Slicer3 and the NA-MIC kit

Sonia Pujol, Ph.D.
Surgical Planning Laboratory
Harvard Medical School
The NA-MIC Kit

3D Slicer

VTK

ITK

Nrrd

KWidgets

CMake

CTest

Dart

Batch Make XNAT

Sonia Pujol, Ph.D.
National Alliance for Medical Image Computing – Neuroimage Analysis Center
3D Slicer

- Open-source application available for Windows, Linux and Mac
- More than 2.8 million lines of code
- Neuroscience and Image-Guided Therapy
3D Slicer History

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

Image Courtesy of the CSAIL, MIT
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
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

---

Sonia Pujol, Ph.D.
National Alliance for Medical Image Computing – Neuroimage Analysis Center
Three ways to use Slicer and the NA-MIC kit
The NA-MIC kit from three user perspectives

- Clinical researchers
- Biomedical engineers
- Algorithm developers

Sonia Pujol, Ph.D.
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

Sonia Pujol, Ph.D.
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

Sonia Pujol, Ph.D.
National Alliance for Medical Image Computing – Neuroimage Analysis Center
Statistical Analysis of Anatomy from Medical Images

Sonia Pujol, Ph.D.
National Alliance for Medical Image Computing – Neuroimage Analysis Center

Courtesy of Tom Fletcher, University of Utah.
**Algorithm Developers**

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

Develop plug-ins to extend image analysis capabilities

```c
#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
Clinical researchers
Biomedical engineers
Algorithm developers

Translate techniques into skills
Learn

NA-MIC Training Compendium & Workshops

3D Visualization

Deformable transform

EM Pipeline: Patient-Specific Atlas Generation

Segmentation Results
Conclusion

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