Slicer3 and the NA-MIC kit

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6TH Annual World Congress for Brain Mapping and Image Guided Therapy

INTERNATIONAL BRAIN MAPPING AND INTRAOPERATIVE SURGICAL PLANNING SOCIETY - IBMISPS
26-29 August, 2009 • Harvard Medical School, Boston, USA

- Operating room of the future
- Image guided therapy
- Radiosurgical planning
- Multi-modality imaging
- Focused ultrasound

Neuroimage
Analysis
Center

The NA-MIC Kit

3D Slicer	VTK	ITK	Nrrd	KWidgets

CMake   CTest   Dart   Batch Make XNAT

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3D Slicer

- Open-source application available for Windows, Linux and Mac

- More than 2.8 million lines of code

- Neuroscience and Image-Guided Therapy

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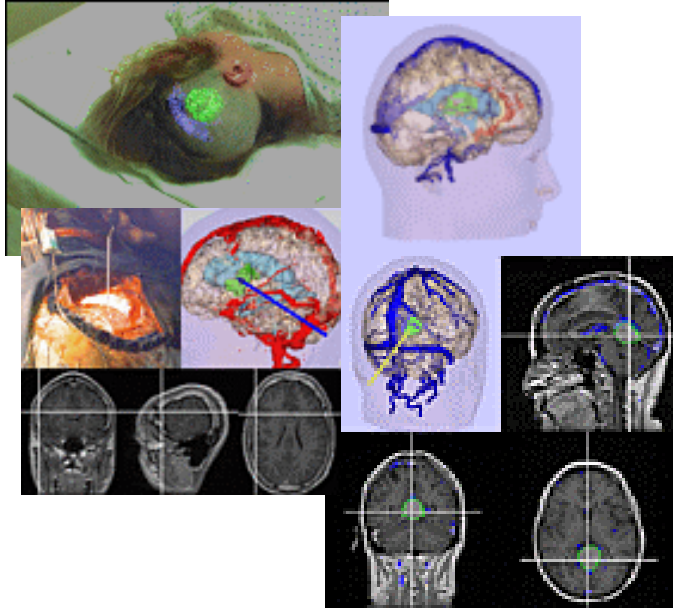
3D Slicer History

Image Courtesy of the CSAIL, MIT

- Started in 1997 between the Surgical Planning Lab (BWH) and the CSAIL (MIT)

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3D Slicer History
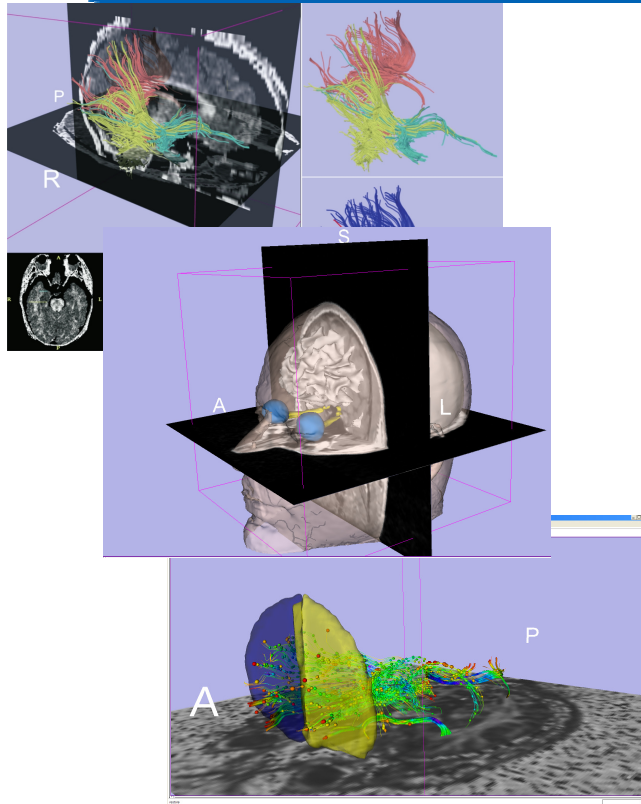
- Started in 1997 between the Surgical Planning Lab (BWH) and the (CSAIL) MIT

- 2009: Multi-institution effort to share the latest advances in image analysis with clinicians and scientists

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3D Slicer Geography
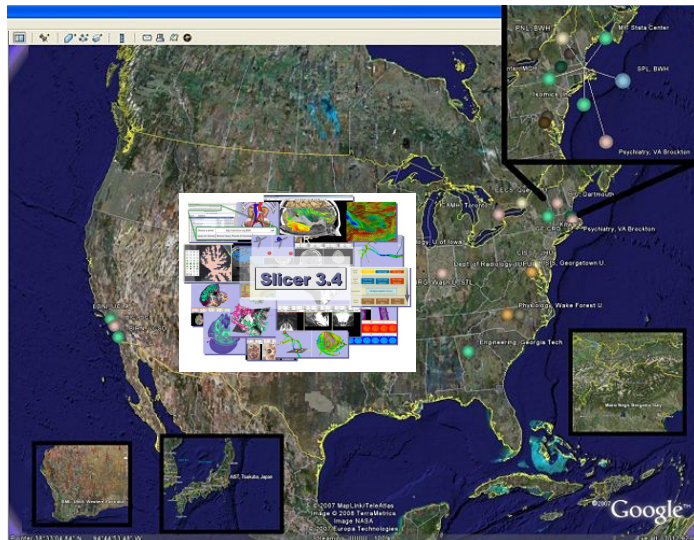
- **Open-source** platform developed on a national scale
- Supported by the **National Institutes of Health** consortia which include
  - National Alliance for Medical Image Computing
  - Neuroimage Analysis Center

  P.I. Prof. Ron Kikinis, MD, Director of the Surgical Planning Lab
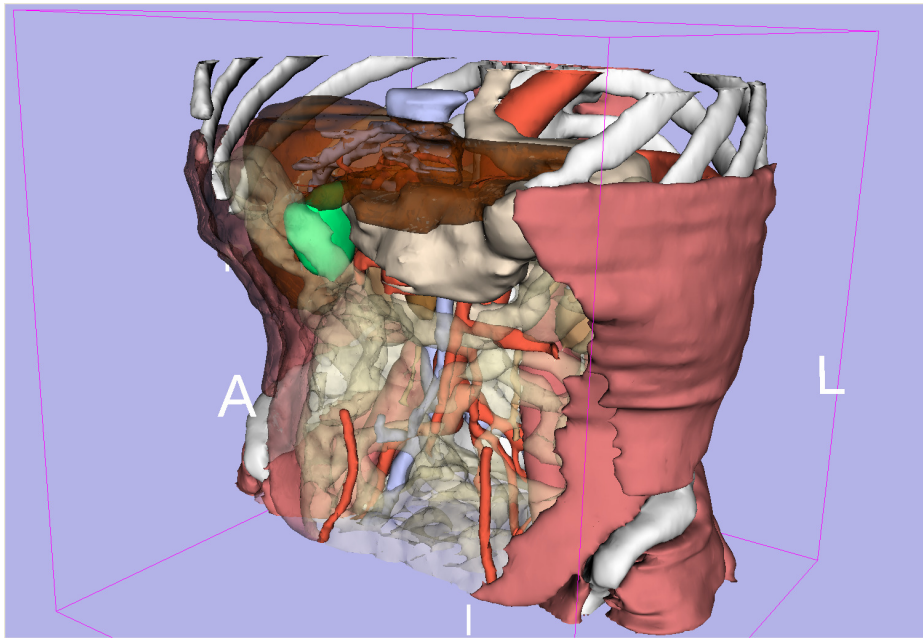
Three ways to use Slicer and the NA-MIC kit

The NA-MIC kit from three user perspectives

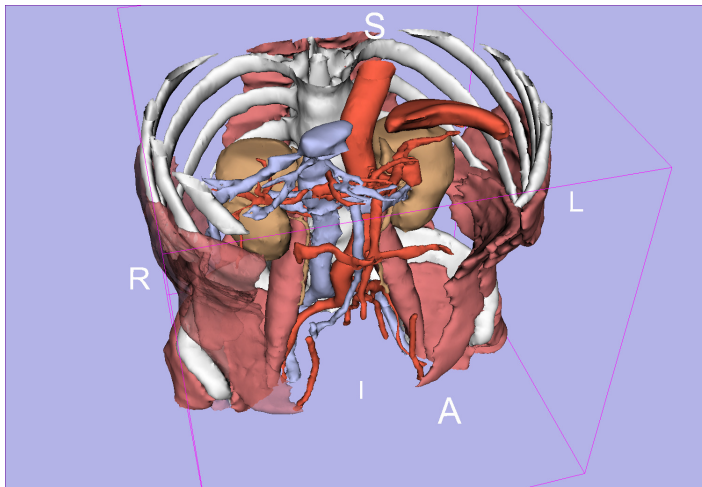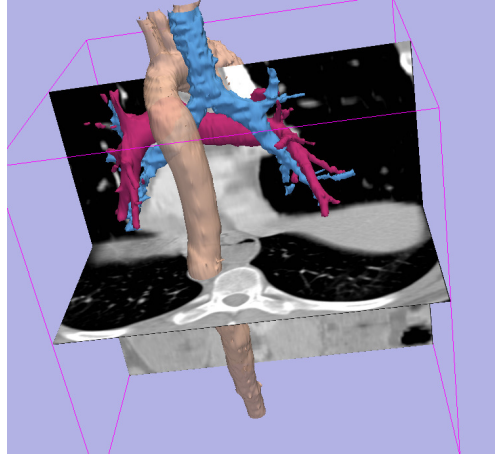- Clinical researchers

- Biomedical engineers

- Algorithm developers

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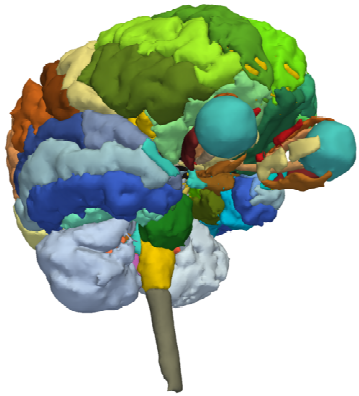*National Alliance for Medical Image Computing – Neuroimage Analysis Center*
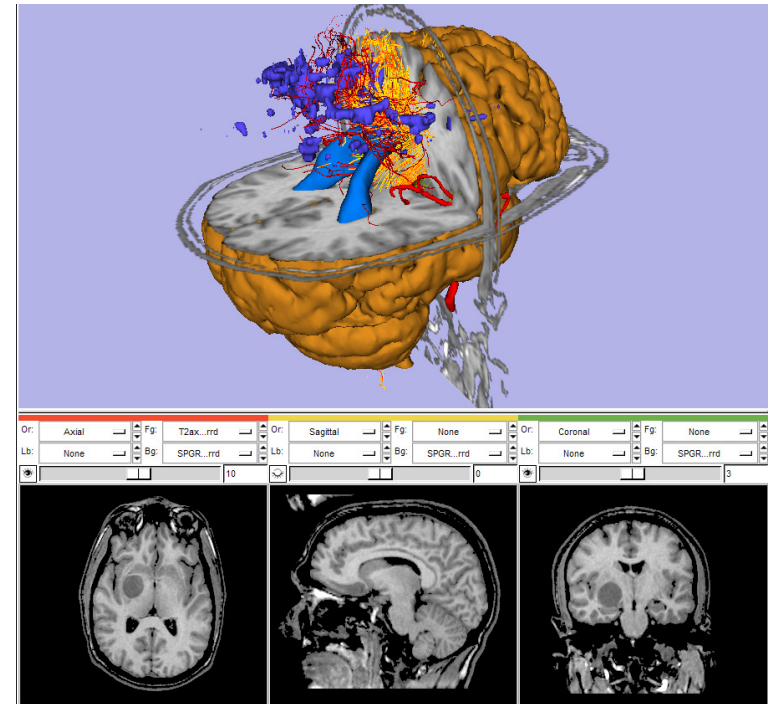
Clinical researchers

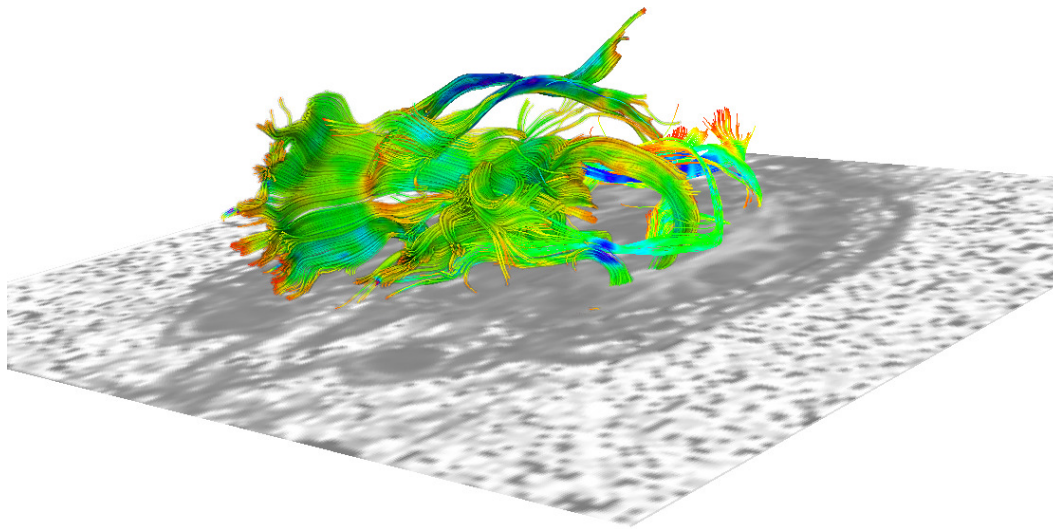**Interact in 3D to enhance data interpretation**

Visualize

- User-driven views of anatomical structures

- Overlay between 2D grey-levels images and 3D anatomical structures

- Intuitive interaction with the 3D models

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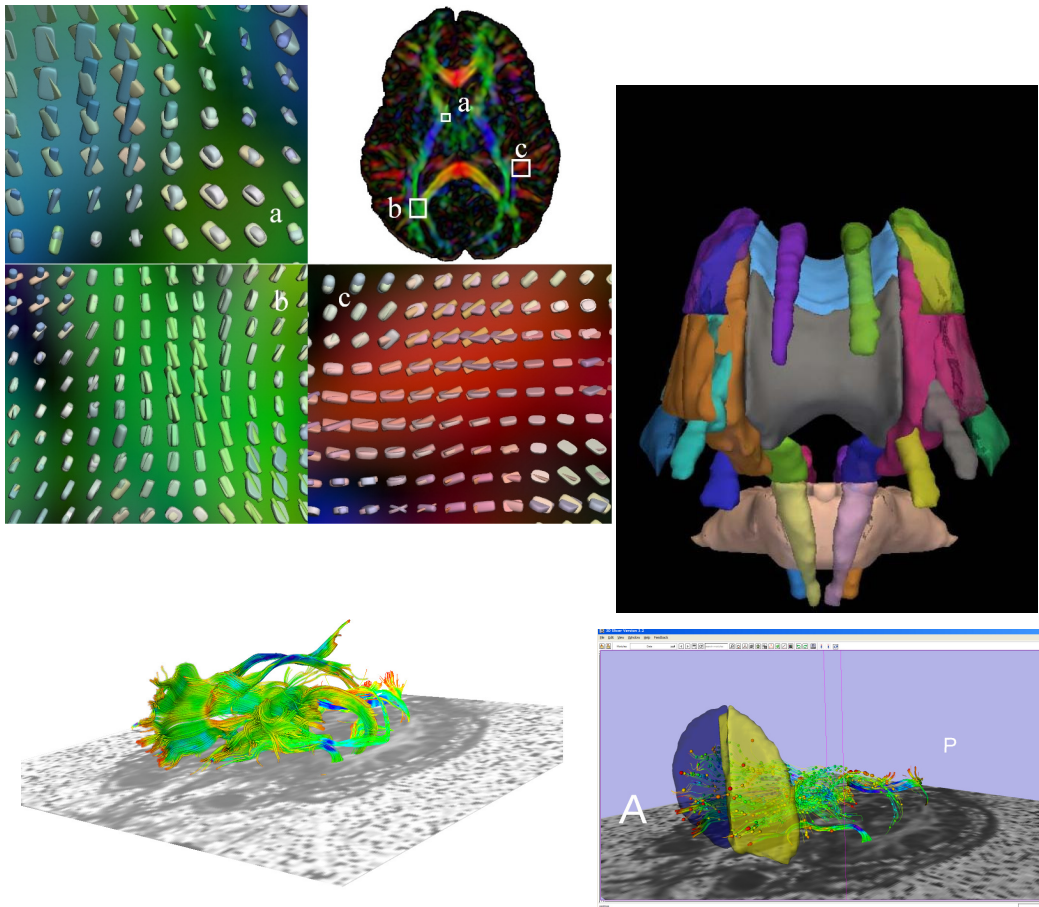*National Alliance for Medical Image Computing – Neuroimage Analysis Center*

Biomedical Engineers

Extract relevant information from complex data

Analyze

- Advanced analysis of complex data

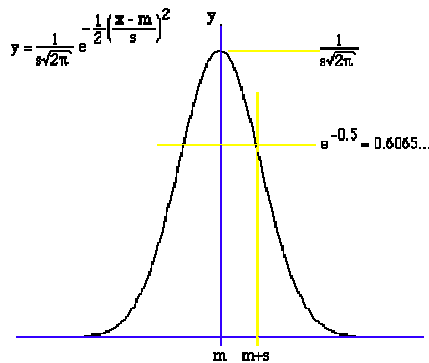- Multimodal data fusion

- Clinical parameters extraction

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Analyze

Statistical Analysis of Anatomy from Medical Images
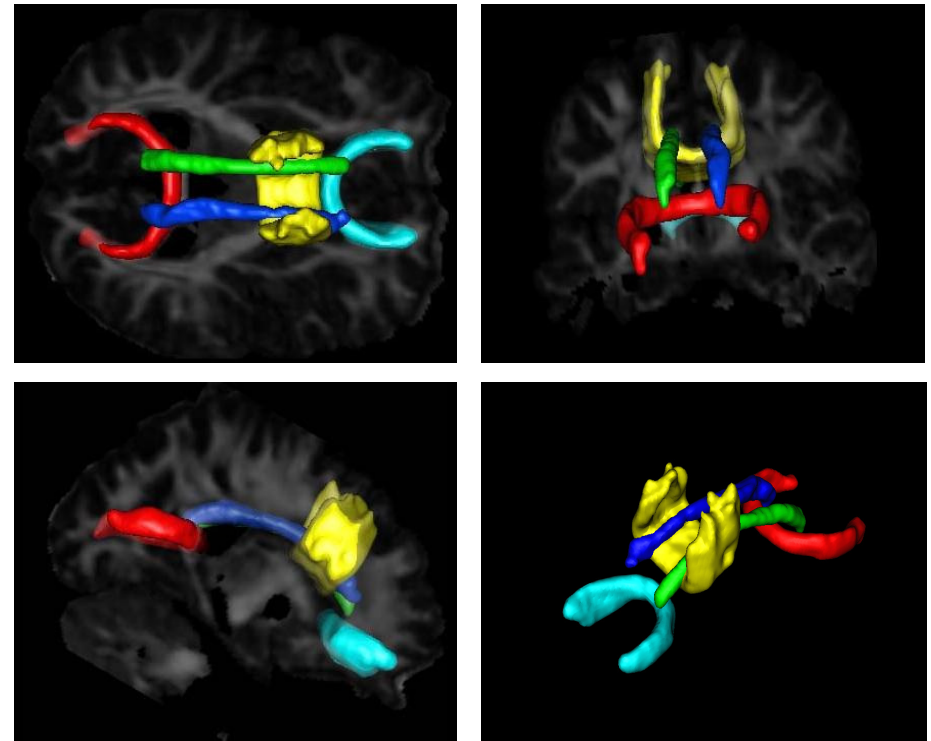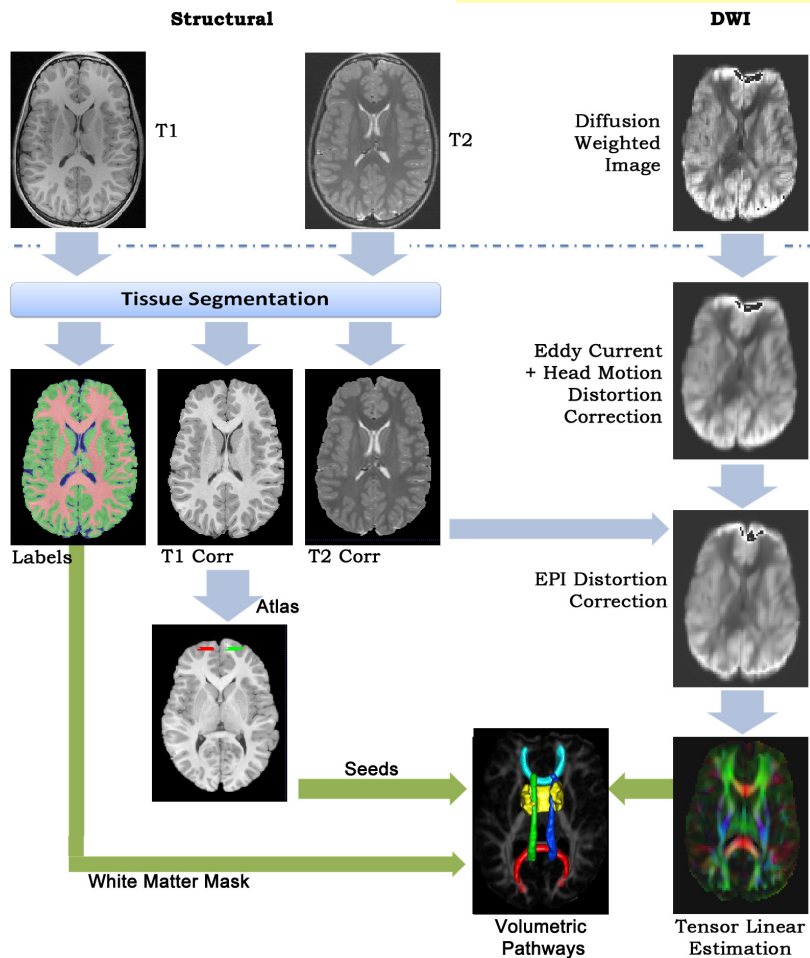
Courtesy of Tom Fletcher, University of Utah.

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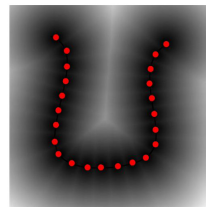National Alliance for Medical Image Computing – Neuroimage Analysis Center

Algorithm Developers

$$\ln p(X \mid \pi, \mu, \Sigma) = \sum_{n=1}^{N} In \left\{ \sum_{k=1}^{K} \pi_k N\left(x_n \mid \mu_k, \Sigma_k\right) \right\}$$
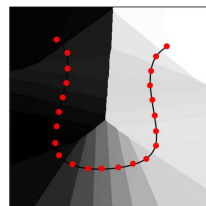
$$p_j^{(k)} = \frac{\sum_{i:D_{ij}=1} W_i^{(k-1)}}{\sum_i W_i^{(k-1)}}$$

$$q_j^{(k)} = \frac{\sum_{i:D_{ij}=0} \left(1 - W_i^{(k-1)}\right)}{\sum_i \left(1 - W_i^{(k-1)}\right)}.$$

(a)

(b)

Develop plug-ins to extend image analysis capabilities

```
#include "itkDiscreteGaussianImageFilter.h"
int main ( int argc, char * argv[])
{
    PARSE_ARGS;
    typedef itk::Image< short, 3 >  ImageType;
    typedef itk::ImageFileReader< ImageType >  ReaderType;
    typedef itk::ImageFileWriter< ImageType >  WriterType;
    ReaderType::Pointer reader = ReaderType::New();
    WriterType::Pointer writer = WriterType::New();
    reader->SetFileName( FilterInputVolume.c_str() );
    writer->SetFileName(FilterOutputVolume.c_str());
    typedef itk::DiscreteGaussianImageFilter <ImageType,  ImageType> FilterType;
    FilterType::Pointer filter = FilterType::New();
```

Create

- Integrate external executables with the Slicer3 platform

- Develop plug-ins in C++, Tcl or Python

- Build upon the NA-MIC kit to meet your scientific goals

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Clinical researchers
Biomedical engineers
Algorithm developers

Translate techniques into skills

Learn

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Conclusion

- An end-user application for image analysis

- An open-source environment for software development

- A technology delivery platform for community breakthroughs

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