The 3D Slicer open-source platform for segmentation, registration, quantitative imaging and 3D visualization of biomedical image data

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Director of 3D Slicer Training
National Alliance for Medical Image Computing (NA-MIC)
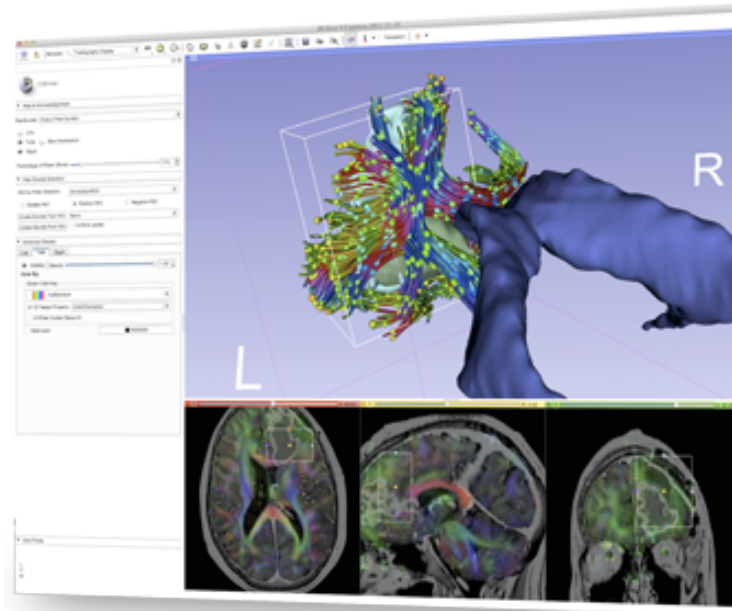Neuroimage Analysis Center (NAC)

3DSlicer
Version 4.0

Outline

- Slicer History
- Slicer Functionalities
- Clinical Applications
- Training Effort
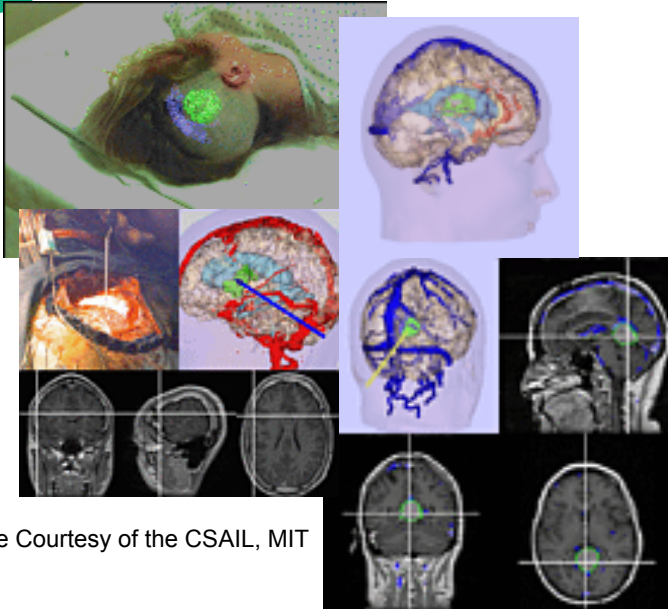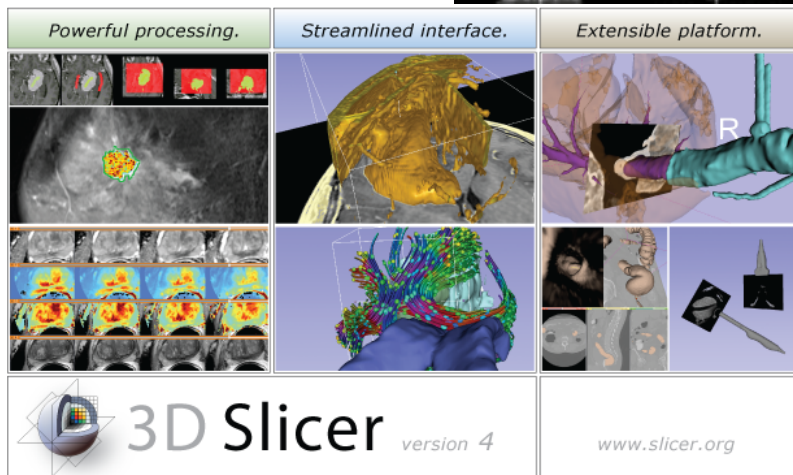
INTRODUCTION

Slicer 19ᵗʰ year Anniversary

Image Courtesy of the CSAIL, MIT

- 1997: Slicer started as a Master's thesis between the Surgical Planning Lab (Harvard) and the Computer Science and Artificial Intelligence Laboratory (CSAIL) at MIT

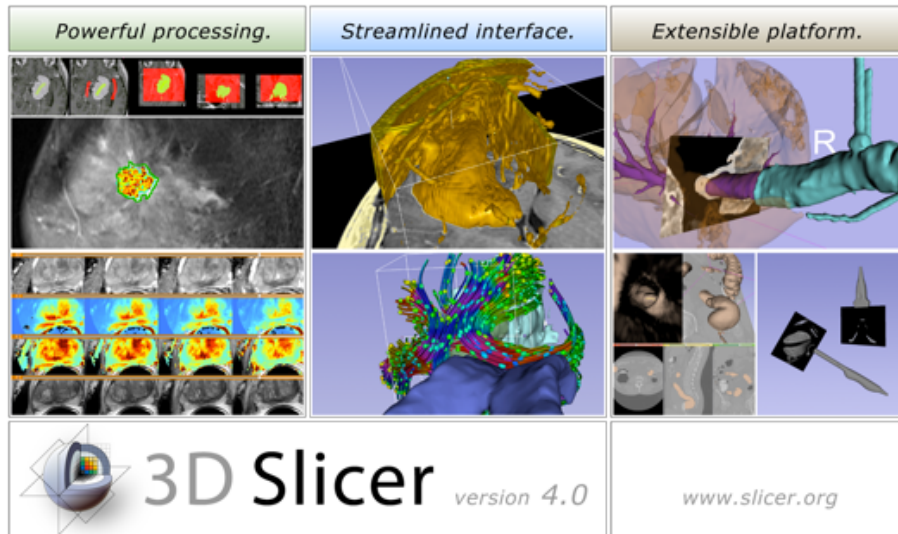- 2016: International open-source platform for medical image computing

P.I. Prof. Ron Kikinis, BWH, Harvard

3D Slicer

- Slicer is a freely available open-source application for viewing, analyzing and interacting with biomedical imaging data

3DSlicer

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- Slicer is multi-platform and runs on Windows, Linux, and Mac

A multi-institutional effort

3D Slicer

- Slicer is distributed under a BSD license with no restriction on use

- Slicer is not FDA-approved nor CE-marked, and is for clinical research only

3D Slicer

3D Slicer workshop, PLA General Hospital, Beijing

Slicer can be used by clinical researchers on their own Mac, Windows or Linux laptops with their own data

Slicer is built every night

Slicer is under active development: built every night on every platform

Slicer Bug Tracker

Slicer4 Download Statistics
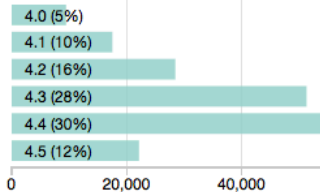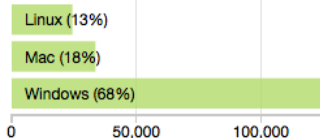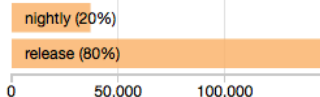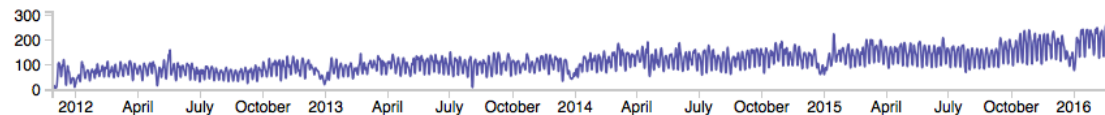
An interdisciplinary platform

An open-source environment for software developers
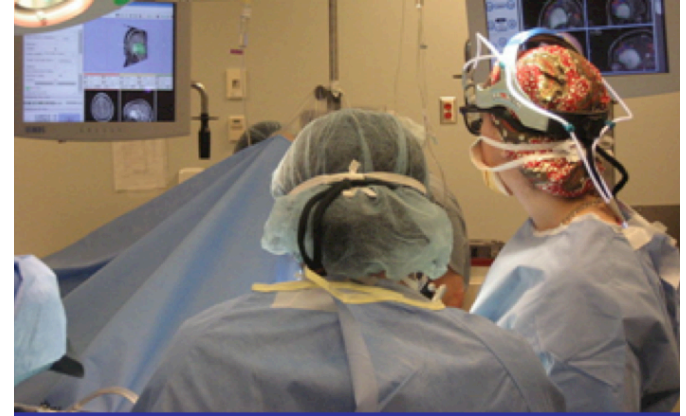
An end-user application for clinical investigators and scientists

A software platform that is both easy to use for clinical researchers and easy to extend for programmers
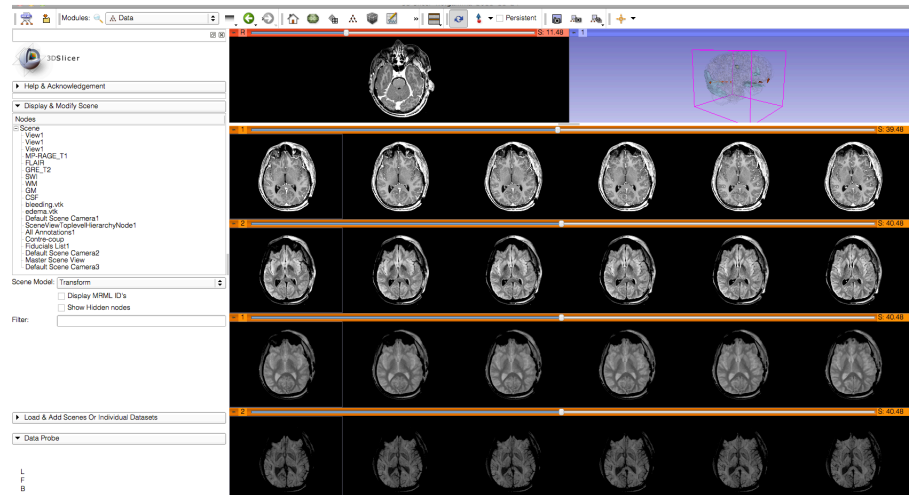
SLICER FUNCTIONALITIES

Core Functionalities
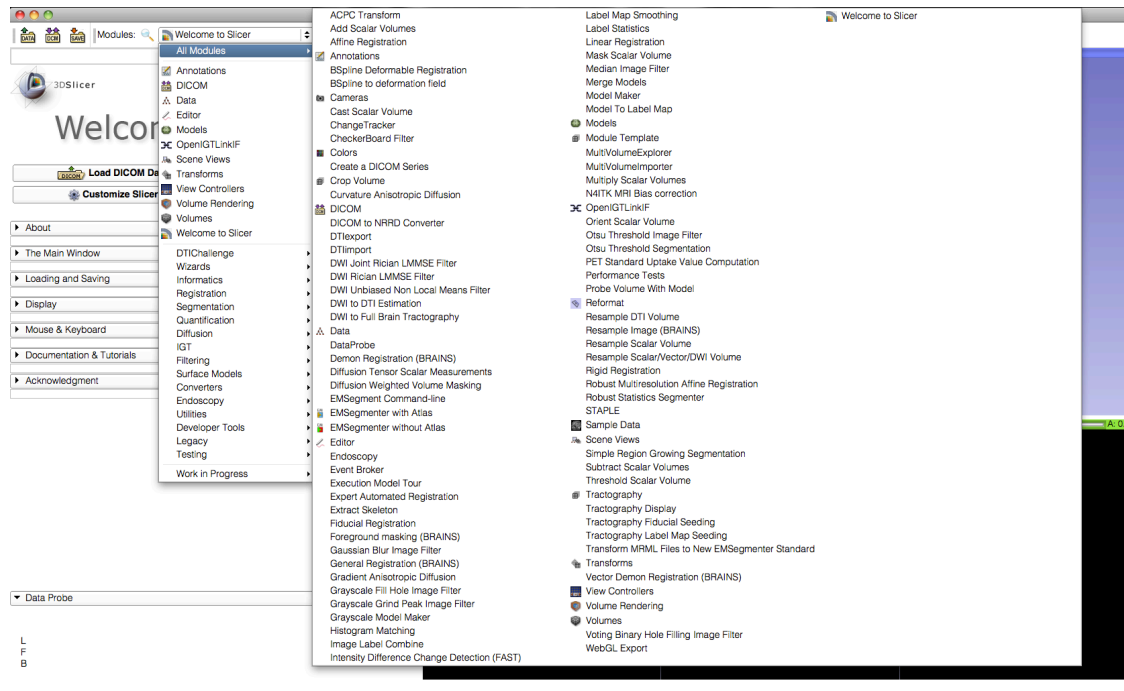
- Visualization
- Segmentation
- Registration
- Reconstruction
- Diffusion
- Image Guided Therapy
- Quantification
- Reporting

Core Functionalities
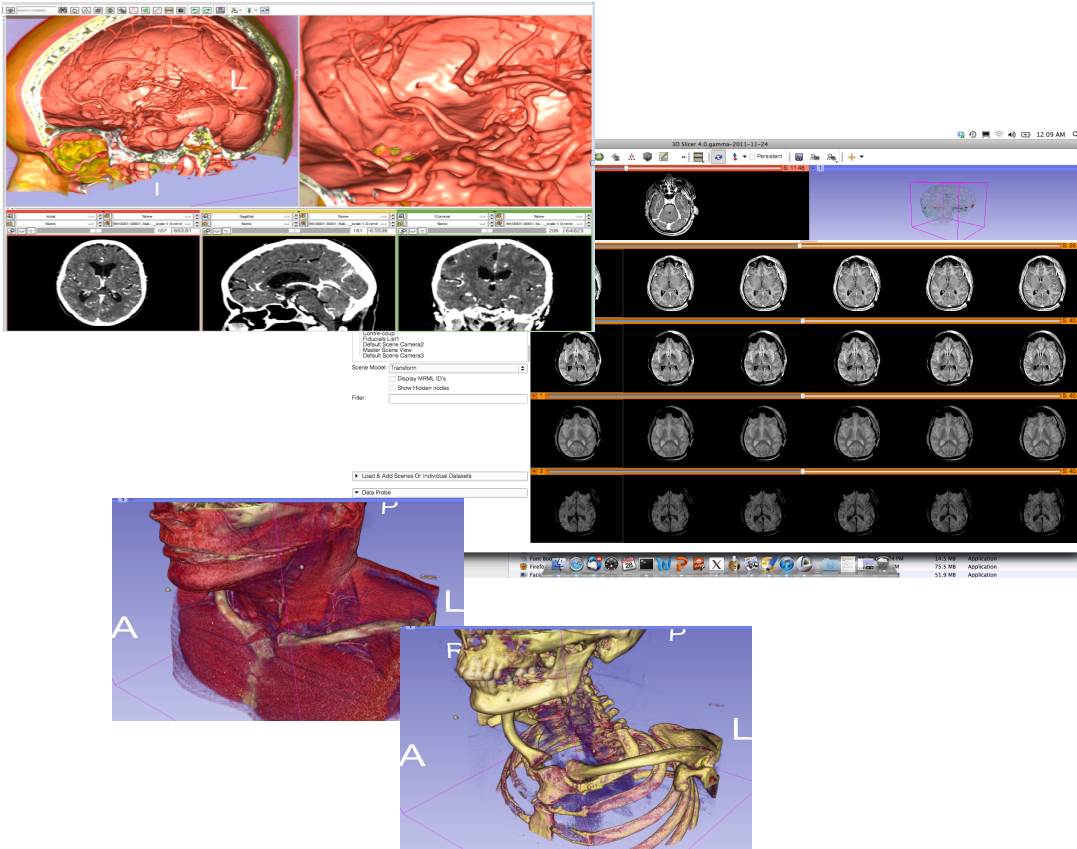
- **Visualization**
- Segmentation
- Registration
- Reconstruction
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- Quantification
- Reporting

Core Functionalities
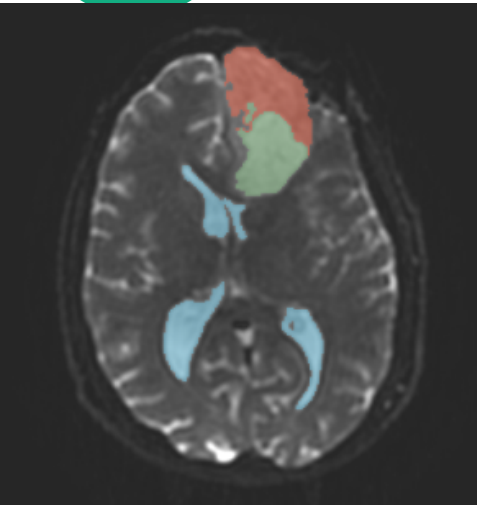
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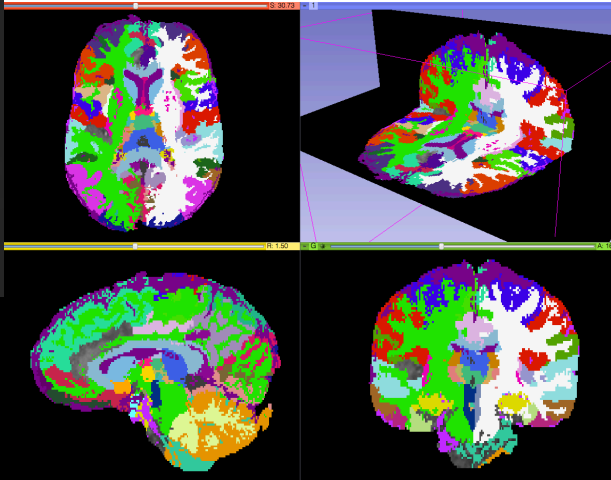
EMSegmenter
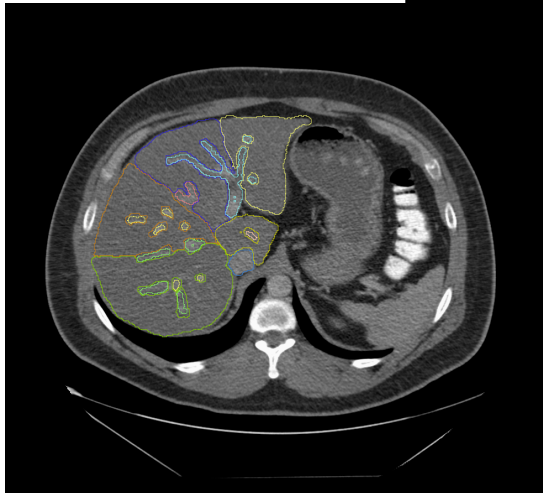
- Visualization
- **Segmentation**
- Registration
- Reconstruction
- Diffusion
- Image Guided Therapy
- Quantification
- Reporting

Core Functionalities
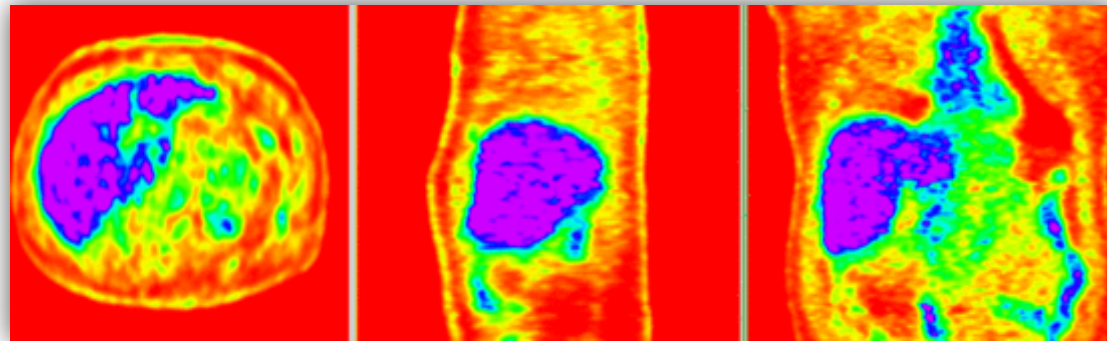
- Visualization
- Segmentation
- **Registration**
- Reconstruction
- Diffusion
- Image Guided Therapy
- Quantification
- Reporting

Core Functionalities
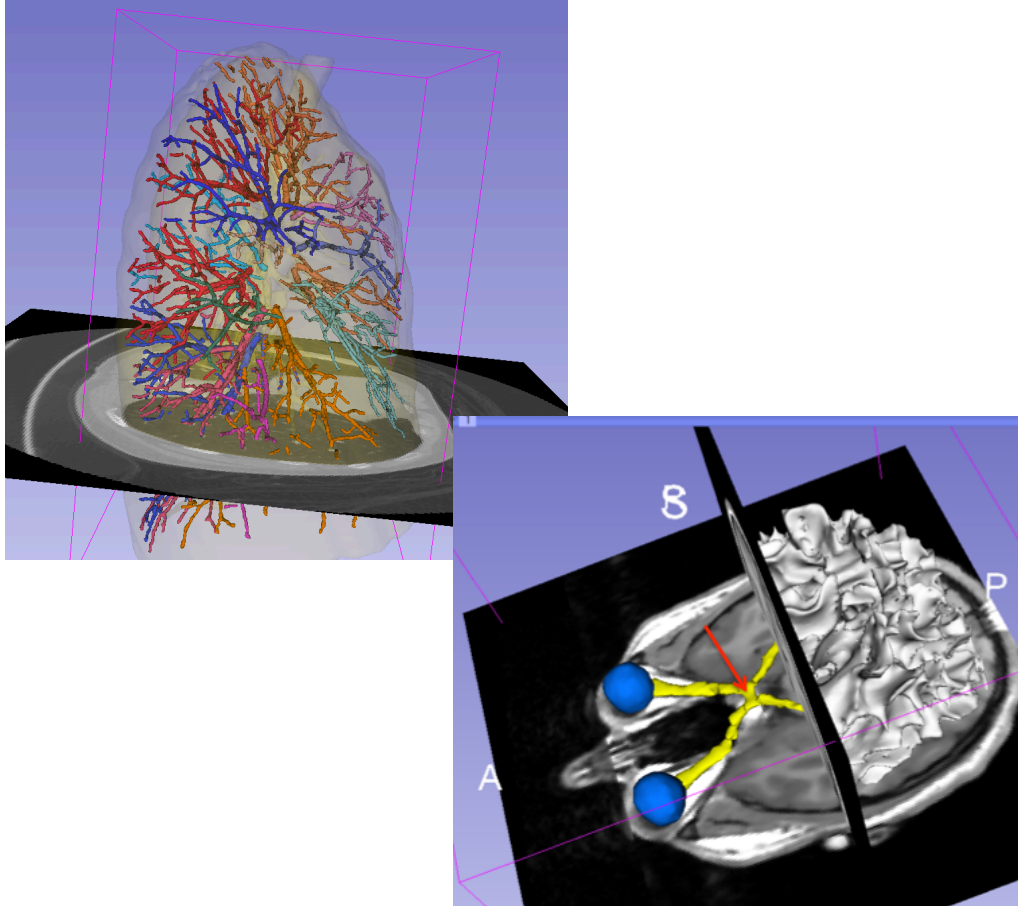
- Visualization
- Segmentation
- Registration
- **Surface Reconstruction**
- Diffusion
- Image Guided Therapy
- Quantification
- Reporting

Core Functionalities
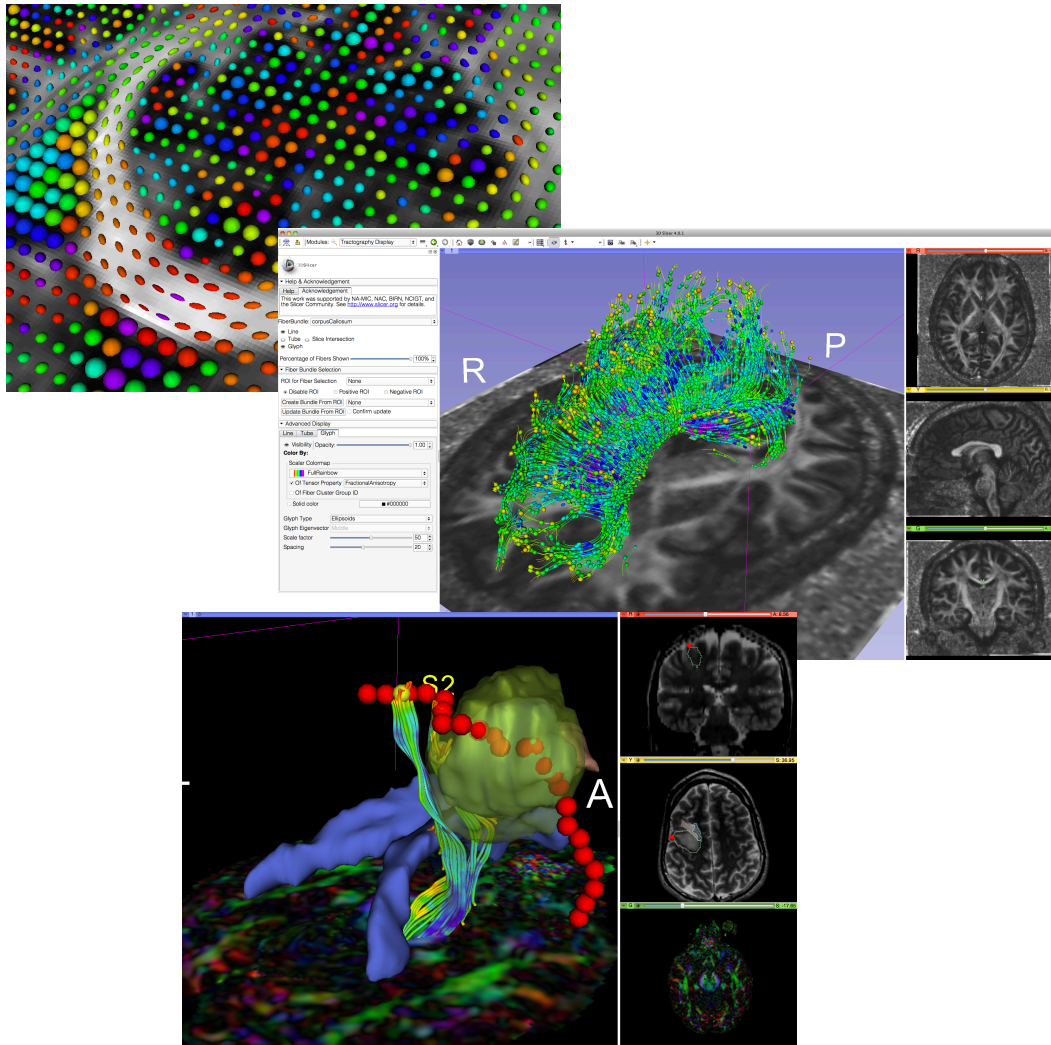
- Visualization
- Segmentation
- Registration
- Reconstruction
- **Diffusion MRI**
- Image Guided Therapy
- Quantification
- Reporting

Core Functionalities
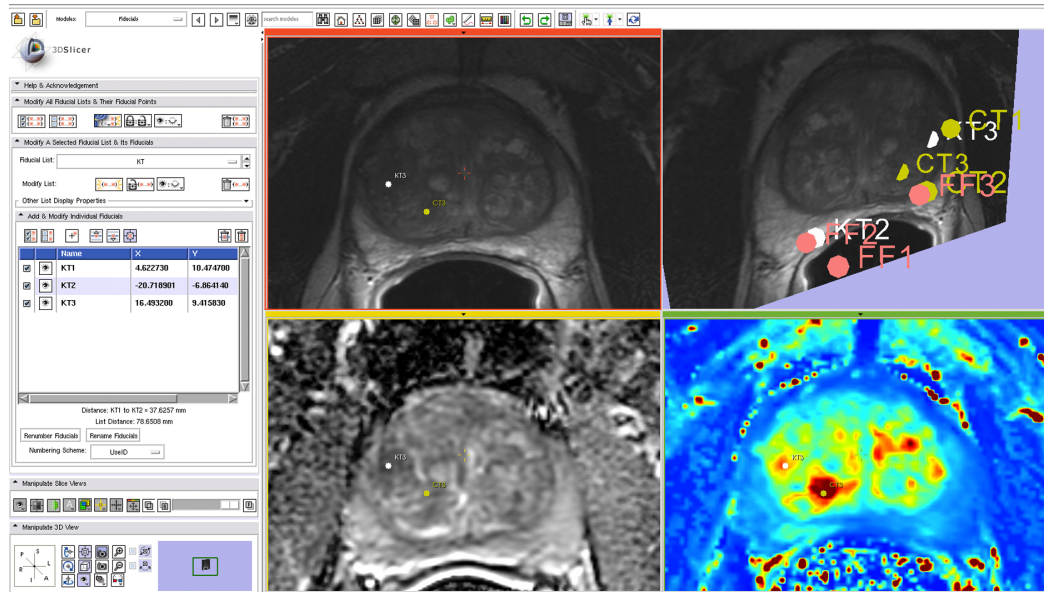
Image Courtesy A.Fedorov, T.Penzkofer, R.Kikinis

- Visualization
- Segmentation
- Registration
- Reconstruction
- Diffusion
- Filtering
- **Image Guided Therapy**
- Quantification

Core Functionalities
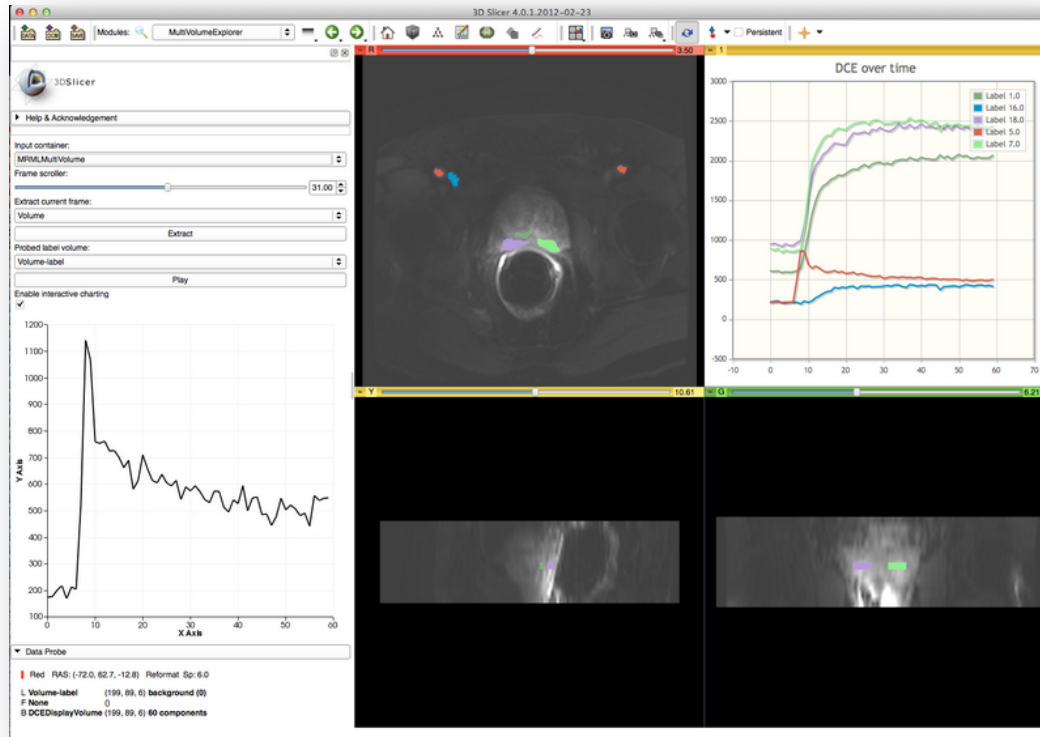
Image Courtesy A.Fedorov, R.Kikinis

- Visualization
- Segmentation
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- Diffusion
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- Image Guided Therapy
- Quantification

Slicer is Extensible

- Slicer is Extensible through plugins called Slicer Extensions

- The Slicer Extension Manager enables users to download + 70 additional Slicer modules
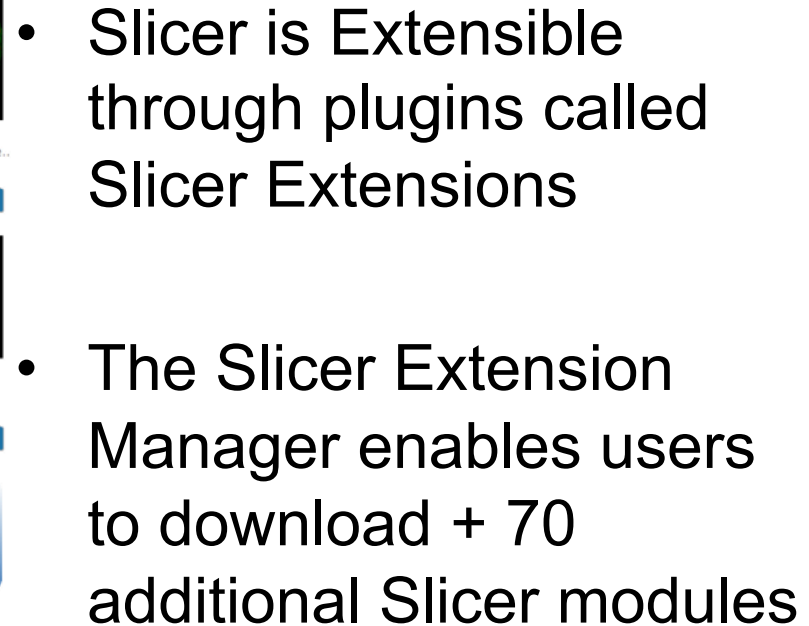
Image Courtesy A.Golby
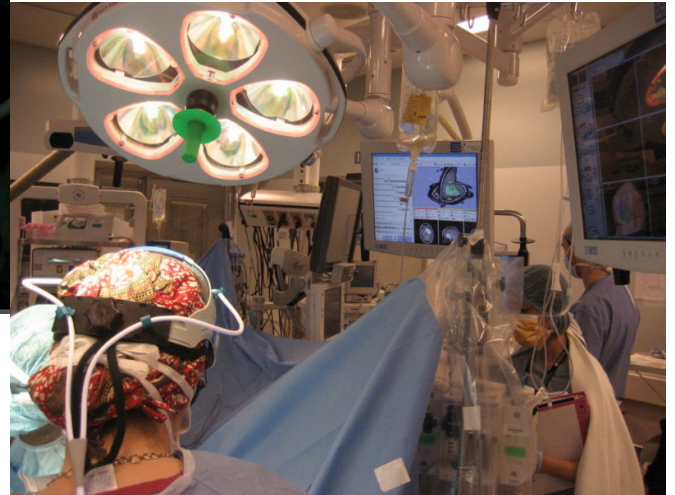
3D SLICER: APPLICATIONS

Slicer applications

- Driving Biological Projects leading to the development of new tools

- Applied science oriented toward subject specific analysis in the presence of pathology
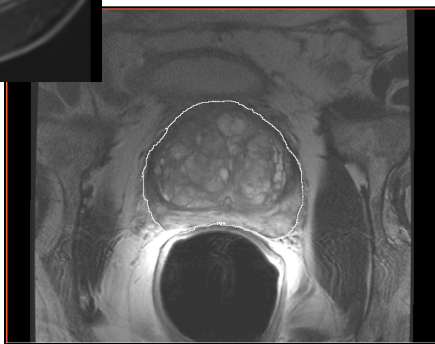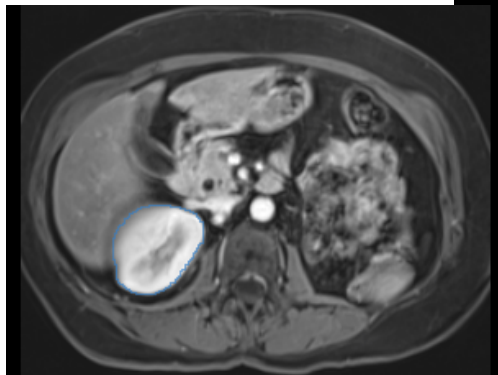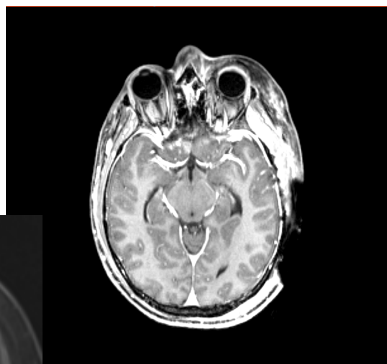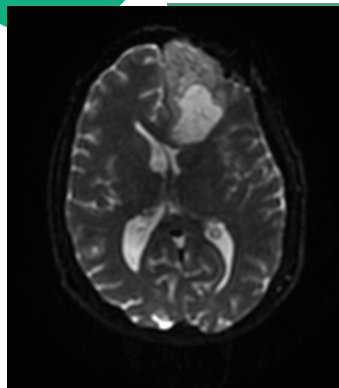
Slicer use in clinical research environment

- AMIGO, BWH, Boston, USA (DTI)

- Slicer RT – Canada

- Quantitative Image Network collaboration with German Cancer Research Institute (PET/CT)

Image-Guided Therapy Research at BWH: Open MRI (1991)
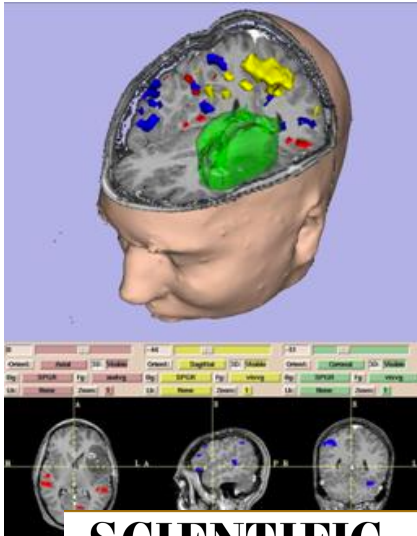
Image-Guided Therapy Research at BWH: AMIGO (2011)

Improving Patient Care with AMIGO
Advanced Multimodality Image Guided Operating Suite

AMIGO (2011-2016): +1,000 clinical cases

MR-guided prostate intervention

T2

FGR
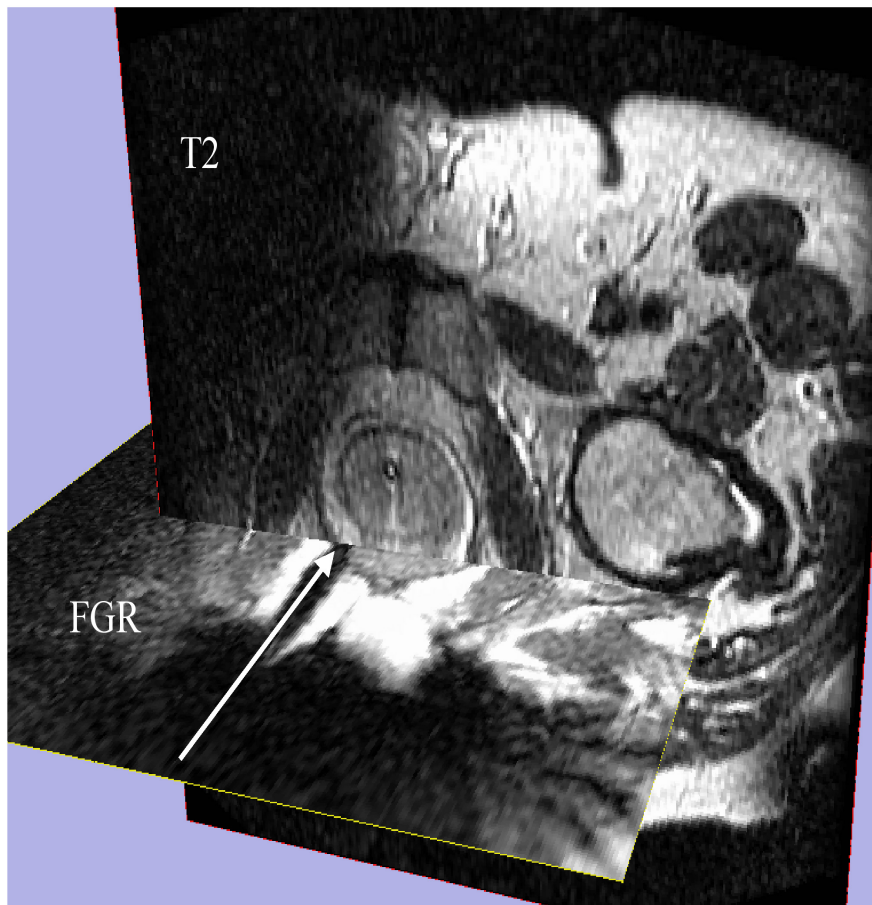
Image-guided therapy
for prostate interventions:

- Brachytherapy Planning
- Navigation for Biopsy

Haker SJ, Mulkern RV, Roebuck JR, Barnes AS, Dimaio S, Hata N, Tempany CM.: Magnetic resonance-guided prostate interventions. Top Magn Reson Imaging. 2005 Oct;16(5):355-68.

Image Courtesy of Steven Haker, PhD and Clare Tempany, MD

Neurosurgical Intervention
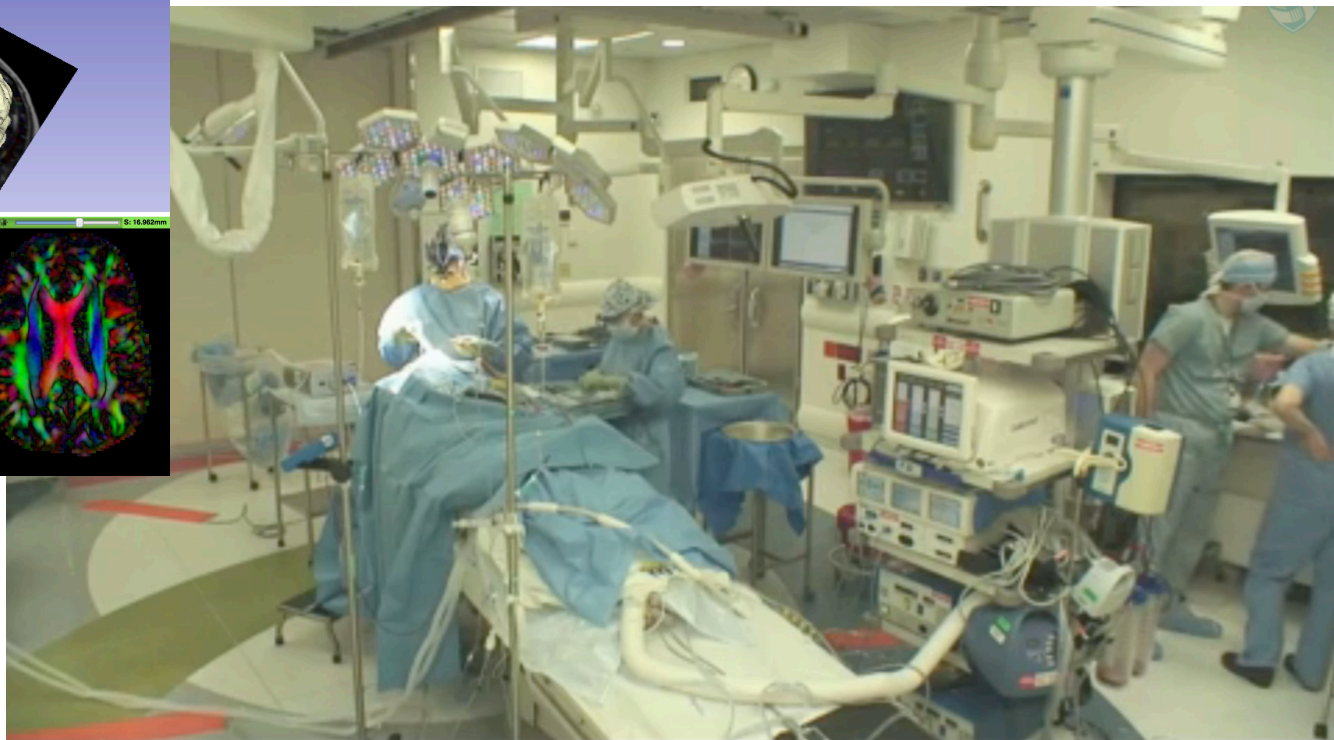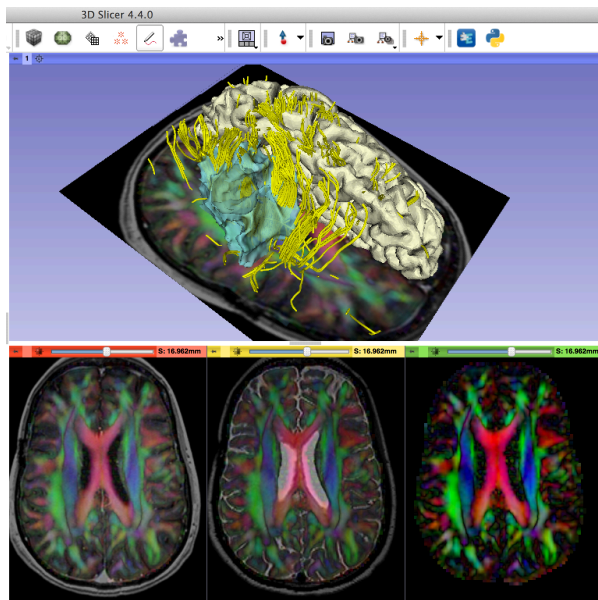
3D SLICER: TRAINING

Slicer Training History: 2005-2016
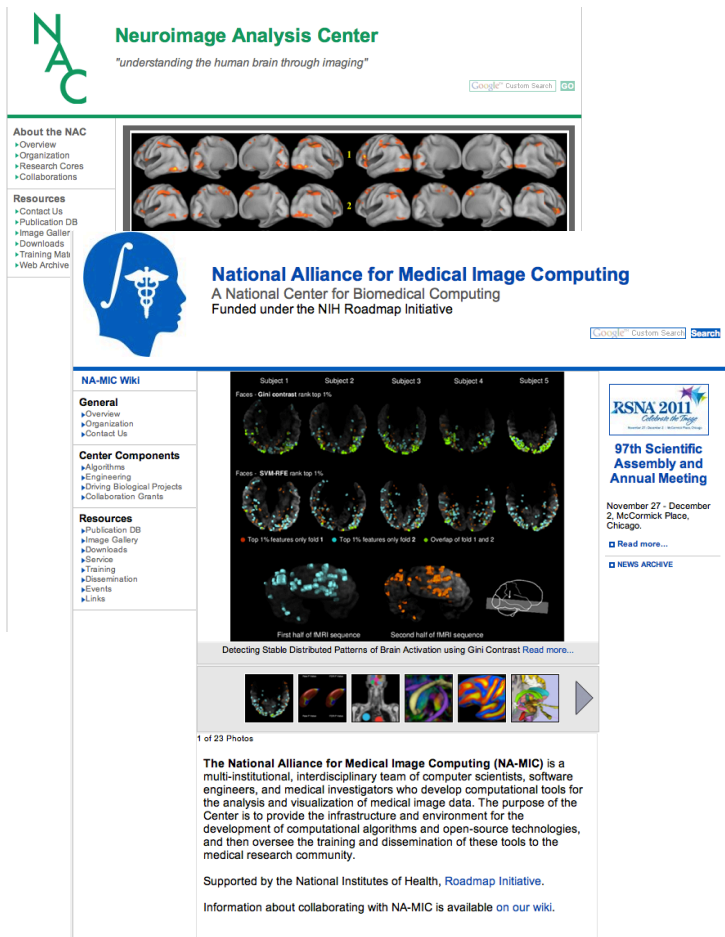
- Training Core of two NIH-funded consortia: the National Alliance for Medical Image Computing (NA-MIC) and the Neuroimage Analysis Center (NAC) (P.I. Ron Kikinis)

3D Slicer Training

- Training effort to transfer scientific advances in medical image computing to clinical researchers

- Courses tailored for clinicians and scientists at national events, invited seminars, and international conferences

Slicer Trainees

- Clinical investigators
- Senior scientists
- Postdoctoral fellows
- Programmers
- Undergraduate and graduate students
- Staff researchers

- +3,500 trainees worldwide

Slicer Project Weeks

- Bi-annual week of hands-on programming

- Practical exchange of idea and experience

- 21 project weeks in the US since 2005

Conclusion

- Slicer is an open-source research platform for medical image analysis

- The Slicer community is an open community with contributors from all over the world

- Slicer is a versatile platform for translational research and subject specific analysis of biomedical image data

Acknowledgments

National Alliance for Medical Image Computing
NIH U54EB005149

Neuroimage Analysis Center
NIH P41RR013218