*NA-MIC*
*National Alliance for Medical Image Computing*
*http://na-mic.org*

# Three ways to use the NA-MIC kit

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# The NA-MIC Kit

3D Slicer


VTK


ITK


Nrrd


KWidgets


CMake

CTest

Dart


Batch Make


XNAT

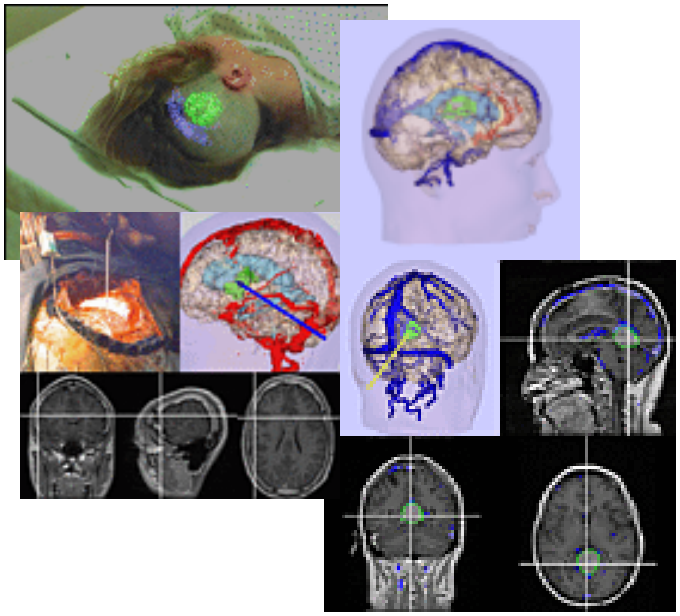
# 3D Slicer

- Open-source application available for Windows, Linux and Mac
- More than 2.8 million lines of code
- Neuroscience and Image-Guided Therapy


Image courtesy of Marianna Jakab, SPL

# 3D Slicer History

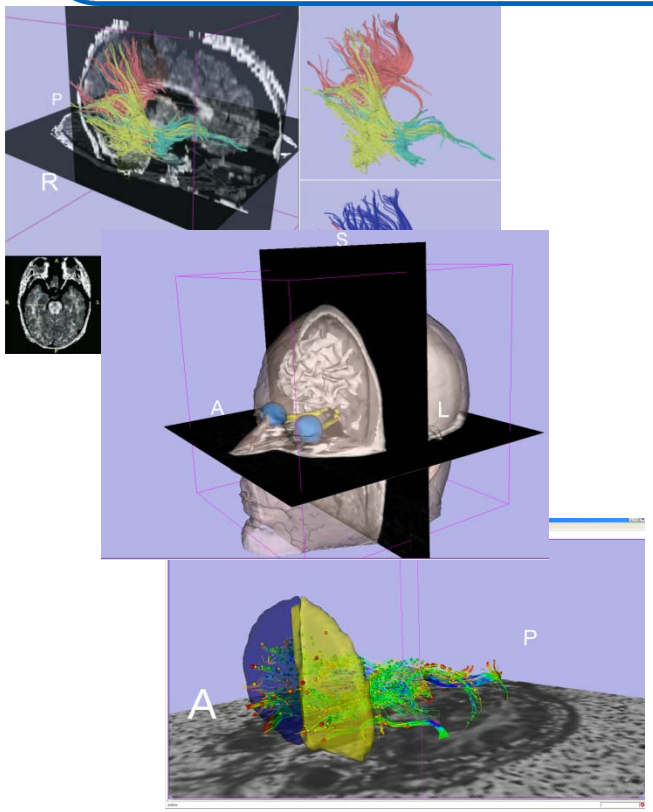


- Started in 1997 between the Surgical Planning Lab (Harvard) and the CSAIL (MIT)

Image Courtesy of the CSAIL, MIT

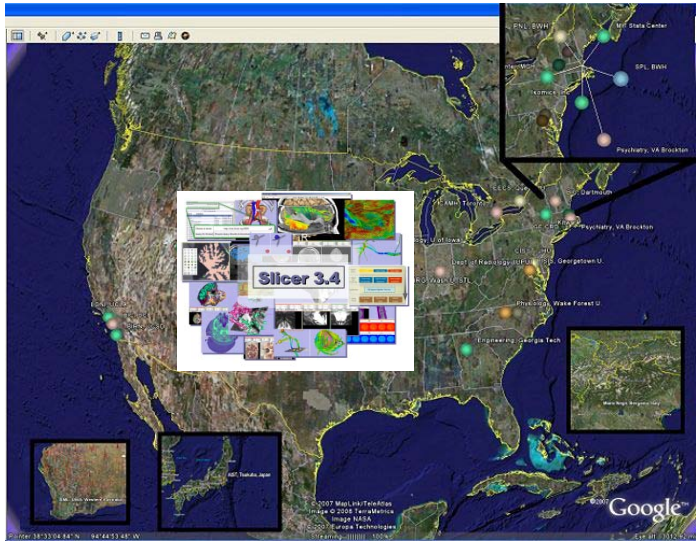
# 3D Slicer History




- Started in 1997 between the Surgical Planning Lab (Harvard) and the (CSAIL) MIT
- 2010: Multi-institution effort to share the latest advances in image analysis with clinicians and scientists

# 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,

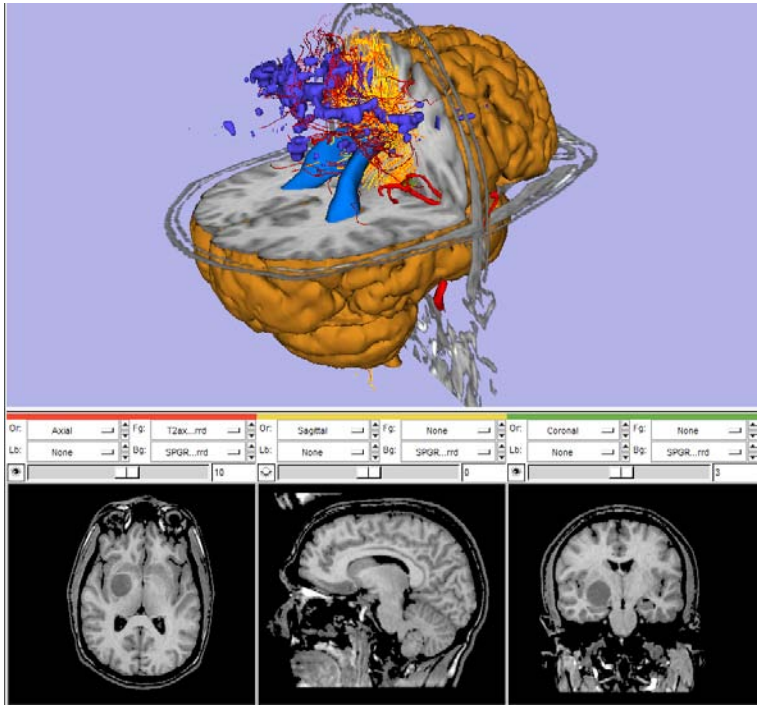
  Director of the Surgical Planning Lab

# *Three ways to use the NA-MIC kit*

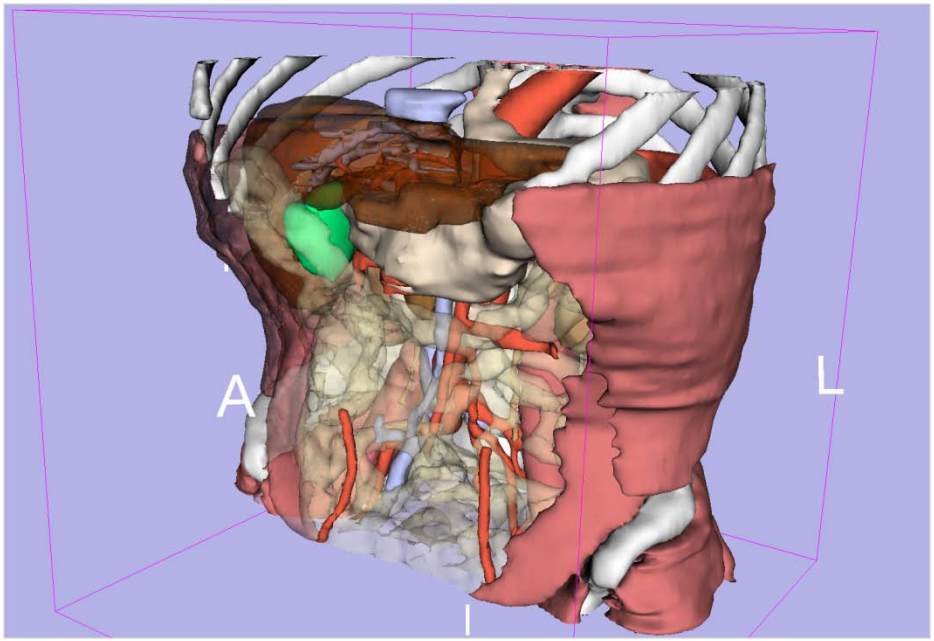
# The NA-MIC kit from three user perspectives

- Clinical researchers
- Biomedical engineers
- Algorithm developers



# *Clinical researchers*




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

# Visualize

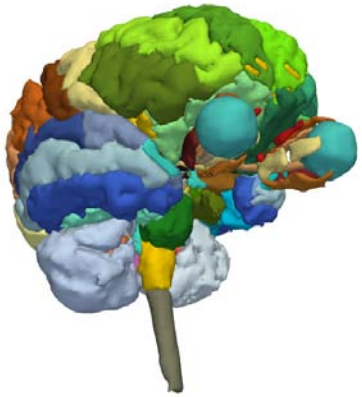
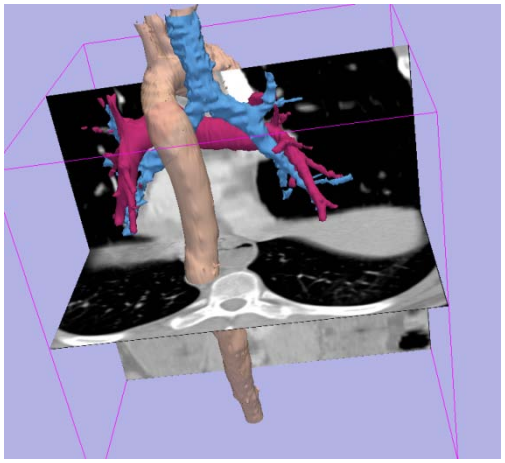
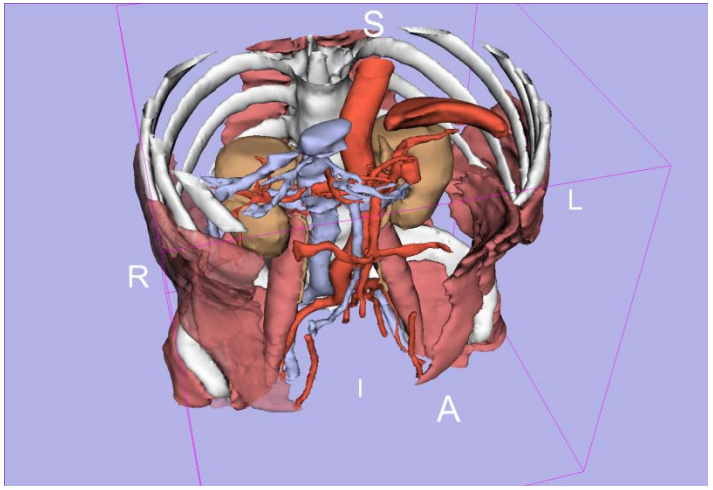


**Image from the SPL-PNL Brain Atlas**
Talos IF, Jakab M, Kikinis R, Shenton ME

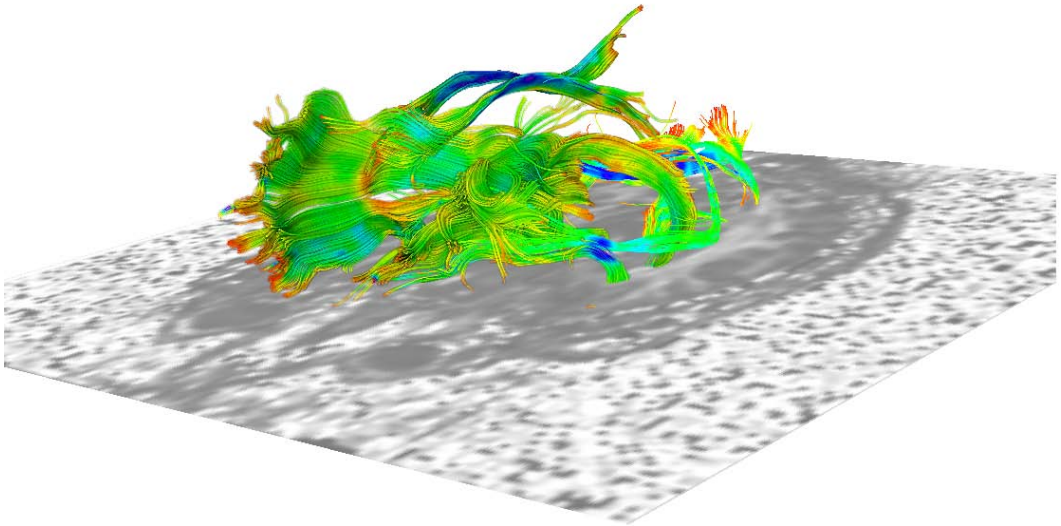





- User-driven views of anatomical structures
- Overlay between 2D grey-levels images and 3D anatomical structures
- Intuitive interaction with the 3D models

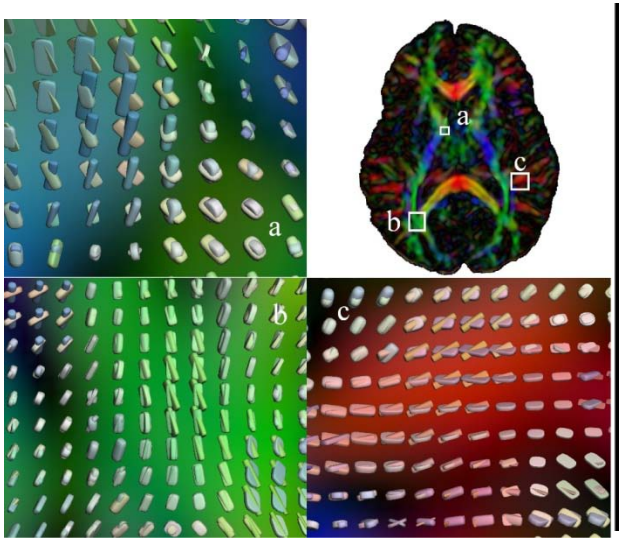
 

*Biomedical Engineers*



***Extract relevant information from complex data***

# Analyze



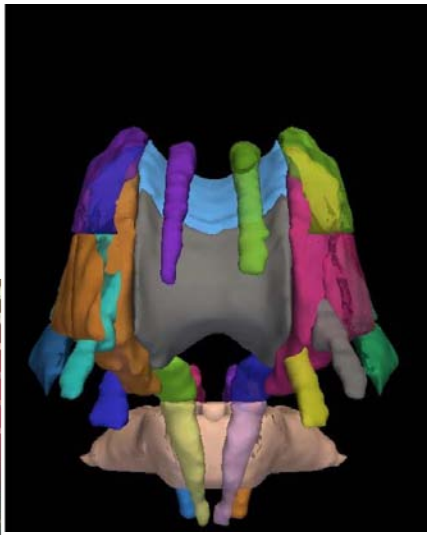
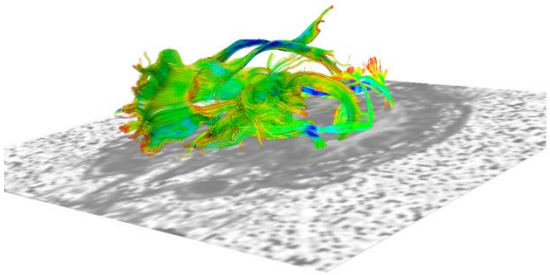
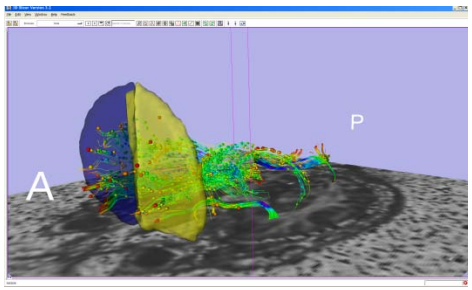



Image courtesy of Mahnaz Maddah, MIT

- Advanced analysis of complex data
- Multimodal data fusion
- Clinical parameters extraction

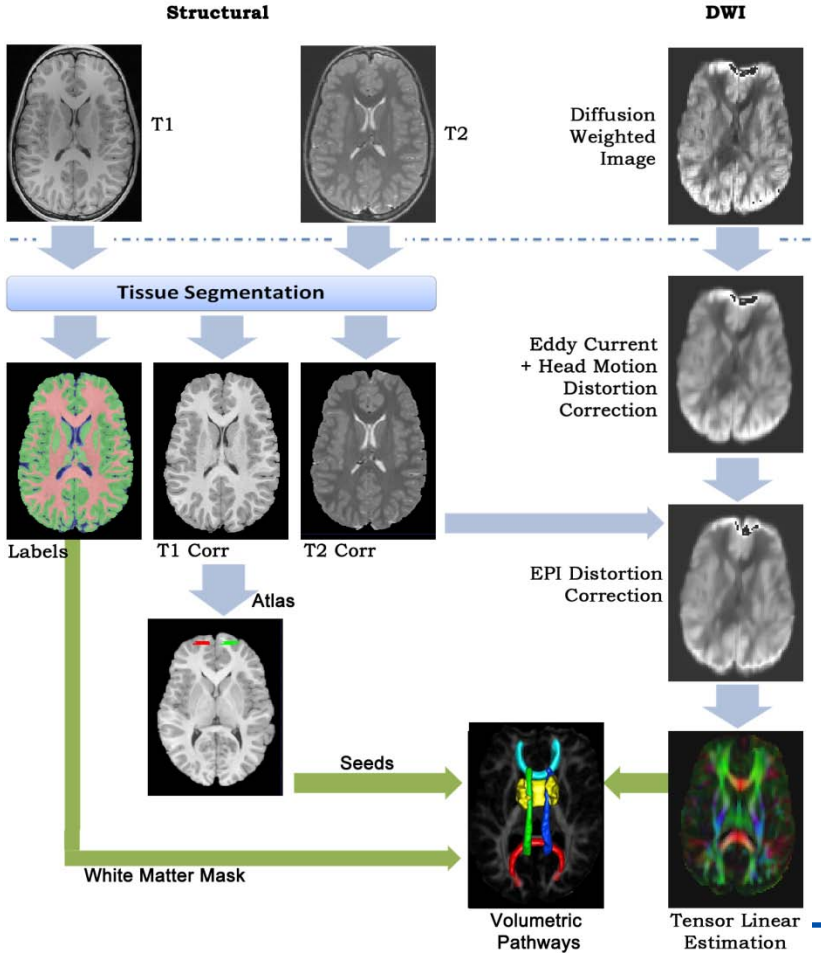


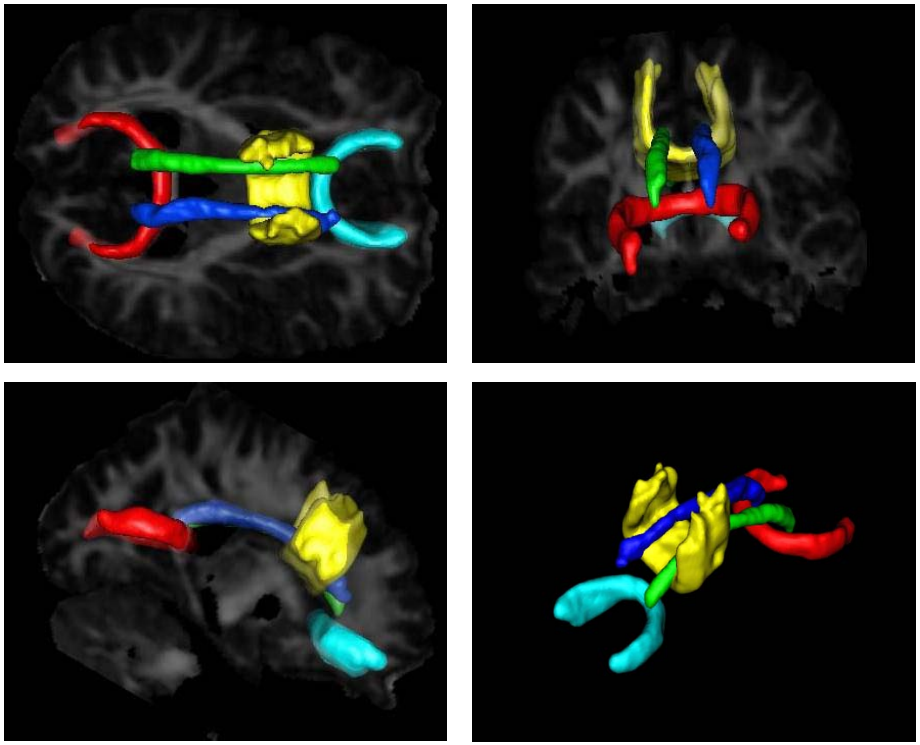


# Analyze

*Statistical Analysis of Anatomy from Medical Images*



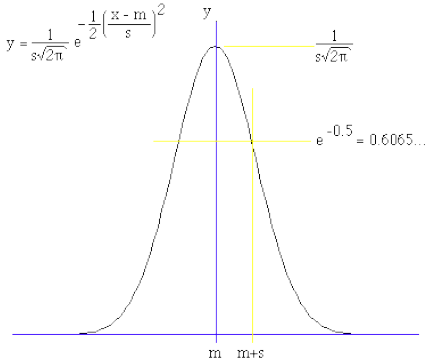



Courtesy of Tom Fletcher, University of Utah.

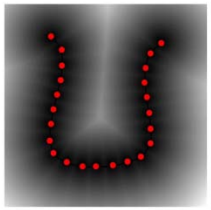
# *Algorithm Developers*

$$\ln p(X \mid \pi, \mu, \Sigma) = \sum_{n=1}^{N} In \{ \sum_{k=1}^{K} \pi_k N\left(x_n \mid \mu_k, \Sigma_k\right) \}$$

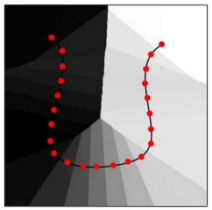



$$p_j^{(k)} = \frac{\sum_{i:D_{ij}=1} W_i^{(k-1)}}{\sum_i W_i^{(k-1)}}$$

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



(a)

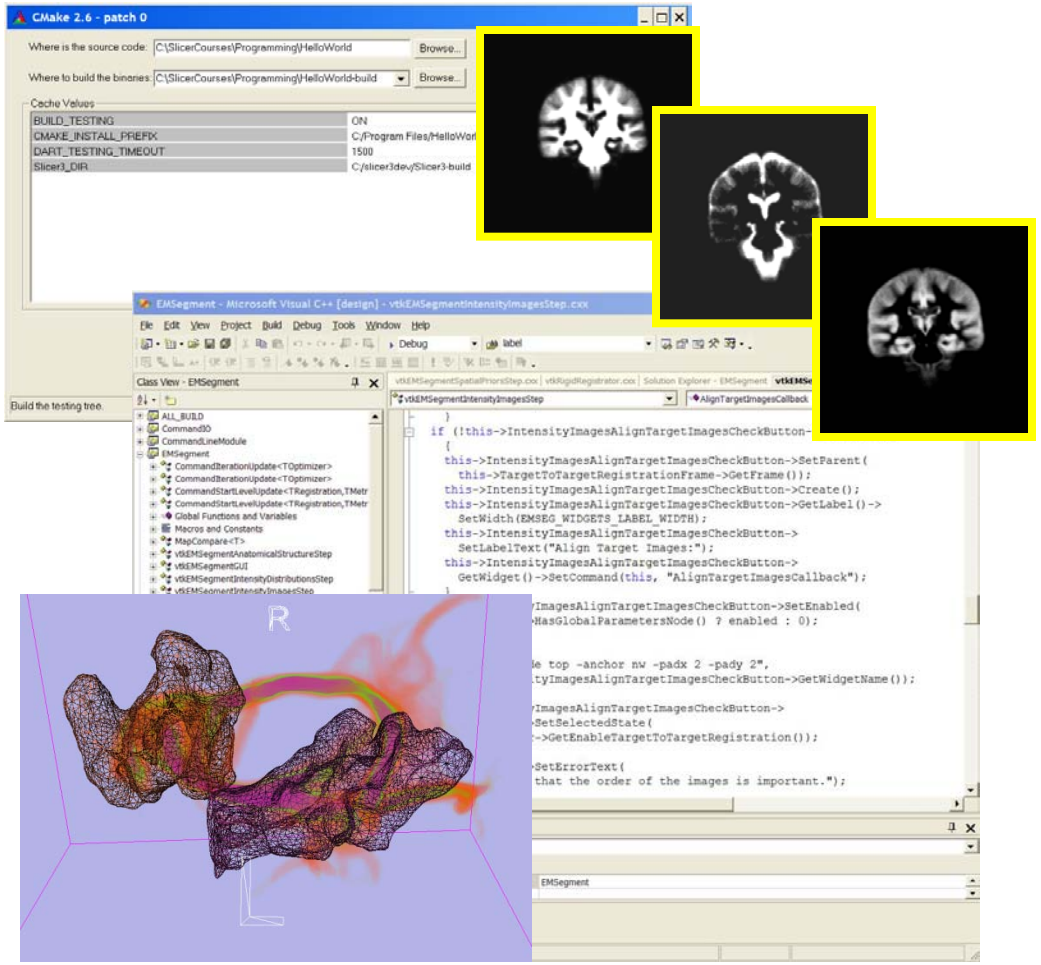


(b)

```
#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();
```

***Develop plug-ins to extend image analysis capabilities***

# 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

*Clinical researchers*
*Biomedical engineers*
*Algorithm developers*

***Translate techniques into skills***

# Learn

## NA-MIC Training Compendium & Workshops

Slicer 3.4 Tutorials

The following table contains "How to" tutorials with matched sample data sets. They demonstrate how to use the 3D Slicer

| Category | Tutorial | Sample |
|---|---|---|
| | | Slicer3M<br>The Slic<br>reconstr |
| | | Slicer3Visualization dataset<br>aset contains two MR scans of the brain, a<br>3D reconstructions of the anatomy. |
| Specialized | 3D Visualization of F<br>The course guides thro<br>reconstruction and parc<br>**Audience**: All users. | |

Leonardo da Vinci (1452-1519), Virgin and Child
Alte Pinakothek, München

3D Visualization

NA-MIC Trainir

Deformable transform

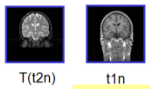

Fixed Image

National Alliance for Medical Image Computing
http://na-mic.org

*EM Pipeline: Patient-Specific Atlas Generation*

Registered Normalized Patient data

Generic atlas





**Atlas to target registrati**
Register the generic atlas to the
create the patient-specific a


Sonia Pujol, Ph.D., Harvard Medical School
National Alliance for Medical Image Computing

*Segmentation Results*

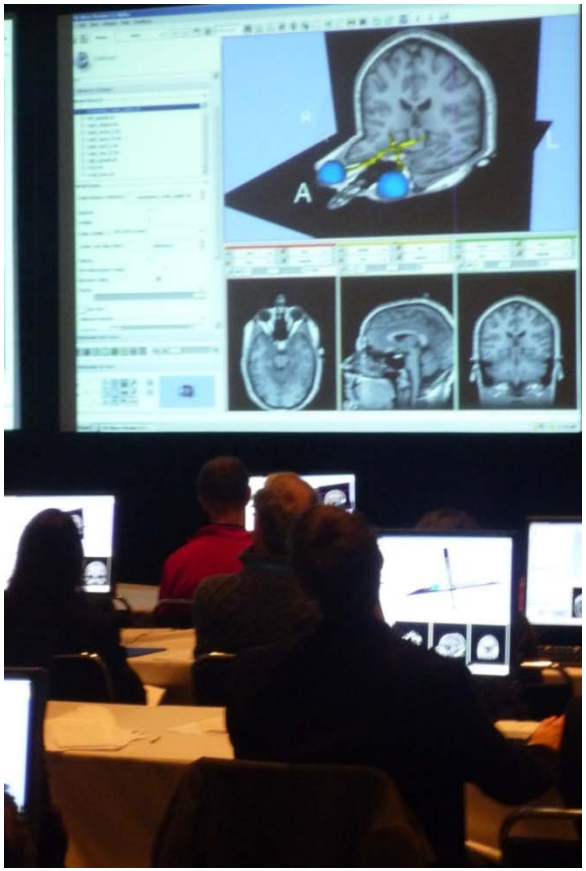
Sonia Pujol, Ph.D., Harvard Medical School
National Alliance for Medical Image Computing

Slicer Tutorial Contest

The following tutorials were part of the Summer 2009 Slicer tutorial contest and Winter 2009 Slicer tutor

| Contest | Tutorial | |
|---|---|---|
| Summer 2009 | Confocal Microscopy (First Prize) | |
| Summer 2009 | ARCTIC: Automatic Regional Cortical ThICkness V2.1 | |
| Summer 2009 | Trans-rectal MR guided prostate biopsy | -- |
| Summer 2009 | Python Stochastic Tractography Module | Stochastic Tractography Data |
| Summer 2009 | White Matter Lesions Segmentation V2.2 | Lesion Segmentation Tutorial Data |

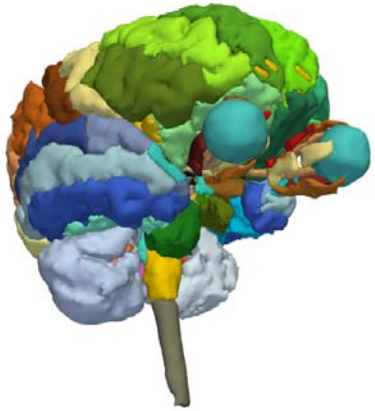
# Slicer3: A Technology Delivery Platform

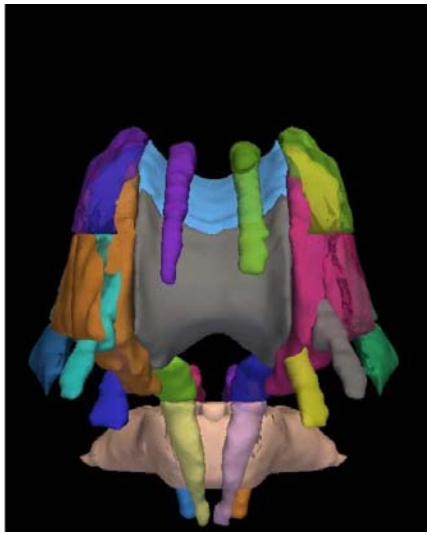


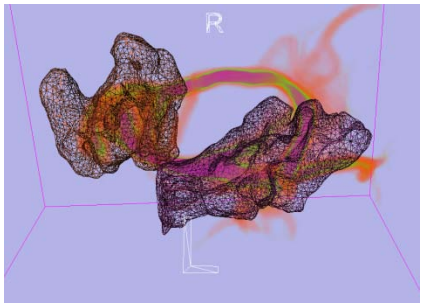
- Integrated solution for delivering technological breakthroughs to the clinical research community
- Practical aspects: Open-source and available on all major computer platforms

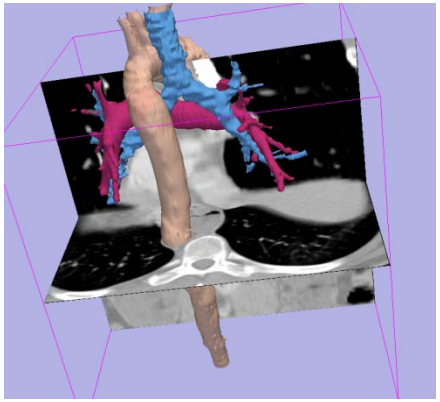
 

# Conclusion









- An end-user application for image analysis
- An open-source environment for software development
- A technology delivery platform for community breakthroughs