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Using ITK images with MITK

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Different image representations

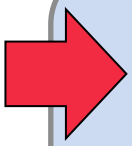
Why do we have different image types?

Library	Task
ITK	3D Image Processing
VTK	Rendering
OpenCV	2D Image Processing

MITK ➔ bridge between different image types
➔ implements additional concepts:
(e.g. for DataManager)

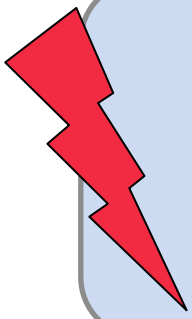
ITK image

- template<class TPixel, unsigned int VImageDimension = 2>
  class itk::Image< TPixel, VImageDimension >



The image type is templated:

We need to know
pixel type and image dimension
at compile time



We usually do NOT know them at compile time:

The bridge to ITK compiles all supported pixel types. At runtime the pixel type is investigated and then the right method/class is called

Image Cast

There are two possible directions:

From ITK to MITK:

- PixelType is already set at compiletime
- MITK can get it by calling mitk::MakePixelType<>()

```
image->Initialize(
  MakePixelType<itk::Image<TPixel,VDimension> >()
);
```

From MITK to ITK:

- PixelType is usually unknown at compiletime
- We need to prepare for several pixel types

→ Multiplexer

Multiplexer

```
#define mitkPixelTypeMultiplex0( function, ptype ) \
{ \
 if ( ptype.GetComponentType() == itk::ImageIOBase::CHAR )\
   function<char>( ptype, );\
 else if ( ptype.GetComponentType() == itk::ImageIOBase::UCHAR)\
   function<unsigned char>( ptype, );\
 else if ( ptype.GetComponentType() == itk::ImageIOBase::SHORT )\
   function<short>( ptype, ); \
 else if ( ptype.GetComponentType() == itk::ImageIOBase::USHORT )\
   function<unsigned short>( ptype, );\
 else if ( ptype.GetComponentType() == itk::ImageIOBase::INT )\
   function<int>( ptype, );\
 else if ( ptype.GetComponentType() == itk::ImageIOBase::UINT )\
   function<unsigned int>( ptype, );\
 else if ( ptype.GetComponentType() == itk::ImageIOBase::LONG )\
   function<long int>( ptype, );\
 else if ( ptype.GetComponentType() == itk::ImageIOBase::ULONG )\
   function<unsigned long int>( ptype, );\
 else if ( ptype.GetComponentType() == itk::ImageIOBase::FLOAT )\
   function<float>( ptype, );\
 else if ( ptype.GetComponentType() == itk::ImageIOBase::DOUBLE )\
   function<double>( ptype, );\
}\
```

ITK → MITK

AccessByItk

- macro that provides a type independent “cast”
- it is necessary to implement a templated method

```
template<TPixel, VImageDimension>
MyAccessMethod(itk::Image<TPixel, VImageDimension>*
itkImage)
{
...
}
```

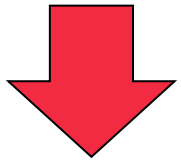
- once the method is defined, the macro can be used:

```
AccessByItk(mitkImage, MyAccessMethod)
```

ITK → MITK

AccessByItk

- If we use the basic macro, we create a lot of code
- `MyAccessMethod` will be compiled for all supported image type



- If we know the image dimension:
  AccessFixedDimensionByItk

- If we know the pixel type:
  AccessFixedTypeByItk

ITK → MITK

If the itk::Image type is known, we can also use:

CastToItkImage (method)

- Casts the pixel type automatically when different

GrabItkImageMemory (method)

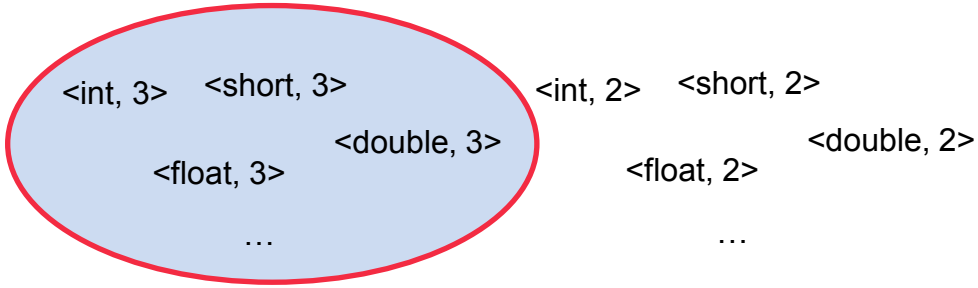
- Lets the mitk::Image manage the itk::Image memory
- Itk::Image remains valid until mitk::Image frees its memory

ImageToItk (filter)

Rules of thumb

- Be aware of the complexity when “casting” to an itk::Image

→ Narrow down possible types and dimensions



- Think about image memory before using macros

→ “Casts” usually do NOT copy image memory for efficiency

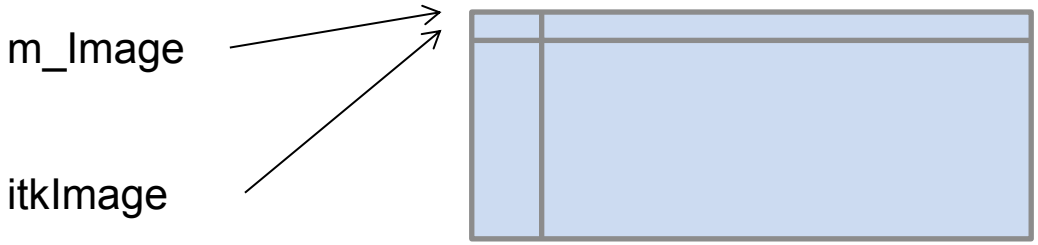
→ Only cast once, mostly there is no reason to cast back

```
CastToItkImage(mitkImage,itkImage);
itkImage->ApplyMagicFilter();
CastToMitkImage(itkImage,mitkImage);
```

Final Slide

- Think about your scope when using AccessByItk

→ The given itk::Image points to the same image memory as your mitk::Image, which could be in your method scope



- More information can be found on:
  http://docs.mitk.org/nightly/group__Adaptor.html#MitkToItk