpoint< D > & *dp*) `[related]`

Shift a point `by` a delta-point `dp`.

Parameters:

↔ ***p*** The targeted point.

← ***dp*** A delta-point.

Returns:

A reference to the point `p` once translated by `dp`.

Precondition:

The type of `dp` has to be compatible with the type of `p`.

10.296.4.2 template<typename P, typename D> P & operator-= (Point< P > & *p*, const Dpoint< D > & *dp*) `[related]`

Shift a point `by` the negate of a delta-point `dp`.

Parameters:

↔ ***p*** The targeted point.

← ***dp*** A delta-point.

Returns:

A reference to the point `p` once translated by - `dp`.

Precondition:

The type of `dp` has to be compatible with the type of `p`.

10.296.4.3 template<typename P, typename D> P & operator/ (Point< P > & *p*, const value::Scalar< D > & *dp*) [related]

Divise a point `by` a scalar `s`.

Parameters:

↔ ***p*** The targeted point.

← ***dp*** A scalar.

Returns:

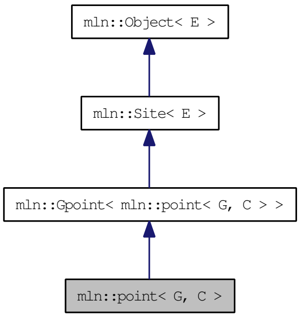
A reference to the point `p` once divised by `s`.

10.297 mln::point< G, C > Struct Template Reference

Generic point class.

`#include <point.hh>`

Inheritance diagram for mln::point< G, C >:



Public Types

- enum { dim = G::dim }
- typedef C coord

  Coordinate associated type.
- typedef dpoint< G, C > delta

  Delta associated type.
- typedef dpoint< G, C > dpsite

  DPsite associated type.
- typedef G grid

  Grid associated type.
- typedef algebra::h_vec< G::dim, float > h_vec

  Algebra hexagonal vector (hvec) associated type.
- typedef algebra::vec< G::dim, float > vec

  Algebra vector (vec) associated type.

Public Member Functions

- C & last_coord ()

  Read-write access to the last coordinate.
- const C & last_coord () const

  Read-only access to the last coordinate.
- point< G, C > & operator+= (const delta &dp)

Shifting by `dp`.

- point< G, C > & operator-= (const delta &dp)

  Shifting by `the` *inverse of dp.*

- C & operator[ ] (unsigned i)

  Read-write access to the `i-th` *coordinate value.*

- const C & operator[ ] (unsigned i) const

  Read-only access to the `i-th` *coordinate value.*

- template<typename F>
  point (const Function_v2v< F > &f)

  Constructor; coordinates are set by function `f`.

- template<typename C2>
  point (const algebra::vec< dim, C2 > &v)

  Constructor from an algebra vector.

- point ()

  Constructor without argument.

- void set_all (C c)

  Set all coordinates to the value `c`.

- h_vec to_h_vec () const

  Transform to point in homogene coordinate system.

- vec to_vec () const

  Explicit conversion towards mln::algebra::vec.

  - point (const literal::origin_t &)

    Constructors/assignments with literals.

  - point (C ind)

Static Public Member Functions

- static const point< G, C > & minus_infty ()

  Point with all coordinates set to the mininum value.

- static const point< G, C > & plus_infty ()

  Point with all coordinates set to the maximum value.

Static Public Attributes

- static const point< G, C > origin = all_to(0)

  Origin point (all coordinates are 0).

Related Functions

(Note that these are not member functions.)

- template<typename P, typename D>
  P operator+ (const Gpoint< P > &p, const Gdpoint< D > &dp)

  Add a delta-point `rhs` *to a grid point* `lhs`.

- template<typename P, typename D>
  P & operator+= (Gpoint< P > &p, const Gdpoint< D > &dp)

  Shift a point `by` *a delta-point* `dp`.

- template<typename L, typename R>
  L::delta operator- (const Gpoint< L > &lhs, const Gpoint< R > &rhs)

  Difference between a couple of grid point `lhs` *and* `rhs`.

- template<typename P, typename D>
  P & operator-= (Gpoint< P > &p, const Gdpoint< D > &dp)

  Shift a point `by` *the negate of a delta-point* `dp`.

- template<typename P, typename D>
  P operator/ (const Gpoint< P > &p, const value::scalar_< D > &dp)

  Divise a point `by` *a scalar* `s`.

- template<typename P>
  std::ostream & operator<< (std::ostream &ostr, const Gpoint< P > &p)

  Print a grid point `p` *into the output stream* `ostr`.

- template<typename L, typename R>
  bool operator== (const Gpoint< L > &lhs, const Gpoint< R > &rhs)

  Equality comparison between a couple of grid point `lhs` *and* `rhs`.

10.297.1 Detailed Description

template<typename G, typename C> struct mln::point< G, C >

Generic point class.

Parameters are `n` the dimension of the space and `C` the coordinate type in this space.

10.297.2 Member Typedef Documentation

10.297.2.1 template<typename G, typename C> typedef C mln::point< G, C >::coord

Coordinate associated type.

10.297.2.2 template<typename G, typename C> typedef dpoint<G,C> mln::point< G, C >::delta

Delta associated type.

10.297.2.3 template<typename G, typename C> typedef dpoint<G,C> mln::point< G, C >::dpsite

DPsite associated type.

10.297.2.4 template<typename G, typename C> typedef G mln::point< G, C >::grid

Grid associated type.

10.297.2.5 template<typename G, typename C> typedef algebra::h_vec<G::dim, float> mln::point< G, C >::h_vec

Algebra hexagonal vector (hvec) associated type.

10.297.2.6 template<typename G, typename C> typedef algebra::vec<G::dim, float> mln::point< G, C >::vec

Algebra vector (vec) associated type.

10.297.3 Member Enumeration Documentation

10.297.3.1 template<typename G, typename C> anonymous enum

Enumerator:

dim Dimension of the space.

Invariant:

dim > 0

10.297.4 Constructor & Destructor Documentation

10.297.4.1 template<typename G, typename C> mln::point< G, C >::point () `[inline]`

Constructor without argument.

10.297.4.2 template<typename G, typename C> template<typename C2> mln::point< G, C >::point (const algebra::vec< dim, C2 > & *v*) [inline]

Constructor from an algebra vector.

References mln::point< G, C >::dim.

10.297.4.3 template<typename G, typename C> mln::point< G, C >::point (C *ind*) [inline, explicit]

Constructors with different numbers of arguments (coordinates) w.r.t. the dimension.

10.297.4.4 template<typename G, typename C> mln::point< G, C >::point (const literal::origin_t &) [inline]

Constructors/assignments with literals.

10.297.4.5 template<typename G, typename C> template<typename F> mln::point< G, C >::point (const Function_v2v< F > & *f*) [inline]

Constructor; coordinates are set by function `f`.

References mln::point< G, C >::dim.

10.297.5 Member Function Documentation

10.297.5.1 template<typename G, typename C> C & mln::point< G, C >::last_coord () [inline]

Read-write access to the last coordinate.

References mln::point< G, C >::dim.

10.297.5.2 template<typename G, typename C> const C & mln::point< G, C >::last_coord () const [inline]

Read-only access to the last coordinate.

References mln::point< G, C >::dim.

Referenced by mln::p_run< P >::end(), mln::p_run< P >::operator[ ](), and mln::debug::put_word().

10.297.5.3 template<typename G, typename C> const point< G, C > & mln::point< G, C >::minus_infty () [inline, static]

Point with all coordinates set to the mininum value.

10.297.5.4 template<typename G, typename C> point< G, C > & mln::point< G, C >::operator+= (const delta & *dp*) [inline]

Shifting by `dp`.

References mln::point< G, C >::dim.

10.297.5.5 template<typename G, typename C> point< G, C > & mln::point< G, C >::operator-= (const delta & *dp*) [inline]

Shifting by the inverse of dp.

References mln::point< G, C >::dim.

10.297.5.6]

template<typename G, typename C> C & **mln::point**< G, C >::operator[ ] (unsigned *i*) [inline]

Read-write access to the i-th coordinate value.

Parameters:

← ***i*** The coordinate index.

Precondition:

i < dim

References mln::point< G, C >::dim.

10.297.5.7]

template<typename G, typename C> const C & **mln::point**< G, C >::operator[ ] (unsigned *i*) const [inline]

Read-only access to the i-th coordinate value.

Parameters:

← ***i*** The coordinate index.

Precondition:

i < dim

References mln::point< G, C >::dim.

10.297.5.8 template<typename G, typename C> const point< G, C > & mln::point< G, C >::plus_infty () [inline, static]

Point with all coordinates set to the maximum value.

10.297.5.9 template<typename G, typename C> void mln::point< G, C >::set_all (C *c*) [inline]

Set all coordinates to the value c.

10.297.5.10 template<typename G, typename C> point< G, C >::h_vec mln::point< G, C >::to_h_vec () const [inline]

Transform to point in homogene coordinate system.

References mln::point< G, C >::dim.

10.297.5.11 template<typename G, typename C> point< G, C >::vec mln::point< G, C >::to_vec () const [inline]

Explicit conversion towards mln::algebra::vec.

References mln::point< G, C >::dim.

Referenced by mln::io::magick::load(), mln::io::dicom::load(), and mln::io::magick::save().

10.297.6 Friends And Related Function Documentation

10.297.6.1 template<typename P, typename D> P operator+ (const Gpoint< P > & *p*, const Gdpoint< D > & *dp*) [related, inherited]

Add a delta-point `rhs` to a grid point `lhs`.

Parameters:

← ***p*** A grid point.

← ***dp*** A delta-point.

The type of `dp` has to compatible with the type of `p`.

Returns:

A point (temporary object).

See also:

mln::Gdpoint

10.297.6.2 template<typename P, typename D> P & operator+= (Gpoint< P > & *p*, const Gdpoint< D > & *dp*) [related, inherited]

Shift a point `by` a delta-point `dp`.

Parameters:

↔ ***p*** The targeted point.

← ***dp*** A delta-point.

Returns:

A reference to the point `p` once translated by `dp`.

Precondition:

The type of `dp` has to be compatible with the type of `p`.

10.297.6.3 template<typename L, typename R> L::delta operator- (const Gpoint< L > & *lhs*, const Gpoint< R > & *rhs*) `[related, inherited]`

Difference between a couple of grid point `lhs` and `rhs`.

Parameters:

← ***lhs*** A first grid point.

← ***rhs*** A second grid point.

Warning:

There is no type promotion in Milena so the client has to make sure that both points are defined with the same type of coordinates.

Precondition:

Both `lhs` and `rhs` have to be defined on the same topology and with the same type of coordinates; otherwise this test does not compile.

Postcondition:

The result, `dp`, is such as `lhs` == `rhs` + `dp`.

Returns:

A delta point (temporary object).

See also:

mln::Gdpoint

10.297.6.4 template<typename P, typename D> P & operator-= (Gpoint< P > & *p*, const Gdpoint< D > & *dp*) `[related, inherited]`

Shift a point `by` the negate of a delta-point `dp`.

Parameters:

↔ ***p*** The targeted point.

← ***dp*** A delta-point.

Returns:

A reference to the point `p` once translated by - `dp`.

Precondition:

The type of `dp` has to be compatible with the type of `p`.

10.297.6.5 template<typename P, typename D> P operator/ (const Gpoint< P > & *p*, const value::scalar_< D > & *dp*) [related, inherited]

Divise a point by a scalar s.

Parameters:

↔ ***p*** The targeted point.

← ***dp*** A scalar.

Returns:

A reference to the point p once divised by s.

10.297.6.6 template<typename P> std::ostream & operator<< (std::ostream & *ostr*, const Gpoint< P > & *p*) [related, inherited]

Print a grid point p into the output stream ostr.

Parameters:

↔ ***ostr*** An output stream.

← ***p*** A grid point.

Returns:

The modified output stream ostr.

References mln::debug::format().

10.297.6.7 template<typename L, typename R> bool operator== (const Gpoint< L > & *lhs*, const Gpoint< R > & *rhs*) [related, inherited]

Equality comparison between a couple of grid point lhs and rhs.

Parameters:

← ***lhs*** A first grid point.

← ***rhs*** A second grid point.

Precondition:

Both lhs and rhs have to be defined on the same topology; otherwise this test does not compile.

Returns:

True if both grid points have the same coordinates, otherwise false.

10.297.7 Member Data Documentation

10.297.7.1 template<typename G, typename C> const point< G, C > mln::point< G, C >::origin = all_to(0) [inline, static]

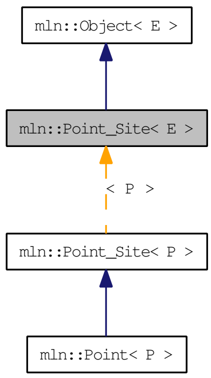
Origin point (all coordinates are 0).

10.298 mln::Point_Site< E > Struct Template Reference

Base class for implementation classes of the notion of "point site".

`#include <point_site.hh>`

Inheritance diagram for mln::Point_Site< E >:



Related Functions

(Note that these are not member functions.)

- template<typename L, typename R>
  L::dpoint operator- (const Point_Site< L > &lhs, const Point_Site< R > &rhs)
  Difference between a couple of point site `lhs` *and* `rhs`.
- template<typename P>
  std::ostream & operator<< (std::ostream &ostr, const Point_Site< P > &p)
  Print a point site `p` *into the output stream* `ostr`.
- template<typename L, typename R>
  bool operator== (const Point_Site< L > &lhs, const Point_Site< R > &rhs)
  Equality comparison between a couple of point site `lhs` *and* `rhs`.

  - template<typename P, typename D>
    P::point operator+ (const Point_Site< P > &p, const Delta_Point_Site< D > &dp)
    Add a delta-point `rhs` *to a point site* `lhs`.
  - template<typename P, typename D>
    P::point operator- (const Point_Site< P > &p, const Delta_Point_Site< D > &dp)
    }

10.298.1 Detailed Description

template<typename E> struct mln::Point_Site< E >

Base class for implementation classes of the notion of "point site".

A point site ("psite" for short) is an object that allows an efficient access to data associated with a point. A point site is either a point or designates a point.

When a point site is not really a point, it is automatically convertible to the point it designates.

Let us take the example of a 2D image encoded as an array of runs of values. With a point, a pair (row index, column index), retrieving the corresponding pixel value would mean to browse the array of runs to find the value location. That would not be efficient. Conversely, a point site dedicated to this image structure allows for value access in contant time; precisely the proper point site is a pair (index of run, index within the run).

10.298.2 Friends And Related Function Documentation

10.298.2.1 template<typename P, typename D> P::point operator+ (const Point_Site< P > & *p*, const Delta_Point_Site< D > & *dp*) `[related]`

Add a delta-point `rhs` to a point site `lhs`.

Parameters:

← ***p*** A point site.
← ***dp*** A delta-point.

The type of `dp` has to compatible with the type of `p`.

Returns:

A point (temporary object).

See also:

mln::Delta_Point_Site

10.298.2.2 template<typename P, typename D> P::point operator- (const Point_Site< P > & *p*, const Delta_Point_Site< D > & *dp*) `[related]`

}

Substract a delta-point `dp` to a point site `p`.

Parameters:

← ***p*** A point site.
← ***dp*** A delta-point.

The type of `dp` has to compatible with the type of `p`.

Returns:

A point (temporary object).

See also:

mln::Dpoint
mln::Delta_Point_Site

10.298.2.3 template<typename L, typename R> L::dpoint operator- (const Point_Site< L > & *lhs*, const Point_Site< R > & *rhs*) [related]

Difference between a couple of point site `lhs` and `rhs`.

Parameters:

← ***lhs*** A first point site.

← ***rhs*** A second point site.

Warning:

There is no type promotion in Milena so the client has to make sure that both points are defined with the same type of coordinates.

Precondition:

Both `lhs` and `rhs` have to be defined on the same topology and with the same type of coordinates; otherwise this test does not compile.

Postcondition:

The result, `dp`, is such as `lhs` == `rhs` + `dp`.

Returns:

A delta point (temporary object).

See also:

mln::Delta_Point_Site

10.298.2.4 template<typename P> std::ostream & operator<< (std::ostream & *ostr*, const Point_Site< P > & *p*) [related]

Print a point site `p` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***p*** A point site.

Returns:

The modified output stream `ostr`.

10.298.2.5 template<typename L, typename R> bool operator== (const Point_Site< L > & *lhs*, const Point_Site< R > & *rhs*) [related]

Equality comparison between a couple of point site `lhs` and `rhs`.

Parameters:

← ***lhs*** A first point site.

← ***rhs*** A second point site.

Precondition:

Both `lhs` and `rhs` have to be defined on the same topology; otherwise this test does not compile.

Returns:

True if both point sites have the same coordinates, otherwise false.

10.299 mln::Point_Site< void > Struct Template Reference

Point site category flag type.

`#include <point_site.hh>`

10.299.1 Detailed Description

template<> struct mln::Point_Site< void >

Point site category flag type.

10.300 mln::Proxy< E > Struct Template Reference

Base class for implementation classes of the notion of "proxy".

`#include <proxy.hh>`

Inherits mln::Object< E >.

Inherited by mln::Accumulator< E >, mln::internal::graph_iter_base< G, Elt, E >, mln::internal::nbh_-iterator_base< G, C, Elt, E >, mln::Site_Proxy< E >, mln::util::array_bkd_iter< T >, mln::util::array_-fwd_iter< T >, mln::util::set_bkd_iter< T >, mln::util::set_fwd_iter< T >, mln::util::timer, mln::value::proxy< I >, and mln::value::shell< F, I >.

10.300.1 Detailed Description

template<typename E> struct mln::Proxy< E >

Base class for implementation classes of the notion of "proxy".

10.301 mln::Proxy< void > Struct Template Reference

Proxy category flag type.

`#include <proxy.hh>`

10.301.1 Detailed Description

template<> struct mln::Proxy< void >

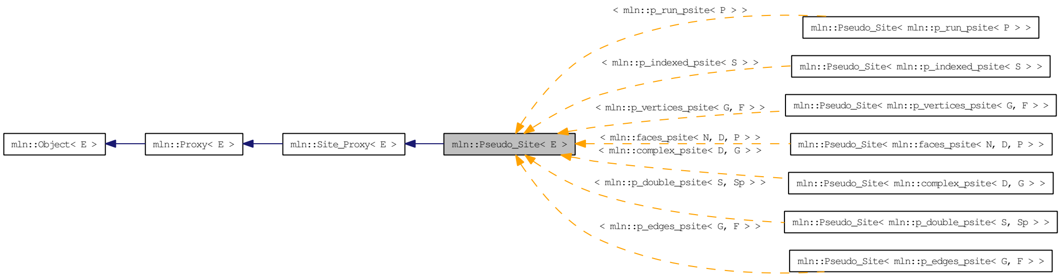
Proxy category flag type.

10.302 mln::Pseudo_Site< E > Struct Template Reference

Base class for implementation classes of the notion of "pseudo site".

```
#include <pseudo_site.hh>
```

Inheritance diagram for mln::Pseudo_Site< E >:



10.302.1 Detailed Description

template<typename E> struct mln::Pseudo_Site< E >

Base class for implementation classes of the notion of "pseudo site".

FIXME: Explain...

10.303 mln::Pseudo_Site< void > Struct Template Reference

Pseudo_Site category flag type.

`#include <pseudo_site.hh>`

10.303.1 Detailed Description

template<> struct mln::Pseudo_Site< void >

Pseudo_Site category flag type.

10.304 mln::pw::image< F, S > Class Template Reference

A generic point-wise image implementation.

```
#include <image.hh>
```

Inherits mln::pw::internal::image_base< F, S, mln::pw::image< F, S > >.

Public Types

- typedef image< tag::function_< F >, tag::domain_< S > > skeleton

    Skeleton.

Public Member Functions

- image (const Function_v2v< F > &f, const Site_Set< S > &ps)

    Constructor.

- image ()

    Constructor without argument.

10.304.1 Detailed Description

template<typename F, typename S> class mln::pw::image< F, S >

A generic point-wise image implementation.

Parameter `F` is a function restricting the domain. Parameter `S` is the domain type.

10.304.2 Member Typedef Documentation

10.304.2.1 template<typename F, typename S> typedef image< tag::function_<F>, tag::domain_<S> > mln::pw::image< F, S >::skeleton

Skeleton.

10.304.3 Constructor & Destructor Documentation

10.304.3.1 template<typename F, typename S> mln::pw::image< F, S >::image () `[inline]`

Constructor without argument.

10.304.3.2 template<typename F, typename S> mln::pw::image< F, S >::image (const Function_v2v< F > & *f*, const Site_Set< S > & *ps*) `[inline]`

Constructor.

10.305 mln::registration::closest_point_basic< P > Class Template Reference

Closest point functor based on map distance.

`#include <icp.hh>`

10.305.1 Detailed Description

template<typename P> class mln::registration::closest_point_basic< P >

Closest point functor based on map distance.

10.306 mln::registration::closest_point_with_map< P > Class Template Reference

Closest point functor based on map distance.

`#include <icp.hh>`

10.306.1 Detailed Description

template<typename P> class mln::registration::closest_point_with_map< P >

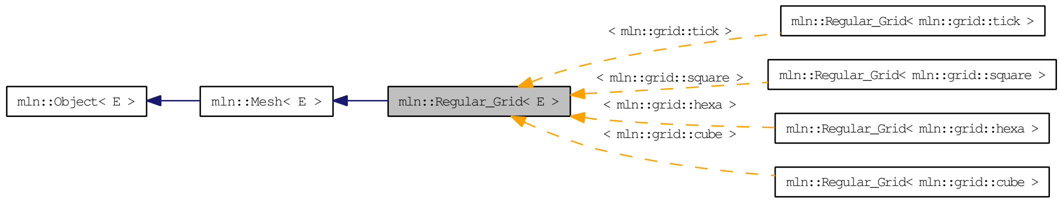
Closest point functor based on map distance.

10.307 mln::Regular_Grid< E > Struct Template Reference

Base class for implementation classes of regular grids.

`#include <regular_grid.hh>`

Inheritance diagram for mln::Regular_Grid< E >:



10.307.1 Detailed Description

template<typename E> struct mln::Regular_Grid< E >

Base class for implementation classes of regular grids.

10.308 mln::safe_image< I > Class Template Reference

Makes an image accessible at undefined location.

```
#include <safe.hh>
```

Inherits mln::internal::image_identity< I, I::domain_t, mln::safe_image< I > >.

Public Types

- typedef safe_image< tag::image_< I > > skeleton
    Skeleton.

Public Member Functions

- operator safe_image< const I > () const
    Const promotion via conversion.

10.308.1 Detailed Description

template<typename I> class mln::safe_image< I >

Makes an image accessible at undefined location.

10.308.2 Member Typedef Documentation

10.308.2.1 template<typename I> typedef safe_image< tag::image_<I> > mln::safe_image< I >::skeleton

Skeleton.

10.308.3 Member Function Documentation

10.308.3.1 template<typename I> mln::safe_image< I >::operator safe_image< const I > () const [inline]

Const promotion via conversion.

10.309 mln::select::p_of< P > Struct Template Reference

Structure p_of.

```
#include <pix.hh>
```

10.309.1 Detailed Description

template<typename P> struct mln::select::p_of< P >

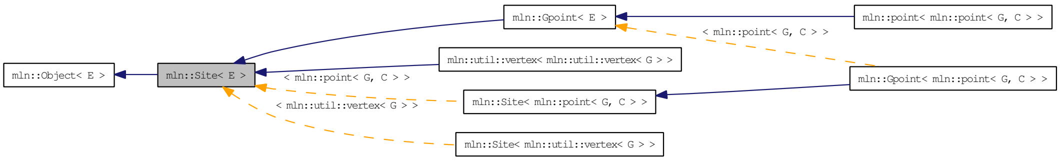
Structure p_of.

10.310 mln::Site< E > Struct Template Reference

Base class for classes that are explicitly sites.

```
#include <site.hh>
```

Inheritance diagram for mln::Site< E >:



10.310.1 Detailed Description

template<typename E> struct mln::Site< E >

Base class for classes that are explicitly sites.

10.311 mln::Site< void > Struct Template Reference

Site category flag type.

`#include <site.hh>`

10.311.1 Detailed Description

template<> struct mln::Site< void >

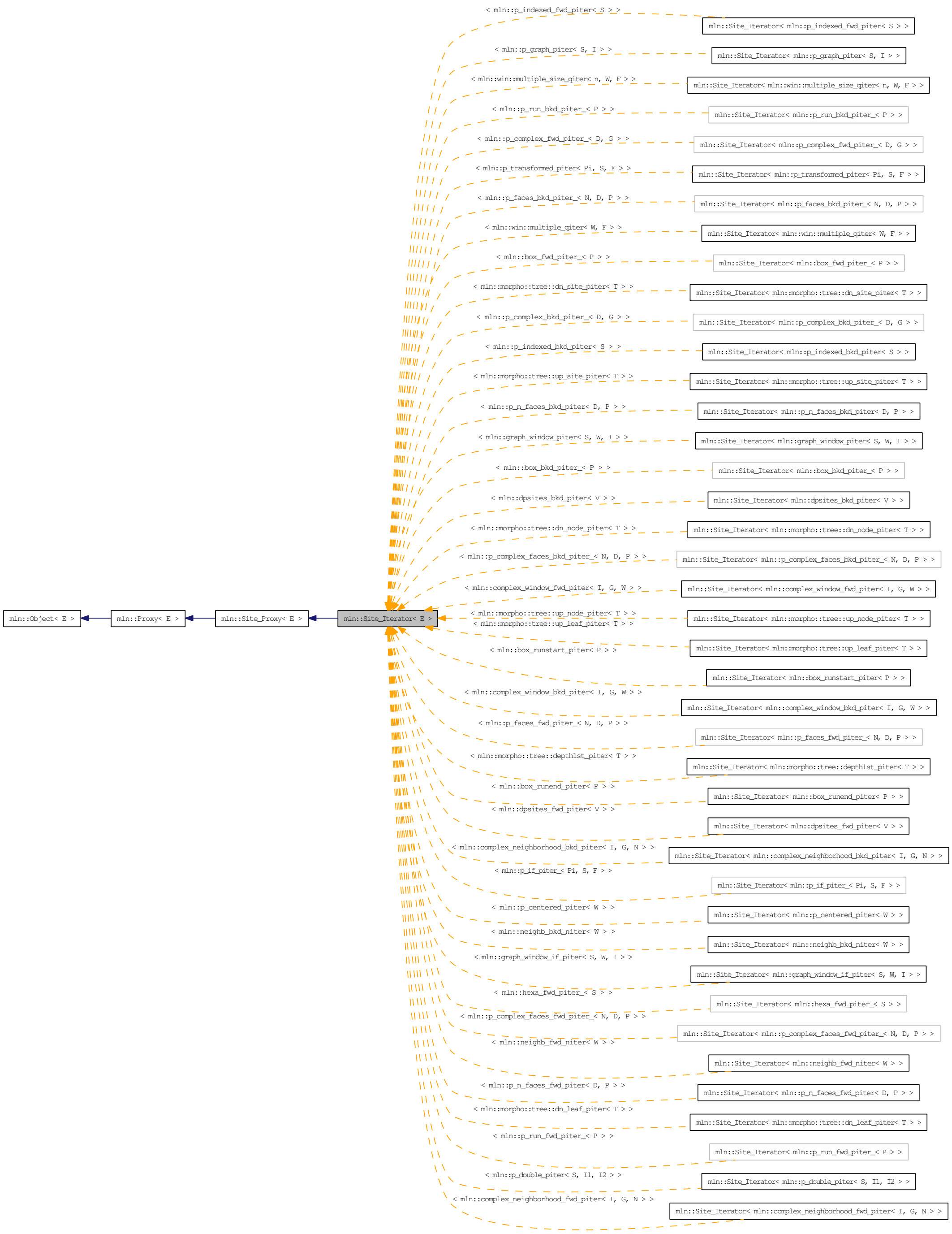
Site category flag type.

10.312 mln::Site_Iterator< E > Struct Template Reference

Base class for implementation of classes of iterator on points.

`#include <site_iterator.hh>`

Inheritance diagram for mln::Site_Iterator< E >:



Public Member Functions

- void next ()

  Go to the next element.

10.312.1 Detailed Description

template<typename E> struct mln::Site_Iterator< E >

Base class for implementation of classes of iterator on points.

An iterator on points is an iterator that browse over a set of points.

See also:

mln::doc::Site_Iterator for a complete documentation of this class contents.

10.312.2 Member Function Documentation

10.312.2.1 template<typename E> void mln::Site_Iterator< E >::next () [inline]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.313 mln::Site_Proxy< E > Struct Template Reference

Base class for implementation classes of the notion of "site proxy".

`#include <site_proxy.hh>`

Inherits mln::Proxy< E >.

Inherited by mln::Pseudo_Site< E >, and mln::Site_Iterator< E >.

10.313.1 Detailed Description

template<typename E> struct mln::Site_Proxy< E >

Base class for implementation classes of the notion of "site proxy".

FIXME: Explain...

10.314 mln::Site_Proxy< void > Struct Template Reference

Site_Proxy category flag type.

`#include <site_proxy.hh>`

10.314.1 Detailed Description

template<> struct mln::Site_Proxy< void >

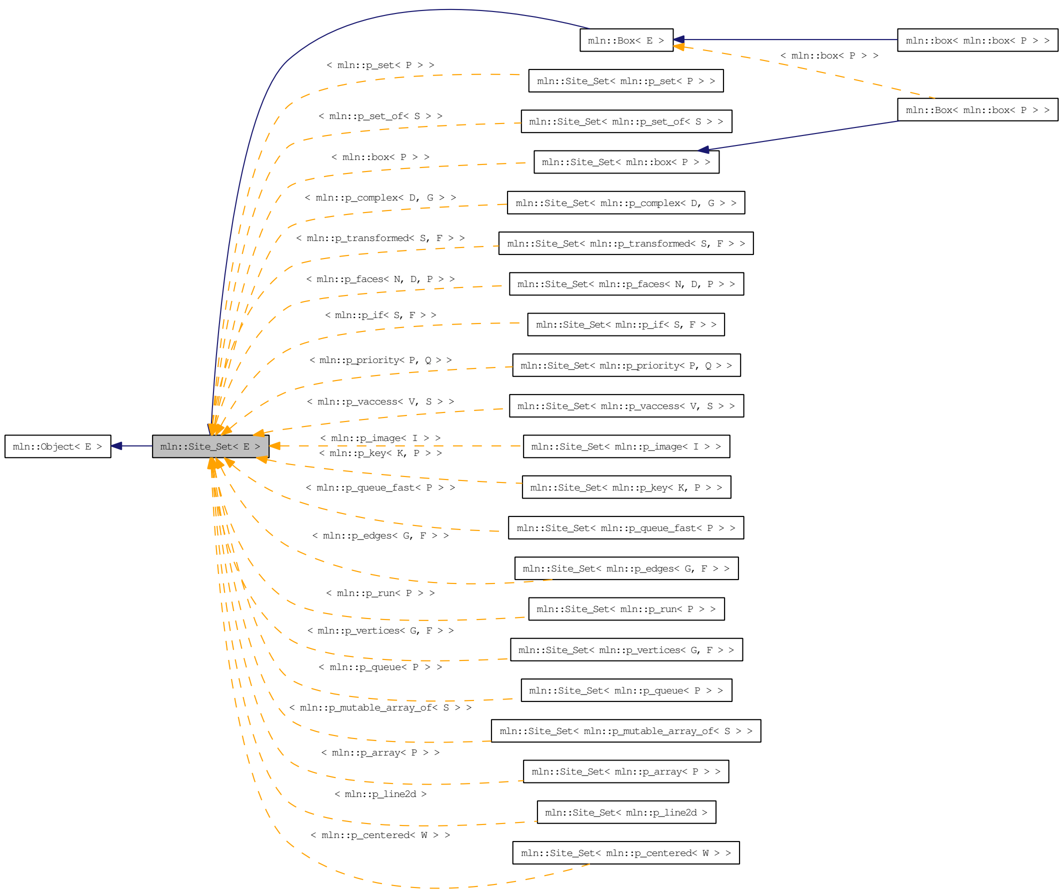
Site_Proxy category flag type.

10.315 mln::Site_Set< E > Struct Template Reference

Base class for implementation classes of site sets.

`#include <site_set.hh>`

Inheritance diagram for mln::Site_Set< E >:



Related Functions

(Note that these are not member functions.)

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic difference of `lhs` *and* `rhs`*.*

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > inter (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Intersection between a couple of point sets.

- template<typename Sl, typename Sr>
  bool operator< (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

Strict inclusion test between site sets `lhs` *and* `rhs`.

- template<typename S>
  std::ostream & operator<< (std::ostream &ostr, const Site_Set< S > &set)

  Print a site set `set` *into the output stream* `ostr`.

- template<typename Sl, typename Sr>
  bool operator<= (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Inclusion test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  bool operator== (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Equality test between site sets `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > sym_diff (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Set theoretic symmetrical difference of `lhs` *and* `rhs`.

- template<typename Sl, typename Sr>
  p_set< typename Sl::site > uni (const Site_Set< Sl > &lhs, const Site_Set< Sr > &rhs)

  Union of a couple of point sets.

- template<typename S>
  p_set< typename S::site > unique (const Site_Set< S > &s)

  Give the unique set of `s`.

10.315.1 Detailed Description

template<typename E> struct mln::Site_Set< E >

Base class for implementation classes of site sets.

See also:

mln::doc::Site_Set for a complete documentation of this class contents.

10.315.2 Friends And Related Function Documentation

10.315.2.1 template<typename Sl, typename Sr> p_set< typename Sl::site > diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related]`

Set theoretic difference of `lhs` and `rhs`.

10.315.2.2 template<typename Sl, typename Sr> p_set< typename Sl::site > inter (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related]`

Intersection between a couple of point sets.

10.315.2.3 template<typename Sl, typename Sr> bool operator< (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related]`

Strict inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (strictly included?).

← ***rhs*** Another site set (includer?).

10.315.2.4 template<typename S> std::ostream & operator<< (std::ostream & *ostr*, const Site_Set< S > & *set*) `[related]`

Print a site set `set` into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***set*** A site set.

Returns:

The modified output stream `ostr`.

10.315.2.5 template<typename Sl, typename Sr> bool operator<= (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related]`

Inclusion test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set (included?).

← ***rhs*** Another site set (includer?).

10.315.2.6 template<typename Sl, typename Sr> bool operator== (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related]`

Equality test between site sets `lhs` and `rhs`.

Parameters:

← ***lhs*** A site set.

← ***rhs*** Another site set.

10.315.2.7 template<typename Sl, typename Sr> p_set< typename Sl::site > sym_diff (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) `[related]`

Set theoretic symmetrical difference of `lhs` and `rhs`.

10.315.2.8 template<typename Sl, typename Sr> p_set< typename Sl::site > uni (const Site_Set< Sl > & *lhs*, const Site_Set< Sr > & *rhs*) [related]

Union of a couple of point sets.

10.315.2.9 template<typename S> p_set< typename S::site > unique (const Site_Set< S > & *s*) [related]

Give the unique set of `s`.

10.316 mln::Site_Set< void > Struct Template Reference

Site_Set category flag type.

`#include <site_set.hh>`

10.316.1 Detailed Description

template<> struct mln::Site_Set< void >

Site_Set category flag type.

10.317 mln::slice_image< I > Struct Template Reference

2D image extracted from a slice of a 3D image.

`#include <slice_image.hh>`

Inherits mln::internal::image_domain_morpher< I, mln::box, mln::slice_image< I > >.

Public Types

- typedef slice_image< tag::image_< I > > skeleton

  Skeleton.

Public Member Functions

- const box2d & domain () const

  Give the definition domain.

- operator slice_image< const I > () const

  Const promotion via conversion.

- internal::morpher_lvalue_< I >::ret operator() (const point2d &p)

  Read-write access to the image value located at point `p`.

- I::rvalue operator() (const point2d &p) const

  Read-only access to the image value located at point `p`.

- def::coord sli () const

  Give the slice number.

- slice_image (I &ima, def::coord sli)

  Constructor from an image `ima` *and a predicate* `f`.

- slice_image ()

  Constructor without argument.

10.317.1 Detailed Description

template<typename I> struct mln::slice_image< I >

2D image extracted from a slice of a 3D image.

10.317.2 Member Typedef Documentation

10.317.2.1 template<typename I> typedef slice_image< tag::image_<I> > mln::slice_image< I >::skeleton

Skeleton.

10.317.3 Constructor & Destructor Documentation

10.317.3.1 template<typename I> mln::slice_image< I >::slice_image () [inline]

Constructor without argument.

10.317.3.2 template<typename I> mln::slice_image< I >::slice_image (I & *ima*, def::coord *sli*) [inline]

Constructor from an image `ima` and a predicate `f`.

10.317.4 Member Function Documentation

10.317.4.1 template<typename I> const box2d & mln::slice_image< I >::domain () const [inline]

Give the definition domain.

10.317.4.2 template<typename I> mln::slice_image< I >::operator slice_image< const I > () const [inline]

Const promotion via conversion.

10.317.4.3 template<typename I> internal::morpher_lvalue_< I >::ret mln::slice_image< I >::operator() (const point2d & *p*) [inline]

Read-write access to the image value located at point `p`.

10.317.4.4 template<typename I> I::rvalue mln::slice_image< I >::operator() (const point2d & *p*) const [inline]

Read-only access to the image value located at point `p`.

10.317.4.5 template<typename I> def::coord mln::slice_image< I >::sli () const [inline]

Give the slice number.

10.318 mln::sub_image< I, S > Struct Template Reference

Image having its domain restricted by a site set.

`#include <sub_image.hh>`

Inherits mln::internal::image_domain_morpher< I, S, mln::sub_image< I, S > >.

Public Types

- typedef sub_image< tag::image_< I >, tag::domain_< S > > skeleton

    Skeleton.

Public Member Functions

- const S & domain () const

    Give the definition domain.

- operator sub_image< const I, S > () const

    Const promotion via conversion.

- sub_image (const I &ima, const S &pset)

    Constructor.

- sub_image ()

    Constructor without argument.

10.318.1 Detailed Description

template<typename I, typename S> struct mln::sub_image< I, S >

Image having its domain restricted by a site set.

10.318.2 Member Typedef Documentation

10.318.2.1 template<typename I, typename S> typedef sub_image< tag::image_<I>, tag::domain_<S> > mln::sub_image< I, S >::skeleton

Skeleton.

10.318.3 Constructor & Destructor Documentation

10.318.3.1 template<typename I, typename S> mln::sub_image< I, S >::sub_image () [inline]

Constructor without argument.

10.318.3.2 template<typename I, typename S> mln::sub_image< I, S >::sub_image (const I & *ima*, const S & *pset*) [inline]

Constructor.

10.318.4 Member Function Documentation

10.318.4.1 template<typename I, typename S> const S & mln::sub_image< I, S >::domain () const [inline]

Give the definition domain.

10.318.4.2 template<typename I, typename S> mln::sub_image< I, S >::operator sub_image< const I, S > () const [inline]

Const promotion via conversion.

10.319 mln::sub_image_if< I, S > Struct Template Reference

Image having its domain restricted by a site set and a function.

```
#include <sub_image_if.hh>
```

Inherits mln::internal::image_domain_morpher< I, mln::p_if< S, mln::fun::p2b::has< I > >, mln::sub_image_if< I, S > >.

Public Types

- typedef sub_image_if< tag::image_< I >, tag::domain_< S > > skeleton

  Skeleton.

Public Member Functions

- const p_if< S, fun::p2b::has< I > > & domain () const

  Give the definition domain.

- sub_image_if (I &ima, const S &s)

  Constructor.

- sub_image_if ()

  Constructor without argument.

10.319.1 Detailed Description

template<typename I, typename S> struct mln::sub_image_if< I, S >

Image having its domain restricted by a site set and a function.

10.319.2 Member Typedef Documentation

10.319.2.1 template<typename I, typename S> typedef sub_image_if< tag::image_<I>, tag::domain_<S> > mln::sub_image_if< I, S >::skeleton

Skeleton.

10.319.3 Constructor & Destructor Documentation

10.319.3.1 template<typename I, typename S> mln::sub_image_if< I, S >::sub_image_if () [inline]

Constructor without argument.

10.319.3.2 template<typename I, typename S> mln::sub_image_if< I, S >::sub_image_if (I & *ima*, const S & *s*) [inline]

Constructor.

10.319.4 Member Function Documentation

10.319.4.1 template<typename I, typename S> const p_if< S, fun::p2b::has< I > > & mln::sub_image_if< I, S >::domain () const [inline]

Give the definition domain.

10.320 mln::thru_image< I, F > Class Template Reference

Morph image values through a function.

```
#include <thru_image.hh>
```

Public Member Functions

- operator thru_image< const I, F > () const
  Const promotion via conversion.

10.320.1 Detailed Description

template<typename I, typename F> class mln::thru_image< I, F >

Morph image values through a function.

10.320.2 Member Function Documentation

10.320.2.1 template<typename I, typename F> mln::thru_image< I, F >::operator thru_image< const I, F > () const [inline]

Const promotion via conversion.

10.321 mln::thrubin_image< I1, I2, F > Class Template Reference

Morphes values from two images through a binary function.

`#include <thrubin_image.hh>`

Inherits mln::internal::image_value_morpher< I1, F::result, mln::thrubin_image< I1, I2, F > >.

Public Types

- typedef I1::psite psite

  Point_Site associated type.

- typedef value rvalue

  Return type of read-only access.

- typedef thrubin_image< tag::image_< I1 >, tag::image_< I2 >, F > skeleton

  Skeleton.

- typedef F::result value

  Value associated type.

Public Member Functions

- operator thrubin_image< const I1, const I2, F > () const

  Const promotion via conversion.

10.321.1 Detailed Description

template<typename I1, typename I2, typename F> class mln::thrubin_image< I1, I2, F >

Morphes values from two images through a binary function.

10.321.2 Member Typedef Documentation

10.321.2.1 template<typename I1, typename I2, typename F> typedef I1 ::psite mln::thrubin_image< I1, I2, F >::psite

Point_Site associated type.

10.321.2.2 template<typename I1, typename I2, typename F> typedef value mln::thrubin_image< I1, I2, F >::rvalue

Return type of read-only access.

10.321.2.3 template<typename I1, typename I2, typename F> typedef thrubin_-image<tag::image_<I1>, tag::image_<I2>, F> mln::thrubin_image< I1, I2, F >::skeleton

Skeleton.

10.321.2.4 template<typename I1, typename I2, typename F> typedef F ::result mln::thrubin_image< I1, I2, F >::value

Value associated type.

10.321.3 Member Function Documentation

10.321.3.1 template<typename I1, typename I2, typename F> mln::thrubin_image< I1, I2, F >::operator thrubin_image< const I1, const I2, F > () const [inline]

Const promotion via conversion.

10.322 mln::topo::adj_higher_dim_connected_n_face_bkd_iter< D > Class Template Reference

Backward iterator on all the n-faces sharing an adjacent (n+1)-face with a (reference) n-face of an mln::complex<D>.

`#include <adj_higher_dim_connected_n_face_iter.hh>`

Inherits mln::topo::internal::backward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::adj_higher_dim_connected_n_face_bkd_iter< D > >, and mln::topo::internal::adj_higher_dim_connected_n_face_iterator< D >.

Public Member Functions

- void next ()

  Go to the next element.

- adj_higher_dim_connected_n_face_bkd_iter ()

  Construction.

10.322.1 Detailed Description

template<unsigned D> class mln::topo::adj_higher_dim_connected_n_face_bkd_iter< D >

Backward iterator on all the n-faces sharing an adjacent (n+1)-face with a (reference) n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.322.2 Constructor & Destructor Documentation

10.322.2.1 template<unsigned D> mln::topo::adj_higher_dim_connected_n_face_bkd_iter< D >::adj_higher_dim_connected_n_face_bkd_iter () `[inline]`

Construction.

10.322.3 Member Function Documentation

10.322.3.1 template<typename E> void mln::Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.323 mln::topo::adj_higher_dim_connected_n_face_fwd_iter< D > Class Template Reference

Forward iterator on all the n-faces sharing an adjacent (n+1)-face with a (reference) n-face of an mln::complex<D>.

`#include <adj_higher_dim_connected_n_face_iter.hh>`

Inherits mln::topo::internal::forward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::adj_higher_dim_connected_n_face_fwd_iter< D > >, and mln::topo::internal::adj_higher_dim_connected_n_face_iterator< D >.

Public Member Functions

- void next ()

  Go to the next element.

- adj_higher_dim_connected_n_face_fwd_iter ()

  Construction.

10.323.1 Detailed Description

template<unsigned D> class mln::topo::adj_higher_dim_connected_n_face_fwd_iter< D >

Forward iterator on all the n-faces sharing an adjacent (n+1)-face with a (reference) n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.323.2 Constructor & Destructor Documentation

10.323.2.1 template<unsigned D> mln::topo::adj_higher_dim_connected_n_face_fwd_iter< D >::adj_higher_dim_connected_n_face_fwd_iter () [inline]

Construction.

10.323.3 Member Function Documentation

10.323.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.324 mln::topo::adj_higher_face_bkd_iter< D > Class Template Reference

Backward iterator on all the adjacent (n+1)-faces of the n-face of an mln::complex<D>.

`#include <adj_higher_face_iter.hh>`

Inherits mln::topo::internal::backward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::adj_higher_face_bkd_iter< D > >.

Public Member Functions

- void next ()
  Go to the next element.

- adj_higher_face_bkd_iter ()
  Construction.

10.324.1 Detailed Description

template<unsigned D> class mln::topo::adj_higher_face_bkd_iter< D >

Backward iterator on all the adjacent (n+1)-faces of the n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.324.2 Constructor & Destructor Documentation

10.324.2.1 template<unsigned D> mln::topo::adj_higher_face_bkd_iter< D >::adj_higher_face_bkd_iter () [inline]

Construction.

10.324.3 Member Function Documentation

10.324.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.325 mln::topo::adj_higher_face_fwd_iter< D > Class Template Reference

Forward iterator on all the adjacent (n+1)-faces of the n-face of an mln::complex<D>.

`#include <adj_higher_face_iter.hh>`

Inherits mln::topo::internal::forward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::adj_higher_face_fwd_iter< D > >.

Public Member Functions

- void next ()
  Go to the next element.
- adj_higher_face_fwd_iter ()
  Construction.

10.325.1 Detailed Description

template<unsigned D> class mln::topo::adj_higher_face_fwd_iter< D >

Forward iterator on all the adjacent (n+1)-faces of the n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.325.2 Constructor & Destructor Documentation

10.325.2.1 template<unsigned D> mln::topo::adj_higher_face_fwd_iter< D >::adj_higher_face_fwd_iter () [inline]

Construction.

10.325.3 Member Function Documentation

10.325.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.326 mln::topo::adj_lower_dim_connected_n_face_bkd_iter< D > Class Template Reference

Backward iterator on all the n-faces sharing an adjacent (n-1)-face with a (reference) n-face of an mln::complex<D>.

`#include <adj_lower_dim_connected_n_face_iter.hh>`

Inherits mln::topo::internal::backward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::adj_lower_dim_connected_n_face_bkd_iter< D > >, and mln::topo::internal::adj_lower_dim_connected_n_face_iterator< D >.

Public Member Functions

- void next ()

  Go to the next element.

- adj_lower_dim_connected_n_face_bkd_iter ()

  Construction.

10.326.1 Detailed Description

template<unsigned D> class mln::topo::adj_lower_dim_connected_n_face_bkd_iter< D >

Backward iterator on all the n-faces sharing an adjacent (n-1)-face with a (reference) n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.326.2 Constructor & Destructor Documentation

10.326.2.1 template<unsigned D> mln::topo::adj_lower_dim_connected_n_face_bkd_iter< D >::adj_lower_dim_connected_n_face_bkd_iter () [inline]

Construction.

10.326.3 Member Function Documentation

10.326.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.327 mln::topo::adj_lower_dim_connected_n_face_fwd_iter< D > Class Template Reference

Forward iterator on all the n-faces sharing an adjacent (n-1)-face with a (reference) n-face of an mln::complex<D>.

`#include <adj_lower_dim_connected_n_face_iter.hh>`

Inherits mln::topo::internal::forward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::adj_lower_dim_connected_n_face_fwd_iter< D > >, and mln::topo::internal::adj_lower_dim_connected_n_face_iterator< D >.

Public Member Functions

- void next ()
  Go to the next element.

- adj_lower_dim_connected_n_face_fwd_iter ()
  Construction.

10.327.1 Detailed Description

template<unsigned D> class mln::topo::adj_lower_dim_connected_n_face_fwd_iter< D >

Forward iterator on all the n-faces sharing an adjacent (n-1)-face with a (reference) n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.327.2 Constructor & Destructor Documentation

10.327.2.1 template<unsigned D> mln::topo::adj_lower_dim_connected_n_face_fwd_iter< D >::adj_lower_dim_connected_n_face_fwd_iter () `[inline]`

Construction.

10.327.3 Member Function Documentation

10.327.3.1 template<typename E> void mln::Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.328 mln::topo::adj_lower_face_bkd_iter< D > Class Template Reference

Backward iterator on all the adjacent (n-1)-faces of the n-face of an mln::complex<D>.

`#include <adj_lower_face_iter.hh>`

Inherits mln::topo::internal::backward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::adj_lower_face_bkd_iter< D > >.

Public Member Functions

- void next ()
  Go to the next element.

- adj_lower_face_bkd_iter ()
  Construction.

10.328.1 Detailed Description

template<unsigned D> class mln::topo::adj_lower_face_bkd_iter< D >

Backward iterator on all the adjacent (n-1)-faces of the n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.328.2 Constructor & Destructor Documentation

10.328.2.1 template<unsigned D> mln::topo::adj_lower_face_bkd_iter< D >::adj_lower_face_bkd_iter () [inline]

Construction.

10.328.3 Member Function Documentation

10.328.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.329 mln::topo::adj_lower_face_fwd_iter< D > Class Template Reference

Forward iterator on all the adjacent (n-1)-faces of the n-face of an mln::complex<D>.

`#include <adj_lower_face_iter.hh>`

Inherits mln::topo::internal::forward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::adj_lower_face_fwd_iter< D > >.

Public Member Functions

- void next ()
  Go to the next element.

- adj_lower_face_fwd_iter ()
  Construction.

10.329.1 Detailed Description

template<unsigned D> class mln::topo::adj_lower_face_fwd_iter< D >

Forward iterator on all the adjacent (n-1)-faces of the n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.329.2 Constructor & Destructor Documentation

10.329.2.1 template<unsigned D> mln::topo::adj_lower_face_fwd_iter< D >::adj_lower_face_fwd_iter () [inline]

Construction.

10.329.3 Member Function Documentation

10.329.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.330 mln::topo::adj_lower_higher_face_bkd_iter< D > Class Template Reference

Forward iterator on all the adjacent (n-1)-faces and (n+1)-faces of the n-face of an mln::complex<D>.

`#include <adj_lower_higher_face_iter.hh>`

Inherits mln::topo::internal::complex_relative_iterator_sequence< mln::topo::adj_higher_face_bkd_iter< D >, mln::topo::adj_lower_face_bkd_iter< D >, mln::topo::adj_lower_higher_face_bkd_iter< D > >.

Public Member Functions

- void next ()
  Go to the next element.

- adj_lower_higher_face_bkd_iter ()
  Construction.

10.330.1 Detailed Description

template<unsigned D> class mln::topo::adj_lower_higher_face_bkd_iter< D >

Forward iterator on all the adjacent (n-1)-faces and (n+1)-faces of the n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.330.2 Constructor & Destructor Documentation

10.330.2.1 template<unsigned D> mln::topo::adj_lower_higher_face_bkd_iter< D >::adj_lower_higher_face_bkd_iter () `[inline]`

Construction.

10.330.3 Member Function Documentation

10.330.3.1 template<typename E> void mln::Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.331 mln::topo::adj_lower_higher_face_fwd_iter< D > Class Template Reference

Forward iterator on all the adjacent (n-1)-faces and (n+1)-faces of the n-face of an mln::complex<D>.

`#include <adj_lower_higher_face_iter.hh>`

Inherits mln::topo::internal::complex_relative_iterator_sequence< mln::topo::adj_lower_face_fwd_iter< D >, mln::topo::adj_higher_face_fwd_iter< D >, mln::topo::adj_lower_higher_face_fwd_iter< D > >.

Public Member Functions

- void next ()
  Go to the next element.

- adj_lower_higher_face_fwd_iter ()
  Construction.

10.331.1 Detailed Description

template<unsigned D> class mln::topo::adj_lower_higher_face_fwd_iter< D >

Forward iterator on all the adjacent (n-1)-faces and (n+1)-faces of the n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.331.2 Constructor & Destructor Documentation

10.331.2.1 template<unsigned D> mln::topo::adj_lower_higher_face_fwd_iter< D >::adj_lower_higher_face_fwd_iter () [inline]

Construction.

10.331.3 Member Function Documentation

10.331.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.332 mln::topo::adj_m_face_bkd_iter< D > Class Template Reference

Backward iterator on all the m-faces transitively adjacent to a (reference) n-face in a complex.

`#include <adj_m_face_iter.hh>`

Inherits mln::topo::internal::backward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::adj_m_face_bkd_iter< D > >, and mln::topo::internal::adj_-m_face_iterator< D >.

Public Member Functions

- void next ()

  Go to the next element.

- template<typename Fref>
  adj_m_face_bkd_iter (const Fref &f_ref, unsigned m)

  Constructs an iterator, with f_ref *as reference face, and a target dimension equal to* m.

- adj_m_face_bkd_iter ()

  Construction.

10.332.1 Detailed Description

template<unsigned D> class mln::topo::adj_m_face_bkd_iter< D >

Backward iterator on all the m-faces transitively adjacent to a (reference) n-face in a complex.

Template Parameters:

D The dimension of the complex this iterator belongs to.

The dimension parameter (*m_*) must be lower or equal to D.

If *m_* is equal to the dimension of the reference face, then the iterated set is empty.

10.332.2 Constructor & Destructor Documentation

10.332.2.1 template<unsigned D> mln::topo::adj_m_face_bkd_iter< D >::adj_m_face_bkd_iter () [inline]

Construction.

Construct an iterator, with an invalid reference face, and a target dimension equal to 0.

10.332.2.2 template<unsigned D> template<typename Fref> mln::topo::adj_m_face_bkd_iter< D >::adj_m_face_bkd_iter (const Fref & *f_ref*, unsigned *m*) [inline]

Constructs an iterator, with *f_ref* as reference face, and a target dimension equal to *m*.

10.332.3 Member Function Documentation

10.332.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.333 mln::topo::adj_m_face_fwd_iter< D > Class Template Reference

Forward iterator on all the m-faces transitively adjacent to a (reference) n-face in a complex.

```
#include <adj_m_face_iter.hh>
```

Inherits mln::topo::internal::forward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::adj_m_face_fwd_iter< D > >, and mln::topo::internal::adj_m_face_iterator< D >.

Public Member Functions

- void next ()
  Go to the next element.

- template<typename Fref>
  adj_m_face_fwd_iter (const Fref &f_ref, unsigned m)
  Constructs an iterator, with f_ref *as reference face, and a target dimension equal to* m.
- adj_m_face_fwd_iter ()
  Construction.

10.333.1 Detailed Description

template<unsigned D> class mln::topo::adj_m_face_fwd_iter< D >

Forward iterator on all the m-faces transitively adjacent to a (reference) n-face in a complex.

Template Parameters:

D The dimension of the complex this iterator belongs to.

The dimension parameter (*m_*) must be lower or equal to D.

If *m_* is equal to the dimension of the reference face, then the iterated set is empty.

10.333.2 Constructor & Destructor Documentation

10.333.2.1 template<unsigned D> mln::topo::adj_m_face_fwd_iter< D >::adj_m_face_fwd_iter () [inline]

Construction.

Construct an iterator, with an invalid reference face, and a target dimension equal to 0.

10.333.2.2 template<unsigned D> template<typename Fref> mln::topo::adj_m_face_fwd_iter< D >::adj_m_face_fwd_iter (const Fref & *f_ref*, unsigned *m*) [inline]

Constructs an iterator, with *f_ref* as reference face, and a target dimension equal to *m*.

10.333.3 Member Function Documentation

10.333.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

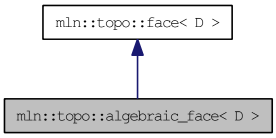
The iterator is valid.

10.334 mln::topo::algebraic_face< D > Struct Template Reference

Algebraic face handle in a complex; the face dimension is dynamic.

```
#include <algebraic_face.hh>
```

Inheritance diagram for mln::topo::algebraic_face< D >:



Public Member Functions

- template<unsigned N>
  algebraic_face (const algebraic_n_face< N, D > &f)

  Build a face handle from an mln::topo::algebraic_n_face.

- algebraic_face (const face< D > &f, bool sign)

  Build an algebraic face handle from an mln::face.

- algebraic_face (complex< D > &complex, unsigned n, unsigned face_id, bool sign)

  Build an algebraic face handle from complex and face_id.

- algebraic_face ()

  Build a non-initialized algebraic face handle.

- void invalidate ()

  Invalidate this handle.

- bool is_valid () const

  Is this handle valid?

  - complex< D > cplx () const

    Accessors.

  - template<unsigned N>
    face_data< N, D > & data () const

    Return the mln::topo::face_data pointed by this handle.

  - void dec_face_id ()

    Decrement the id of the face.

  - void dec_n ()

    Decrement the dimension of the face.

  - unsigned face_id () const

    Return the id of the face.

- std::vector< algebraic_face< D > > higher_dim_adj_faces () const
  Return an array of face handles pointing to adjacent (n+1)-faces.
- void inc_face_id ()
  Increment the id of the face.
- void inc_n ()
  Increment the dimension of the face.
- std::vector< algebraic_face< D > > lower_dim_adj_faces () const
  Return an array of face handles pointing to adjacent (n-1)-faces.
- unsigned n () const
  Return the dimension of the face.
- void set_cplx (const complex< D > &cplx)
  Set the complex the face belongs to.
- void set_face_id (unsigned face_id)
  Set the id of the face.
- void set_n (unsigned n)
  Set the dimension of the face.

- void set_sign (bool sign)
  Set the sign of this face.
- bool sign () const
  Accessors.

10.334.1 Detailed Description

template<unsigned D> struct mln::topo::algebraic_face< D >

Algebraic face handle in a complex; the face dimension is dynamic.

Contrary to an mln::topo::algebraic_n_face, the dimension of an mln::topo::algebraic_face is not fixed.

10.334.2 Constructor & Destructor Documentation

10.334.2.1 template<unsigned D> mln::topo::algebraic_face< D >::algebraic_face () [inline]

Build a non-initialized algebraic face handle.

10.334.2.2 template<unsigned D> mln::topo::algebraic_face< D >::algebraic_face (complex< D > & *complex*, unsigned *n*, unsigned *face_id*, bool *sign*) [inline]

Build an algebraic face handle from *complex* and *face_id*.

10.334.2.3 template<unsigned D> mln::topo::algebraic_face< D >::algebraic_face (const face< D > & *f*, bool *sign*) [inline]

Build an algebraic face handle from an mln::face.

References mln::topo::face< D >::n().

10.334.2.4 template<unsigned D> template<unsigned N> mln::topo::algebraic_face< D >::algebraic_face (const algebraic_n_face< N, D > & *f*) [inline]

Build a face handle from an mln::topo::algebraic_n_face.

10.334.3 Member Function Documentation

10.334.3.1 template<unsigned D> complex< D > mln::topo::face< D >::cplx () const [inline, inherited]

Accessors.

Return the complex the face belongs to.

Referenced by mln::complex_psite< D, G >::complex_psite(), mln::topo::operator!=(), and mln::topo::operator==().

10.334.3.2 template<unsigned D> template<unsigned N> face_data< N, D > & mln::topo::face< D >::data () const [inline, inherited]

Return the mln::topo::face_data pointed by this handle.

References mln::topo::face< D >::is_valid().

10.334.3.3 template<unsigned D> void mln::topo::face< D >::dec_face_id () [inline, inherited]

Decrement the id of the face.

10.334.3.4 template<unsigned D> void mln::topo::face< D >::dec_n () [inline, inherited]

Decrement the dimension of the face.

10.334.3.5 template<unsigned D> unsigned mln::topo::face< D >::face_id () const [inline, inherited]

Return the id of the face.

Referenced by mln::geom::complex_geometry< D, P >::operator()(), and mln::topo::operator==().

10.334.3.6 template< unsigned D > std::vector< algebraic_face< D > > mln::topo::face< D >::higher_dim_adj_faces () const [inline, inherited]

Return an array of face handles pointing to adjacent (n+1)-faces.

10.334.3.7 template< unsigned D > void mln::topo::face< D >::inc_face_id () [inline, inherited]

Increment the id of the face.

10.334.3.8 template< unsigned D > void mln::topo::face< D >::inc_n () [inline, inherited]

Increment the dimension of the face.

10.334.3.9 template< unsigned D > void mln::topo::face< D >::invalidate () [inline, inherited]

Invalidate this handle.

References mln::topo::face< D >::set_face_id(), and mln::topo::face< D >::set_n().

10.334.3.10 template< unsigned D > bool mln::topo::face< D >::is_valid () const [inline, inherited]

Is this handle valid?

Referenced by mln::topo::face< D >::data().

10.334.3.11 template< unsigned D > std::vector< algebraic_face< D > > mln::topo::face< D >::lower_dim_adj_faces () const [inline, inherited]

Return an array of face handles pointing to adjacent (n-1)-faces.

10.334.3.12 template< unsigned D > unsigned mln::topo::face< D >::n () const [inline, inherited]

Return the dimension of the face.

Referenced by mln::topo::algebraic_face< D >::algebraic_face(), mln::geom::complex_geometry< D, P >::operator()(), and mln::topo::operator==().

10.334.3.13 template< unsigned D > void mln::topo::face< D >::set_cplx (const complex< D > & *cplx*) [inline, inherited]

Set the complex the face belongs to.

10.334.3.14 template<unsigned D> void mln::topo::face< D >::set_face_id (unsigned *face_id*) [inline, inherited]

Set the id of the face.

Referenced by mln::topo::face< D >::invalidate().

10.334.3.15 template<unsigned D> void mln::topo::face< D >::set_n (unsigned *n*) [inline, inherited]

Set the dimension of the face.

Referenced by mln::topo::face< D >::invalidate().

10.334.3.16 template<unsigned D> void mln::topo::algebraic_face< D >::set_sign (bool *sign*) [inline]

Set the sign of this face.

10.334.3.17 template<unsigned D> bool mln::topo::algebraic_face< D >::sign () const [inline]

Accessors.

Return the sign of this face.

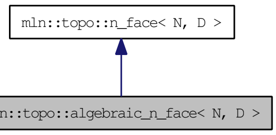
Referenced by mln::topo::operator==().

10.335 mln::topo::algebraic_n_face< N, D > Class Template Reference

Algebraic `N-face` handle in a complex.

`#include <algebraic_n_face.hh>`

Inheritance diagram for mln::topo::algebraic_n_face< N, D >:



Public Member Functions

- algebraic_n_face (const n_face< N, D > &f, bool sign)
  Build an algebraic face handle from an mln::n_face.
- algebraic_n_face (complex< D > &complex, unsigned face_id, bool sign)
  Build an algebraic face handle from complex and face_id.
- algebraic_n_face ()
  Build a non-initialized algebraic face handle.
- void invalidate ()
  Invalidate this handle.
- bool is_valid () const
  Is this handle valid?

  - complex< D > cplx () const
    Accessors.
  - face_data< N, D > & data () const
    Return the mln::topo::face_data pointed by this handle.
  - void dec_face_id ()
    Decrement the id of the face.
  - unsigned face_id () const
    Return the id of the face.
  - std::vector< algebraic_n_face< N+1, D > > higher_dim_adj_faces () const
    Return an array of face handles pointing to adjacent (n+1)-faces.
  - void inc_face_id ()
    Increment the id of the face.
  - std::vector< algebraic_n_face< N-1, D > > lower_dim_adj_faces () const

Return an array of face handles pointing to adjacent (n-1)-faces.

- unsigned n () const

  Return the dimension of the face.

- void set_cplx (const complex< D > &cplx)

  Set the complex the face belongs to.

- void set_face_id (unsigned face_id)

  Set the id of the face.

- void set_sign (bool sign)

  Set the sign of this face.

- bool sign () const

  Accessors.

10.335.1 Detailed Description

template<unsigned N, unsigned D> class mln::topo::algebraic_n_face< N, D >

Algebraic `N-face` handle in a complex.

Contrary to an mln::topo::algebraic_face, the dimension of an mln::topo::algebraic_n_face is fixed.

10.335.2 Constructor & Destructor Documentation

10.335.2.1 template<unsigned N, unsigned D> mln::topo::algebraic_n_face< N, D >::algebraic_n_face () `[inline]`

Build a non-initialized algebraic face handle.

References mln::topo::n_face< N, D >::is_valid().

10.335.2.2 template<unsigned N, unsigned D> mln::topo::algebraic_n_face< N, D >::algebraic_n_face (complex< D > & *complex*, unsigned *face_id*, bool *sign*) `[inline]`

Build an algebraic face handle from *complex* and *face_id*.

10.335.2.3 template<unsigned N, unsigned D> mln::topo::algebraic_n_face< N, D >::algebraic_n_face (const n_face< N, D > & *f*, bool *sign*) `[inline]`

Build an algebraic face handle from an mln::n_face.

10.335.3 Member Function Documentation

10.335.3.1 template<unsigned N, unsigned D> complex< D > mln::topo::n_face< N, D >::cplx () const [inline, inherited]

Accessors.

Return the complex the face belongs to.

Referenced by mln::topo::n_faces_set< N, D >::add(), mln::topo::operator!=(), and mln::topo::operator==().

10.335.3.2 template<unsigned N, unsigned D> face_data< N, D > & mln::topo::n_face< N, D >::data () const [inline, inherited]

Return the mln::topo::face_data pointed by this handle.

References mln::topo::n_face< N, D >::is_valid().

10.335.3.3 template<unsigned N, unsigned D> void mln::topo::n_face< N, D >::dec_face_id () [inline, inherited]

Decrement the id of the face.

10.335.3.4 template<unsigned N, unsigned D> unsigned mln::topo::n_face< N, D >::face_id () const [inline, inherited]

Return the id of the face.

Referenced by mln::topo::operator==().

10.335.3.5 template<unsigned N, unsigned D> std::vector< algebraic_n_face< N+1, D > > mln::topo::n_face< N, D >::higher_dim_adj_faces () const [inline, inherited]

Return an array of face handles pointing to adjacent (n+1)-faces.

References mln::topo::n_face< N, D >::is_valid().

Referenced by mln::topo::edge().

10.335.3.6 template<unsigned N, unsigned D> void mln::topo::n_face< N, D >::inc_face_id () [inline, inherited]

Increment the id of the face.

10.335.3.7 template<unsigned N, unsigned D> void mln::topo::n_face< N, D >::invalidate () [inline, inherited]

Invalidate this handle.

References mln::topo::n_face< N, D >::set_face_id().

10.335.3.8 template<unsigned N, unsigned D> bool mln::topo::n_face< N, D >::is_valid () const [inline, inherited]

Is this handle valid?

Referenced by mln::topo::algebraic_n_face< N, D >::algebraic_n_face(), mln::topo::n_face< N, D >::data(), mln::topo::n_face< N, D >::higher_dim_adj_faces(), mln::topo::n_face< N, D >::lower_dim_adj_faces(), and mln::topo::n_face< N, D >::n_face().

10.335.3.9 template<unsigned N, unsigned D> std::vector< algebraic_n_face< N-1, D > > mln::topo::n_face< N, D >::lower_dim_adj_faces () const [inline, inherited]

Return an array of face handles pointing to adjacent (n-1)-faces.

References mln::topo::n_face< N, D >::is_valid().

10.335.3.10 template<unsigned N, unsigned D> unsigned mln::topo::n_face< N, D >::n () const [inline, inherited]

Return the dimension of the face.

10.335.3.11 template<unsigned N, unsigned D> void mln::topo::n_face< N, D >::set_cplx (const complex< D > & *cplx*) [inline, inherited]

Set the complex the face belongs to.

10.335.3.12 template<unsigned N, unsigned D> void mln::topo::n_face< N, D >::set_face_id (unsigned *face_id*) [inline, inherited]

Set the id of the face.

Referenced by mln::topo::n_face< N, D >::invalidate().

10.335.3.13 template<unsigned N, unsigned D> void mln::topo::algebraic_n_face< N, D >::set_sign (bool *sign*) [inline]

Set the sign of this face.

10.335.3.14 template<unsigned N, unsigned D> bool mln::topo::algebraic_n_face< N, D >::sign () const [inline]

Accessors.

Return the sign of this face.

Referenced by mln::topo::operator==().

10.336 mln::topo::center_only_iter< D > Class Template Reference

Iterator on all the adjacent (n-1)-faces of the n-face of an mln::complex<D>.

`#include <center_only_iter.hh>`

Inherits mln::topo::internal::forward_complex_relative_iterator_base< mln::topo::face< D >, mln::topo::algebraic_face< D >, mln::topo::center_only_iter< D > >.

Public Member Functions

- void next ()

  Go to the next element.

- center_only_iter ()

  Construction.

10.336.1 Detailed Description

template<unsigned D> class mln::topo::center_only_iter< D >

Iterator on all the adjacent (n-1)-faces of the n-face of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

mln::topo::center_only_iter inherits from mln::topo::internal::forward_complex_relative_iterator_base, but it could inherit from mln::topo::internal::backward_complex_relative_iterator_base as well, since it always contains a single element, the center/reference face (and the traversal order is meaningless).

This iterator is essentially used to implement other iterators.

See also:

mln::topo::centered_iter_adapter
mln::complex_lower_window
mln::complex_higher_window
mln::complex_lower_higher_window

10.336.2 Constructor & Destructor Documentation

10.336.2.1 template<unsigned D> mln::topo::center_only_iter< D >::center_only_iter () [inline]

Construction.

10.336.3 Member Function Documentation

10.336.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.337 mln::topo::centered_bkd_iter_adapter< D, I > Class Template Reference

Forward complex relative iterator adapters adding the central (reference) point to the set of iterated faces.

`#include <centered_iter_adapter.hh>`

Inherits mln::topo::internal::complex_relative_iterator_sequence< I, mln::topo::center_only_iter< D >, mln::topo::centered_bkd_iter_adapter< D, I > >.

Public Member Functions

- void next ()
  Go to the next element.

- centered_bkd_iter_adapter ()
  Construction.

10.337.1 Detailed Description

template<unsigned D, typename I> class mln::topo::centered_bkd_iter_adapter< D, I >

Forward complex relative iterator adapters adding the central (reference) point to the set of iterated faces.

Template Parameters:

D The dimension of the complex this iterator belongs to.
I The adapated complex relative iterator.

10.337.2 Constructor & Destructor Documentation

10.337.2.1 template<unsigned D, typename I> mln::topo::centered_bkd_iter_adapter< D, I >::centered_bkd_iter_adapter () [inline]

Construction.

10.337.3 Member Function Documentation

10.337.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.338 mln::topo::centered_fwd_iter_adapter< D, I > Class Template Reference

Backward complex relative iterator adapters adding the central (reference) point to the set of iterated faces.

`#include <centered_iter_adapter.hh>`

Inherits mln::topo::internal::complex_relative_iterator_sequence< mln::topo::center_only_iter< D >, I, mln::topo::centered_fwd_iter_adapter< D, I > >.

Public Member Functions

- void next ()
  Go to the next element.

- centered_fwd_iter_adapter ()
  Construction.

10.338.1 Detailed Description

template<unsigned D, typename I> class mln::topo::centered_fwd_iter_adapter< D, I >

Backward complex relative iterator adapters adding the central (reference) point to the set of iterated faces.

Template Parameters:

D The dimension of the complex this iterator belongs to.

I The adapated complex relative iterator.

10.338.2 Constructor & Destructor Documentation

10.338.2.1 template<unsigned D, typename I> mln::topo::centered_fwd_iter_adapter< D, I >::centered_fwd_iter_adapter () [inline]

Construction.

10.338.3 Member Function Documentation

10.338.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.339 mln::topo::complex< D > Class Template Reference

General complex of dimension D.

```
#include <complex.hh>
```

Public Types

- typedef face_bkd_iter< D > bkd_citer

  Backward mln::Iterator type iterating on all faces.

- typedef face_fwd_iter< D > fwd_citer

  Forward mln::Iterator type iterating on all faces.

Public Member Functions

- const void ∗ addr () const

  Get the address of the data of this complex.

- template<unsigned N>
  n_face< N+1, D > add_face (const n_faces_set< N, D > &adjacent_faces)

  Add a (N+1)-face to the complex (with N >= 0).

- n_face< 0u, D > add_face ()

  Add a 0-face to the complex.

- complex ()

  Complex construction.

- unsigned nfaces () const

  Static manipulators.

- template<unsigned N>
  unsigned nfaces_of_static_dim () const

  Return the number of N-faces.

- unsigned nfaces_of_dim (unsigned n) const

  Dynamic manipulators.

- void print (std::ostream &ostr) const

  Pretty-printing.

- template<unsigned N>
  void print_faces (std::ostream &ostr) const

  Print the faces of dimension N.

10.339.1 Detailed Description

template<unsigned D> class mln::topo::complex< D >

General complex of dimension D.

10.339.2 Member Typedef Documentation

10.339.2.1 template<unsigned D> typedef face_bkd_iter<D> mln::topo::complex< D >::bkd_citer

Backward mln::Iterator type iterating on all faces.

10.339.2.2 template<unsigned D> typedef face_fwd_iter<D> mln::topo::complex< D >::fwd_citer

Forward mln::Iterator type iterating on all faces.

10.339.3 Constructor & Destructor Documentation

10.339.3.1 template<unsigned D> mln::topo::complex< D >::complex () [inline]

Complex construction.

Create a new `D-complex`.

10.339.4 Member Function Documentation

10.339.4.1 template<unsigned D> template<unsigned N> n_face< N+1, D > mln::topo::complex< D >::add_face (const n_faces_set< N, D > & *adjacent_faces*) [inline]

Add a (N+1)-face to the complex (with N >= 0).

Parameters:

adjacent_faces The (`N-1`)-faces adjacent to the new `N-face`.

References mln::topo::n_faces_set< N, D >::faces().

10.339.4.2 template<unsigned D> n_face< 0u, D > mln::topo::complex< D >::add_face () [inline]

Add a 0-face to the complex.

10.339.4.3 template<unsigned D> const void * mln::topo::complex< D >::addr () const [inline]

Get the address of the data of this complex.

This address is a concise and useful information to print and track the actual content of this complex.

10.339.4.4 template<unsigned D> unsigned mln::topo::complex< D >::nfaces () const [inline]

Static manipulators.

These methods use statically-known input.

Return the total number of faces, whatever their dimension.

10.339.4.5 template<unsigned D> unsigned mln::topo::complex< D >::nfaces_of_dim (unsigned *n*) const [inline]

Dynamic manipulators.

These methods use input know as run time.

Return the number of *n-faces*.

Warning, this function has a complexity linear in term of N, since each n_faces_set is checked (the present implementation does not provide a direct access to n_faces_set through a dynamic value of the dimension).

10.339.4.6 template<unsigned D> template<unsigned N> unsigned mln::topo::complex< D >::nfaces_of_static_dim () const [inline]

Return the number of `N-faces`.

10.339.4.7 template<unsigned D> void mln::topo::complex< D >::print (std::ostream & *ostr*) const [inline]

Pretty-printing.

Print the complex.

Referenced by mln::topo::operator<<().

10.339.4.8 template<unsigned D> template<unsigned N> void mln::topo::complex< D >::print_faces (std::ostream & *ostr*) const [inline]

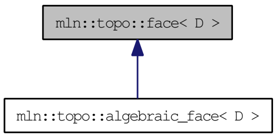
Print the faces of dimension `N`.

10.340 mln::topo::face< D > Struct Template Reference

Face handle in a complex; the face dimension is dynamic.

`#include <face.hh>`

Inheritance diagram for mln::topo::face< D >:



Public Member Functions

- template<unsigned N>
  face (const n_face< N, D > &f)

  Build a face handle from an mln::topo::n_face.

- face (complex< D > &complex, unsigned n, unsigned face_id)

  Build a face handle from complex *and* face_id.

- face ()

  Build a non-initialized face handle.

- void invalidate ()

  Invalidate this handle.

- bool is_valid () const

  Is this handle valid?

  - complex< D > cplx () const

    Accessors.

  - template<unsigned N>
    face_data< N, D > & data () const

    Return the mln::topo::face_data pointed by this handle.

  - void dec_face_id ()

    Decrement the id of the face.

  - void dec_n ()

    Decrement the dimension of the face.

  - unsigned face_id () const

    Return the id of the face.

  - std::vector< algebraic_face< D > > higher_dim_adj_faces () const

    Return an array of face handles pointing to adjacent (n+1)-faces.

- void inc_face_id ()
  Increment the id of the face.
- void inc_n ()
  Increment the dimension of the face.
- std::vector< algebraic_face< D > > lower_dim_adj_faces () const
  Return an array of face handles pointing to adjacent (n-1)-faces.
- unsigned n () const
  Return the dimension of the face.
- void set_cplx (const complex< D > &cplx)
  Set the complex the face belongs to.
- void set_face_id (unsigned face_id)
  Set the id of the face.
- void set_n (unsigned n)
  Set the dimension of the face.

10.340.1 Detailed Description

template<unsigned D> struct mln::topo::face< D >

Face handle in a complex; the face dimension is dynamic.

Contrary to an mln::topo::n_face, the dimension of an mln::topo::face is not fixed.

10.340.2 Constructor & Destructor Documentation

10.340.2.1 template<unsigned D> mln::topo::face< D >::face () [inline]

Build a non-initialized face handle.

10.340.2.2 template<unsigned D> mln::topo::face< D >::face (complex< D > & *complex*, unsigned *n*, unsigned *face_id*) [inline]

Build a face handle from *complex* and *face_id*.

10.340.2.3 template<unsigned D> template<unsigned N> mln::topo::face< D >::face (const n_face< N, D > & *f*) [inline]

Build a face handle from an mln::topo::n_face.

10.340.3 Member Function Documentation

10.340.3.1 template<unsigned D> complex< D > mln::topo::face< D >::cplx () const [inline]

Accessors.

Return the complex the face belongs to.

Referenced by mln::complex_psite< D, G >::complex_psite(), mln::topo::operator!=(), and mln::topo::operator==().

10.340.3.2 template<unsigned D> template<unsigned N> face_data< N, D > & mln::topo::face< D >::data () const [inline]

Return the mln::topo::face_data pointed by this handle.

References mln::topo::face< D >::is_valid().

10.340.3.3 template<unsigned D> void mln::topo::face< D >::dec_face_id () [inline]

Decrement the id of the face.

10.340.3.4 template<unsigned D> void mln::topo::face< D >::dec_n () [inline]

Decrement the dimension of the face.

10.340.3.5 template<unsigned D> unsigned mln::topo::face< D >::face_id () const [inline]

Return the id of the face.

Referenced by mln::geom::complex_geometry< D, P >::operator()(), and mln::topo::operator==().

10.340.3.6 template<unsigned D> std::vector< algebraic_face< D > > mln::topo::face< D >::higher_dim_adj_faces () const [inline]

Return an array of face handles pointing to adjacent (n+1)-faces.

10.340.3.7 template<unsigned D> void mln::topo::face< D >::inc_face_id () [inline]

Increment the id of the face.

10.340.3.8 template<unsigned D> void mln::topo::face< D >::inc_n () [inline]

Increment the dimension of the face.

10.340.3.9 template<unsigned D> void mln::topo::face< D >::invalidate () [inline]

Invalidate this handle.

References mln::topo::face< D >::set_face_id(), and mln::topo::face< D >::set_n().

10.340.3.10 template<unsigned D> bool mln::topo::face< D >::is_valid () const [inline]

Is this handle valid?

Referenced by mln::topo::face< D >::data().

10.340.3.11 template<unsigned D> std::vector< algebraic_face< D > > mln::topo::face< D >::lower_dim_adj_faces () const [inline]

Return an array of face handles pointing to adjacent (n-1)-faces.

10.340.3.12 template<unsigned D> unsigned mln::topo::face< D >::n () const [inline]

Return the dimension of the face.

Referenced by mln::topo::algebraic_face< D >::algebraic_face(), mln::geom::complex_geometry< D, P >::operator()(), and mln::topo::operator==().

10.340.3.13 template<unsigned D> void mln::topo::face< D >::set_cplx (const complex< D > & *cplx*) [inline]

Set the complex the face belongs to.

10.340.3.14 template<unsigned D> void mln::topo::face< D >::set_face_id (unsigned *face_id*) [inline]

Set the id of the face.

Referenced by mln::topo::face< D >::invalidate().

10.340.3.15 template<unsigned D> void mln::topo::face< D >::set_n (unsigned *n*) [inline]

Set the dimension of the face.

Referenced by mln::topo::face< D >::invalidate().

10.341 mln::topo::face_bkd_iter< D > Class Template Reference

Backward iterator on all the faces of an mln::complex<D>.

`#include <face_iter.hh>`

Inherits mln::topo::internal::complex_set_iterator_base< mln::topo::face< D >, mln::topo::face_bkd_-iter< D > >.

Public Member Functions

- void next ()
  Go to the next element.

- face_bkd_iter ()
  Construction and assignment.

- void start ()
  Manipulation.

10.341.1 Detailed Description

template<unsigned D> class mln::topo::face_bkd_iter< D >

Backward iterator on all the faces of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.341.2 Constructor & Destructor Documentation

10.341.2.1 template<unsigned D> mln::topo::face_bkd_iter< D >::face_bkd_iter () `[inline]`

Construction and assignment.

10.341.3 Member Function Documentation

10.341.3.1 template<typename E> void mln::Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.341.3.2 template<unsigned D> void mln::topo::face_bkd_iter< D >::start () [inline]

Manipulation.

Start an iteration.

10.342 mln::topo::face_fwd_iter< D > Class Template Reference

Forward iterator on all the faces of an mln::complex<D>.

`#include <face_iter.hh>`

Inherits mln::topo::internal::complex_set_iterator_base< mln::topo::face< D >, mln::topo::face_fwd_iter< D > >.

Public Member Functions

- void next ()
  Go to the next element.

- face_fwd_iter ()
  Construction and assignment.

- void start ()
  Manipulation.

10.342.1 Detailed Description

template<unsigned D> class mln::topo::face_fwd_iter< D >

Forward iterator on all the faces of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.342.2 Constructor & Destructor Documentation

10.342.2.1 template<unsigned D> mln::topo::face_fwd_iter< D >::face_fwd_iter () `[inline]`

Construction and assignment.

10.342.3 Member Function Documentation

10.342.3.1 template<typename E> void mln::Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.342.3.2 template<unsigned D> void mln::topo::face_fwd_iter< D >::start () [inline]

Manipulation.

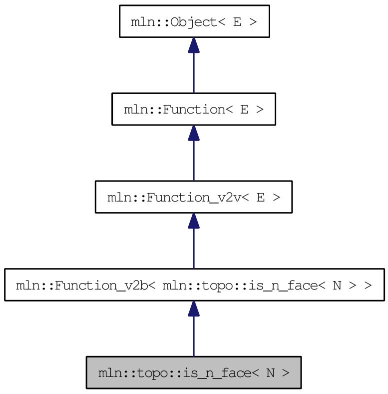
Test if the iterator is valid.

10.343 mln::topo::is_n_face< N > Struct Template Reference

A functor testing wheter a mln::complex_psite is an `N` -face.

`#include <is_n_face.hh>`

Inheritance diagram for mln::topo::is_n_face< N >:



10.343.1 Detailed Description

template<unsigned N> struct mln::topo::is_n_face< N >

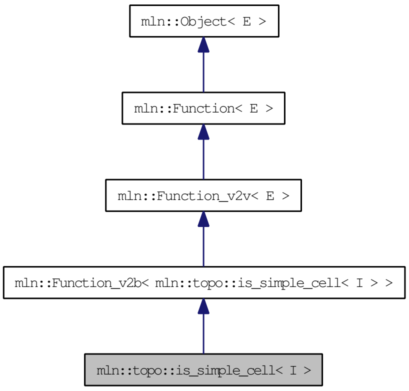
A functor testing wheter a mln::complex_psite is an `N` -face.

10.344 mln::topo::is_simple_cell< I > Class Template Reference

A predicate for the simplicity of a point based on the collapse property of the attachment.

#include <is_simple_cell.hh>

Inheritance diagram for mln::topo::is_simple_cell< I >:



Public Types

- typedef mln::complex_psite< D, G > psite

  Psite type.

- typedef bool result

  Result type of the functor.

Public Member Functions

- typedef mln_geom (I) G

  Geometry of the image.

- bool operator() (const mln::complex_psite< I::dim, mln_geom(I)> &p) const

  Based on the algorithm A2 from couprie.08.pami.

- void set_image (const mln::Image< I > &ima)

  Set the underlying image.

Static Public Attributes

- static const unsigned D = I::dim

  Dimension of the image (and therefore of the complex).

10.344.1 Detailed Description

template<typename I> class mln::topo::is_simple_cell< I >

A predicate for the simplicity of a point based on the collapse property of the attachment.

The functor does not actually take a cell as input, but a face that is expected to be a D-facet.

10.344.2 Member Typedef Documentation

10.344.2.1 template<typename I> typedef mln::complex_psite<D, G> mln::topo::is_simple_cell< I >::psite

Psite type.

10.344.2.2 template<typename I> typedef bool mln::topo::is_simple_cell< I >::result

Result type of the functor.

Reimplemented from mln::Function_v2b< E >.

10.344.3 Member Function Documentation

10.344.3.1 template<typename I> typedef mln::topo::is_simple_cell< I >::mln_geom (I)

Geometry of the image.

10.344.3.2 template<typename I> bool mln::topo::is_simple_cell< I >::operator() (const mln::complex_psite< I::dim, mln_geom(I)> & *p*) const `[inline]`

Based on the algorithm A2 from couprie.08.pami.

References mln::make::attachment().

10.344.3.3 template<typename I> void mln::topo::is_simple_cell< I >::set_image (const mln::Image< I > & *ima*) `[inline]`

Set the underlying image.

10.344.4 Member Data Documentation

10.344.4.1 template<typename I> const unsigned mln::topo::is_simple_cell< I >::D = I::dim `[static]`

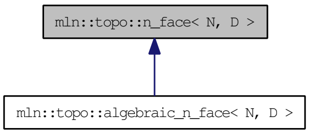
Dimension of the image (and therefore of the complex).

10.345 mln::topo::n_face< N, D > Class Template Reference

N-face handle in a complex.

#include <n_face.hh>

Inheritance diagram for mln::topo::n_face< N, D >:



Public Member Functions

- void invalidate ()

  Invalidate this handle.

- bool is_valid () const

  Is this handle valid?

- n_face (complex< D > &complex, unsigned face_id)

  Build a face handle from complex and face_id.

- n_face ()

  Build a non-initialized face handle.

  - complex< D > cplx () const

    Accessors.

  - face_data< N, D > & data () const

    Return the mln::topo::face_data pointed by this handle.

  - void dec_face_id ()

    Decrement the id of the face.

  - unsigned face_id () const

    Return the id of the face.

  - std::vector< algebraic_n_face< N+1, D > > higher_dim_adj_faces () const

    Return an array of face handles pointing to adjacent (n+1)-faces.

  - void inc_face_id ()

    Increment the id of the face.

  - std::vector< algebraic_n_face< N-1, D > > lower_dim_adj_faces () const

    Return an array of face handles pointing to adjacent (n-1)-faces.

  - unsigned n () const

    Return the dimension of the face.

- void set_cplx (const complex< D > &cplx)
  Set the complex the face belongs to.
- void set_face_id (unsigned face_id)
  Set the id of the face.

10.345.1 Detailed Description

template<unsigned N, unsigned D> class mln::topo::n_face< N, D >

`N-face` handle in a complex.

Contrary to an mln::topo::face, the dimension of an mln::topo::n_face is fixed.

10.345.2 Constructor & Destructor Documentation

10.345.2.1 template<unsigned N, unsigned D> mln::topo::n_face< N, D >::n_face () [inline]

Build a non-initialized face handle.

References mln::topo::n_face< N, D >::is_valid().

10.345.2.2 template<unsigned N, unsigned D> mln::topo::n_face< N, D >::n_face (complex< D > & *complex*, unsigned *face_id*) [inline]

Build a face handle from *complex* and *face_id*.

10.345.3 Member Function Documentation

10.345.3.1 template<unsigned N, unsigned D> complex< D > mln::topo::n_face< N, D >::cplx () const [inline]

Accessors.

Return the complex the face belongs to.

Referenced by mln::topo::n_faces_set< N, D >::add(), mln::topo::operator!=(), and mln::topo::operator==().

10.345.3.2 template<unsigned N, unsigned D> face_data< N, D > & mln::topo::n_face< N, D >::data () const [inline]

Return the mln::topo::face_data pointed by this handle.

References mln::topo::n_face< N, D >::is_valid().

10.345.3.3 template<unsigned N, unsigned D> void mln::topo::n_face< N, D >::dec_face_id () [inline]

Decrement the id of the face.

10.345.3.4 template<unsigned N, unsigned D> unsigned mln::topo::n_face< N, D >::face_id () const [inline]

Return the id of the face.

Referenced by mln::topo::operator==().

10.345.3.5 template<unsigned N, unsigned D> std::vector< algebraic_n_face< N+1, D > > mln::topo::n_face< N, D >::higher_dim_adj_faces () const [inline]

Return an array of face handles pointing to adjacent (n+1)-faces.

References mln::topo::n_face< N, D >::is_valid().

Referenced by mln::topo::edge().

10.345.3.6 template<unsigned N, unsigned D> void mln::topo::n_face< N, D >::inc_face_id () [inline]

Increment the id of the face.

10.345.3.7 template<unsigned N, unsigned D> void mln::topo::n_face< N, D >::invalidate () [inline]

Invalidate this handle.

References mln::topo::n_face< N, D >::set_face_id().

10.345.3.8 template<unsigned N, unsigned D> bool mln::topo::n_face< N, D >::is_valid () const [inline]

Is this handle valid?

Referenced by mln::topo::algebraic_n_face< N, D >::algebraic_n_face(), mln::topo::n_face< N, D >::data(), mln::topo::n_face< N, D >::higher_dim_adj_faces(), mln::topo::n_face< N, D >::lower_dim_adj_faces(), and mln::topo::n_face< N, D >::n_face().

10.345.3.9 template<unsigned N, unsigned D> std::vector< algebraic_n_face< N-1, D > > mln::topo::n_face< N, D >::lower_dim_adj_faces () const [inline]

Return an array of face handles pointing to adjacent (n-1)-faces.

References mln::topo::n_face< N, D >::is_valid().

10.345.3.10 template<unsigned N, unsigned D> unsigned mln::topo::n_face< N, D >::n () const [inline]

Return the dimension of the face.

10.345.3.11 template<unsigned N, unsigned D> void mln::topo::n_face< N, D >::set_cplx (const complex< D > & *cplx*) [inline]

Set the complex the face belongs to.

10.345.3.12 template<unsigned N, unsigned D> void mln::topo::n_face< N, D >::set_face_id (unsigned *face_id*) [inline]

Set the id of the face.

Referenced by mln::topo::n_face< N, D >::invalidate().

10.346 mln::topo::n_face_bkd_iter< D > Class Template Reference

Backward iterator on all the faces of an mln::complex<D>.

`#include <n_face_iter.hh>`

Inherits mln::topo::internal::complex_set_iterator_base< mln::topo::face< D >, mln::topo::n_face_bkd_iter< D > >.

Public Member Functions

- void next ()
  Go to the next element.
- unsigned n () const
  Accessors.
- n_face_bkd_iter ()
  Construction and assignment.
- void start ()
  Manipulation.

10.346.1 Detailed Description

template<unsigned D> class mln::topo::n_face_bkd_iter< D >

Backward iterator on all the faces of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.346.2 Constructor & Destructor Documentation

10.346.2.1 template<unsigned D> mln::topo::n_face_bkd_iter< D >::n_face_bkd_iter () [inline]

Construction and assignment.

10.346.3 Member Function Documentation

10.346.3.1 template<unsigned D> unsigned mln::topo::n_face_bkd_iter< D >::n () const [inline]

Accessors.

Shortcuts to face_'s accessors.

Referenced by mln::topo::n_face_bkd_iter< D >::start().

10.346.3.2 template<typename E> void mln::Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.346.3.3 template<unsigned D> void mln::topo::n_face_bkd_iter< D >::start () `[inline]`

Manipulation.

Start an iteration.

References mln::topo::n_face_bkd_iter< D >::n().

10.347 mln::topo::n_face_fwd_iter< D > Class Template Reference

Forward iterator on all the faces of an mln::complex<D>.

`#include <n_face_iter.hh>`

Inherits mln::topo::internal::complex_set_iterator_base< mln::topo::face< D >, mln::topo::n_face_fwd_iter< D > >.

Public Member Functions

- void next ()
  Go to the next element.
- unsigned n () const
  Accessors.
- n_face_fwd_iter ()
  Construction and assignment.
- void start ()
  Manipulation.

10.347.1 Detailed Description

template<unsigned D> class mln::topo::n_face_fwd_iter< D >

Forward iterator on all the faces of an mln::complex<D>.

Template Parameters:

D The dimension of the complex this iterator belongs to.

10.347.2 Constructor & Destructor Documentation

10.347.2.1 template<unsigned D> mln::topo::n_face_fwd_iter< D >::n_face_fwd_iter () [inline]

Construction and assignment.

10.347.3 Member Function Documentation

10.347.3.1 template<unsigned D> unsigned mln::topo::n_face_fwd_iter< D >::n () const [inline]

Accessors.

Shortcuts to face_'s accessors.

10.347.3.2 template<typename E> void mln::Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.347.3.3 template<unsigned D> void mln::topo::n_face_fwd_iter< D >::start () `[inline]`

Manipulation.

Test if the iterator is valid.

10.348 mln::topo::n_faces_set< N, D > Class Template Reference

Set of face handles of dimension N.

`#include <n_faces_set.hh>`

Public Types

- typedef std::vector< algebraic_n_face< N, D > > faces_type

  The type of the set of face handles.

Public Member Functions

- void add (const algebraic_n_face< N, D > &f)

  Append an algebraic face f *to the set.*

- void reserve (size_t n)

  Reserve n *cells in the set.*

- const faces_type & faces () const

  Accessors.

10.348.1 Detailed Description

template<unsigned N, unsigned D> class mln::topo::n_faces_set< N, D >

Set of face handles of dimension N.

10.348.2 Member Typedef Documentation

10.348.2.1 template<unsigned N, unsigned D> typedef std::vector< algebraic_n_face<N, D> > mln::topo::n_faces_set< N, D >::faces_type

The type of the set of face handles.

10.348.3 Member Function Documentation

10.348.3.1 template<unsigned N, unsigned D> void mln::topo::n_faces_set< N, D >::add (const algebraic_n_face< N, D > & *f*) [inline]

Append an algebraic face *f* to the set.

References mln::topo::n_face< N, D >::cplx().

Referenced by mln::topo::operator+(), and mln::topo::operator-().

10.348.3.2 template<unsigned N, unsigned D> const std::vector< algebraic_n_face< N, D > > & mln::topo::n_faces_set< N, D >::faces () const [inline]

Accessors.

Return the set of handles.

Referenced by mln::topo::complex< D >::add_face().

10.348.3.3 template<unsigned N, unsigned D> void mln::topo::n_faces_set< N, D >::reserve (size_t *n*) [inline]

Reserve *n* cells in the set.

This methods does not change the content of *faces_*; it only pre-allocate memory. Method reserve is provided for efficiency purpose, and its use is completely optional.

10.349 mln::topo::static_n_face_bkd_iter< N, D > Class Template Reference

Backward iterator on all the N-faces of a mln::complex<D>.

`#include <static_n_face_iter.hh>`

Inherits mln::topo::internal::complex_set_iterator_base< mln::topo::face< D >, mln::topo::static_n_face_bkd_iter< N, D > >.

Public Member Functions

- void next ()
  Go to the next element.
- void start ()
  Manipulation.
- static_n_face_bkd_iter ()
  Construction and assignment.

10.349.1 Detailed Description

template<unsigned N, unsigned D> class mln::topo::static_n_face_bkd_iter< N, D >

Backward iterator on all the N-faces of a mln::complex<D>.

Template Parameters:

N The dimension of the face associated to this iterator.

D The dimension of the complex this iterator belongs to.

10.349.2 Constructor & Destructor Documentation

10.349.2.1 template<unsigned N, unsigned D> mln::topo::static_n_face_bkd_iter< N, D >::static_n_face_bkd_iter () [inline]

Construction and assignment.

10.349.3 Member Function Documentation

10.349.3.1 template<typename E> void mln::Iterator< E >::next () [inline, inherited]

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.349.3.2 template<unsigned N, unsigned D> void mln::topo::static_n_face_bkd_iter< N, D >::start () [inline]

Manipulation.

Start an iteration.

10.350 mln::topo::static_n_face_fwd_iter< N, D > Class Template Reference

Forward iterator on all the `N-faces` of a mln::complex<D>.

`#include <static_n_face_iter.hh>`

Inherits mln::topo::internal::complex_set_iterator_base< mln::topo::face< D >, mln::topo::static_n_face_fwd_iter< N, D > >.

Public Member Functions

- void next ()
  Go to the next element.
- void start ()
  Manipulation.
- static_n_face_fwd_iter ()
  Construction and assignment.

10.350.1 Detailed Description

template<unsigned N, unsigned D> class mln::topo::static_n_face_fwd_iter< N, D >

Forward iterator on all the `N-faces` of a mln::complex<D>.

Template Parameters:

N The dimension of the face associated to this iterator.
D The dimension of the complex this iterator belongs to.

10.350.2 Constructor & Destructor Documentation

10.350.2.1 template<unsigned N, unsigned D> mln::topo::static_n_face_fwd_iter< N, D >::static_n_face_fwd_iter () `[inline]`

Construction and assignment.

10.350.3 Member Function Documentation

10.350.3.1 template<typename E> void mln::Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.350.3.2 template<unsigned N, unsigned D> void mln::topo::static_n_face_fwd_iter< N, D >::start () [inline]

Manipulation.

Test if the iterator is valid.

10.351 mln::tr_image< S, I, T > Struct Template Reference

Transform an image by a given transformation.

`#include <tr_image.hh>`

Inherits mln::internal::image_identity< I, S, mln::tr_image< S, I, T > >.

Public Types

- typedef I::value lvalue
  Return type of read-write access.
- typedef I::psite psite
  Point_Site associated type.
- typedef I::value rvalue
  Return type of read-only access.
- typedef I::site site
  Site associated type.
- typedef tr_image< S, tag::image_< I >, T > skeleton
  Skeleton.
- typedef I::value value
  Value associated type.

Public Member Functions

- const S & domain () const
  Return the domain morpher.
- bool has (const vec_t &v) const
  Test if a pixel value is accessible at v.
- bool is_valid () const
  Test if this image has been initialized.
- I::value operator() (const psite &p) const
  Read-only access of pixel value at point site p.
- void set_tr (T &tr)
  Set the transformation.
- const T & tr () const
  Return the underlying transformation.
- tr_image (const S &s, const I &ima, const T &tr)
  Constructors.

10.351.1 Detailed Description

template<typename S, typename I, typename T> struct mln::tr_image< S, I, T >

Transform an image by a given transformation.

10.351.2 Member Typedef Documentation

10.351.2.1 template<typename S, typename I, typename T> typedef I ::value mln::tr_image< S, I, T >::lvalue

Return type of read-write access.

10.351.2.2 template<typename S, typename I, typename T> typedef I ::psite mln::tr_image< S, I, T >::psite

Point_Site associated type.

10.351.2.3 template<typename S, typename I, typename T> typedef I ::value mln::tr_image< S, I, T >::rvalue

Return type of read-only access.

10.351.2.4 template<typename S, typename I, typename T> typedef I ::site mln::tr_image< S, I, T >::site

Site associated type.

10.351.2.5 template<typename S, typename I, typename T> typedef tr_image< S, tag::image_<I>, T> mln::tr_image< S, I, T >::skeleton

Skeleton.

10.351.2.6 template<typename S, typename I, typename T> typedef I ::value mln::tr_image< S, I, T >::value

Value associated type.

10.351.3 Constructor & Destructor Documentation

10.351.3.1 template<typename S, typename I, typename T> mln::tr_image< S, I, T >::tr_image (const S & *s*, const I & *ima*, const T & *tr*) `[inline]`

Constructors.

10.351.4 Member Function Documentation

10.351.4.1 template<typename S, typename I, typename T> const S & mln::tr_image< S, I, T >::domain () const [inline]

Return the domain morpher.

10.351.4.2 template<typename S, typename I, typename T> bool mln::tr_image< S, I, T >::has (const vec_t & *v*) const [inline]

Test if a pixel value is accessible at `v`.

10.351.4.3 template<typename S, typename I, typename T> bool mln::tr_image< S, I, T >::is_valid () const [inline]

Test if this image has been initialized.

10.351.4.4 template<typename S, typename I, typename T> I::value mln::tr_image< S, I, T >::operator() (const psite & *p*) const [inline]

Read-only access of pixel value at point site `p`.

Mutable access is only OK for reading (not writing).

10.351.4.5 template<typename S, typename I, typename T> void mln::tr_image< S, I, T >::set_tr (T & *tr*) [inline]

Set the transformation.

10.351.4.6 template<typename S, typename I, typename T> const T & mln::tr_image< S, I, T >::tr () const [inline]

Return the underlying transformation.

10.352 mln::transformed_image< I, F > Struct Template Reference

Image having its domain restricted by a site set.

`#include <transformed_image.hh>`

Inherits mln::internal::image_domain_morpher< I, mln::p_transformed< I::domain_t, F >, mln::transformed_image< I, F > >.

Public Types

- typedef transformed_image< tag::image_< I >, tag::function_< F > > skeleton

  Skeleton.

Public Member Functions

- const p_transformed< typename I::domain_t, F > & domain () const

  Give the definition domain.

- operator transformed_image< const I, F > () const

  Const promotion via conversion.

- internal::morpher_lvalue_< I >::ret operator() (const typename I::psite &p)

  Read and "write if possible" access of pixel value at point site `p`.

- I::rvalue operator() (const typename I::psite &p) const

  Read-only access of pixel value at point site `p`.

- transformed_image (I &ima, const F &f)

  Constructor.

- transformed_image ()

  Constructor without argument.

10.352.1 Detailed Description

template<typename I, typename F> struct mln::transformed_image< I, F >

Image having its domain restricted by a site set.

10.352.2 Member Typedef Documentation

10.352.2.1 template<typename I, typename F> typedef transformed_image< tag::image_<I>, tag::function_<F> > mln::transformed_image< I, F >::skeleton

Skeleton.

10.352.3 Constructor & Destructor Documentation

10.352.3.1 template<typename I, typename F> mln::transformed_image< I, F >::transformed_image () [inline]

Constructor without argument.

10.352.3.2 template<typename I, typename F> mln::transformed_image< I, F >::transformed_image (I & *ima*, const F & *f*) [inline]

Constructor.

10.352.4 Member Function Documentation

10.352.4.1 template<typename I, typename F> const p_transformed< typename I::domain_t, F > & mln::transformed_image< I, F >::domain () const [inline]

Give the definition domain.

10.352.4.2 template<typename I, typename F> mln::transformed_image< I, F >::operator transformed_image< const I, F > () const [inline]

Const promotion via conversion.

10.352.4.3 template<typename I, typename F> internal::morpher_lvalue_< I >::ret mln::transformed_image< I, F >::operator() (const typename I::psite & *p*) [inline]

Read and "write if possible" access of pixel value at point site `p`.

10.352.4.4 template<typename I, typename F> I::rvalue mln::transformed_image< I, F >::operator() (const typename I::psite & *p*) const [inline]

Read-only access of pixel value at point site `p`.

10.353 mln::unproject_image< I, D, F > Struct Template Reference

Un-projects an image.

`#include <unproject_image.hh>`

Inherits mln::internal::image_domain_morpher< I, D, mln::unproject_image< I, D, F > >.

Public Member Functions

- const D & domain () const
  Give the definition domain.
- internal::morpher_lvalue_< I >::ret operator() (const typename D::psite &p)
  Read-write access to the image value located at point `p`.
- I::rvalue operator() (const typename D::psite &p) const
  Read-only access to the image value located at point `p`.
- unproject_image (I &ima, const D &dom, const F &f)
  Constructor from an image `ima`*, a domain* `dom`*, and a function* `f`.
- unproject_image ()
  Constructor without argument.

10.353.1 Detailed Description

template<typename I, typename D, typename F> struct mln::unproject_image< I, D, F >

Un-projects an image.

10.353.2 Constructor & Destructor Documentation

10.353.2.1 template<typename I, typename D, typename F> mln::unproject_image< I, D, F >::unproject_image () `[inline]`

Constructor without argument.

10.353.2.2 template<typename I, typename D, typename F> mln::unproject_image< I, D, F >::unproject_image (I & *ima*, const D & *dom*, const F & *f*) `[inline]`

Constructor from an image `ima`, a domain `dom`, and a function `f`.

10.353.3 Member Function Documentation

10.353.3.1 template<typename I, typename D, typename F> const D & mln::unproject_image< I, D, F >::domain () const `[inline]`

Give the definition domain.

10.353.3.2 template<typename I, typename D, typename F> internal::morpher_lvalue_< I >::ret mln::unproject_image< I, D, F >::operator() (const typename D::psite & *p*) [inline]

Read-write access to the image value located at point p.

10.353.3.3 template<typename I, typename D, typename F> I::rvalue mln::unproject_image< I, D, F >::operator() (const typename D::psite & *p*) const [inline]

Read-only access to the image value located at point p.

10.354 mln::util::adjacency_matrix< V > Class Template Reference

A class of adjacency matrix.

`#include <adjacency_matrix.hh>`

Inherits mln::util::internal::adjacency_matrix_impl_selector< V, mln::metal::equal< mln_trait_value_quant(V), mln::trait::value::quant::low >::eval >.

Public Member Functions

- adjacency_matrix (const V &nelements)

  Construct an adjacency matrix with `nelements` *elements maximum.*

- adjacency_matrix ()

  Constructors.

10.354.1 Detailed Description

template<typename V = def::coord> class mln::util::adjacency_matrix< V >

A class of adjacency matrix.

Support low and high quantification value types. In case of low quantification value type, it uses an image2d to store adjacency information. In case of high quantification value type, it uses a util::set to store the adjacency information.

10.354.2 Constructor & Destructor Documentation

10.354.2.1 template<typename V> mln::util::adjacency_matrix< V >::adjacency_matrix () [inline]

Constructors.

@{

Default

10.354.2.2 template<typename V> mln::util::adjacency_matrix< V >::adjacency_matrix (const V & *nelements*) [inline]

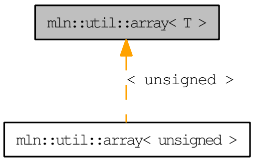
Construct an adjacency matrix with `nelements` elements maximum.

10.355 mln::util::array< T > Class Template Reference

A dynamic array class.

`#include <array.hh>`

Inheritance diagram for mln::util::array< T >:



Public Types

- typedef T element

    Element associated type.

- typedef array_bkd_iter< T > bkd_eiter

    Backward iterator associated type.

- typedef fwd_eiter eiter

    Iterator associated type.

- typedef array_fwd_iter< T > fwd_eiter

    Iterator types
    Forward iterator associated type.

- typedef T result

    Returned value types.

Public Member Functions

- template<typename U>
  array< T > & append (const array< U > &other)

    Add the elements of `other` *at the end of this array.*

- array< T > & append (const T &elt)

    Add the element `elt` *at the end of this array.*

- void clear ()

    Empty the array.

- void fill (const T &value)

    Fill the whole array with value `value`.

- bool is_empty () const

  Test if the array is empty.

- std::size_t memory_size () const

  Return the size of this array in memory.

- unsigned nelements () const

  Return the number of elements of the array.

- mutable_result operator() (unsigned i)

  Return the `i-th` *element of the array.*

- ro_result operator() (unsigned i) const

  Return the `i-th` *element of the array.*

- mutable_result operator[ ] (unsigned i)

  Return the `i-th` *element of the array.*

- ro_result operator[ ] (unsigned i) const

  Return the `i-th` *element of the array.*

- void reserve (unsigned n)

  Reserve memory for `n` *elements.*

- void resize (unsigned n, const T &value)

  Resize this array to `n` *elements with* `value` *as value.*

- void resize (unsigned n)

  Resize this array to `n` *elements.*

- unsigned size () const

  Return the number of elements of the array.

- const std::vector< T > & std_vector () const

  Return the corresponding std::vector of elements.

  - array (unsigned n, const T &value)

    Construct a new array, resize it to elements and fill it with `default_value`.

  - array (unsigned n)

    Construct a new array and resize it to elements.

  - array ()

    Constructors
    Constructor without arguments.

10.355.1 Detailed Description

template<typename T> class mln::util::array< T >

A dynamic array class.

Elements are stored by copy. Implementation is lazy.

The parameter `T` is the element type, which shall not be const-qualified.

10.355.2 Member Typedef Documentation

10.355.2.1 template<typename T> typedef array_bkd_iter<T> mln::util::array< T >::bkd_eiter

Backward iterator associated type.

10.355.2.2 template<typename T> typedef fwd_eiter mln::util::array< T >::eiter

Iterator associated type.

10.355.2.3 template<typename T> typedef T mln::util::array< T >::element

Element associated type.

10.355.2.4 template<typename T> typedef array_fwd_iter<T> mln::util::array< T >::fwd_eiter

Iterator types

Forward iterator associated type.

10.355.2.5 template<typename T> typedef T mln::util::array< T >::result

Returned value types.

Related to the Function_v2v concept.

10.355.3 Constructor & Destructor Documentation

10.355.3.1 template<typename T> mln::util::array< T >::array () `[inline]`

Constructors

Constructor without arguments.

10.355.3.2 template<typename T> mln::util::array< T >::array (unsigned *n*) `[inline]`

Construct a new array and resize it to

elements.

10.355.3.3 template<typename T> mln::util::array< T >::array (unsigned *n*, const T & *value*) [inline]

Construct a new array, resize it to

elements and fill it with `default_value`.

10.355.4 Member Function Documentation

10.355.4.1 template<typename T> template<typename U> array< T > & mln::util::array< T >::append (const array< U > & *other*) [inline]

Add the elements of `other` at the end of this array.

References mln::util::array< T >::is_empty(), and mln::util::array< T >::std_vector().

10.355.4.2 template<typename T> array< T > & mln::util::array< T >::append (const T & *elt*) [inline]

Add the element `elt` at the end of this array.

Referenced by mln::io::plot::load(), and mln::data::impl::generic::sort_offsets_increasing().

10.355.4.3 template<typename T> void mln::util::array< T >::clear () [inline]

Empty the array.

All elements contained in the array are destroyed.

Postcondition:

is_empty() == true

References mln::util::array< T >::is_empty().

Referenced by mln::io::plot::load().

10.355.4.4 template<typename T> void mln::util::array< T >::fill (const T & *value*) [inline]

Fill the whole array with value `value`.

10.355.4.5 template<typename T> bool mln::util::array< T >::is_empty () const [inline]

Test if the array is empty.

References mln::util::array< T >::nelements().

Referenced by mln::util::array< T >::append(), mln::util::array< T >::clear(), mln::make::image3d(), and mln::io::pnms::load().

10.355.4.6 template<typename T> std::size_t mln::util::array< T >::memory_size () const [inline]

Return the size of this array in memory.

References mln::util::array< T >::nelements().

10.355.4.7 template<typename T> unsigned mln::util::array< T >::nelements () const `[inline]`

Return the number of elements of the array.

Referenced by mln::labeling::fill_holes(), mln::make::image3d(), mln::util::array< T >::is_empty(), mln::io::pnms::load(), mln::util::array< T >::memory_size(), mln::util::operator<<(), mln::util::array< T >::operator[ ](), and mln::util::array< T >::size().

10.355.4.8 template<typename T> array< T >::mutable_result mln::util::array< T >::operator() (unsigned *i*) `[inline]`

Return the `i-th` element of the array.

Precondition:

i < nelements()

10.355.4.9 template<typename T> array< T >::ro_result mln::util::array< T >::operator() (unsigned *i*) const `[inline]`

Return the `i-th` element of the array.

Precondition:

i < nelements()

10.355.4.10]

template<typename T> **array**< T >::mutable_result **mln::util::array**< T >::operator[ ] (unsigned *i*) `[inline]`

Return the `i-th` element of the array.

Precondition:

i < nelements()

References mln::util::array< T >::nelements().

10.355.4.11]

template<typename T> **array**< T >::ro_result **mln::util::array**< T >::operator[ ] (unsigned *i*) const `[inline]`

Return the `i-th` element of the array.

Precondition:

i < nelements()

References mln::util::array< T >::nelements().

10.355.4.12 template<typename T> void mln::util::array< T >::reserve (unsigned *n*) [inline]

Reserve memory for n elements.

Referenced by mln::data::impl::generic::sort_offsets_increasing().

10.355.4.13 template<typename T> void mln::util::array< T >::resize (unsigned *n*, const T & *value*) [inline]

Resize this array to n elements with value as value.

10.355.4.14 template<typename T> void mln::util::array< T >::resize (unsigned *n*) [inline]

Resize this array to n elements.

10.355.4.15 template<typename T> unsigned mln::util::array< T >::size () const [inline]

Return the number of elements of the array.

Added for compatibility with fun::i2v::array.

See also:

nelements

References mln::util::array< T >::nelements().

Referenced by mln::value::lut_vec< S, T >::lut_vec(), and mln::labeled_image_base< I, E >::update_-data().

10.355.4.16 template<typename T> const std::vector< T > & mln::util::array< T >::std_vector () const [inline]

Return the corresponding std::vector of elements.

Referenced by mln::util::array< T >::append(), mln::value::lut_vec< S, T >::lut_vec(), and mln::util::operator==().

10.356 mln::util::branch< T > Class Template Reference

Class of generic branch.

`#include <tree.hh>`

Public Member Functions

- tree_node< T > & apex ()

  The getter of the appex.

- branch (tree< T > &tree, tree_node< T > &apex)

  Constructor.

- tree< T > & util_tree ()

  The getter of the tree.

10.356.1 Detailed Description

template<typename T> class mln::util::branch< T >

Class of generic branch.

10.356.2 Constructor & Destructor Documentation

10.356.2.1 template<typename T> mln::util::branch< T >::branch (util::tree< T > & *tree*, util::tree_node< T > & *apex*) [inline]

Constructor.

Parameters:

← ***tree*** The tree of the branch.

← ***apex*** The apex of the branch.

10.356.3 Member Function Documentation

10.356.3.1 template<typename T> util::tree_node< T > & mln::util::branch< T >::apex () [inline]

The getter of the appex.

Returns:

The tree_node appex of the current branch.

10.356.3.2 template<typename T> mln::util::tree< T > & mln::util::branch< T >::util_tree () [inline]

The getter of the tree.

Returns:

The tree of the current branch.

10.357 mln::util::branch_iter< T > Class Template Reference

Basic 2D image class.

`#include <branch_iter.hh>`

Public Member Functions

- unsigned deepness () const

  Give how deep is the iterator in the branch.

- void invalidate ()

  Invalidate the iterator.

- bool is_valid () const

  Test the iterator validity.

- void next ()

  Go to the next point.

- operator util::tree_node< T > & () const

  Conversion to node.

- void start ()

  Start an iteration.

10.357.1 Detailed Description

template<typename T> class mln::util::branch_iter< T >

Basic 2D image class.

The parameter `T` is the type of node's data. branch_iter is used to pre-order walk a branch.

10.357.2 Member Function Documentation

10.357.2.1 template<typename T> unsigned mln::util::branch_iter< T >::deepness () const `[inline]`

Give how deep is the iterator in the branch.

References mln::util::branch_iter< T >::is_valid(), and mln::util::tree_node< T >::parent().

10.357.2.2 template<typename T> void mln::util::branch_iter< T >::invalidate () `[inline]`

Invalidate the iterator.

Referenced by mln::util::branch_iter< T >::next().

10.357.2.3 template<typename T> bool mln::util::branch_iter< T >::is_valid () const [inline]

Test the iterator validity.

Referenced by mln::util::branch_iter< T >::deepness().

10.357.2.4 template<typename T> void mln::util::branch_iter< T >::next () [inline]

Go to the next point.

References mln::util::branch_iter< T >::invalidate().

10.357.2.5 template<typename T> mln::util::branch_iter< T >::operator util::tree_node< T > & () const [inline]

Conversion to node.

10.357.2.6 template<typename T> void mln::util::branch_iter< T >::start () [inline]

Start an iteration.

10.358 mln::util::branch_iter_ind< T > Class Template Reference

Basic 2D image class.

`#include <branch_iter_ind.hh>`

Public Member Functions

- unsigned deepness () const

  Give how deep is the iterator in the branch.

- void invalidate ()

  Invalidate the iterator.

- bool is_valid () const

  Test the iterator validity.

- void next ()

  Go to the next point.

- operator util::tree_node< T > & () const

  Conversion to node.

- void start ()

  Start an iteration.

10.358.1 Detailed Description

template<typename T> class mln::util::branch_iter_ind< T >

Basic 2D image class.

The parameter `T` is the type of node's data. branch_iter_ind is used to pre-order walk a branch.

10.358.2 Member Function Documentation

10.358.2.1 template<typename T> unsigned mln::util::branch_iter_ind< T >::deepness () const [inline]

Give how deep is the iterator in the branch.

References mln::util::branch_iter_ind< T >::is_valid(), and mln::util::tree_node< T >::parent().

10.358.2.2 template<typename T> void mln::util::branch_iter_ind< T >::invalidate () [inline]

Invalidate the iterator.

Referenced by mln::util::branch_iter_ind< T >::next().

10.358.2.3 template<typename T> bool mln::util::branch_iter_ind< T >::is_valid () const [inline]

Test the iterator validity.

Referenced by mln::util::branch_iter_ind< T >::deepness().

10.358.2.4 template<typename T> void mln::util::branch_iter_ind< T >::next () [inline]

Go to the next point.

References mln::util::branch_iter_ind< T >::invalidate().

10.358.2.5 template<typename T> mln::util::branch_iter_ind< T >::operator util::tree_node< T > & () const [inline]

Conversion to node.

10.358.2.6 template<typename T> void mln::util::branch_iter_ind< T >::start () [inline]

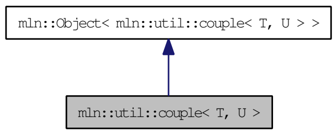
Start an iteration.

10.359 mln::util::couple< T, U > Class Template Reference

Definition of a couple.

`#include <couple.hh>`

Inheritance diagram for mln::util::couple< T, U >:



Public Member Functions

- void change_both (const T &first, const U &second)
  Replace both members of the couple by val.
- void change_first (const T &val)
  Replace the first member of the couple by val.
- void change_second (const U &val)
  Replace the second member of the couple by val.

- const T & first () const
  Get the first member of the couple.

- const U & second () const
  Get the second member of the couple.

10.359.1 Detailed Description

template<typename T, typename U> class mln::util::couple< T, U >

Definition of a couple.

10.359.2 Member Function Documentation

10.359.2.1 template<typename T, typename U> void mln::util::couple< T, U >::change_both (const T & *first*, const U & *second*) `[inline]`

Replace both members of the couple by *val*.

10.359.2.2 template<typename T, typename U> void mln::util::couple< T, U >::change_first (const T & *val*) `[inline]`

Replace the first member of the couple by *val*.

10.359.2.3 template<typename T, typename U> void mln::util::couple< T, U >::change_second (const U & *val*) [inline]

Replace the second member of the couple by *val*.

10.359.2.4 template<typename T, typename U> const T & mln::util::couple< T, U >::first () const [inline]

Get the first member of the couple.

10.359.2.5 template<typename T, typename U> const U & mln::util::couple< T, U >::second () const [inline]

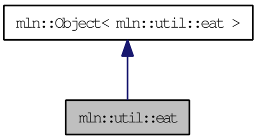
Get the second member of the couple.

10.360 mln::util::eat Struct Reference

Eat structure.

`#include <eat.hh>`

Inheritance diagram for mln::util::eat:



10.360.1 Detailed Description

Eat structure.

10.361 mln::util::edge< G > Class Template Reference

Edge of a graph G.

`#include <edge.hh>`

Inherits mln::util::internal::edge_impl_< G >.

Public Types

- typedef Edge< void > category
  Object category.
- typedef G graph_t
  Graph associated type.
- typedef edge_id_t id_t
  The edge type id.
- typedef edge_id_t::value_t id_value_t
  The underlying type used to store edge ids.

Public Member Functions

- void change_graph (const G &g)
  Set g_ with g*;.*
- const G & graph () const
  Return a reference to the graph holding this edge.
- edge_id_t id () const
  Return the edge id.
- void invalidate ()
  Invalidate that vertex.
- bool is_valid () const
  Misc.
- operator edge_id_t () const
  Conversion to the edge id.
- void update_id (const edge_id_t &id)
  Set id_ with id*;.*

- edge ()
  Constructors.

- edge_id_t ith_nbh_edge (unsigned i) const

Return the `i` *th adjacent edge.*

- size_t nmax_nbh_edges () const
  Return the number max of adjacent edges.
- vertex_id_t v1 () const
  Edge oriented.
- vertex_id_t v2 () const
  Return the highest vertex id adjacent to this edge.
- vertex_id_t v_other (const vertex_id_t &id_v) const
  Vertex and edges oriented.

10.361.1 Detailed Description

template<typename G> class mln::util::edge< G >

Edge of a graph `G`.

10.361.2 Member Typedef Documentation

10.361.2.1 template<typename G> typedef Edge<void> mln::util::edge< G >::category

Object category.

10.361.2.2 template<typename G> typedef G mln::util::edge< G >::graph_t

Graph associated type.

10.361.2.3 template<typename G> typedef edge_id_t mln::util::edge< G >::id_t

The edge type id.

10.361.2.4 template<typename G> typedef edge_id_t::value_t mln::util::edge< G >::id_value_t

The underlying type used to store edge ids.

10.361.3 Constructor & Destructor Documentation

10.361.3.1 template<typename G> mln::util::edge< G >::edge () `[inline]`

Constructors.

References mln::util::edge< G >::invalidate().

10.361.4 Member Function Documentation

10.361.4.1 template<typename G> void mln::util::edge< G >::change_graph (const G & *g*) [inline]

Set g_ with `g`;.

10.361.4.2 template<typename G> const G & mln::util::edge< G >::graph () const [inline]

Return a reference to the graph holding this edge.

Referenced by mln::p_edges< G, F >::has(), and mln::util::line_graph< G >::has().

10.361.4.3 template<typename G> edge_id_t mln::util::edge< G >::id () const [inline]

Return the edge id.

Referenced by mln::util::line_graph< G >::has().

10.361.4.4 template<typename G> void mln::util::edge< G >::invalidate () [inline]

Invalidate that vertex.

Referenced by mln::util::edge< G >::edge().

10.361.4.5 template<typename G> bool mln::util::edge< G >::is_valid () const [inline]

Misc.

Return whether is points to a known edge.

References mln::util::object_id< Tag, V >::is_valid().

Referenced by mln::p_edges< G, F >::has().

10.361.4.6 template<typename G> edge_id_t mln::util::edge< G >::ith_nbh_edge (unsigned *i*) const [inline]

Return the `i` th adjacent edge.

10.361.4.7 template<typename G> size_t mln::util::edge< G >::nmax_nbh_edges () const [inline]

Return the number max of adjacent edges.

10.361.4.8 template<typename G> mln::util::edge< G >::operator edge_id_t () const [inline]

Conversion to the edge id.

10.361.4.9 template<typename G> void mln::util::edge< G >::update_id (const edge_id_t & *id*) [inline]

Set id_ with `id`;.

10.361.4.10 template<typename G> vertex_id_t mln::util::edge< G >::v1 () const [inline]

Edge oriented.

Return the lowest vertex id adjacent to this edge.

Referenced by mln::util::edge< G >::v_other().

10.361.4.11 template<typename G> vertex_id_t mln::util::edge< G >::v2 () const [inline]

Return the highest vertex id adjacent to this edge.

Referenced by mln::util::edge< G >::v_other().

10.361.4.12 template<typename G> vertex_id_t mln::util::edge< G >::v_other (const vertex_id_t & *id_v*) const [inline]

Vertex and edges oriented.

Return the vertex id of this edge which is different from `id_v`.

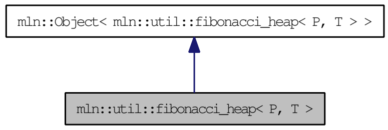
References mln::util::edge< G >::v1(), and mln::util::edge< G >::v2().

10.362 mln::util::fibonacci_heap< P, T > Class Template Reference

Fibonacci heap.

`#include <fibonacci_heap.hh>`

Inheritance diagram for mln::util::fibonacci_heap< P, T >:



Public Member Functions

- void clear ()

  Clear all elements in the heap and make the heap empty.

- fibonacci_heap (const fibonacci_heap< P, T > &node)

  Copy constructor Be ware that once this heap is constructed, the argument `node` *is cleared and all its elements are part of this new heap.*

- fibonacci_heap ()

  Default constructor.

- const T & front () const

  Return the minimum value in the heap.

- bool is_empty () const

  Is it empty?

- bool is_valid () const

  return false if it is empty.

- unsigned nelements () const

  Return the number of elements.

- fibonacci_heap< P, T > & operator= (fibonacci_heap< P, T > &rhs)

  Assignment operator.

- T pop_front ()

  Return and remove the minimum value in the heap.

- void push (fibonacci_heap< P, T > &other_heap)

  Take `other_heap's` *elements and insert them in this heap.*

- void push (const P &priority, const T &value)

  Push a new element in the heap.

10.362.1 Detailed Description

template<typename P, typename T> class mln::util::fibonacci_heap< P, T >

Fibonacci heap.

10.362.2 Constructor & Destructor Documentation

10.362.2.1 template<typename P, typename T> mln::util::fibonacci_heap< P, T >::fibonacci_heap () `[inline]`

Default constructor.

10.362.2.2 template<typename P, typename T> mln::util::fibonacci_heap< P, T >::fibonacci_heap (const fibonacci_heap< P, T > & *node*) `[inline]`

Copy constructor Be ware that once this heap is constructed, the argument `node` is cleared and all its elements are part of this new heap.

References mln::util::fibonacci_heap< P, T >::min_root, mln::util::fibonacci_heap< P, T >::num_-marked_nodes, mln::util::fibonacci_heap< P, T >::num_nodes, and mln::util::fibonacci_heap< P, T >::num_trees.

10.362.3 Member Function Documentation

10.362.3.1 template<typename P, typename T> void mln::util::fibonacci_heap< P, T >::clear () `[inline]`

Clear all elements in the heap and make the heap empty.

References mln::util::fibonacci_heap< P, T >::pop_front().

10.362.3.2 template<typename P, typename T> const T & mln::util::fibonacci_heap< P, T >::front () const `[inline]`

Return the minimum value in the heap.

10.362.3.3 template<typename P, typename T> bool mln::util::fibonacci_heap< P, T >::is_empty () const `[inline]`

Is it empty?

Referenced by mln::util::fibonacci_heap< P, T >::pop_front(), and mln::util::fibonacci_heap< P, T >::push().

10.362.3.4 template<typename P, typename T> bool mln::util::fibonacci_heap< P, T >::is_valid () const `[inline]`

return false if it is empty.

Referenced by mln::util::fibonacci_heap< P, T >::pop_front().

10.362.3.5 template<typename P, typename T> unsigned mln::util::fibonacci_heap< P, T >::nelements () const [inline]

Return the number of elements.

10.362.3.6 template<typename P, typename T> fibonacci_heap< P, T > & mln::util::fibonacci_heap< P, T >::operator= (fibonacci_heap< P, T > & *rhs*) [inline]

Assignment operator.

Be ware that this operator do *not* copy the data from `rhs` to this heap. It moves all elements which means that afterwards, `rhs` is is cleared and all its elements are part of this new heap.

References mln::util::fibonacci_heap< P, T >::min_root, mln::util::fibonacci_heap< P, T >::num_marked_nodes, mln::util::fibonacci_heap< P, T >::num_nodes, and mln::util::fibonacci_heap< P, T >::num_trees.

10.362.3.7 template<typename P, typename T> T mln::util::fibonacci_heap< P, T >::pop_front () [inline]

Return and remove the minimum value in the heap.

References mln::util::fibonacci_heap< P, T >::is_empty(), mln::util::fibonacci_heap< P, T >::is_valid(), mln::util::fibonacci_heap< P, T >::min_root, and mln::util::fibonacci_heap< P, T >::push().

Referenced by mln::util::fibonacci_heap< P, T >::clear().

10.362.3.8 template<typename P, typename T> void mln::util::fibonacci_heap< P, T >::push (fibonacci_heap< P, T > & *other_heap*) [inline]

Take `other_heap's` elements and insert them in this heap.

After this call `other_heap` is cleared.

References mln::util::fibonacci_heap< P, T >::is_empty(), mln::util::fibonacci_heap< P, T >::min_root, mln::util::fibonacci_heap< P, T >::num_marked_nodes, mln::util::fibonacci_heap< P, T >::num_nodes, and mln::util::fibonacci_heap< P, T >::num_trees.

10.362.3.9 template<typename P, typename T> void mln::util::fibonacci_heap< P, T >::push (const P & *priority*, const T & *value*) [inline]

Push a new element in the heap.

See also:

insert

Referenced by mln::util::fibonacci_heap< P, T >::pop_front().

10.363 mln::util::graph Class Reference

Undirected graph.

`#include <graph.hh>`

Inherits mln::util::internal::graph_base< mln::util::graph >.

Public Types

- typedef std::set< edge_data_t > edges_set_t

  A set to test the presence of a given edge.

- typedef std::vector< edge_data_t > edges_t

  The type of the set of edges.

- typedef std::vector< vertex_data_t > vertices_t

  The type of the set of vertices.

  - typedef mln::internal::edge_fwd_iterator< graph > edge_fwd_iter

    Edge iterators.

  - typedef mln::internal::edge_nbh_edge_fwd_iterator< graph > edge_nbh_edge_fwd_iter

    Edge centered edge iterators.

  - typedef mln::internal::vertex_fwd_iterator< graph > vertex_fwd_iter

    Iterator types
    Vertex iterators.

  - typedef mln::internal::vertex_nbh_edge_fwd_iterator< graph > vertex_nbh_edge_fwd_iter

    Vertex centered edge iterators.

  - typedef mln::internal::vertex_nbh_vertex_fwd_iterator< graph > vertex_nbh_vertex_fwd_iter

    Vertex centered vertex iterators.

Public Member Functions

- graph (unsigned nvertices)

  Construct a graph with `nvertices` vertices.

- graph ()
- bool has_v (const vertex_id_t &id_v) const

  Check whether a vertex id `id_v` exists in the graph.

- edge_id_t v_ith_nbh_edge (const vertex_id_t &id_v, unsigned i) const

Returns the i *th edge adjacent to the vertex* id_v*.*

- vertex_id_t v_ith_nbh_vertex (const vertex_id_t &id_v, unsigned i) const

  Returns the i *th vertex adjacent to the vertex* id_v*.*

- size_t v_nmax () const

  Return the number of vertices in the graph.

- size_t v_nmax_nbh_edges (const vertex_id_t &id_v) const

  Return the number of adjacent edges of vertex id_v*.*

- size_t v_nmax_nbh_vertices (const vertex_id_t &id_v) const

  Return the number of adjacent vertices of vertex id_v*.*

- edge_id_t add_edge (const vertex_id_t &id_v1, const vertex_id_t &id_v2)

  Edge oriented.

- edge_id_t e_ith_nbh_edge (const edge_id_t &id_e, unsigned i) const

  Return the i *th edge adjacent to the edge* id_e*.*

- size_t e_nmax () const

  Return the number of edges in the graph.

- size_t e_nmax_nbh_edges (const edge_id_t &id_e) const

  Return the number max of adjacent edge, given an edge id_e*.*

- edge_t edge (const vertex_t &v1, const vertex_t &v2) const

  @}

- edge_t edge (const edge_id_t &e) const

  Return the edge whose id is e*.*

- const std::vector< util::ord_pair< vertex_id_t > > & edges () const

  Return the list of all edges.

- bool has_e (const edge_id_t &id_e) const

  Return whether id_e *is in the graph.*

- template<typename G2>
  bool is_subgraph_of (const G2 &g) const

  *Return whether this graph is a subgraph Return true if g and *this have the same graph_id.*

- vertex_id_t v1 (const edge_id_t &id_e) const

  Return the first vertex associated to the edge id_e*.*

- vertex_id_t v2 (const edge_id_t &id_e) const

  Return the second vertex associated to edge id_e*.*

- unsigned add_vertex ()

  Vertex oriented.

- std::pair< vertex_id_t, vertex_id_t > add_vertices (unsigned n)
  Add n *vertices to the graph.*
- vertex_t vertex (vertex_id_t id_v) const
  Return the vertex whose id is v.

10.363.1 Detailed Description

Undirected graph.

10.363.2 Member Typedef Documentation

10.363.2.1 typedef mln::internal::edge_fwd_iterator<graph> mln::util::graph::edge_fwd_iter

Edge iterators.

10.363.2.2 typedef mln::internal::edge_nbh_edge_fwd_iterator<graph> mln::util::graph::edge_nbh_edge_fwd_iter

Edge centered edge iterators.

10.363.2.3 typedef std::set<edge_data_t> mln::util::graph::edges_set_t

A set to test the presence of a given edge.

10.363.2.4 typedef std::vector<edge_data_t> mln::util::graph::edges_t

The type of the set of edges.

10.363.2.5 typedef mln::internal::vertex_fwd_iterator<graph> mln::util::graph::vertex_fwd_iter

Iterator types

Vertex iterators.

10.363.2.6 typedef mln::internal::vertex_nbh_edge_fwd_iterator<graph> mln::util::graph::vertex_nbh_edge_fwd_iter

Vertex centered edge iterators.

10.363.2.7 typedef mln::internal::vertex_nbh_vertex_fwd_iterator<graph> mln::util::graph::vertex_nbh_vertex_fwd_iter

Vertex centered vertex iterators.

10.363.2.8 typedef std::vector< vertex_data_t > mln::util::graph::vertices_t

The type of the set of vertices.

10.363.3 Constructor & Destructor Documentation

10.363.3.1 mln::util::graph::graph () [inline]

Constructor.

10.363.3.2 mln::util::graph::graph (unsigned *nvertices*) [inline]

Construct a graph with `nvertices` vertices.

10.363.4 Member Function Documentation

10.363.4.1 edge_id_t mln::util::graph::add_edge (const vertex_id_t & *id_v1*, const vertex_id_t & *id_v2*) [inline]

Edge oriented.

Add an edge.

Returns:

The id of the new edge if it does not exist yet; otherwise, return `mln_max(unsigned)`.

References edge(), and has_v().

Referenced by mln::make::voronoi().

10.363.4.2 unsigned mln::util::graph::add_vertex () [inline]

Vertex oriented.

Shortcuts factoring the insertion of vertices and edges. Add a vertex.

Returns:

The id of the new vertex.

References v_nmax().

Referenced by mln::make::voronoi().

10.363.4.3 std::pair< vertex_id_t, vertex_id_t > mln::util::graph::add_vertices (unsigned *n*) [inline]

Add `n` vertices to the graph.

Returns:

A range of vertex ids.

References v_nmax().

10.363.4.4 edge_id_t mln::util::graph::e_ith_nbh_edge (const edge_id_t & *id_e*, unsigned *i*) const [inline]

Return the `i` th edge adjacent to the edge `id_e`.

References e_nmax(), e_nmax_nbh_edges(), has_e(), v1(), v2(), v_ith_nbh_edge(), and v_nmax_nbh_-edges().

10.363.4.5 size_t mln::util::graph::e_nmax () const [inline]

Return the number of edges in the graph.

Referenced by e_ith_nbh_edge(), and edge().

10.363.4.6 size_t mln::util::graph::e_nmax_nbh_edges (const edge_id_t & *id_e*) const [inline]

Return the number max of adjacent edge, given an edge `id_e`.

References has_e(), v1(), v2(), and v_nmax_nbh_edges().

Referenced by e_ith_nbh_edge().

10.363.4.7 graph::edge_t mln::util::graph::edge (const vertex_t & *v1*, const vertex_t & *v2*) const [inline]

@}

Return the corresponding edge id if exists. If it is not, returns an invalid edge.

References has_v(), and mln::util::vertex< G >::id().

10.363.4.8 graph::edge_t mln::util::graph::edge (const edge_id_t & *e*) const [inline]

Return the edge whose id is *e*.

References e_nmax().

Referenced by add_edge().

10.363.4.9 const std::vector< util::ord_pair< vertex_id_t > > & mln::util::graph::edges () const [inline]

Return the list of all edges.

10.363.4.10 bool mln::util::graph::has_e (const edge_id_t & *id_e*) const [inline]

Return whether `id_e` is in the graph.

@{

Referenced by e_ith_nbh_edge(), e_nmax_nbh_edges(), v1(), and v2().

10.363.4.11 bool mln::util::graph::has_v (const vertex_id_t & *id_v*) const [inline]

Check whether a vertex id `id_v` exists in the graph.

Referenced by add_edge(), edge(), v_ith_nbh_edge(), v_ith_nbh_vertex(), v_nmax_nbh_edges(), v_-nmax_nbh_vertices(), and vertex().

10.363.4.12 template<typename G2> bool mln::util::graph::is_subgraph_of (const G2 & *g*) const [inline]

Return whether this graph is a subgraph Return true if g and *this have the same graph_id.

10.363.4.13 vertex_id_t mln::util::graph::v1 (const edge_id_t & *id_e*) const [inline]

Return the first vertex associated to the edge `id_e`.

References has_e().

Referenced by e_ith_nbh_edge(), and e_nmax_nbh_edges().

10.363.4.14 vertex_id_t mln::util::graph::v2 (const edge_id_t & *id_e*) const [inline]

Return the second vertex associated to edge `id_e`.

References has_e().

Referenced by e_ith_nbh_edge(), and e_nmax_nbh_edges().

10.363.4.15 edge_id_t mln::util::graph::v_ith_nbh_edge (const vertex_id_t & *id_v*, unsigned *i*) const [inline]

Returns the `i` th edge adjacent to the vertex `id_v`.

References has_v(), and v_nmax_nbh_edges().

Referenced by e_ith_nbh_edge(), and v_ith_nbh_vertex().

10.363.4.16 vertex_id_t mln::util::graph::v_ith_nbh_vertex (const vertex_id_t & *id_v*, unsigned *i*) const [inline]

Returns the `i` th vertex adjacent to the vertex `id_v`.

References has_v(), and v_ith_nbh_edge().

10.363.4.17 size_t mln::util::graph::v_nmax () const [inline]

Return the number of vertices in the graph.

Referenced by add_vertex(), and add_vertices().

10.363.4.18 size_t mln::util::graph::v_nmax_nbh_edges (const vertex_id_t & *id_v*) const [inline]

Return the number of adjacent edges of vertex `id_v`.

References has_v().

Referenced by e_ith_nbh_edge(), e_nmax_nbh_edges(), v_ith_nbh_edge(), and v_nmax_nbh_vertices().

10.363.4.19 size_t mln::util::graph::v_nmax_nbh_vertices (const vertex_id_t & *id_v*) const [inline]

Return the number of adjacent vertices of vertex `id_v`.

References has_v(), and v_nmax_nbh_edges().

10.363.4.20 graph::vertex_t mln::util::graph::vertex (vertex_id_t *id_v*) const [inline]

Return the vertex whose id is *v*.

References has_v().

10.364 mln::util::greater_point< I > Class Template Reference

A "greater than" functor comparing points w.r.t.

`#include <greater_point.hh>`

Public Member Functions

- bool operator() (const point &x, const point &y)
  Is x *greater than* y*?*

10.364.1 Detailed Description

template<typename I> class mln::util::greater_point< I >

A "greater than" functor comparing points w.r.t.

the values they refer to in an image.

This functor used in useful to implement ordered queues of points.

10.364.2 Member Function Documentation

10.364.2.1 template<typename I> bool mln::util::greater_point< I >::operator() (const point & *x*, const point & *y*) [inline]

Is *x* greater than *y*?

10.365 mln::util::greater_psite< I > Class Template Reference

A “greater than” functor comparing psites w.r.t.

`#include <greater_psite.hh>`

Public Member Functions

- bool operator() (const psite &x, const psite &y)

  Is x *greater than* y*?*

10.365.1 Detailed Description

template<typename I> class mln::util::greater_psite< I >

A “greater than” functor comparing psites w.r.t.

the values they refer to in an image.

This functor used in useful to implement ordered queues of psites.

10.365.2 Member Function Documentation

10.365.2.1 template<typename I> bool mln::util::greater_psite< I >::operator() (const psite & *x*, const psite & *y*) [inline]

Is *x* greater than *y*?

10.366 mln::util::head< T, R > Class Template Reference

Top structure of the soft heap.

```
#include <soft_heap.hh>
```

10.366.1 Detailed Description

template<typename T, typename R> class mln::util::head< T, R >

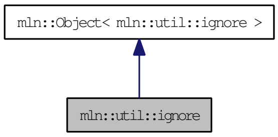
Top structure of the soft heap.

10.367 mln::util::ignore Struct Reference

Ignore structure.

`#include <ignore.hh>`

Inheritance diagram for mln::util::ignore:



10.367.1 Detailed Description

Ignore structure.

10.368 mln::util::ilcell< T > Struct Template Reference

Element of an item list. Store the data (key) used in soft_heap.

`#include <soft_heap.hh>`

10.368.1 Detailed Description

template<typename T> struct mln::util::ilcell< T >

Element of an item list. Store the data (key) used in soft_heap.

10.369 mln::util::line_graph< G > Class Template Reference

Undirected line graph of a graph of type G.

`#include <line_graph.hh>`

Inherits mln::util::internal::graph_base< mln::util::line_graph< G > >.

Public Types

- typedef std::vector< edge_data_t > edges_t

  The type of the set of edges.

- typedef std::vector< vertex_data_t > vertices_t

  The type of the set of vertices.

  - typedef mln::internal::edge_fwd_iterator< line_graph< G > > edge_fwd_iter

    Edge iterators.

  - typedef mln::internal::edge_nbh_edge_fwd_iterator< line_graph< G > > edge_nbh_edge_-fwd_iter

    Edge nbh edge iterators.

  - typedef mln::internal::vertex_fwd_iterator< line_graph< G > > vertex_fwd_iter

    Iterator types
    Vertex iterators.

  - typedef mln::internal::vertex_nbh_edge_fwd_iterator< line_graph< G > > vertex_nbh_edge_-fwd_iter

    Vertex nbh edge iterators.

  - typedef mln::internal::vertex_nbh_vertex_fwd_iterator< line_graph< G > > vertex_nbh_-vertex_fwd_iter

    Vertex nbh vertex iterators.

Public Member Functions

- template<typename G2>
  bool has (const util::vertex< G2 > &v) const

  Check whether an edge `v` *exists in the graph.*

- bool has_v (const vertex_id_t &id_v) const

  Check whether a vertex id `id_v` *exists in the graph.*

- edge_id_t v_ith_nbh_edge (const vertex_id_t &id_v, unsigned i) const

Returns the i *th edge adjacent to the vertex* id_v*.*

- vertex_id_t v_ith_nbh_vertex (const vertex_id_t &id_v, unsigned i) const

  Returns the i *th vertex adjacent to the vertex* id_v*.*

- size_t v_nmax () const

  Return the number of vertices in the graph.

- size_t v_nmax_nbh_edges (const vertex_id_t &id_v) const

  Return the number of adjacent edges of vertex id_v*.*

- size_t v_nmax_nbh_vertices (const vertex_id_t &id_v) const

  Return the number of adjacent vertices of vertex id_v*.*

- edge_id_t e_ith_nbh_edge (const edge_id_t &id_e, unsigned i) const

  Return the i *th edge adjacent to the edge* id_e*.*

- size_t e_nmax () const

  Return the number of edges in the graph.

- size_t e_nmax_nbh_edges (const edge_id_t &id_e) const

  Return the number max of adjacent edge, given an edge id_e*.*

- edge_t edge (const edge_id_t &e) const

  Edge oriented.

- const G & graph () const

  Return the underlying graph.

- template<typename G2>
  bool has (const util::edge< G2 > &e) const

  Return whether e *is in the graph.*

- bool has_e (const util::edge_id_t &id_e) const

  Return whether id_e *is in the graph.*

- template<typename G2>
  bool is_subgraph_of (const G2 &g) const

  Return whether this graph is a subgraph Return true if g and ∗this have the same graph_id.

- vertex_id_t v1 (const edge_id_t &id_e) const

  Return the first vertex associated to the edge id_e*.*

- vertex_id_t v2 (const edge_id_t &id_e) const

  Return the second vertex associated to edge id_e*.*

- vertex_t vertex (const vertex_id_t &id_v) const

  Vertex oriented.

10.369.1 Detailed Description

template<typename G> class mln::util::line_graph< G >

Undirected line graph of a graph of type G.

10.369.2 Member Typedef Documentation

10.369.2.1 template<typename G> typedef mln::internal::edge_fwd_iterator< line_graph<G> > mln::util::line_graph< G >::edge_fwd_iter

Edge iterators.

10.369.2.2 template<typename G> typedef mln::internal::edge_nbh_edge_fwd_iterator< line_graph<G> > mln::util::line_graph< G >::edge_nbh_edge_fwd_iter

Edge nbh edge iterators.

10.369.2.3 template<typename G> typedef std::vector<edge_data_t> mln::util::line_graph< G >::edges_t

The type of the set of edges.

10.369.2.4 template<typename G> typedef mln::internal::vertex_fwd_iterator< line_graph<G> > mln::util::line_graph< G >::vertex_fwd_iter

Iterator types

Vertex iterators.

10.369.2.5 template<typename G> typedef mln::internal::vertex_nbh_edge_fwd_iterator< line_graph<G> > mln::util::line_graph< G >::vertex_nbh_edge_fwd_iter

Vertex nbh edge iterators.

10.369.2.6 template<typename G> typedef mln::internal::vertex_nbh_vertex_fwd_iterator< line_graph<G> > mln::util::line_graph< G >::vertex_nbh_vertex_fwd_iter

Vertex nbh vertex iterators.

10.369.2.7 template<typename G> typedef std::vector<vertex_data_t> mln::util::line_graph< G >::vertices_t

The type of the set of vertices.

10.369.3 Member Function Documentation

10.369.3.1 template<typename G> edge_id_t mln::util::line_graph< G >::e_ith_nbh_edge (const edge_id_t & *id_e*, unsigned *i*) const [inline]

Return the i th edge adjacent to the edge id_e.

References mln::util::line_graph< G >::e_nmax(), mln::util::line_graph< G >::e_nmax_nbh_edges(), mln::util::line_graph< G >::has_e(), mln::util::line_graph< G >::v1(), mln::util::line_graph< G >::v2(), mln::util::line_graph< G >::v_ith_nbh_edge(), and mln::util::line_graph< G >::v_nmax_nbh_edges().

10.369.3.2 template<typename G> size_t mln::util::line_graph< G >::e_nmax () const [inline]

Return the number of edges in the graph.

Referenced by mln::util::line_graph< G >::e_ith_nbh_edge(), and mln::util::line_graph< G >::edge().

10.369.3.3 template<typename G> size_t mln::util::line_graph< G >::e_nmax_nbh_edges (const edge_id_t & *id_e*) const [inline]

Return the number max of adjacent edge, given an edge id_e.

References mln::util::line_graph< G >::has_e(), mln::util::line_graph< G >::v1(), mln::util::line_graph< G >::v2(), and mln::util::line_graph< G >::v_nmax_nbh_edges().

Referenced by mln::util::line_graph< G >::e_ith_nbh_edge().

10.369.3.4 template<typename G> line_graph< G >::edge_t mln::util::line_graph< G >::edge (const edge_id_t & *e*) const [inline]

Edge oriented.

Return the edge whose id is *e*.

References mln::util::line_graph< G >::e_nmax().

10.369.3.5 template<typename G> const G & mln::util::line_graph< G >::graph () const [inline]

Return the underlying graph.

10.369.3.6 template<typename G> template<typename G2> bool mln::util::line_graph< G >::has (const util::edge< G2 > & *e*) const [inline]

Return whether e is in the graph.

References mln::util::edge< G >::graph(), mln::util::line_graph< G >::has_e(), and mln::util::edge< G >::id().

10.369.3.7 template<typename G> template<typename G2> bool mln::util::line_graph< G >::has (const util::vertex< G2 > & *v*) const [inline]

Check whether an edge `v` exists in the graph.

References mln::util::vertex< G >::graph(), mln::util::line_graph< G >::has_v(), and mln::util::vertex< G >::id().

10.369.3.8 template<typename G> bool mln::util::line_graph< G >::has_e (const util::edge_id_t & *id_e*) const [inline]

Return whether `id_e` is in the graph.

Referenced by mln::util::line_graph< G >::e_ith_nbh_edge(), mln::util::line_graph< G >::e_nmax_nbh_edges(), mln::util::line_graph< G >::has(), mln::util::line_graph< G >::v1(), and mln::util::line_graph< G >::v2().

10.369.3.9 template<typename G> bool mln::util::line_graph< G >::has_v (const vertex_id_t & *id_v*) const [inline]

Check whether a vertex id `id_v` exists in the graph.

Referenced by mln::util::line_graph< G >::has(), mln::util::line_graph< G >::v_ith_nbh_edge(), mln::util::line_graph< G >::v_ith_nbh_vertex(), mln::util::line_graph< G >::v_nmax_nbh_edges(), mln::util::line_graph< G >::v_nmax_nbh_vertices(), and mln::util::line_graph< G >::vertex().

10.369.3.10 template<typename G> template<typename G2> bool mln::util::line_graph< G >::is_subgraph_of (const G2 & *g*) const [inline]

Return whether this graph is a subgraph Return true if g and *this have the same graph_id.

10.369.3.11 template<typename G> vertex_id_t mln::util::line_graph< G >::v1 (const edge_id_t & *id_e*) const [inline]

Return the first vertex associated to the edge `id_e`.

References mln::util::line_graph< G >::has_e().

Referenced by mln::util::line_graph< G >::e_ith_nbh_edge(), and mln::util::line_graph< G >::e_nmax_nbh_edges().

10.369.3.12 template<typename G> vertex_id_t mln::util::line_graph< G >::v2 (const edge_id_t & *id_e*) const [inline]

Return the second vertex associated to edge `id_e`.

References mln::util::line_graph< G >::has_e().

Referenced by mln::util::line_graph< G >::e_ith_nbh_edge(), and mln::util::line_graph< G >::e_nmax_nbh_edges().

10.369.3.13 template<typename G> edge_id_t mln::util::line_graph< G >::v_ith_nbh_edge (const vertex_id_t & *id_v*, unsigned *i*) const [inline]

Returns the i th edge adjacent to the vertex id_v.

References mln::util::line_graph< G >::has_v(), mln::util::line_graph< G >::v_nmax(), and mln::util::line_graph< G >::v_nmax_nbh_edges().

Referenced by mln::util::line_graph< G >::e_ith_nbh_edge(), and mln::util::line_graph< G >::v_ith_nbh_vertex().

10.369.3.14 template<typename G> vertex_id_t mln::util::line_graph< G >::v_ith_nbh_vertex (const vertex_id_t & *id_v*, unsigned *i*) const [inline]

Returns the i th vertex adjacent to the vertex id_v.

References mln::util::line_graph< G >::has_v(), and mln::util::line_graph< G >::v_ith_nbh_edge().

10.369.3.15 template<typename G> size_t mln::util::line_graph< G >::v_nmax () const [inline]

Return the number of vertices in the graph.

Referenced by mln::util::line_graph< G >::v_ith_nbh_edge().

10.369.3.16 template<typename G> size_t mln::util::line_graph< G >::v_nmax_nbh_edges (const vertex_id_t & *id_v*) const [inline]

Return the number of adjacent edges of vertex id_v.

References mln::util::line_graph< G >::has_v().

Referenced by mln::util::line_graph< G >::e_ith_nbh_edge(), mln::util::line_graph< G >::e_nmax_nbh_edges(), mln::util::line_graph< G >::v_ith_nbh_edge(), and mln::util::line_graph< G >::v_nmax_nbh_vertices().

10.369.3.17 template<typename G> size_t mln::util::line_graph< G >::v_nmax_nbh_vertices (const vertex_id_t & *id_v*) const [inline]

Return the number of adjacent vertices of vertex id_v.

References mln::util::line_graph< G >::has_v(), and mln::util::line_graph< G >::v_nmax_nbh_edges().

10.369.3.18 template<typename G> line_graph< G >::vertex_t mln::util::line_graph< G >::vertex (const vertex_id_t & *id_v*) const [inline]

Vertex oriented.

Shortcuts factoring the insertion of vertices and edges.

Return the vertex whose id is *v*.

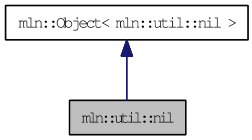
References mln::util::line_graph< G >::has_v().

10.370 mln::util::nil Struct Reference

Nil structure.

`#include <nil.hh>`

Inheritance diagram for mln::util::nil:



10.370.1 Detailed Description

Nil structure.

10.371 mln::util::node< T, R > Class Template Reference

Meta-data of an element in the heap.

`#include <soft_heap.hh>`

10.371.1 Detailed Description

template<typename T, typename R> class mln::util::node< T, R >

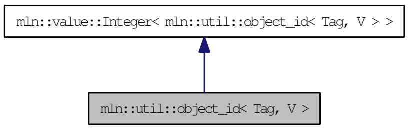
Meta-data of an element in the heap.

10.372 mln::util::object_id< Tag, V > Class Template Reference

Base class of an object id.

#include <object_id.hh>

Inheritance diagram for mln::util::object_id< Tag, V >:



Public Types

- typedef V value_t

  The underlying type id.

Public Member Functions

- object_id ()

  Constructors.

10.372.1 Detailed Description

template<typename Tag, typename V> class mln::util::object_id< Tag, V >

Base class of an object id.

Template Parameters:

Tag the tag type

Equiv the equivalent value.

10.372.2 Member Typedef Documentation

10.372.2.1 template<typename Tag, typename V> typedef V mln::util::object_id< Tag, V >::value_t

The underlying type id.

10.372.3 Constructor & Destructor Documentation

10.372.3.1 template<typename Tag, typename V> mln::util::object_id< Tag, V >::object_id () [inline]

Constructors.

10.373 mln::util::ord< T > Struct Template Reference

Function-object that defines an ordering between objects with type `T`: *lhs* R *rhs*.

`#include <ord.hh>`

10.373.1 Detailed Description

template<typename T> struct mln::util::ord< T >

Function-object that defines an ordering between objects with type `T`: *lhs* R *rhs*.

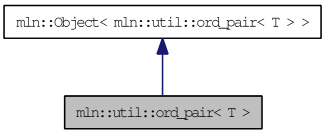
Its meaning is "lhs less-than rhs."

10.374 mln::util::ord_pair< T > Struct Template Reference

Ordered pair structure s.a.

`#include <ord_pair.hh>`

Inheritance diagram for mln::util::ord_pair< T >:



Public Member Functions

- void change_both (const T &first, const T &second)
  Replace both members of the pair by val*, while keeping the relative order.*
- void change_first (const T &val)
  Replace the first member of the pair by val*, while keeping the relative order.*
- void change_second (const T &val)
  Replace the second member of the pair by val*, while keeping the relative order.*

- const T & first () const
  Get the first (lowest) member of the pair.

- const T & second () const
  Get the second (highest) member of the pair.

10.374.1 Detailed Description

template<typename T> struct mln::util::ord_pair< T >

Ordered pair structure s.a.

this->first <= this->second; ordered pairs are partially ordered using lexicographical ordering.

10.374.2 Member Function Documentation

10.374.2.1 template<typename T> void mln::util::ord_pair< T >::change_both (const T & *first*, const T & *second*) `[inline]`

Replace both members of the pair by *val*, while keeping the relative order.

Postcondition:

*first_* <= *second_* (with <= being the mln::util::ord_weak relationship).

References mln::util::ord_strict(), and mln::util::ord_weak().

10.374.2.2 template<typename T> void mln::util::ord_pair< T >::change_first (const T & *val*) [inline]

Replace the first member of the pair by *val*, while keeping the relative order.

Postcondition:

*first_* <= *second_* (with <= being the mln::util::ord_weak relationship).

References mln::util::ord_strict(), and mln::util::ord_weak().

10.374.2.3 template<typename T> void mln::util::ord_pair< T >::change_second (const T & *val*) [inline]

Replace the second member of the pair by *val*, while keeping the relative order.

Postcondition:

*first_* <= *second_* (with <= being the mln::util::ord_weak relationship).

References mln::util::ord_strict(), and mln::util::ord_weak().

10.374.2.4 template<typename T> const T & mln::util::ord_pair< T >::first () const [inline]

Get the first (lowest) member of the pair.

10.374.2.5 template<typename T> const T & mln::util::ord_pair< T >::second () const [inline]

Get the second (highest) member of the pair.

10.375 mln::util::pix< I > Struct Template Reference

Structure pix.

`#include <pix.hh>`

Public Types

- typedef I::psite psite

    Point_Site associated type.

- typedef I::value value

    Value associated type.

Public Member Functions

- const I & ima () const

    The getter of the image associate to pix structure.

- const I::psite & p () const

    The getter of psite associate to pix structure.

- pix (const Image< I > &ima, const typename I::psite &p)

    Constructor.

- I::rvalue v () const

    The getter of value associate to pix structure.

10.375.1 Detailed Description

template<typename I> struct mln::util::pix< I >

Structure pix.

10.375.2 Member Typedef Documentation

10.375.2.1 template<typename I> typedef I ::psite mln::util::pix< I >::psite

Point_Site associated type.

10.375.2.2 template<typename I> typedef I ::value mln::util::pix< I >::value

Value associated type.

10.375.3 Constructor & Destructor Documentation

10.375.3.1 template<typename I> mln::util::pix< I >::pix (const Image< I > & *ima*, const typename I::psite & *p*) [inline]

Constructor.

Parameters:

← ***ima*** The image.

← ***p*** The p_site.

10.375.4 Member Function Documentation

10.375.4.1 template<typename I> const I & mln::util::pix< I >::ima () const [inline]

The getter of the image associate to pix structure.

Returns:

The image ima_.

10.375.4.2 template<typename I> const I::psite & mln::util::pix< I >::p () const [inline]

The getter of psite associate to pix structure.

Returns:

The psite p_.

10.375.4.3 template<typename I> I::rvalue mln::util::pix< I >::v () const [inline]

The getter of value associate to pix structure.

Returns:

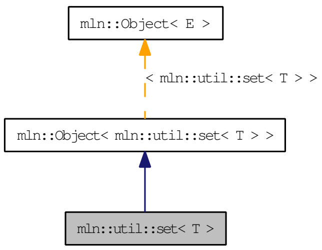
The value of pix.

10.376 mln::util::set< T > Class Template Reference

An "efficient" mathematical set class.

`#include <set.hh>`

Inheritance diagram for mln::util::set< T >:



Public Types

- typedef set_bkd_iter< T > bkd_eiter

  Backward iterator associated type.

- typedef fwd_eiter eiter

  Iterator associated type.

- typedef T element

  Element associated type.

- typedef set_fwd_iter< T > fwd_eiter

  Forward iterator associated type.

Public Member Functions

- void clear ()

  Empty the set.

- const T first_element () const

  Return the first element of the set.

- bool has (const T &elt) const

  Test if the object `elt` *belongs to the set.*

- template<typename U>
  set< T > & insert (const set< U > &other)

  Insert the elements of `other` *into the set.*

- set< T > & insert (const T &elt)

  Insert an element `elt` *into the set.*

- bool is_empty () const

  Test if the set is empty.

- const T last_element () const

  Return the last element of the set.

- std::size_t memory_size () const

  Return the size of this set in memory.

- unsigned nelements () const

  Return the number of elements of the set.

- const T & operator[ ] (unsigned i) const

  Return the i-th element of the set.

- set< T > & remove (const T &elt)

  Remove an element `elt` into the set.

- set ()

  Constructor without arguments.

- const std::vector< T > & std_vector () const

  Give access to the set elements.

10.376.1 Detailed Description

template<typename T> class mln::util::set< T >

An "efficient" mathematical set class.

This set class is designed to store a mathematical set and to present it to the user as a linear array (std::vector).

Elements are stored by copy. Implementation is lazy.

The set has two states: frozen or not. There is an automatic switch of state when the user modifies its contents (insert, remove, or clear) or access to its contents (op[i]).

The parameter `T` is the element type, which shall not be const-qualified.

The unicity of set elements is handled by the mln::util::ord mechanism.

See also:

mln::util::ord

10.376.2 Member Typedef Documentation

10.376.2.1 template<typename T> typedef set_bkd_iter<T> mln::util::set< T >::bkd_eiter

Backward iterator associated type.

10.376.2.2 template<typename T> typedef fwd_eiter mln::util::set< T >::eiter

Iterator associated type.

10.376.2.3 template<typename T> typedef T mln::util::set< T >::element

Element associated type.

10.376.2.4 template<typename T> typedef set_fwd_iter<T> mln::util::set< T >::fwd_eiter

Forward iterator associated type.

10.376.3 Constructor & Destructor Documentation

10.376.3.1 template<typename T> mln::util::set< T >::set () `[inline]`

Constructor without arguments.

10.376.4 Member Function Documentation

10.376.4.1 template<typename T> void mln::util::set< T >::clear () `[inline]`

Empty the set.

All elements contained in the set are destroyed so the set is emptied.

Postcondition:

is_empty() == true

References mln::util::set< T >::is_empty().

10.376.4.2 template<typename T> const T mln::util::set< T >::first_element () const `[inline]`

Return the first element of the set.

Precondition:

not is_empty()

References mln::util::set< T >::is_empty().

10.376.4.3 template<typename T> bool mln::util::set< T >::has (const T & *elt*) const `[inline]`

Test if the object `elt` belongs to the set.

Parameters:

← ***elt*** A possible element of the set.

Returns:

True is `elt` is in the set.

10.376.4.4 template<typename T> template<typename U> set< T > & mln::util::set< T >::insert (const set< U > & *other*) [inline]

Insert the elements of `other` into the set.

Parameters:

← *other* The set containing the elements to be inserted.

Returns:

The set itself after insertion.

References mln::util::set< T >::is_empty(), and mln::util::set< T >::std_vector().

10.376.4.5 template<typename T> set< T > & mln::util::set< T >::insert (const T & *elt*) [inline]

Insert an element `elt` into the set.

Parameters:

← *elt* The element to be inserted.

If `elt` is already in the set, this method is a no-op.

Returns:

The set itself after insertion.

Referenced by mln::p_key< K, P >::change_keys().

10.376.4.6 template<typename T> bool mln::util::set< T >::is_empty () const [inline]

Test if the set is empty.

References mln::util::set< T >::nelements().

Referenced by mln::util::set< T >::clear(), mln::util::set< T >::first_element(), mln::util::set< T >::insert(), and mln::util::set< T >::last_element().

10.376.4.7 template<typename T> const T mln::util::set< T >::last_element () const [inline]

Return the last element of the set.

Precondition:

not is_empty()

References mln::util::set< T >::is_empty().

10.376.4.8 template<typename T> std::size_t mln::util::set< T >::memory_size () const [inline]

Return the size of this set in memory.

References mln::util::set< T >::nelements().

10.376.4.9 template<typename T> unsigned mln::util::set< T >::nelements () const [inline]

Return the number of elements of the set.

Referenced by mln::util::set< T >::is_empty(), mln::util::set< T >::memory_size(), and mln::util::set< T >::operator[ ]().

10.376.4.10]

template<typename T> const T & **mln::util::set**< T >::operator[ ] (unsigned *i*) const [inline]

Return the i-th element of the set.

Parameters:

← ***i*** Index of the element to retrieve.

Precondition:

i < nelements()

The element is returned by reference and is constant.

References mln::util::set< T >::nelements().

10.376.4.11 template<typename T> set< T > & mln::util::set< T >::remove (const T & *elt*) [inline]

Remove an element `elt` into the set.

Parameters:

← ***elt*** The element to be inserted.

If `elt` is already in the set, this method is a no-op.

Returns:

The set itself after suppression.

10.376.4.12 template<typename T> const std::vector< T > & mln::util::set< T >::std_vector () const [inline]

Give access to the set elements.

The complexity of this method is O(1).

Postcondition:

The set is frozen.

Returns:

An array (std::vector) of elements.

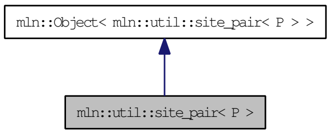
Referenced by mln::util::set< T >::insert().

10.377 mln::util::site_pair< P > Class Template Reference

A pair of sites.

```
#include <site_pair.hh>
```

Inheritance diagram for mln::util::site_pair< P >:



Public Member Functions

- const P & first () const
  Return the first site.
- const util::ord_pair< P > & pair () const
  Return the underlying pair.
- const P & second () const
  Return the second site.

10.377.1 Detailed Description

template<typename P> class mln::util::site_pair< P >

A pair of sites.

It can be used as site.

10.377.2 Member Function Documentation

10.377.2.1 template<typename P> const P & mln::util::site_pair< P >::first () const [inline]

Return the first site.

10.377.2.2 template<typename P> const util::ord_pair< P > & mln::util::site_pair< P >::pair () const [inline]

Return the underlying pair.

10.377.2.3 template<typename P> const P & mln::util::site_pair< P >::second () const [inline]

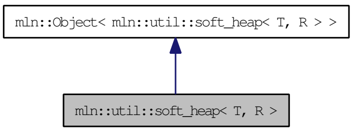
Return the second site.

10.378 mln::util::soft_heap< T, R > Class Template Reference

Soft heap.

```
#include <soft_heap.hh>
```

Inheritance diagram for mln::util::soft_heap< T, R >:



Public Types

- typedef T element

    Element associated type.

Public Member Functions

- void clear ()

    Clear the heap.

- bool is_empty () const

    Return true if there is at least one element.

- bool is_valid () const

    Return true if there is at least one element.

- int nelements () const

    Return the number of element in the heap.

- T pop_front ()

    Returns the element with the lowest priority and remove it from the heap.

- void push (soft_heap< T, R > &sh)

    Merge `sh` *with this heap.*

- void push (const T &element)

    Add a new element `element`.

- soft_heap (unsigned r=20)

    Default constructor.

- ~soft_heap ()

    Destructor.

10.378.1 Detailed Description

template<typename T, typename R> class mln::util::soft_heap< T, R >

Soft heap.

T key, the data to store in the heap. For instance a point 2d. R rank, for instance int_u8

10.378.2 Member Typedef Documentation

10.378.2.1 template<typename T, typename R> typedef T mln::util::soft_heap< T, R >::element

Element associated type.

10.378.3 Constructor & Destructor Documentation

10.378.3.1 template<typename T, typename R> mln::util::soft_heap< T, R >::soft_heap (unsigned *r* = `20`) `[inline]`

Default constructor.

A corruption threshold `r` can be specified. This threshold means that if nodes have a rank higher than this threshold they can be "corrupted" and therefore their rank can be reduced.

10.378.3.2 template<typename T, typename R> mln::util::soft_heap< T, R >::~soft_heap () `[inline]`

Destructor.

References mln::util::head< T, R >::next(), and mln::util::head< T, R >::queue().

10.378.4 Member Function Documentation

10.378.4.1 template<typename T, typename R> void mln::util::soft_heap< T, R >::clear () `[inline]`

Clear the heap.

References mln::util::head< T, R >::next(), mln::util::head< T, R >::queue(), mln::util::head< T, R >::set_next(), and mln::util::head< T, R >::set_prev().

10.378.4.2 template<typename T, typename R> bool mln::util::soft_heap< T, R >::is_empty () const `[inline]`

Return true if there is at least one element.

10.378.4.3 template<typename T, typename R> bool mln::util::soft_heap< T, R >::is_valid () const `[inline]`

Return true if there is at least one element.

Referenced by mln::util::soft_heap< T, R >::pop_front().

10.378.4.4 template<typename T, typename R> int mln::util::soft_heap< T, R >::nelements () const [inline]

Return the number of element in the heap.

Referenced by mln::util::soft_heap< T, R >::push().

10.378.4.5 template<typename T, typename R> T mln::util::soft_heap< T, R >::pop_front () [inline]

Returns the element with the lowest priority and remove it from the heap.

References mln::util::soft_heap< T, R >::is_valid(), mln::util::head< T, R >::next(), mln::util::node< T, R >::next(), mln::util::head< T, R >::prev(), mln::util::head< T, R >::queue(), and mln::util::head< T, R >::set_queue().

10.378.4.6 template<typename T, typename R> void mln::util::soft_heap< T, R >::push (soft_heap< T, R > & *sh*) [inline]

Merge `sh` with this heap.

Be ware that after this call, `sh` will be empty. This heap will hold the elements which were part of `sh`.

References mln::util::soft_heap< T, R >::nelements(), mln::util::head< T, R >::next(), and mln::util::head< T, R >::queue().

10.378.4.7 template<typename T, typename R> void mln::util::soft_heap< T, R >::push (const T & *element*) [inline]

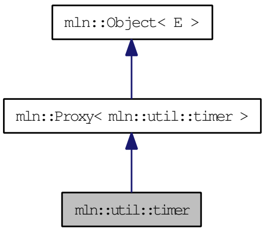
Add a new element `element`.

10.379 mln::util::timer Class Reference

Timer structure.

`#include <timer.hh>`

Inheritance diagram for mln::util::timer:



10.379.1 Detailed Description

Timer structure.

10.380 mln::util::tracked_ptr< T > Struct Template Reference

Smart pointer for shared data with tracking.

`#include <tracked_ptr.hh>`

Public Member Functions

- operator bool () const

  Coercion towards Boolean (for arithmetical tests).
- bool operator! () const

  Negation (for arithmetical tests).
- T ∗ operator → ()

  Mimics the behavior of op-> for a pointer in the mutable case.
- const T ∗ operator → () const

  Mimics the behavior of op-> for a pointer in the const case.
- tracked_ptr< T > & operator= (T ∗ptr)

  Assignment.
- tracked_ptr< T > & operator= (const tracked_ptr< T > &rhs)

  Assignment.
- ∼tracked_ptr ()

  Destructor.

  - tracked_ptr (const tracked_ptr< T > &rhs)

    Copy constructor.
  - tracked_ptr ()

    Constructors.

10.380.1 Detailed Description

template<typename T> struct mln::util::tracked_ptr< T >

Smart pointer for shared data with tracking.

10.380.2 Constructor & Destructor Documentation

10.380.2.1 template<typename T> mln::util::tracked_ptr< T >::tracked_ptr () [inline]

Constructors.

10.380.2.2 template<typename T> mln::util::tracked_ptr< T >::tracked_ptr (const tracked_ptr< T > & *rhs*) [inline]

Copy constructor.

10.380.2.3 template<typename T> mln::util::tracked_ptr< T >::~tracked_ptr () [inline]

Destructor.

10.380.3 Member Function Documentation

10.380.3.1 template<typename T> mln::util::tracked_ptr< T >::operator bool () const [inline]

Coercion towards Boolean (for arithmetical tests).

10.380.3.2 template<typename T> bool mln::util::tracked_ptr< T >::operator! () const [inline]

Negation (for arithmetical tests).

10.380.3.3 template<typename T> T ∗ mln::util::tracked_ptr< T >::operator → () [inline]

Mimics the behavior of op-> for a pointer in the mutable case.

Invariant:

Pointer proxy exists.

10.380.3.4 template<typename T> const T ∗ mln::util::tracked_ptr< T >::operator → () const [inline]

Mimics the behavior of op-> for a pointer in the const case.

Invariant:

Pointer proxy exists.

10.380.3.5 template<typename T> tracked_ptr< T > & mln::util::tracked_ptr< T >::operator= (T ∗ *ptr*) [inline]

Assignment.

10.380.3.6 template<typename T> tracked_ptr< T > & mln::util::tracked_ptr< T >::operator= (const tracked_ptr< T > & *rhs*) [inline]

Assignment.

10.381 mln::util::tree< T > Class Template Reference

Class of generic tree.

`#include <tree.hh>`

Public Member Functions

- void add_tree_down (T &elt)

  Bind a new tree downer the current.

- void add_tree_up (T &elt)

  Bind a new tree upper the current.

- bool check_consistency ()

  Check the consistency of the tree.

- branch< T > main_branch ()

  Convert the tree into brach.

- tree_node< T > * root ()

  The getter of the root.

- tree (tree_node< T > *root)

  Constructor.

- tree ()

  Constructor.

10.381.1 Detailed Description

template<typename T> class mln::util::tree< T >

Class of generic tree.

10.381.2 Constructor & Destructor Documentation

10.381.2.1 template<typename T> mln::util::tree< T >::tree () `[inline]`

Constructor.

10.381.2.2 template<typename T> mln::util::tree< T >::tree (tree_node< T > * *root*) `[inline]`

Constructor.

Parameters:

← ***root*** The root of the tree.

10.381.3 Member Function Documentation

10.381.3.1 template<typename T> void mln::util::tree< T >::add_tree_down (T & *elt*) [inline]

Bind a new tree downer the current.

Parameters:

← *elt* The new value of the new tree_node of the new tree add downer the current.

10.381.3.2 template<typename T> void mln::util::tree< T >::add_tree_up (T & *elt*) [inline]

Bind a new tree upper the current.

Parameters:

← *elt* The new value of the new tree_node of the new tree add upper the current.

References mln::util::tree_node< T >::children().

10.381.3.3 template<typename T> bool mln::util::tree< T >::check_consistency () [inline]

Check the consistency of the tree.

Returns:

true if no error, else false.

References mln::util::tree< T >::root().

10.381.3.4 template<typename T> branch< T > mln::util::tree< T >::main_branch () [inline]

Convert the tree into brach.

Returns:

The root's tree_node of the the current tree.

References mln::util::tree< T >::root().

10.381.3.5 template<typename T> tree_node< T > * mln::util::tree< T >::root () [inline]

The getter of the root.

Returns:

The root's tree_node of the the current tree.

Referenced by mln::util::tree< T >::check_consistency(), mln::util::display_tree(), mln::util::tree< T >::main_branch(), and mln::util::tree_to_fast().

10.382 mln::util::tree_node< T > Class Template Reference

Class of generic tree_node for tree.

`#include <tree.hh>`

Public Member Functions

- tree_node< T > ∗ add_child (tree_node< T > ∗tree_node)

  Bind `tree_node` *to the current tree_node and become its child.*

- tree_node< T > ∗ add_child (T elt)

  Create a tree_node with `elt` *which become the child of the current tree_node.*

- bool check_consistency ()

  Check the consistency of the tree_node.

- const children_t & children () const

  The getter of the children.

- children_t & children ()

  The getter of the children.

- tree_node< T > ∗ delete_tree_node ()

  Delete the current tree_node.

- const T & elt () const

  The const getter of the element.

- T & elt ()

  The getter of the element.

- tree_node< T > ∗ parent ()

  The getter of the parent.

- void print (std::ostream &ostr, int level=0)

  Print on `ostr` *the arborescence with the current tree_node as root.*

- tree_node< T > ∗ search (T &elt)

  Search the tree_node with value `elt` *in the arborescence of the current tree_node.*

- int search_rec (tree_node< T > ∗∗res, T &elt)

  The using method for method search.

- void set_parent (tree_node< T > ∗parent)

  Bind `tree_node` *to the current tree_node and become its parent.*

- tree_node (T elt)

  Constructor.

- tree_node ()
  Constructor.

10.382.1 Detailed Description

template<typename T> class mln::util::tree_node< T >

Class of generic tree_node for tree.

10.382.2 Constructor & Destructor Documentation

10.382.2.1 template<typename T> mln::util::tree_node< T >::tree_node () [inline]

Constructor.

10.382.2.2 template<typename T> mln::util::tree_node< T >::tree_node (T *elt*) [inline]

Constructor.

Parameters:

← ***elt*** The element of tree_node.

10.382.3 Member Function Documentation

10.382.3.1 template<typename T> tree_node< T > * mln::util::tree_node< T >::add_child (tree_node< T > * *tree_node*) [inline]

Bind `tree_node` to the current tree_node and become its child.

Parameters:

← ***tree_node*** The new child tree_node.

Returns:

The child tree_node.

References mln::util::tree_node< T >::children(), and mln::util::tree_node< T >::parent().

10.382.3.2 template<typename T> tree_node< T > * mln::util::tree_node< T >::add_child (T *elt*) [inline]

Create a tree_node with `elt` which become the child of the current tree_node.

Parameters:

← ***elt*** The element of the new child to add.

Returns:

The new tree_node created.

10.382.3.3 template<typename T> bool mln::util::tree_node< T >::check_consistency () [inline]

Check the consistency of the tree_node.

Returns:

true if no error, else false.

10.382.3.4 template<typename T> const std::vector< tree_node< T > * > & mln::util::tree_node< T >::children () const [inline]

The getter of the children.

Returns:

The children of the tree_node in const.

10.382.3.5 template<typename T> std::vector< tree_node< T > * > & mln::util::tree_node< T >::children () [inline]

The getter of the children.

Returns:

The children of the tree_node.

Referenced by mln::util::tree_node< T >::add_child(), and mln::util::tree< T >::add_tree_up().

10.382.3.6 template<typename T> tree_node< T > * mln::util::tree_node< T >::delete_tree_node () [inline]

Delete the current tree_node.

10.382.3.7 template<typename T> const T & mln::util::tree_node< T >::elt () const [inline]

The const getter of the element.

Returns:

The element of the tree_node in const.

10.382.3.8 template<typename T> T & mln::util::tree_node< T >::elt () [inline]

The getter of the element.

Returns:

The element of the tree_node.

Referenced by mln::util::tree_node< T >::print().

10.382.3.9 template<typename T> tree_node< T > * mln::util::tree_node< T >::parent () [inline]

The getter of the parent.

Returns:

The parent of the tree_node.

Referenced by mln::util::tree_node< T >::add_child(), mln::util::branch_iter_ind< T >::deepness(), and mln::util::branch_iter< T >::deepness().

10.382.3.10 template<typename T> void mln::util::tree_node< T >::print (std::ostream & *ostr*, int *level* = 0) [inline]

Print on `ostr` the arborescence with the current tree_node as root.

Parameters:

← ***ostr*** The output stream.

← ***level*** The deep level

References mln::util::tree_node< T >::elt().

10.382.3.11 template<typename T> tree_node< T > * mln::util::tree_node< T >::search (T & *elt*) [inline]

Search the tree_node with value `elt` in the arborescence of the current tree_node.

Parameters:

← ***elt*** The value of the searched tree_node.

Returns:

If not found 0 else the tree_node with `elt` value.

References mln::util::tree_node< T >::search_rec().

10.382.3.12 template<typename T> int mln::util::tree_node< T >::search_rec (tree_node< T > ** *res*, T & *elt*) [inline]

The using method for method search.

Referenced by mln::util::tree_node< T >::search().

10.382.3.13 template<typename T> void mln::util::tree_node< T >::set_parent (tree_node< T > * *parent*) [inline]

Bind `tree_node` to the current tree_node and become its parent.

Parameters:

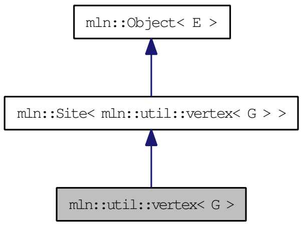
← ***parent*** The new parent tree_node.

10.383 mln::util::vertex< G > Class Template Reference

Vertex of a graph G.

```
#include <vertex.hh>
```

Inheritance diagram for mln::util::vertex< G >:



Public Types

- typedef Vertex< void > Category

  Object category.

- typedef G graph_t

  Graph associated type.

- typedef vertex_id_t id_t

  The vertex type id.

- typedef vertex_id_t::value_t id_value_t

  The underlying type used to store vertex ids.

Public Member Functions

- void change_graph (const G &g)

  Change the parent graph of that vertex.

- edge< G > edge_with (const vertex< G > &v_id) const

  Returns true if this vertex has an edge with the given vertex.

- const G & graph () const

  Returns the graph pointer this vertex belongs to.

- const vertex_id_t & id () const

  Returns the vertex id.

- void invalidate ()

  Invalidate that vertex.

- bool is_valid () const

Check whether the vertex is still part of the graph.

- edge_id_t ith_nbh_edge (unsigned i) const

  Returns the ith edge starting from this vertex.

- vertex_id_t ith_nbh_vertex (unsigned i) const

  Returns the ith vertex adjacent to this vertex.

- unsigned nmax_nbh_edges () const

  Returns the number max of edges starting from this vertex.

- unsigned nmax_nbh_vertices () const

  Returns the number max of vertices adjacent to this vertex.

- operator vertex_id_t () const

  Conversion to the vertex id.

- vertex_id_t other (const edge_id_t &id_e) const

  Returns the other vertex located on edge `id_e`*.*

- void update_id (const vertex_id_t &id)

  Update the vertex id.

  - vertex ()

    Constructors.

10.383.1 Detailed Description

template<typename G> class mln::util::vertex< G >

Vertex of a graph `G`.

10.383.2 Member Typedef Documentation

10.383.2.1 template<typename G> typedef Vertex<void> mln::util::vertex< G >::Category

Object category.

10.383.2.2 template<typename G> typedef G mln::util::vertex< G >::graph_t

Graph associated type.

10.383.2.3 template<typename G> typedef vertex_id_t mln::util::vertex< G >::id_t

The vertex type id.

10.383.2.4 template<typename G> typedef vertex_id_t::value_t mln::util::vertex< G >::id_value_t

The underlying type used to store vertex ids.

10.383.3 Constructor & Destructor Documentation

10.383.3.1 template<typename G> mln::util::vertex< G >::vertex () [inline]

Constructors.

References mln::util::vertex< G >::invalidate().

10.383.4 Member Function Documentation

10.383.4.1 template<typename G> void mln::util::vertex< G >::change_graph (const G & *g*) [inline]

Change the parent graph of that vertex.

10.383.4.2 template<typename G> edge< G > mln::util::vertex< G >::edge_with (const vertex< G > & *v_id*) const [inline]

Returns true if this vertex has an edge with the given vertex.

10.383.4.3 template<typename G> const G & mln::util::vertex< G >::graph () const [inline]

Returns the graph pointer this vertex belongs to.

Referenced by mln::p_vertices< G, F >::has(), mln::util::line_graph< G >::has(), and mln::util::operator==().

10.383.4.4 template<typename G> const vertex_id_t & mln::util::vertex< G >::id () const [inline]

Returns the vertex id.

Referenced by mln::util::graph::edge(), mln::util::line_graph< G >::has(), and mln::util::operator==().

10.383.4.5 template<typename G> void mln::util::vertex< G >::invalidate () [inline]

Invalidate that vertex.

Referenced by mln::util::vertex< G >::vertex().

10.383.4.6 template<typename G> bool mln::util::vertex< G >::is_valid () const [inline]

Check whether the vertex is still part of the graph.

Referenced by mln::p_vertices< G, F >::has().

10.383.4.7 template<typename G> edge_id_t mln::util::vertex< G >::ith_nbh_edge (unsigned *i*) const [inline]

Returns the ith edge starting from this vertex.

10.383.4.8 template<typename G> vertex_id_t mln::util::vertex< G >::ith_nbh_vertex (unsigned *i*) const [inline]

Returns the ith vertex adjacent to this vertex.

10.383.4.9 template<typename G> unsigned mln::util::vertex< G >::nmax_nbh_edges () const [inline]

Returns the number max of edges starting from this vertex.

If g_ is a sub graph of another graph, nmax will be retrived from the initial graph.

10.383.4.10 template<typename G> unsigned mln::util::vertex< G >::nmax_nbh_vertices () const [inline]

Returns the number max of vertices adjacent to this vertex.

10.383.4.11 template<typename G> mln::util::vertex< G >::operator vertex_id_t () const [inline]

Conversion to the vertex id.

FIXME: May cause ambiguities... :(

10.383.4.12 template<typename G> vertex_id_t mln::util::vertex< G >::other (const edge_id_t & *id_e*) const [inline]

Returns the other vertex located on edge `id_e`.

10.383.4.13 template<typename G> void mln::util::vertex< G >::update_id (const vertex_id_t & *id*) [inline]

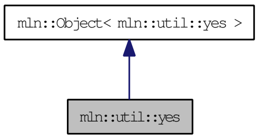
Update the vertex id.

10.384 mln::util::yes Struct Reference

Object that always says "yes".

```
#include <yes.hh>
```

Inheritance diagram for mln::util::yes:



10.384.1 Detailed Description

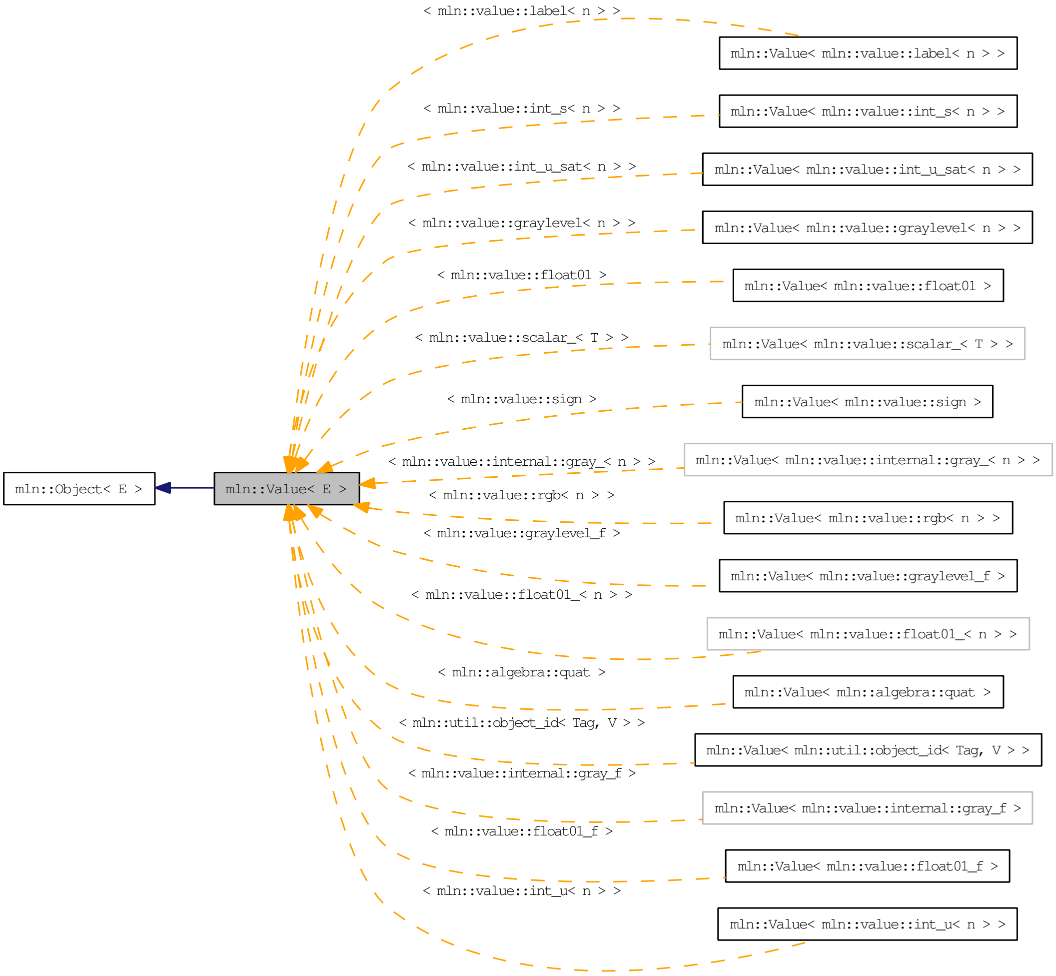
Object that always says "yes".

10.385 mln::Value< E > Struct Template Reference

Base class for implementation classes of values.

`#include <value.hh>`

Inheritance diagram for mln::Value< E >:



10.385.1 Detailed Description

template<typename E> struct mln::Value< E >

Base class for implementation classes of values.

See also:

mln::doc::Value for a complete documentation of this class contents.

10.386 mln::value::float01 Class Reference

Class for floating values restricted to the interval [0.

`#include <float01.hh>`

Inherits mln::value::Floating< mln::value::float01 >.

Public Types

- typedef std::pair< unsigned, unsigned long > enc

    Encoding associated type.

- typedef float equiv

    Equivalent associated type.

Public Member Functions

- float01 (unsigned nbits, float val)

    Ctor.

- template<unsigned n>
  float01 (const float01_< n > &val)

    Ctor.

- float01 ()

    Ctor.

- unsigned nbits () const

    Access to the encoding size.

- operator float () const

    Conversion to float.

- float01 & set_nbits (unsigned nbits)

    Set the encoding size to nbits.

- const float01 to_nbits (unsigned nbits) const

    Return an equivalent gray encoded on `nbits` *bits.*

- float value () const

    Access to std type.

- unsigned long value_ind () const

    Access to the position in the quantized interval.

10.386.1 Detailed Description

Class for floating values restricted to the interval [0.

.1] and discretized with n bits.

10.386.2 Member Typedef Documentation

10.386.2.1 typedef std::pair<unsigned, unsigned long> mln::value::float01::enc

Encoding associated type.

10.386.2.2 typedef float mln::value::float01::equiv

Equivalent associated type.

10.386.3 Constructor & Destructor Documentation

10.386.3.1 mln::value::float01::float01 () `[inline]`

Ctor.

10.386.3.2 template<unsigned n> mln::value::float01::float01 (const float01_< n > & *val*) `[inline]`

Ctor.

10.386.3.3 mln::value::float01::float01 (unsigned *nbits*, float *val*) `[inline]`

Ctor.

10.386.4 Member Function Documentation

10.386.4.1 unsigned mln::value::float01::nbits () const `[inline]`

Access to the encoding size.

10.386.4.2 mln::value::float01::operator float () const `[inline]`

Conversion to float.

10.386.4.3 float01 & mln::value::float01::set_nbits (unsigned *nbits*) `[inline]`

Set the encoding size to nbits.

Referenced by to_nbits().

10.386.4.4 const float01 mln::value::float01::to_nbits (unsigned *nbits*) const [inline]

Return an equivalent gray encoded on `nbits` bits.

References set_nbits().

10.386.4.5 float mln::value::float01::value () const [inline]

Access to std type.

10.386.4.6 unsigned long mln::value::float01::value_ind () const [inline]

Access to the position in the quantized interval.

10.387 mln::value::float01_f Struct Reference

Class for floating values restricted to the interval [0..1].

`#include <float01_f.hh>`

Inherits mln::value::Floating< mln::value::float01_f >, and mln::value::internal::value_like_< float, float, float, mln::value::float01_f >.

Public Member Functions

- float01_f (float val)
  Constructor from a float.
- float01_f ()
  Constructor without argument.
- operator float () const
  Conversion to a float.
- float01_f & operator= (const float val)
  Assignment from a float.
- float value () const
  Access to float value.

10.387.1 Detailed Description

Class for floating values restricted to the interval [0..1].

10.387.2 Constructor & Destructor Documentation

10.387.2.1 mln::value::float01_f::float01_f () [inline]

Constructor without argument.

10.387.2.2 mln::value::float01_f::float01_f (float *val*) [inline]

Constructor from a float.

10.387.3 Member Function Documentation

10.387.3.1 mln::value::float01_f::operator float () const [inline]

Conversion to a float.

10.387.3.2 float01_f & mln::value::float01_f::operator= (const float *val*) [inline]

Assignment from a float.

10.387.3.3 float mln::value::float01_f::value () const [inline]

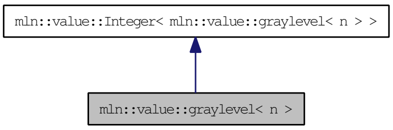
Access to float value.

10.388 mln::value::graylevel< n > Struct Template Reference

General gray-level class on n bits.

```
#include <graylevel.hh>
```

Inheritance diagram for mln::value::graylevel< n >:



Public Member Functions

- template<unsigned m>
  graylevel (const graylevel< m > &rhs)

  Constructor from any graylevel.
- graylevel (int val)

  Constructor from int.
- graylevel (const graylevel< n > &rhs)

  Copy constructor.
- graylevel ()

  Constructor without argument.
- template<unsigned m>
  graylevel< n > & operator= (const graylevel< m > &rhs)

  Assigment with any graylevel.
- graylevel< n > & operator= (int val)

  Assigment with int.
- graylevel< n > & operator= (const graylevel< n > &rhs)

  Assigment.
- float to_float () const

  Conversion to float between 0 and 1.
- unsigned value () const

  Access to std type.

  - graylevel (const mln::literal::black_t &)

    Ctors with literals.

  - graylevel< n > & operator= (const mln::literal::black_t &)

    Assigment with literals.

10.388.1 Detailed Description

template<unsigned n> struct mln::value::graylevel< n >

General gray-level class on n bits.

10.388.2 Constructor & Destructor Documentation

10.388.2.1 template<unsigned n> mln::value::graylevel< n >::graylevel () [inline]

Constructor without argument.

10.388.2.2 template<unsigned n> mln::value::graylevel< n >::graylevel (const graylevel< n > & *rhs*) [inline]

Copy constructor.

10.388.2.3 template<unsigned n> mln::value::graylevel< n >::graylevel (int *val*) [inline]

Constructor from int.

10.388.2.4 template<unsigned n> template<unsigned m> mln::value::graylevel< n >::graylevel (const graylevel< m > & *rhs*) [inline]

Constructor from any graylevel.

References mln::value::graylevel< n >::value().

10.388.2.5 template<unsigned n> mln::value::graylevel< n >::graylevel (const mln::literal::black_t &) [inline]

Ctors with literals.

10.388.3 Member Function Documentation

10.388.3.1 template<unsigned n> graylevel< n > & mln::value::graylevel< n >::operator= (const mln::literal::black_t &) [inline]

Assigment with literals.

10.388.3.2 template<unsigned n> template<unsigned m> graylevel< n > & mln::value::graylevel< n >::operator= (const graylevel< m > & *rhs*) [inline]

Assigment with any graylevel.

References mln::value::graylevel< n >::value().

10.388.3.3 template< unsigned n > graylevel< n > & mln::value::graylevel< n >::operator= (int *val*) [inline]

Assigment with int.

10.388.3.4 template< unsigned n > graylevel< n > & mln::value::graylevel< n >::operator= (const graylevel< n > & *rhs*) [inline]

Assigment.

10.388.3.5 template< unsigned n > float mln::value::graylevel< n >::to_float () const [inline]

Conversion to float between 0 and 1.

Referenced by mln::value::graylevel_f::graylevel_f(), and mln::value::graylevel_f::operator=().

10.388.3.6 template< unsigned n > unsigned mln::value::graylevel< n >::value () const [inline]

Access to std type.

Referenced by mln::value::graylevel< n >::graylevel(), and mln::value::graylevel< n >::operator=().

10.389 mln::value::graylevel_f Struct Reference

General gray-level class on n bits.

`#include <graylevel_f.hh>`

Inherits mln::value::Floating< mln::value::graylevel_f >, and mln::value::internal::value_like_< mln::value::float01_f, float01_f::enc, mln::value::internal::gray_f, mln::value::graylevel_f >.

Public Member Functions

- template<unsigned n>
  graylevel_f (const graylevel< n > &rhs)

  Constructor from graylevel.

- graylevel_f (float val)

  Constructor from float.

- graylevel_f (const graylevel_f &rhs)

  Copy constructor.

- graylevel_f ()

  Constructor without argument.

- template<unsigned n>
  operator graylevel< n > () const

  Conversion to graylevel<n>.

- template<unsigned n>
  graylevel_f & operator= (const graylevel< n > &rhs)

  Assigment with graylevel.

- graylevel_f & operator= (float val)

  Assigment with float.

- graylevel_f & operator= (const graylevel_f &rhs)

  Assigment.

- float value () const

  Access to std type.

  - graylevel_f (const mln::literal::black_t &)

    Ctors with literals.

  - graylevel_f & operator= (const mln::literal::black_t &)

    Assigment with literals.

10.389.1 Detailed Description

General gray-level class on n bits.

10.389.2 Constructor & Destructor Documentation

10.389.2.1 mln::value::graylevel_f::graylevel_f () [inline]

Constructor without argument.

10.389.2.2 mln::value::graylevel_f::graylevel_f (const graylevel_f & *rhs*) [inline]

Copy constructor.

10.389.2.3 mln::value::graylevel_f::graylevel_f (float *val*) [inline]

Constructor from float.

10.389.2.4 template<unsigned n> mln::value::graylevel_f::graylevel_f (const graylevel< n > & *rhs*) [inline]

Constructor from graylevel.

References mln::value::graylevel< n >::to_float().

10.389.2.5 mln::value::graylevel_f::graylevel_f (const mln::literal::black_t &) [inline]

Ctors with literals.

10.389.3 Member Function Documentation

10.389.3.1 template<unsigned n> mln::value::graylevel_f::operator graylevel< n > () const [inline]

Conversion to graylevel<n>.

10.389.3.2 graylevel_f & mln::value::graylevel_f::operator= (const mln::literal::black_t &) [inline]

Assigment with literals.

10.389.3.3 template<unsigned n> graylevel_f & mln::value::graylevel_f::operator= (const graylevel< n > & *rhs*) [inline]

Assigment with graylevel.

References mln::value::graylevel< n >::to_float().

10.389.3.4 graylevel_f & mln::value::graylevel_f::operator= (float *val*) [inline]

Assigment with float.

10.389.3.5 graylevel_f & mln::value::graylevel_f::operator= (const graylevel_f & *rhs*) [inline]

Assigment.

10.389.3.6 float mln::value::graylevel_f::value () const [inline]

Access to std type.

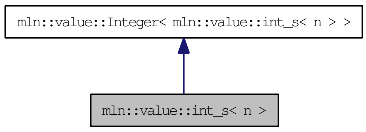
Referenced by mln::value::operator<<().

10.390 mln::value::int_s< n > Struct Template Reference

Signed integer value class.

`#include <int_s.hh>`

Inheritance diagram for mln::value::int_s< n >:



Public Member Functions

- int_s (int i)

  Constructor from an integer.

- int_s ()

  Constructor without argument.

- operator int () const

  Conversion to an integer.

- int_s< n > & operator= (int i)

  Assignment from an integer.

  - int_s (const mln::literal::zero_t &)

    Constructors/assignments with literals.

Static Public Attributes

- static const int_s< n > one = 1

  Unit value.

- static const int_s< n > zero = 0

  Zero value.

10.390.1 Detailed Description

template< unsigned n > struct mln::value::int_s< n >

Signed integer value class.

The parameter is `n` the number of encoding bits.

10.390.2 Constructor & Destructor Documentation

10.390.2.1 template<unsigned n> mln::value::int_s< n >::int_s () [inline]

Constructor without argument.

10.390.2.2 template<unsigned n> mln::value::int_s< n >::int_s (int *i*) [inline]

Constructor from an integer.

10.390.2.3 template<unsigned n> mln::value::int_s< n >::int_s (const mln::literal::zero_t &) [inline]

Constructors/assignments with literals.

10.390.3 Member Function Documentation

10.390.3.1 template<unsigned n> mln::value::int_s< n >::operator int () const [inline]

Conversion to an integer.

10.390.3.2 template<unsigned n> int_s< n > & mln::value::int_s< n >::operator= (int *i*) [inline]

Assignment from an integer.

10.390.4 Member Data Documentation

10.390.4.1 template<unsigned n> const int_s< n > mln::value::int_s< n >::one = 1 [inline, static]

Unit value.

10.390.4.2 template<unsigned n> const int_s< n > mln::value::int_s< n >::zero = 0 [inline, static]

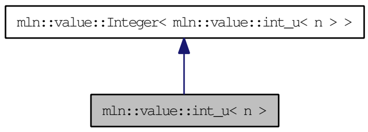
Zero value.

10.391 mln::value::int_u< n > Struct Template Reference

Unsigned integer value class.

```
#include <int_u.hh>
```

Inheritance diagram for mln::value::int_u< n >:



Public Member Functions

- int_u (int i)
  Constructor from an integer.
- int_u ()
  Constructor without argument.
- int_u< n > next () const
  Give the next value (i.e., i + 1).
- operator unsigned () const
  Conversion to an unsigned integer.
- int operator- () const
  Unary operator minus.
- int_u< n > & operator= (int i)
  Assignment from an integer.

  - int_u (const mln::literal::zero_t &)
    Constructors/assignments with literals.

10.391.1 Detailed Description

template<unsigned n> struct mln::value::int_u< n >

Unsigned integer value class.

The parameter is n the number of encoding bits.

10.391.2 Constructor & Destructor Documentation

10.391.2.1 template<unsigned n> mln::value::int_u< n >::int_u () [inline]

Constructor without argument.

10.391.2.2 template<unsigned n> mln::value::int_u< n >::int_u (int *i*) [inline]

Constructor from an integer.

10.391.2.3 template<unsigned n> mln::value::int_u< n >::int_u (const mln::literal::zero_t &) [inline]

Constructors/assignments with literals.

10.391.3 Member Function Documentation

10.391.3.1 template<unsigned n> int_u< n > mln::value::int_u< n >::next () const [inline]

Give the next value (i.e., i + 1).

10.391.3.2 template<unsigned n> mln::value::int_u< n >::operator unsigned () const [inline]

Conversion to an unsigned integer.

10.391.3.3 template<unsigned n> int mln::value::int_u< n >::operator- () const [inline]

Unary operator minus.

10.391.3.4 template<unsigned n> int_u< n > & mln::value::int_u< n >::operator= (int *i*) [inline]

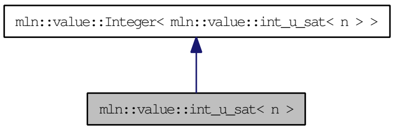
Assignment from an integer.

10.392 mln::value::int_u_sat< n > Struct Template Reference

Unsigned integer value class with saturation behavior.

`#include <int_u_sat.hh>`

Inheritance diagram for mln::value::int_u_sat< n >:



Public Member Functions

- int_u_sat (int i)

  Constructor from an integer.

- int_u_sat ()

  Constructor without argument.

- operator int () const

  Conversion to an integer.

- int_u_sat< n > & operator+= (int i)

  Self addition.

- int_u_sat< n > & operator-= (int i)

  Self subtraction.

- int_u_sat< n > & operator= (int i)

  Assignment from an integer.

Static Public Attributes

- static const int_u_sat< n > one = 1

  Unit value.

- static const int_u_sat< n > zero = 0

  Zero value.

10.392.1 Detailed Description

template<unsigned n> struct mln::value::int_u_sat< n >

Unsigned integer value class with saturation behavior.

The parameter is `n` the number of encoding bits.

10.392.2 Constructor & Destructor Documentation

10.392.2.1 template<unsigned n> mln::value::int_u_sat< n >::int_u_sat () [inline]

Constructor without argument.

10.392.2.2 template<unsigned n> mln::value::int_u_sat< n >::int_u_sat (int *i*) [inline]

Constructor from an integer.

10.392.3 Member Function Documentation

10.392.3.1 template<unsigned n> mln::value::int_u_sat< n >::operator int () const [inline]

Conversion to an integer.

10.392.3.2 template<unsigned n> int_u_sat< n > & mln::value::int_u_sat< n >::operator+= (int *i*) [inline]

Self addition.

10.392.3.3 template<unsigned n> int_u_sat< n > & mln::value::int_u_sat< n >::operator-= (int *i*) [inline]

Self subtraction.

10.392.3.4 template<unsigned n> int_u_sat< n > & mln::value::int_u_sat< n >::operator= (int *i*) [inline]

Assignment from an integer.

10.392.4 Member Data Documentation

10.392.4.1 template<unsigned n> const int_u_sat< n > mln::value::int_u_sat< n >::one = 1 [inline, static]

Unit value.

10.392.4.2 template<unsigned n> const int_u_sat< n > mln::value::int_u_sat< n >::zero = 0 [inline, static]

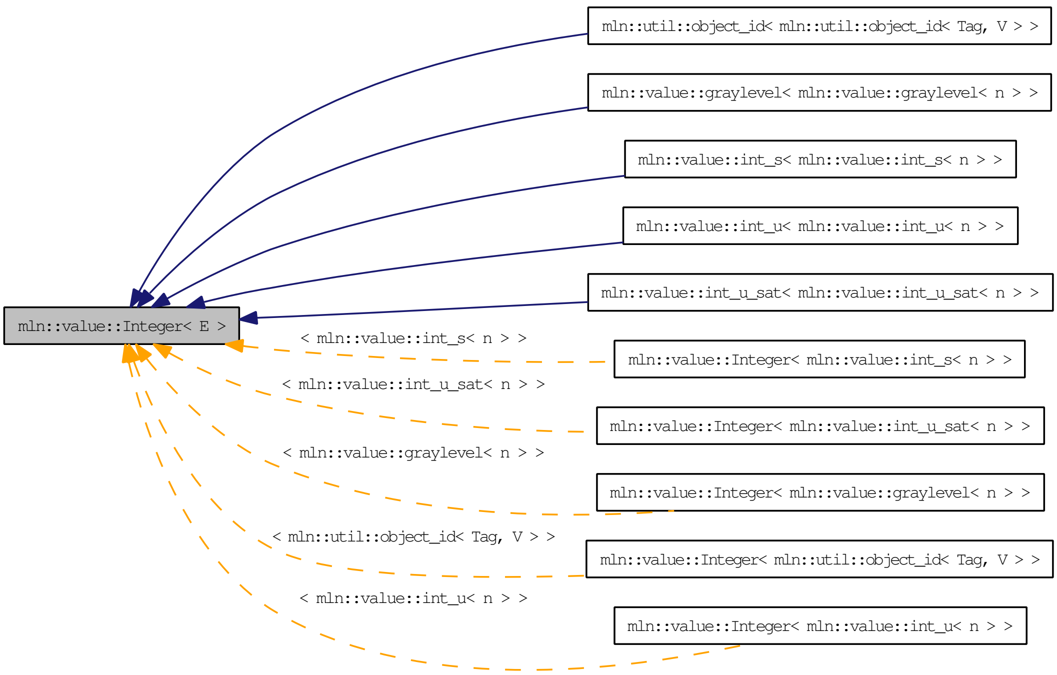
Zero value.

10.393 mln::value::Integer< E > Struct Template Reference

Concept of integer.

`#include <integer.hh>`

Inheritance diagram for mln::value::Integer< E >:



10.393.1 Detailed Description

template<typename E> struct mln::value::Integer< E >

Concept of integer.

10.394 mln::value::Integer< void > Struct Template Reference

Category flag type.

```
#include <integer.hh>
```

10.394.1 Detailed Description

template<> struct mln::value::Integer< void >

Category flag type.

10.395 mln::value::label< n > Struct Template Reference

Label value class.

`#include <label.hh>`

Inherits mln::value::Symbolic< mln::value::label< n > >, and mln::value::internal::value_like_< unsigned, mln::value::internal::encoding_unsigned_< n >::ret, int, mln::value::label< n > >.

Public Types

- typedef internal::encoding_unsigned_< n >::ret enc

  Encoding associated type.

Public Member Functions

- label (const literal::zero_t &v)

  Constructor from literal::zero.

- label (unsigned i)

  Constructor from an (unsigned) integer.

- label ()

  Constructor without argument.

- label< n > next () const

  Return the next value.

- operator unsigned () const

  Conversion to an unsigned integer.

- label< n > & operator++ ()

  Self increment.

- label< n > & operator– ()

  Self decrement.

- label< n > & operator= (const literal::zero_t &v)

  Assignment from literal::zero.

- label< n > & operator= (unsigned i)

  Assignment from an (unsigned) integer.

- label< n > prev () const

  Return the previous value.

10.395.1 Detailed Description

template<unsigned n> struct mln::value::label< n >

Label value class.

The parameter n is the number of encoding bits.

10.395.2 Member Typedef Documentation

10.395.2.1 template<unsigned n> typedef internal::encoding_unsigned_<n>::ret mln::value::label< n >::enc

Encoding associated type.

10.395.3 Constructor & Destructor Documentation

10.395.3.1 template<unsigned n> mln::value::label< n >::label () [inline]

Constructor without argument.

10.395.3.2 template<unsigned n> mln::value::label< n >::label (unsigned *i*) [inline]

Constructor from an (unsigned) integer.

10.395.3.3 template<unsigned n> mln::value::label< n >::label (const literal::zero_t & *v*) [inline]

Constructor from literal::zero.

10.395.4 Member Function Documentation

10.395.4.1 template<unsigned n> label< n > mln::value::label< n >::next () const [inline]

Return the next value.

10.395.4.2 template<unsigned n> mln::value::label< n >::operator unsigned () const [inline]

Conversion to an unsigned integer.

10.395.4.3 template<unsigned n> label< n > & mln::value::label< n >::operator++ () [inline]

Self increment.

10.395.4.4 template<unsigned n> label< n > & mln::value::label< n >::operator-- () [inline]

Self decrement.

10.395.4.5 template<unsigned n> label< n > & mln::value::label< n >::operator= (const literal::zero_t & *v*) [inline]

Assignment from literal::zero.

10.395.4.6 template<unsigned n> label< n > & mln::value::label< n >::operator= (unsigned *i*) [inline]

Assignment from an (unsigned) integer.

10.395.4.7 template<unsigned n> label< n > mln::value::label< n >::prev () const [inline]

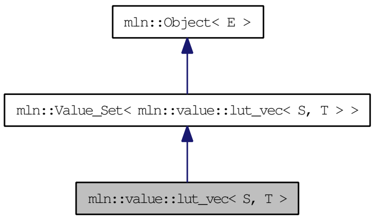
Return the previous value.

10.396 mln::value::lut_vec< S, T > Struct Template Reference

Class that defines FIXME.

`#include <lut_vec.hh>`

Inheritance diagram for mln::value::lut_vec< S, T >:



Public Types

- typedef bkd_viter_< lut_vec< S, T > > bkd_viter

  Backward Value_Iterator associated type.

- typedef fwd_viter_< lut_vec< S, T > > fwd_viter

  Forward Value_Iterator associated type.

- typedef T value

  Value associated type.

Public Member Functions

- bool has (const value &v) const

  Test if `v` *belongs to this set.*

- unsigned index_of (const value &v) const

  Give the index of value `v` *in this set.*

- unsigned nvalues () const

  Give the number of values.

- T operator[ ] (unsigned i) const

  Give the `i-th` *value.*

- template<typename V>
  lut_vec (const S &vset, const Function_v2v< util::array< V > > &f)

  Constructor from a value set and any util::array.

- template<typename V>
  lut_vec (const S &vset, const Function_v2v< fun::i2v::array< V > > &f)

  Constructor from a value set and any fun::i2v::array.

- template<typename F>
  lut_vec (const S &vset, const Function_v2v< F > &f)
  Constructors
  Constructor from a value set and any Function_v2v.

10.396.1 Detailed Description

template<typename S, typename T> struct mln::value::lut_vec< S, T >

Class that defines FIXME.

Warning:

This is a multi-set!!! FIXME

10.396.2 Member Typedef Documentation

10.396.2.1 template<typename S, typename T> typedef bkd_viter_< lut_vec<S,T> > mln::value::lut_vec< S, T >::bkd_viter

Backward Value_Iterator associated type.

10.396.2.2 template<typename S, typename T> typedef fwd_viter_< lut_vec<S,T> > mln::value::lut_vec< S, T >::fwd_viter

Forward Value_Iterator associated type.

10.396.2.3 template<typename S, typename T> typedef T mln::value::lut_vec< S, T >::value

Value associated type.

10.396.3 Constructor & Destructor Documentation

10.396.3.1 template<typename S, typename T> template<typename F> mln::value::lut_vec< S, T >::lut_vec (const S & *vset*, const Function_v2v< F > & *f*) `[inline]`

Constructors

Constructor from a value set and any Function_v2v.

10.396.3.2 template<typename S, typename T> template<typename V> mln::value::lut_vec< S, T >::lut_vec (const S & *vset*, const Function_v2v< fun::i2v::array< V > > & *f*) `[inline]`

Constructor from a value set and any fun::i2v::array.

10.396.3.3 template<typename S, typename T> template<typename V> mln::value::lut_vec< S, T >::lut_vec (const S & *vset*, const Function_v2v< util::array< V > > & *f*) [inline]

Constructor from a value set and any util::array.

References mln::util::array< T >::size(), and mln::util::array< T >::std_vector().

10.396.4 Member Function Documentation

10.396.4.1 template<typename S, typename T> bool mln::value::lut_vec< S, T >::has (const value & *v*) const [inline]

Test if v belongs to this set.

10.396.4.2 template<typename S, typename T> unsigned mln::value::lut_vec< S, T >::index_of (const value & *v*) const [inline]

Give the index of value v in this set.

10.396.4.3 template<typename S, typename T> unsigned mln::value::lut_vec< S, T >::nvalues () const [inline]

Give the number of values.

Referenced by mln::value::lut_vec< S, T >::operator[ ]().

10.396.4.4]

template<typename S, typename T> T **mln::value::lut_vec< S, T >**::operator[ ] (unsigned *i*) const [inline]

Give the i-th value.

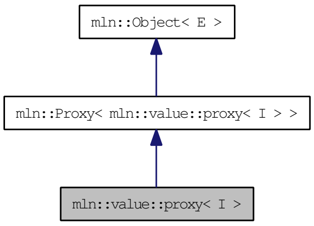
References mln::value::lut_vec< S, T >::nvalues().

10.397 mln::value::proxy< I > Class Template Reference

Generic proxy class for an image pixel value.

`#include <proxy.hh>`

Inheritance diagram for mln::value::proxy< I >:



Public Types

- typedef void enc

    Encoding associated type.

- typedef I::value equiv

    Equivalent associated type.

Public Member Functions

- template<typename J >
  proxy< I > & operator= (const proxy< J > &rhs)

    Assignment (write access); with other proxy.

- proxy< I > & operator= (const proxy< I > &rhs)

    Assignment (write access); replacement for default op.

- proxy (I &ima, const typename I::psite &p)

    Constructor.

- proxy ()

    Constructor.

- I::value to_value () const

    Explicit read access.

- ~proxy ()

    Destructor.

10.397.1 Detailed Description

template<typename I> class mln::value::proxy< I >

Generic proxy class for an image pixel value.

The parameter `I` is an image type.

10.397.2 Member Typedef Documentation

10.397.2.1 template<typename I> typedef void mln::value::proxy< I >::enc

Encoding associated type.

10.397.2.2 template<typename I> typedef I ::value mln::value::proxy< I >::equiv

Equivalent associated type.

10.397.3 Constructor & Destructor Documentation

10.397.3.1 template<typename I> mln::value::proxy< I >::proxy () `[inline]`

Constructor.

10.397.3.2 template<typename I> mln::value::proxy< I >::proxy (I & *ima*, const typename I::psite & *p*) `[inline]`

Constructor.

10.397.3.3 template<typename I> mln::value::proxy< I >::~proxy () `[inline]`

Destructor.

10.397.4 Member Function Documentation

10.397.4.1 template<typename I> template<typename J> proxy< I > & mln::value::proxy< I >::operator= (const proxy< J > & *rhs*) `[inline]`

Assignment (write access); with other proxy.

References mln::value::proxy< I >::to_value().

10.397.4.2 template<typename I> proxy< I > & mln::value::proxy< I >::operator= (const proxy< I > & *rhs*) `[inline]`

Assignment (write access); replacement for default op.

References mln::value::proxy< I >::to_value().

10.397.4.3 template<typename I> I::value mln::value::proxy< I >::to_value () const [inline]

Explicit read access.

Referenced by mln::value::proxy< I >::operator=().

10.398 mln::value::rgb< n > Struct Template Reference

Color class for red-green-blue where every component is n-bit encoded.

`#include <rgb.hh>`

Inherits mln::value::Vectorial< mln::value::rgb< n > >, and mln::value::internal::value_like_< mln::algebra::vec< 3, mln::value::int_u< n > >, mln::algebra::vec< 3, mln::value::int_u< n > >, mln::algebra::vec< 3, int >, mln::value::rgb< n > >.

Public Member Functions

- rgb< n > & operator= (const rgb< n > &rhs)
  Assignment.
- rgb (const algebra::vec< 3, int > &rhs)
  Constructor from a algebra::vec.
- rgb (int r, int g, int b)
  Constructor from component values.
- rgb ()
  Constructor without argument.

  - int_u< n > red () const
    Acces to red/green/blue component.

  - rgb (const mln::literal::white_t &)
    Constructors with literals.

Static Public Attributes

- static const rgb< n > zero
  Zero value.

10.398.1 Detailed Description

template<unsigned n> struct mln::value::rgb< n >

Color class for red-green-blue where every component is n-bit encoded.

10.398.2 Constructor & Destructor Documentation

10.398.2.1 template<unsigned n> mln::value::rgb< n >::rgb () [inline]

Constructor without argument.

10.398.2.2 template<unsigned n> mln::value::rgb< n >::rgb (int *r*, int *g*, int *b*) [inline]

Constructor from component values.

10.398.2.3 template<unsigned n> mln::value::rgb< n >::rgb (const algebra::vec< 3, int > & *rhs*) [inline]

Constructor from a algebra::vec.

10.398.2.4 template<unsigned n> mln::value::rgb< n >::rgb (const mln::literal::white_t &) [inline]

Constructors with literals.

10.398.3 Member Function Documentation

10.398.3.1 template<unsigned n> rgb< n > & mln::value::rgb< n >::operator= (const rgb< n > & *rhs*) [inline]

Assignment.

10.398.3.2 template<unsigned n> int_u<n> mln::value::rgb< n >::red () const [inline]

Acces to red/green/blue component.

Referenced by mln::io::magick::do_it().

10.398.4 Member Data Documentation

10.398.4.1 template<unsigned n> const rgb< n > mln::value::rgb< n >::zero [inline, static]

Zero value.

10.399 mln::value::set< T > Struct Template Reference

Class that defines the set of values of type `T`.

`#include <set.hh>`

Inherits mln::value::internal::set_selector_< T, mln::value::set< T >, mln::metal::equal< mln_trait_-value_quant(T), mln::trait::value::quant::low >::value >.

Static Public Member Functions

- static const set< T > & the ()

  Return a singleton.

10.399.1 Detailed Description

template<typename T> struct mln::value::set< T >

Class that defines the set of values of type `T`.

This is the exhaustive set of values obtainable from type `T`.

10.399.2 Member Function Documentation

10.399.2.1 template<typename T> const set< T > & mln::value::set< T >::the () `[inline, static]`

Return a singleton.

10.400 mln::value::sign Class Reference

The sign class represents the value type composed by the set (-1, 0, 1) sign value type is a subset of the int value type.

`#include <sign.hh>`

Inherits mln::value::internal::Integer< mln::value::sign >.

Public Types

- typedef int enc
  FIXME Are these typedefs correct?
- typedef int equiv
  Define the equivalent type.

Public Member Functions

- operator int () const
  Conversion to an integer.
- sign & operator= (int i)
  Assignment from an integer.
- sign (int i)
  Constructor from an integer.
- sign ()
  Constructor without argument.

  - sign (const mln::literal::zero_t &)
    Constructors/assignments with literals.

Static Public Attributes

- static const sign one = 1
  Unit value.
- static const sign zero = 0
  Zero value.

10.400.1 Detailed Description

The sign class represents the value type composed by the set (-1, 0, 1) sign value type is a subset of the int value type.

10.400.2 Member Typedef Documentation

10.400.2.1 typedef int mln::value::sign::enc

FIXME Are these typedefs correct?

Define the encoding type

10.400.2.2 typedef int mln::value::sign::equiv

Define the equivalent type.

10.400.3 Constructor & Destructor Documentation

10.400.3.1 mln::value::sign::sign () `[inline]`

Constructor without argument.

10.400.3.2 mln::value::sign::sign (int *i*) `[inline]`

Constructor from an integer.

10.400.3.3 mln::value::sign::sign (const mln::literal::zero_t &) `[inline]`

Constructors/assignments with literals.

10.400.4 Member Function Documentation

10.400.4.1 mln::value::sign::operator int () const `[inline]`

Conversion to an integer.

10.400.4.2 sign & mln::value::sign::operator= (int *i*) `[inline]`

Assignment from an integer.

10.400.5 Member Data Documentation

10.400.5.1 const sign mln::value::sign::one = 1 `[static]`

Unit value.

10.400.5.2 const sign mln::value::sign::zero = 0 `[static]`

Zero value.

10.401 mln::value::stack_image< n, I > Struct Template Reference

Stack image class.

`#include <stack.hh>`

Inherits mln::internal::image_value_morpher< I, mln::algebra::vec< n, I::value >, mln::value::stack_-image< n, I > >.

Public Types

- typedef I::domain_t domain_t

  Site_Set associated type.

- typedef internal::helper_stack_image_lvalue_< n, I >::ret lvalue

  Return type of read-write access.

- typedef I::psite psite

  Point_Site associated type.

- typedef value rvalue

  Return type of read-only access.

- typedef stack_image< n, tag::image_< I > > skeleton

  Skeleton.

- typedef algebra::vec< n, typename I::value > value

  Value associated type.

Public Member Functions

- bool is_valid () const

  Test if this image has been initialized.

- lvalue operator() (const psite &)

  Read-write access of pixel value at point site `p`.

- rvalue operator() (const psite &p) const

  Read-only access of pixel value at point site `p`.

  - stack_image (const algebra::vec< n, I > &imas)

    Constructors.

10.401.1 Detailed Description

template<unsigned n, typename I> struct mln::value::stack_image< n, I >

Stack image class.

mln::value::stack_image stores a vector of n images of the same domain.

The parameter `n` is the number of images, `I` is the type of a stack element. Acces a value will compute a vector which contains n coordinates : [stack[0](p), stack[1](p), ... , stack[n](p)]

10.401.2 Member Typedef Documentation

10.401.2.1 template<unsigned n, typename I> typedef I ::domain_t mln::value::stack_image< n, I >::domain_t

Site_Set associated type.

10.401.2.2 template<unsigned n, typename I> typedef internal::helper_-stack_image_lvalue_<n,I>::ret mln::value::stack_image< n, I >::lvalue

Return type of read-write access.

10.401.2.3 template<unsigned n, typename I> typedef I ::psite mln::value::stack_image< n, I >::psite

Point_Site associated type.

10.401.2.4 template<unsigned n, typename I> typedef value mln::value::stack_image< n, I >::rvalue

Return type of read-only access.

The rvalue type is not a const reference, since the value type is built on the fly, and return by value (copy).

10.401.2.5 template<unsigned n, typename I> typedef stack_image< n, tag::image_<I> > mln::value::stack_image< n, I >::skeleton

Skeleton.

10.401.2.6 template<unsigned n, typename I> typedef algebra::vec<n, typename I ::value> mln::value::stack_image< n, I >::value

Value associated type.

10.401.3 Constructor & Destructor Documentation

10.401.3.1 template<unsigned n, typename I> mln::value::stack_image< n, I >::stack_image (const algebra::vec< n, I > & *imas*) [inline]

Constructors.

10.401.4 Member Function Documentation

10.401.4.1 template<unsigned n, typename I> bool mln::value::stack_image< n, I >::is_valid () const [inline]

Test if this image has been initialized.

10.401.4.2 template<unsigned n, typename I> stack_image< n, I >::lvalue mln::value::stack_image< n, I >::operator() (const psite & *p*) [inline]

Read-write access of pixel value at point site `p`.

10.401.4.3 template<unsigned n, typename I> stack_image< n, I >::rvalue mln::value::stack_image< n, I >::operator() (const psite & *p*) const [inline]

Read-only access of pixel value at point site `p`.

10.402 mln::value::super_value< sign > Struct Template Reference

Specializations:.

```
#include <super_value.hh>
```

10.402.1 Detailed Description

template<> struct mln::value::super_value< sign >

Specializations:.

Sign type is a subset of the short value type.

10.403 mln::value::value_array< T, V > Struct Template Reference

Generic array class over indexed by a value set with type T.

`#include <value_array.hh>`

Public Member Functions

- const V & operator() (const T &v) const

  }

- const V & operator[ ] (unsigned i) const

  }

- value_array ()

  Constructors.

- const mln::value::set< T > & vset () const

  }

10.403.1 Detailed Description

template<typename T, typename V> struct mln::value::value_array< T, V >

Generic array class over indexed by a value set with type T.

10.403.2 Constructor & Destructor Documentation

10.403.2.1 template<typename T, typename V> mln::value::value_array< T, V >::value_array () `[inline]`

Constructors.

{

10.403.3 Member Function Documentation

10.403.3.1 template<typename T, typename V> const V & mln::value::value_array< T, V >::operator() (const T & *v*) const `[inline]`

}

Access elements through a value of T. {

10.403.3.2]

template<typename T, typename V> const V & **mln::value::value_array**< T, V >::operator[ ] (unsigned *i*) const `[inline]`

}

Access elements through array indexes. {

10.403.3.3 template<typename T, typename V> const mln::value::set< T > & mln::value::value_array< T, V >::vset () const [inline]

}

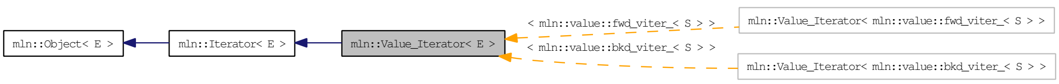
Reference to the set of T.

10.404 mln::Value_Iterator< E > Struct Template Reference

Base class for implementation of classes of iterator on values.

```
#include <value_iterator.hh>
```

Inheritance diagram for mln::Value_Iterator< E >:



Public Member Functions

- void next ()

  Go to the next element.

Related Functions

(Note that these are not member functions.)

- template<typename E>
  std::ostream & operator<< (std::ostream &ostr, const Value_Iterator< E > &v)

  Print an iterator `v` *on value set into the output stream* `ostr`.

10.404.1 Detailed Description

template<typename E> struct mln::Value_Iterator< E >

Base class for implementation of classes of iterator on values.

An iterator on values is an iterator that browse over a set of values.

See also:

mln::doc::Value_Iterator for a complete documentation of this class contents.

10.404.2 Member Function Documentation

10.404.2.1 template<typename E> void mln::Iterator< E >::next () `[inline, inherited]`

Go to the next element.

Warning:

This is a final method; iterator classes should not re-defined this method. The actual "next" operation has to be defined through the *next_* method.

Precondition:

The iterator is valid.

10.404.3 Friends And Related Function Documentation

10.404.3.1 template<typename E> std::ostream & operator<< (std::ostream & *ostr*, const Value_Iterator< E > & *v*) [related]

Print an iterator `v` on value set into the output stream `ostr`.

Parameters:

↔ ***ostr*** An output stream.

← ***v*** An iterator on value set.

Precondition:

`v` is a valid.

Returns:

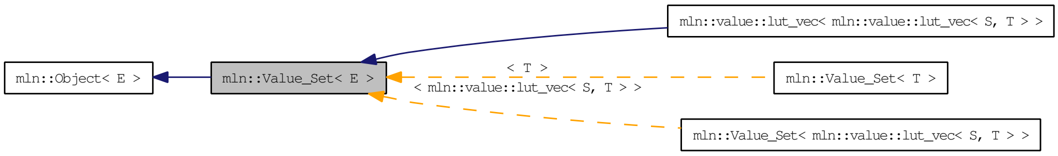
The modified output stream `ostr`.

10.405 mln::Value_Set< E > Struct Template Reference

Base class for implementation classes of sets of values.

`#include <value_set.hh>`

Inheritance diagram for mln::Value_Set< E >:



10.405.1 Detailed Description

template<typename E> struct mln::Value_Set< E >

Base class for implementation classes of sets of values.

See also:

mln::doc::Value_Set for a complete documentation of this class contents.

10.406 mln::Vertex< E > Struct Template Reference

Vertex category flag type.

`#include <vertex.hh>`

10.406.1 Detailed Description

template<typename E> struct mln::Vertex< E >

Vertex category flag type.

10.407 mln::vertex_image< P, V, G > Class Template Reference

Image based on graph vertices.

`#include <vertex_image.hh>`

Inherits mln::pw::internal::image_base< mln::fun::i2v::array< V >, mln::p_vertices< G, mln::internal::vfsite_selector< P, G >::mln::fun::i2v::array >, mln::vertex_image< P, V, G > >.

Public Types

- typedef G graph_t

  The type of the underlying graph.

- typedef vertex_nbh_t nbh_t

  Neighborhood type.

- typedef internal::vfsite_selector< P, G >::site_function_t site_function_t

  Function mapping graph elements to sites.

- typedef vertex_image< tag::psite_< P >, tag::value_< V >, tag::graph_< G > > skeleton

  Skeleton type.

- typedef graph_elt_neighborhood< G, S > vertex_nbh_t

  Vertex Neighborhood type.

- typedef graph_elt_window< G, S > vertex_win_t

  Vertex Window type.

- typedef vertex_win_t win_t

  Window type.

Public Member Functions

- rvalue operator() (unsigned v_id) const

  Value accessors/operators overloads.

- vertex_image ()

  Constructors.

10.407.1 Detailed Description

template<typename P, typename V, typename G = util::graph> class mln::vertex_image< P, V, G >

Image based on graph vertices.

10.407.2 Member Typedef Documentation

10.407.2.1 template<typename P, typename V, typename G = util::graph> typedef G mln::vertex_image< P, V, G >::graph_t

The type of the underlying graph.

10.407.2.2 template<typename P, typename V, typename G = util::graph> typedef vertex_nbh_t mln::vertex_image< P, V, G >::nbh_t

Neighborhood type.

10.407.2.3 template<typename P, typename V, typename G = util::graph> typedef internal::vfsite_selector<P,G>::site_function_t mln::vertex_image< P, V, G >::site_function_t

Function mapping graph elements to sites.

10.407.2.4 template<typename P, typename V, typename G = util::graph> typedef vertex_image< tag::psite_<P>, tag::value_<V>, tag::graph_<G> > mln::vertex_image< P, V, G >::skeleton

Skeleton type.

10.407.2.5 template<typename P, typename V, typename G = util::graph> typedef graph_elt_neighborhood<G,S> mln::vertex_image< P, V, G >::vertex_nbh_t

Vertex Neighborhood type.

10.407.2.6 template<typename P, typename V, typename G = util::graph> typedef graph_elt_window<G,S> mln::vertex_image< P, V, G >::vertex_win_t

Vertex Window type.

10.407.2.7 template<typename P, typename V, typename G = util::graph> typedef vertex_win_t mln::vertex_image< P, V, G >::win_t

Window type.

10.407.3 Constructor & Destructor Documentation

10.407.3.1 template<typename P, typename V, typename G> mln::vertex_image< P, V, G >::vertex_image () [inline]

Constructors.

10.407.4 Member Function Documentation

10.407.4.1 template<typename P, typename V, typename G> vertex_image< P, V, G >::rvalue mln::vertex_image< P, V, G >::operator() (unsigned *v_id*) const [inline]

Value accessors/operators overloads.

10.408 mln::violent_cast_image< T, I > Struct Template Reference

Violently cast image values to a given type.

`#include <violent_cast_image.hh>`

Inherits mln::internal::image_value_morpher< I, T, mln::violent_cast_image< T, I > >.

Public Types

- typedef T lvalue

  Return type of read-write access.

- typedef T rvalue

  Return type of read-only access.

- typedef violent_cast_image< tag::value_< T >, tag::image_< I > > skeleton

  Skeleton.

- typedef T value

  Value associated type.

Public Member Functions

- T operator() (const typename I::psite &p)

  Mutable access is only OK for reading (not writing).

- T operator() (const typename I::psite &p) const

  Read-only access of pixel value at point site p.

- violent_cast_image (const Image< I > &ima)

  Constructor.

10.408.1 Detailed Description

template<typename T, typename I> struct mln::violent_cast_image< T, I >

Violently cast image values to a given type.

10.408.2 Member Typedef Documentation

10.408.2.1 template<typename T, typename I> typedef T mln::violent_cast_image< T, I >::lvalue

Return type of read-write access.

10.408.2.2 template<typename T, typename I> typedef T mln::violent_cast_image< T, I >::rvalue

Return type of read-only access.

10.408.2.3 template<typename T, typename I> typedef violent_cast_image< tag::value_<T>, tag::image_<I> > mln::violent_cast_image< T, I >::skeleton

Skeleton.

10.408.2.4 template<typename T, typename I> typedef T mln::violent_cast_image< T, I >::value

Value associated type.

10.408.3 Constructor & Destructor Documentation

10.408.3.1 template<typename T, typename I> mln::violent_cast_image< T, I >::violent_cast_image (const Image< I > & *ima*) `[inline]`

Constructor.

10.408.4 Member Function Documentation

10.408.4.1 template<typename T, typename I> T mln::violent_cast_image< T, I >::operator() (const typename I::psite & *p*) `[inline]`

Mutable access is only OK for reading (not writing).

10.408.4.2 template<typename T, typename I> T mln::violent_cast_image< T, I >::operator() (const typename I::psite & *p*) const `[inline]`

Read-only access of pixel value at point site `p`.

10.409 mln::w_window< D, W > Struct Template Reference

Generic w_window class.

`#include <w_window.hh>`

Inherits mln::internal::weighted_window_base< mln::window< D >, mln::w_window< D, W > >.

Public Types

- typedef with_w_< dpsites_bkd_piter< w_window< D, W > >, W > bkd_qiter
  Site_Iterator type to browse (backward) the points of a generic w_window.
- typedef D dpsite
  Dpsite associated type.
- typedef with_w_< dpsites_fwd_piter< w_window< D, W > >, W > fwd_qiter
  Site_Iterator type to browse (forward) the points of a generic w_window.
- typedef W weight
  Weight associated type.

Public Member Functions

- void clear ()
  Clear this window.
- w_window< D, W > & insert (const W &w, const D &d)
  Insert a couple of weight `w` *and delta-point* `d`*.*
- bool is_symmetric () const
  Test if the window is symmetric.
- const std::vector< D > & std_vector () const
  Give access to the vector of delta-points.
- void sym ()
  Apply a central symmetry to the window.
- W w (unsigned i) const
  Give the `i-th` *weight.*
- w_window ()
  Constructor without argument.
- const std::vector< W > & weights () const
  Give access to the vector of weights.
- const mln::window< D > & win () const
  Give the corresponding window.

Related Functions

(Note that these are not member functions.)

- template<typename W>
  W operator- (const Weighted_Window< W > &rhs)

  Compute the symmetrical weighted window of `rhs`.

- template<typename D, typename W>
  std::ostream & operator<< (std::ostream &ostr, const w_window< D, W > &w_win)

  Print a weighted window `w_win` *into an output stream* `ostr`.

- template<typename D, typename Wl, typename Wr>
  bool operator== (const w_window< D, Wl > &lhs, const w_window< D, Wr > &rhs)

  Equality test between two weighted windows `lhs` *and* `rhs`.

10.409.1 Detailed Description

template<typename D, typename W> struct mln::w_window< D, W >

Generic w_window class.

This type of w_window is just like a set of delta-points. The parameter `D` is the type of delta-points; the parameter `W` is the type of weights.

10.409.2 Member Typedef Documentation

10.409.2.1 template<typename D, typename W> typedef with_w_< dpsites_bkd_piter< w_window<D, W> >, W > mln::w_window< D, W >::bkd_qiter

Site_Iterator type to browse (backward) the points of a generic w_window.

10.409.2.2 template<typename D, typename W> typedef D mln::w_window< D, W >::dpsite

Dpsite associated type.

10.409.2.3 template<typename D, typename W> typedef with_w_< dpsites_fwd_piter< w_window<D, W> >, W > mln::w_window< D, W >::fwd_qiter

Site_Iterator type to browse (forward) the points of a generic w_window.

10.409.2.4 template<typename D, typename W> typedef W mln::w_window< D, W >::weight

Weight associated type.

10.409.3 Constructor & Destructor Documentation

10.409.3.1 template<typename D, typename W> mln::w_window< D, W >::w_window () [inline]

Constructor without argument.

10.409.4 Member Function Documentation

10.409.4.1 template<typename D, typename W> void mln::w_window< D, W >::clear () [inline]

Clear this window.

References mln::w_window< D, W >::clear().

Referenced by mln::w_window< D, W >::clear().

10.409.4.2 template<typename D, typename W> w_window< D, W > & mln::w_window< D, W >::insert (const W & *w*, const D & *d*) [inline]

Insert a couple of weight `w` and delta-point `d`.

Referenced by mln::w_window< D, W >::sym(), mln::make::w_window(), mln::make::w_window1d(), mln::make::w_window3d(), and mln::make::w_window_directional().

10.409.4.3 template<typename D, typename W> bool mln::w_window< D, W >::is_symmetric () const [inline]

Test if the window is symmetric.

References mln::w_window< D, W >::sym().

10.409.4.4 template<typename D, typename W> const std::vector< D > & mln::w_window< D, W >::std_vector () const [inline]

Give access to the vector of delta-points.

10.409.4.5 template<typename D, typename W> void mln::w_window< D, W >::sym () [inline]

Apply a central symmetry to the window.

References mln::w_window< D, W >::insert().

Referenced by mln::w_window< D, W >::is_symmetric().

10.409.4.6 template<typename D, typename W> W mln::w_window< D, W >::w (unsigned *i*) const [inline]

Give the `i-th` weight.

10.409.4.7 template<typename D, typename W> const std::vector< W > & mln::w_window< D, W >::weights () const [inline]

Give access to the vector of weights.

Referenced by mln::w_window< D, W >::operator==().

10.409.4.8 template<typename D, typename W> const mln::window< D > & mln::w_window< D, W >::win () const [inline]

Give the corresponding window.

Referenced by mln::w_window< D, W >::operator==().

10.409.5 Friends And Related Function Documentation

10.409.5.1 template<typename W> W operator- (const Weighted_Window< W > & *rhs*) [related, inherited]

Compute the symmetrical weighted window of `rhs`.

10.409.5.2 template<typename D, typename W> std::ostream & operator<< (std::ostream & *ostr*, const w_window< D, W > & *w_win*) [related]

Print a weighted window `w_win` into an output stream `ostr`.

10.409.5.3 template<typename D, typename Wl, typename Wr> bool operator== (const w_window< D, Wl > & *lhs*, const w_window< D, Wr > & *rhs*) [related]

Equality test between two weighted windows `lhs` and `rhs`.

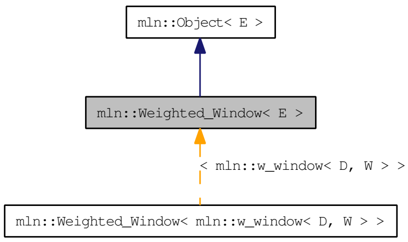
References mln::w_window< D, W >::weights(), and mln::w_window< D, W >::win().

10.410 mln::Weighted_Window< E > Struct Template Reference

Base class for implementation classes that are weighted_windows.

```
#include <weighted_window.hh>
```

Inheritance diagram for mln::Weighted_Window< E >:



Related Functions

(Note that these are not member functions.)

- template<typename W>
  W operator- (const Weighted_Window< W > &rhs)
  Compute the symmetrical weighted window of `rhs`.

10.410.1 Detailed Description

template<typename E> struct mln::Weighted_Window< E >

Base class for implementation classes that are weighted_windows.

See also:

mln::doc::Weighted_Window for a complete documentation of this class contents.

10.410.2 Friends And Related Function Documentation

10.410.2.1 template<typename W> W operator- (const Weighted_Window< W > & *rhs*) `[related]`

Compute the symmetrical weighted window of `rhs`.

10.411 mln::win::backdiag2d Struct Reference

Diagonal line window defined on the 2D square grid.

`#include <backdiag2d.hh>`

Inherits mln::internal::classical_window_base< mln::dpoint, mln::win::backdiag2d >.

Public Member Functions

- backdiag2d (unsigned length)
  Constructor.
- unsigned length () const
  Give the diagonal length, that is, its width.

10.411.1 Detailed Description

Diagonal line window defined on the 2D square grid.

An backdiag2d is centered and symmetric. its width (length) is odd.

For instance:

```
*  o
*    o
*      x
*        o
*          o
*
```

is defined with length = 5.

10.411.2 Constructor & Destructor Documentation

10.411.2.1 mln::win::backdiag2d::backdiag2d (unsigned *length*) `[inline]`

Constructor.

Parameters:

← ***length*** Length, thus width, of the diagonal line.

Precondition:

`length` is odd.

10.411.3 Member Function Documentation

10.411.3.1 unsigned mln::win::backdiag2d::length () const `[inline]`

Give the diagonal length, that is, its width.

10.412 mln::win::ball< G, C > Struct Template Reference

Generic ball window defined on a given grid.

`#include <ball.hh>`

Inherits mln::internal::classical_window_base< mln::dpoint< G, C >, mln::win::ball< G, C > >.

Public Member Functions

- ball (unsigned diameter)

  Constructor.

- unsigned diameter () const

  Give the ball diameter.

10.412.1 Detailed Description

template<typename G, typename C> struct mln::win::ball< G, C >

Generic ball window defined on a given grid.

A ball is centered and symmetric; so its diameter is odd.

G is the given grid on which the ball is defined and C is the type of coordinates.

10.412.2 Constructor & Destructor Documentation

10.412.2.1 template<typename G, typename C> mln::win::ball< G, C >::ball (unsigned *diameter*) `[inline]`

Constructor.

Parameters:

← ***diameter*** Diameter of the ball.

Precondition:

`diameter` is odd.

References mln::literal::origin.

10.412.3 Member Function Documentation

10.412.3.1 template<typename G, typename C> unsigned mln::win::ball< G, C >::diameter () const `[inline]`

Give the ball diameter.

10.413 mln::win::cube3d Struct Reference

Cube window defined on the 3D grid.

`#include <cube3d.hh>`

Inherits mln::internal::classical_window_base< mln::dpoint, mln::win::cube3d >.

Public Member Functions

- cube3d (unsigned length)

  Constructor.

- unsigned length () const

  Give the cube length, that is, its height.

10.413.1 Detailed Description

Cube window defined on the 3D grid.

An cube3d is centered and symmetric; so its height (length) is odd.

For instance:

```
*    o o o
*   o o o
*  o o o

*    o o o
*   o x o
*  o o o

*    o o o
*   o o o
*  o o o
*
```

is defined with length = 3.

10.413.2 Constructor & Destructor Documentation

10.413.2.1 mln::win::cube3d::cube3d (unsigned *length*) `[inline]`

Constructor.

Parameters:

← ***length*** Length, thus height, of the cube3d.

Precondition:

`length` is odd.

10.413.3 Member Function Documentation

10.413.3.1 unsigned mln::win::cube3d::length () const [inline]

Give the cube length, that is, its height.

10.414 mln::win::cuboid3d Struct Reference

Cuboid defined on the 3-D square grid.

`#include <cuboid3d.hh>`

Inherits mln::internal::classical_window_base< mln::dpoint, mln::win::cuboid3d >.

Public Member Functions

- cuboid3d (unsigned depth, unsigned height, unsigned width)
  Constructor.
- unsigned volume () const
  Return the volume of the cuboid.

  - unsigned depth () const
    Accessors.
  - unsigned height () const
    Return the height of the cuboid.
  - unsigned width () const
    Return the width of the cuboid.

10.414.1 Detailed Description

Cuboid defined on the 3-D square grid.

A cuboid3d is a 3-D window with cuboid (also known as rectangular prism or rectangular parallelepiped) shape. It is centered and symmetric.

For instance:

```
    o o o o o o o
   o o o o o o o
  o o o o o o o
 o o o o o o o
o o o o o o o

    o o o o o o o
   o o o o o o o
  o o o x o o o
 o o o o o o o
o o o o o o o

    o o o o o o o
   o o o o o o o
  o o o o o o o
 o o o o o o o
o o o o o o o
```

is defined with depth = 3, height = 5 and width = 7.

Reference: http://en.wikipedia.org/wiki/Cuboid

10.414.2 Constructor & Destructor Documentation

10.414.2.1 mln::win::cuboid3d::cuboid3d (unsigned *depth*, unsigned *height*, unsigned *width*) [inline]

Constructor.

Parameters:

← ***depth*** The depth of the cuboid3d.

← ***height*** The height of the cuboid3d.

← ***width*** The width of the cuboid3d.

Precondition:

Argument *depth*, *height* and *width* must be odd.

10.414.3 Member Function Documentation

10.414.3.1 unsigned mln::win::cuboid3d::depth () const [inline]

Accessors.

Return the depth of the cuboid.

10.414.3.2 unsigned mln::win::cuboid3d::height () const [inline]

Return the height of the cuboid.

10.414.3.3 unsigned mln::win::cuboid3d::volume () const [inline]

Return the volume of the cuboid.

10.414.3.4 unsigned mln::win::cuboid3d::width () const [inline]

Return the width of the cuboid.

10.415 mln::win::diag2d Struct Reference

Diagonal line window defined on the 2D square grid.

`#include <diag2d.hh>`

Inherits mln::internal::classical_window_base< mln::dpoint, mln::win::diag2d >.

Public Member Functions

- diag2d (unsigned length)
  Constructor.
- unsigned length () const
  Give the diagonal length, that is, its width.

10.415.1 Detailed Description

Diagonal line window defined on the 2D square grid.

An diag2d is centered and symmetric. its width (length) is odd.

For instance:

```
*           o
*         o
*       x
*     o
*   o
*
```

is defined with length = 5.

10.415.2 Constructor & Destructor Documentation

10.415.2.1 mln::win::diag2d::diag2d (unsigned *length*) [inline]

Constructor.

Parameters:

← ***length*** Length, thus width, of the diagonal line.

Precondition:

`length` is odd.

10.415.3 Member Function Documentation

10.415.3.1 unsigned mln::win::diag2d::length () const [inline]

Give the diagonal length, that is, its width.

10.416 mln::win::line< M, i, C > Struct Template Reference

Generic line window defined on a given grid in the given dimension.

`#include <line.hh>`

Inherits mln::internal::classical_window_base< mln::dpoint< M, C >, mln::win::line< M, i, C > >.

Public Types

- enum

    Direction.

Public Member Functions

- unsigned length () const

    Give the line length.

- line (unsigned length)

    Constructor.

- unsigned size () const

    Give the line size, that is, its length.

10.416.1 Detailed Description

template<typename M, unsigned i, typename C> struct mln::win::line< M, i, C >

Generic line window defined on a given grid in the given dimension.

An line is centered and symmetric; so its length is odd.

M is the given grid on which the line is defined, i is the given dimension of the line end C is the type of the coordinates.

See also:

mln::win::hline2d for an exemple of his use.

10.416.2 Member Enumeration Documentation

10.416.2.1 template<typename M, unsigned i, typename C> anonymous enum

Direction.

10.416.3 Constructor & Destructor Documentation

10.416.3.1 template<typename M, unsigned i, typename C> mln::win::line< M, i, C >::line (unsigned *length*) [inline]

Constructor.

Parameters:

← ***length*** Length of the line.

Precondition:

`length` is odd.

References mln::dpoint< G, C >::set_all().

10.416.4 Member Function Documentation

10.416.4.1 template<typename M, unsigned i, typename C> unsigned mln::win::line< M, i, C >::length () const [inline]

Give the line length.

10.416.4.2 template<typename M, unsigned i, typename C> unsigned mln::win::line< M, i, C >::size () const [inline]

Give the line size, that is, its length.

10.417 mln::win::multiple< W, F > Class Template Reference

Multiple window.

`#include <multiple.hh>`

Inherits mln::internal::window_base< W::dpsite, mln::win::multiple< W, F > >.

10.417.1 Detailed Description

template<typename W, typename F> class mln::win::multiple< W, F >

Multiple window.

10.418 mln::win::multiple_size< n, W, F > Class Template Reference

Definition of a multiple-size window.

`#include <multiple_size.hh>`

Inherits mln::internal::window_base< W::dpsite, mln::win::multiple_size< n, W, F > >.

10.418.1 Detailed Description

template<unsigned n, typename W, typename F> class mln::win::multiple_size< n, W, F >

Definition of a multiple-size window.

10.419 mln::win::octagon2d Struct Reference

Octagon window defined on the 2D square grid.

`#include <octagon2d.hh>`

Inherits mln::internal::classical_window_base< mln::dpoint, mln::win::octagon2d >.

Public Member Functions

- unsigned area () const

  Give the area.

- unsigned length () const

  Give the octagon length, that is, its width.

- octagon2d (unsigned length)

  Constructor.

10.419.1 Detailed Description

Octagon window defined on the 2D square grid.

An octagon2d is centered and symmetric.

The length L of the octagon is such as L = 6 ∗ l + 1 where l >= 0.

For instance:

```
*     o o o
*   o o o o o
* o o o o o o o
* o o o x o o o
* o o o o o o o
*   o o o o o
*     o o o
*
```

is defined with L = 7 (l = 1).

10.419.2 Constructor & Destructor Documentation

10.419.2.1 mln::win::octagon2d::octagon2d (unsigned *length*) `[inline]`

Constructor.

Parameters:

← ***length*** Length, of the octagon.

Precondition:

`length` is such as length = 6∗x + 1 where x >= 0.

10.419.3 Member Function Documentation

10.419.3.1 unsigned mln::win::octagon2d::area () const [inline]

Give the area.

10.419.3.2 unsigned mln::win::octagon2d::length () const [inline]

Give the octagon length, that is, its width.

10.420 mln::win::rectangle2d Struct Reference

Rectangular window defined on the 2D square grid.

`#include <rectangle2d.hh>`

Inherits mln::internal::classical_window_base< mln::dpoint, mln::win::rectangle2d >.

Public Member Functions

- unsigned area () const
  Give the rectangle area.
- unsigned height () const
  Give the rectangle height.
- rectangle2d (unsigned height, unsigned width)
  Constructor.
- const std::vector< dpoint2d > & std_vector () const
  Give the std vector of delta-points.
- unsigned width () const
  Give the rectangle width.

10.420.1 Detailed Description

Rectangular window defined on the 2D square grid.

A rectangle2d is a 2D window with rectangular shape. It is centered and symmetric.

For instance:

```
*   o o o o o
*   o o x o o
*   o o o o o
*
```

is defined with height = 3 and width = 5.

10.420.2 Constructor & Destructor Documentation

10.420.2.1 mln::win::rectangle2d::rectangle2d (unsigned *height*, unsigned *width*) `[inline]`

Constructor.

Parameters:

← ***height*** Height of the rectangle2d.
← ***width*** Width of the rectangle2d.

Precondition:

Height and width are odd.

10.420.3 Member Function Documentation

10.420.3.1 unsigned mln::win::rectangle2d::area () const [inline]

Give the rectangle area.

10.420.3.2 unsigned mln::win::rectangle2d::height () const [inline]

Give the rectangle height.

10.420.3.3 const std::vector< dpoint2d > & mln::win::rectangle2d::std_vector () const [inline]

Give the std vector of delta-points.

10.420.3.4 unsigned mln::win::rectangle2d::width () const [inline]

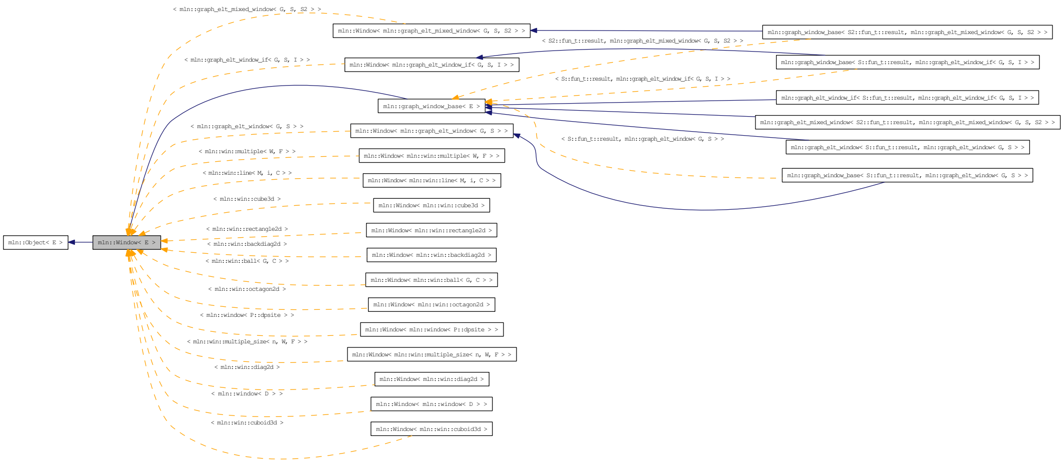
Give the rectangle width.

10.421 mln::Window< E > Struct Template Reference

Base class for implementation classes that are windows.

`#include <window.hh>`

Inheritance diagram for mln::Window< E >:



10.421.1 Detailed Description

template<typename E> struct mln::Window< E >

Base class for implementation classes that are windows.

See also:

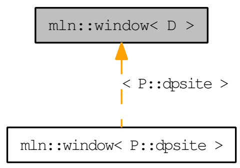
mln::doc::Window for a complete documentation of this class contents.

10.422 mln::window< D > Class Template Reference

Generic window class.

#include <window.hh>

Inheritance diagram for mln::window< D >:



Public Types

- typedef dpsites_bkd_piter< window< D > > bkd_qiter
  Site_Iterator type to browse the points of a basic window w.r.t. the reverse ordering of delta-points.
- typedef dpsites_fwd_piter< window< D > > fwd_qiter
  Site_Iterator type to browse the points of a basic window w.r.t. the ordering of delta-points.
- typedef fwd_qiter qiter
  Site_Iterator type to browse the points of a basic window whatever the ordering of delta-points.
- typedef window< D > regular
  Regular window associated type.

Public Member Functions

- void clear ()
  Clear the window.
- unsigned delta () const
  Give the maximum coordinate gap between the window center and a window point.
- const D & dp (unsigned i) const
  Give the `i-th` *delta-point.*
- bool has (const D &dp) const
  Test if `dp` *is in this window definition.*
- template<typename W>
  window< D > & insert (const Window< W > &win)
  Insert another window `win`.
- window< D > & insert (const D &dp)
  Insert a delta-point `dp`.

- bool is_centered () const

  Test if the window is centered.

- bool is_empty () const

  Test if the window is empty (null size; no delta-point).

- bool is_symmetric () const
- void print (std::ostream &ostr) const

  Print the window definition into `ostr`.

- unsigned size () const

  Give the window size, i.e., the number of delta-sites.

- const std::vector< D > & std_vector () const

  Give the std vector of delta-points.

- void sym ()

  Apply a central symmetry to the target window.

- window ()

  Constructor without argument.

  - window< D > & insert (const typename D::coord &dind)

Related Functions

(Note that these are not member functions.)

- template<typename D>
  bool operator== (const window< D > &lhs, const window< D > &rhs)

  Equality comparison between windows `lhs` *and* `rhs`.

10.422.1 Detailed Description

template<typename D> class mln::window< D >

Generic window class.

This type of window is just like a set of delta-points. The parameter is `D`, type of delta-point.

10.422.2 Member Typedef Documentation

10.422.2.1 template<typename D> typedef dpsites_bkd_piter< window<D> > mln::window< D >::bkd_qiter

Site_Iterator type to browse the points of a basic window w.r.t. the reverse ordering of delta-points.

10.422.2.2 template<typename D> typedef dpsites_fwd_piter< window<D> > mln::window< D >::fwd_qiter

Site_Iterator type to browse the points of a basic window w.r.t. the ordering of delta-points.

10.422.2.3 template<typename D> typedef fwd_qiter mln::window< D >::qiter

Site_Iterator type to browse the points of a basic window whatever the ordering of delta-points.

10.422.2.4 template<typename D> typedef window<D> mln::window< D >::regular

Regular window associated type.

10.422.3 Constructor & Destructor Documentation

10.422.3.1 template<typename D> mln::window< D >::window () `[inline]`

Constructor without argument.

The constructed window is empty.

10.422.4 Member Function Documentation

10.422.4.1 template<typename D> void mln::window< D >::clear () `[inline]`

Clear the window.

10.422.4.2 template<typename D> unsigned mln::window< D >::delta () const `[inline]`

Give the maximum coordinate gap between the window center and a window point.

References mln::window< D >::dp(), and mln::window< D >::size().

10.422.4.3 template<typename D> const D & mln::window< D >::dp (unsigned *i*) const `[inline]`

Give the `i-th` delta-point.

References mln::window< D >::size().

Referenced by mln::window< D >::delta(), and mln::window< D >::insert().

10.422.4.4 template<typename D> bool mln::window< D >::has (const D & *dp*) const `[inline]`

Test if `dp` is in this window definition.

Referenced by mln::window< D >::is_centered().

10.422.4.5 template<typename D> window< D > & mln::window< D >::insert (const typename D::coord & *dind*) [inline]

Insertion of a delta-point with different numbers of arguments (coordinates) w.r.t. the dimension.

References mln::window< D >::dp(), and mln::window< D >::insert().

10.422.4.6 template<typename D> template<typename W> window< D > & mln::window< D >::insert (const Window< W > & *win*) [inline]

Insert another window `win`.

10.422.4.7 template<typename D> window< D > & mln::window< D >::insert (const D & *dp*) [inline]

Insert a delta-point `dp`.

Referenced by mln::c18(), mln::c26(), mln::c4_3d(), mln::c6(), mln::window< D >::insert(), mln::morpho::line_gradient(), mln::window< D >::sym(), mln::convert::to_upper_window(), mln::convert::to_window(), mln::win_c4p(), mln::win_c4p_3d(), mln::win_c8p(), and mln::win_-c8p_3d().

10.422.4.8 template<typename D> bool mln::window< D >::is_centered () const [inline]

Test if the window is centered.

Returns:

True if the delta-point 0 belongs to the window.

References mln::window< D >::has(), and mln::literal::zero.

10.422.4.9 template<typename D> bool mln::window< D >::is_empty () const [inline]

Test if the window is empty (null size; no delta-point).

References mln::window< D >::is_empty().

Referenced by mln::window< D >::is_empty().

10.422.4.10 template<typename D> bool mln::window< D >::is_symmetric () const [inline]

Test if the window is symmetric.

Returns:

True if for every dp of this window, -dp is also in this window.

References mln::window< D >::sym().

10.422.4.11 template<typename D> void mln::window< D >::print (std::ostream & *ostr*) const [inline]

Print the window definition into `ostr`.

10.422.4.12 template<typename D> unsigned mln::window< D >::size () const [inline]

Give the window size, i.e., the number of delta-sites.

Referenced by mln::window< D >::delta(), mln::window< D >::dp(), mln::window< D >::sym(), mln::win_c4p(), mln::win_c4p_3d(), mln::win_c8p(), and mln::win_c8p_3d().

10.422.4.13 template<typename D> const std::vector< D > & mln::window< D >::std_vector () const [inline]

Give the std vector of delta-points.

10.422.4.14 template<typename D> void mln::window< D >::sym () [inline]

Apply a central symmetry to the target window.

References mln::window< D >::insert(), and mln::window< D >::size().

Referenced by mln::window< D >::is_symmetric().

10.422.5 Friends And Related Function Documentation

10.422.5.1 template<typename D> bool operator== (const window< D > & *lhs*, const window< D > & *rhs*) [related]

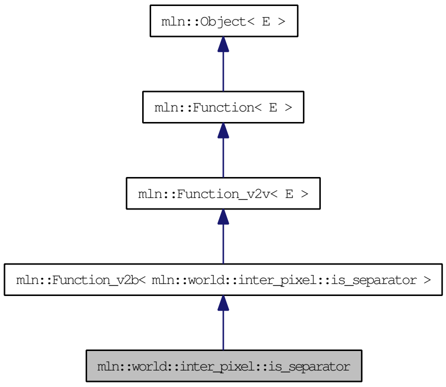
Equality comparison between windows `lhs` and `rhs`.

10.423 mln::world::inter_pixel::is_separator Struct Reference

Functor returning whether a site is a separator in an inter-pixel image.

`#include <is_separator.hh>`

Inheritance diagram for mln::world::inter_pixel::is_separator:



10.423.1 Detailed Description

Functor returning whether a site is a separator in an inter-pixel image.

10.424 trait::graph< I > Struct Template Reference

Graph traits.

```
#include <morpho.hh>
```

10.424.1 Detailed Description

template<typename I> struct trait::graph< I >

Graph traits.

10.425 trait::graph< mln::complex_image< 1, G, V > > Struct Template Reference

Graph traits for 1-complexes images.

```
#include <morpho.hh>
```

10.425.1 Detailed Description

template<typename G, typename V> struct trait::graph< mln::complex_image< 1, G, V > >

Graph traits for 1-complexes images.

10.426 trait::graph< mln::image2d< T > > Struct Template Reference

Graph traits for mln::image2d.

```
#include <morpho.hh>
```

10.426.1 Detailed Description

template<typename T> struct trait::graph< mln::image2d< T > >

Graph traits for mln::image2d.

Index