3D Slicer

An Open Source Platform for Registration, Segmentation, Quantitative Analysis, and Visualization of Biomedical Image Data

About 3D Slicer

3D Slicer is a multi-platform, free and open source software package for visualization and medical image computing.

The software platform is community created for the purpose of subject specific medical image analysis and visualization. Slicer includes support for:

- Multi-modality imaging including, MRI, CT, US, nuclear medicine, and microscopy
- Multi organ from head to toe
- Bidirectional interface for devices
- Expandable and interfaced to multiple toolkits

History: Slicer was initiated as a masters thesis project between the Surgical Planning Laboratory at the Brigham and Women’s Hospital and the MIT Artificial Intelligence Laboratory in 1998. Slicer has been downloaded many thousand times. A variety of publications were authored for the Slicer software. A new 3.2 was released in May of 2008, version 3.4 was released in May of 2009 and the newest version 3.6 of Slicer has been completely re-architected version of Slicer was developed and released in 2007. Subsequently, version 3.2 was released in November of 2010.

License: Slicer executables and source code are available under a BSD-style, free open source licensing agreement under which there are no reciprocity requirements, no restrictions on use, and no guarantees of performance. Slicer leverages a variety of toolkits and software methodologies that have been labeled the NA-MIC kit. Please see http://wiki.na-mic.org/wiki/index.php/NA-MIC-Kit for more information.

Segmentation & Registration

Segmentation is required for defining features of interest in imaging data for quantification and analysis.

3D Slicer has a variety of interactive and automated segmentation methods:

- Support for manual contouring and setting
- Region growing and level sets
- Graph cuts with priori support
- Seed stopping and hierarchical brain segmentation

The desktop application provides interactive visualization of the results and an intuitive GUI.

Timeseries analysis and multi-subject analysis require good registration of imaging data acquired at different times, on different scanners, and across modalities.

Slicer also provides a variety of registration methods and resources to support versatile applications:

- Deformation models: rigid, non-rigid, fluid
- Algorithms types: elastic, affine, intensity-based
- Image types: scalar, vector, tensor
- Google “3D Slicer registration documentation” for the extensive collection of Slicer registration cases and recipes

Quantitative Analysis

Many hundreds of imaging biomarkers are used in clinical practice, drug discovery and development. A free and open source platform can improve access to standard methods of image quantification and rapidly translate experimental methods into the clinical research setting for validation and refinement.

3D Slicer includes tools to quantify:

- PET/CT studies (SUV body weight)
- Tumor growth (experimental)
- Tumor response to treatment (measurements for RECIST)
- DCE-MRI (pharmacokinetics)

IGT and Other Success Stories

3D Slicer has been used in clinical research, with IRB clinical protocols appropriately created and managed. In image-guided therapy (IGT) research, Slicer is frequently used to construct and visualize collections of MRI data that are available pre- and intra-operatively, and to display the tracked spatial position of surgical instruments.

Learning & Support

To support user and developer communities and the effective translation of tools into the clinical research setting, the 3D Slicer Project provides many outreach materials and activities including:

- Slicer Training Events
- Slicer Tutorial Materials & datasets
- Slicer Reference Style Documentation
- Slicer mailing lists
- Project week events for Developers

Multi-modality Visualization

A combined visualization of multiple imaging modalities and derived data can provide clinician scientists with an integrated understanding of anatomy and pathology.

3D Slicer offers a suite of layouts and the ability to visualize many types of data including:

- Grey scale volumetric data
- Parameter maps and VOIs
- Measurement tools & annotations
- Tracking devices

New hardware accelerated volume rendering is available in 3D Slicer version 3.6.

Slicer extensive Registration Case Library. Some of the registration applications covered in the 3D Slicer extensive Registration Case Library.