3D Slicer for Medical Physics Research

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Acknowledgments
Disclaimer

“The Software has been designed for research purposes only and has not been reviewed or approved by the Food and Drug Administration or by any other agency”
Open Community Process

Open development
- Mailing lists
- Documentation
- Source code control
- Bug reporting

Open working meetings called *project weeks*

January in Salt Lake City, June in Boston
Open Source Software

BSD-style license
No protected IP

Software can move with scientists
Coexist with proprietary software

Cross-platform: Windows, Linux, OSX
Basic visualization

Window/level
Pseudo-color
Mosaic
Multi-modal fusion

2 images
+ 1 labelmap
Interactive editor

Paint, draw, threshold, morphological operations, ...
3D visualization

Ray casting
  - Color and opacity transfer functions
  - Composite displays

Shaded surfaces
  - Pseudo-color
  - Shaded lighting

Maximum intensity projection
Interactive registration
MRML tree

Data items are stored in the MRML tree

- Images
- Transforms
- Models
Interactive deformable registration
Automatic registration
## Automatic registration

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# Slicer extensions

![Slicer Extension Manager Wizard](image)

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Download and install selected extensions...
Registration portal

Slicer3:Registration

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2. Find Registration Method by Category: looking for.....
3. Default Registration Modules
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7. Registration Examples / Use-Cases
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Registration in 3D Slicer

An extensive set of tools is available within 3D Slicer to support your registration or image fusion task. The right module will depend on your input data and the underlying question asked. Below is an overview of the main and auxiliary modules related to image registration. The spectrum ranges from fully automated to fiducial to fully interactive manual alignment, and from rigid to fully elastic image warping. Most modules are generic and can handle any image content, but a few are designed specifically for brain images. They have a brain contour in the icon.

There are also many auxiliary/support modules that perform important functions you may need to successfully complete your registration, such as the ROI or Interactive Editor modules to obtain masks, or the Resample modules to properly apply your result transform to the image.

This page is organized by methods. Alternatively the Slicer Registration Case Library is organized by data type, i.e. it provides example cases, complete with tutorials, for a variety of registration problems collected in the "real world". You may find a good starting point and helpful discussion in those examples. If you find something amiss, please let us know so we can amend (meier at bwh harvard edu).
Segmentation

Fast marching segmentation
Segmentation

Grow-cut segmentation
Segmentation

EM segmentation
Other capabilities

- Meshing and model generation
- Image-guided therapy
- Vascular modeling
- SUV computation
- Tractography
DICOM-RT Interchange

• RT Dose
  – Import / Export

• RT Structure Sets *
  – Import / Export

* with caveats
Structure and Dose Warping
Developing slicer modules

Three kinds of modules:
- Command line module
- Scripted module
- Loadable module
Command line module

User interface is generated by slicer

C/C++ files → executable → XML file

- 3D Slicer
- B-spline Deformable Registration
- Input/Output
  - Parameter set
  - Status: Idle
  - Fixed volume
  - Moving volume
  - Output volume
  - Output B-spline transform (MRML)
  - Output vector field (MRML)
  - Output B-spline transform (file)
  - Output vector field (file)
  - Cost function
  - Hardware: GPU, CPU
(1) Slicer writes your input files, then launches your executable

(2) Your executable runs, and it writes output files

(3) Slicer loads your output files
More information

Slicer email lists

- slicer-users@bwh.harvard.edu
- slicer-devel@bwh.harvard.edu

Documentation & tutorials


Contact Greg:

- gcsharp@partners.org