3D Data Loading and Visualization

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Slicer is a freely available open-source platform for segmentation, registration and 3D visualization of medical imaging data.

Slicer is a multi-institutional effort supported by the National Institute of Health.
Translational research

An open-source environment for software developers

An end-user application for clinical investigators and scientists

3D Slicer: an open-source platform for *translating* innovative algorithms into clinical research applications
3DSlicer History

- 1997: Slicer started as a research project between the Surgical Planning Lab (Harvard) and the CSAIL (MIT)

Image Courtesy of the CSAIL, MIT
3DSlicer History

1997: Slicer started as a research project between the Surgical Planning Lab (Harvard) and the CSAIL (MIT)

2014: Multi-institution effort to share the latest advances in image analysis with clinicians and scientists
A Multi-institution Effort

- Infrastructure grants fund the platform
- Collaborative projects (e.g. Canada, Japan, Australia, Italy) fund the application packages
Slicer Is Open

• Open Science
  =
  Open Source
  +
  Open Data
  +
  Open Community

Courtesy R. Kikinis
Slicer Open Community

- 80 authorized developers contributing to the source code of Slicer
- Over 700 subscribers on Slicer user and Slicer developer mailing list
Nov. 2011 - March. 2014
Downloads

Slicer4 download stats

Date range
- Nov 28, 2011 - Sep 24, 2014

Version
- 4.0 (6%)
- 4.1 (17%)
- 4.2 (58%)
- 4.3 (19%)

Operating system
- Linux (11%)
- Mac (19%)
- Windows (69%)

Stability
- nightly (20%)
- release (80%)

Region
- Northern America (30,744)
- Western Europe (16,520)
- Eastern Asia (13,686)
- Southern Europe (10,348)
- Eastern Europe (6,061)
- Northern Europe (6,532)
- South America (4,424)
- Southern Asia (6,688)
- Australia, New Zealand (2,306)

Country
- United States (26,110)
- China (7,251)
- Germany (7,382)
- Italy (2,236)
- Canada (6,603)
- United Kingdom (4,932)
- France (3,464)
- Spain (3,209)
- Japan (3,178)
- India (2,667)
- Australia (2,027)
- Poland (1,217)
- Russian Federation (1,870)
- Netherlands (1,782)
- Brazil (1,702)
- Austria (1,514)
- Switzerland (1,509)
- South Korea (1,486)

Downloads per day

101,101
3D Slicer in practice

- Slicer is open-source
- Slicer works on Windows, Linux, and Mac
- Slicer is distributed under a BSD-style license agreement with no restriction on use
Slicer: Behind the scenes

Slicer is built every night on Windows, Mac and Linux platforms.
Slicer Training

- Hands-on training workshops at national and international venues
- >3,000 clinicians, clinical researchers and scientists trained since 2005
3D Visualization of the Anatomy

Following this tutorial, you will be able to load and visualize volumes within Slicer4, and to interact in 3D with structural images and models of the anatomy.
3D Slicer Version 4

The **Welcome** module is the default start-up module.
Each module of Slicer includes a series of tabs, which gives access to different functionalities.

Click on the arrow symbol to display the content of each tab.
The Main Window tab contains information on the basic organization of Slicer’s user interface.

Scroll down to see all the contents.
Slicer User Interface

Welcome Module

Data Probe

Toolbar

User Interface (UI) panel of the Slicer Welcome Module

3D Viewer

2D anatomical viewers
Browse to the 3DVisualizationData file and select **MR-head.nrrd** on your disk.

Drag and drop into Slicer.
Click on **OK** to load the dataset into Slicer.
Loading a volume

The axial, sagittal and coronal views appear in the 2D viewers.
Loading a volume

Click on the Slicer layout icon
Loading a volume

Click on the Red slice only option
Position your mouse over the **pin icon** to display the slice viewer toolbar.

Loading a volume
Loading a volume

Once the slice viewer toolbar is displayed, click on the “>>”
Loading a volume

This menu will appear once the “>>” button is pressed.
Click on the Lightbox menu and choose the option "6x6 view"
Slicer displays 36 consecutive images of the DICOM volume. Use the red slice slider to browse through the data.
Click on the Slicer layout icon and select Conventional.
Position your arrow again on the **pin icon** of the red viewer, select the **Lightbox** menu and change it back to "**1x1 view**".
Position your arrow again on the **pin icon** of the red viewer and click on the links icon to link all three viewers.
Loading a volume

Once the icons are linked, click on the eye icon to display all 3 anatomical slices in the 3D viewer.
Loading a volume

All three anatomical slices are shown in the 3D viewer.
Welcome

Use the left mouse button to rotate the camera and the right mouse button to zoom in and out.

Loading a volume
To close the scene, click on **File** and select **Close Scene**.
Exit Slicer

To exit Slicer, click on File and select Exit.
Part 2

3D Visualization of Surface Models of the Brain
Drag and drop the file ‘3DHeadScene.mrml’ into Slicer.
Slicer automatically opens the ‘Add data into the scene’ window. Click on OK to load the scene file.
A 3D surface model of the head, and 2D anatomical slices appear in the Slicer Viewer.
Loading the Slicer Scene

Select the Modules menu and select Models.
Models Module

The list of 3D models appears in the panel.
Position the cursor over the **pin icon** to reveal the slice menu and click on the **eye icon** to reveal the axial slice.
Once the axial slice is displayed in the 3D viewer, click on **Skin.vtk** in the list of 3D scenes.

Notice the axial slice through the 3D model of the head.
Scroll down the **Display** tab and locate the "**Color**" tab. Lower the **Opacity** to a transparent level, around 0.30.
Notice the skin has become almost fully transparent
3D Visualization

Scroll back up to the 3D scenes menu and select skull_bone.vtk
3D Visualization

Turn off its visibility by unchecking the **Visibility** option and notice the bone disappearing from the 3D view of the head.
Position your mouse over the **pin icon** in the coronal slice view and select the **eye icon** to reveal the coronal slice in the 3D view.
The coronal slice is shown in the 3D viewer
Scroll up and select the 3D scene `hemispheric_white_matter.vtk`, then check off the option for Clip under the Visibility tab.
Scroll down and find the tab \textit{Clipping}, and check off the options for \textit{Green Slice Clipping} and \textit{Negative Space}.\[3D\text{ Visualization}\]
The optic chiasm appears in the 3D viewer.
Scroll up and uncheck the option **Clip**
Lower the **Opacity** of **hemispheric_white_matter.vtk**
Check the option **Slice Intersections Visible**

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The intersection of the white matter surface with the 2D anatomical slices are shown in the 2D viewers.
Position your cursor over the **pin icon** in the coronal slice view and unselect the **eye icon**
Click on the **Slicer Layout icon** and select **Conventional**
Position your cursor over the **pin icon** in the 3D viewer to display the 3D control windows. Select the **A (Anterior) view** of the 3D models.
Part 3:  
Saving a scene
Click on **File** and select **Save** or press **Ctrl+S**
The **Save Scene and Unsaved Data** window lists all the elements of the slicer scene.
Check the box next to the scene named `3DHeadScene.mrml` and double click on it. Rename it `MyNewScene.mrml` and select `Save`.
Click on **File** and select **Exit** to close **MyNewScene.mrml** and exit Slicer.
Scene Restore

Restart Slicer and find MyNewScene.mrml on your computer
Scene Restore

Drag and drop the **MyNewScene.mrml** file that’s in the **3DHeadData** folder into the Slicer window.
Scene Restore

Click OK
The 3D scene **MyNewScene.mrml** appears in the viewer
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