

ITK-SNAP User Training

Manual Capabilities

Automatic Capabilities

itksnap.org

RSNA ITK-SNAP Course

Dec 1, 2015

History of ITK-SNAP

- '99-'02: SNAP (Snake Automatic Partitioning) tool developed as a team programming project in a computer science graduate course at UNC led by Guido Gerig
- '03-'04: SNAP integrated into the NIH Insight Toolkit (ITK) and renamed ITK-SNAP
- '04-'15: ITK-SNAP maintained by Paul Yushkevich and colleagues at Penn with funding from NIBIB
- '12-'15: ITK-SNAP 3.x with a new user interface and support for multi-modality data developed (Penn/Utah)
- '07-'15: Command-line tool Convert3D developed to provide functionality complementary to ITK-SNAP



Prof. Guido Gerig,
NYU
creator of original
SNAP tool



Prof. Paul Yushkevich,
U-Penn,
creator of ITK-SNAP

Funding / Numbers

Continued development and maintenance of ITK-SNAP is supported by the grant R01 EB014346 from the National Institute of Biomedical Imaging and Bioengineering (NIBIB)

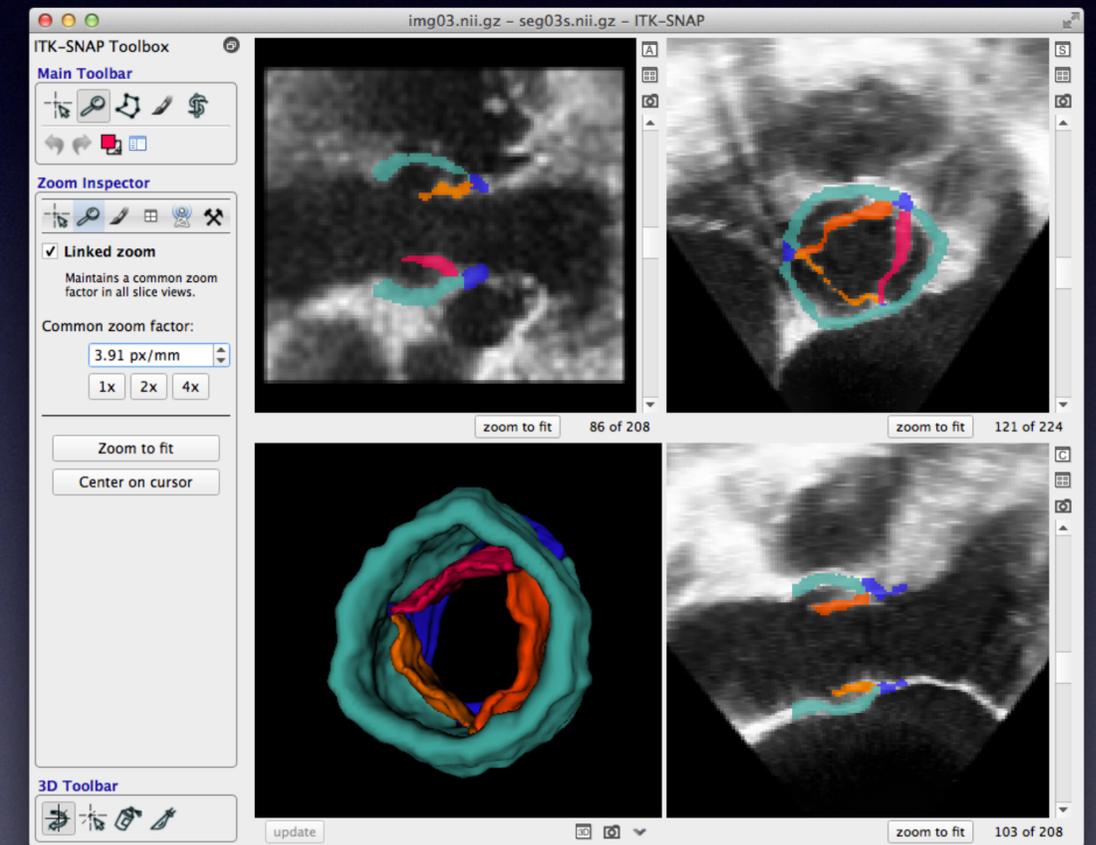


By the numbers:

- 15 years in development
- 100,000+ lines of code
- ~2,000 downloads per month
- >1,600 citations
- 3 funding NIH grants / contracts
- 20+ contributors

What is ITK-SNAP?

- Interactive tool for labeling structures in 3D medical image volumes
- Free open-source software that runs on multiple operating systems
- Vision:
 - a robust and easy to use tool with a set of capabilities limited to 3D image segmentation
 - minimize “feature creep”



Course Objectives

After completing this course, you should be able to use ITK-SNAP confidently to:

- Visualize 3D image volumes
- Label anatomical structures and lesions in 3D images both manually and semi-automatically
- Edit your segmentations using 3D tools
- Load and save segmentation files
- Know where to look for help

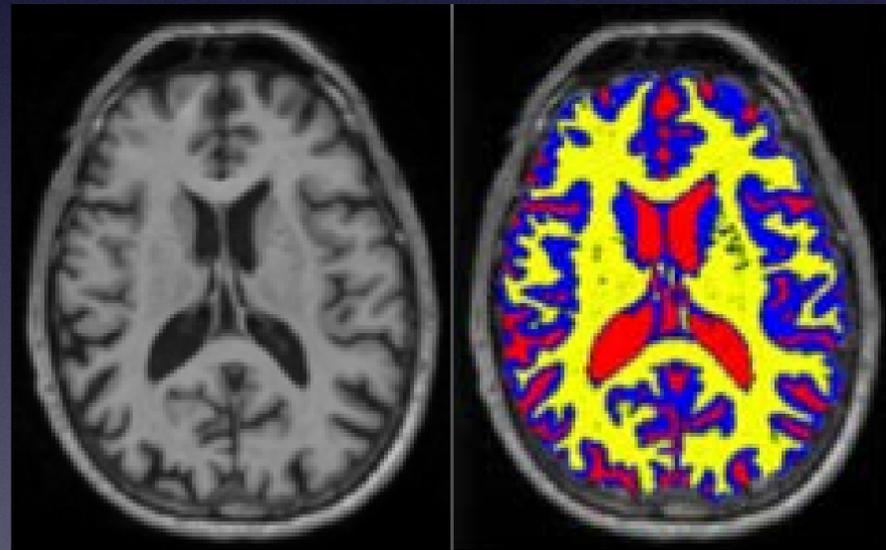
Course Organization

Course runs from 8:30 am to 10:00 pm

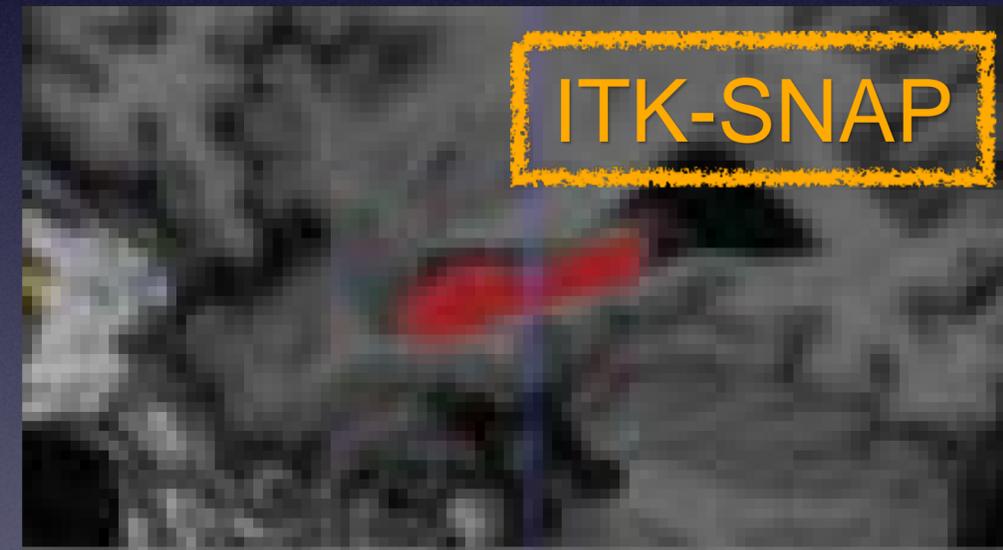
- First session (Guido Gerig)
 - 15' Introduction and demo of manual capabilities
 - 30' Exercise - navigation and manual segmentation
- Second session (Paul Yushkevich)
 - 10' Overview of automatic capabilities
 - 30' Exercise – automatic segmentation
- 5' Conclusion & wrap-up

What is Segmentation?

The process of locating structures of interest in an image and separating them from other structures and the background



Label all voxels of a particular class



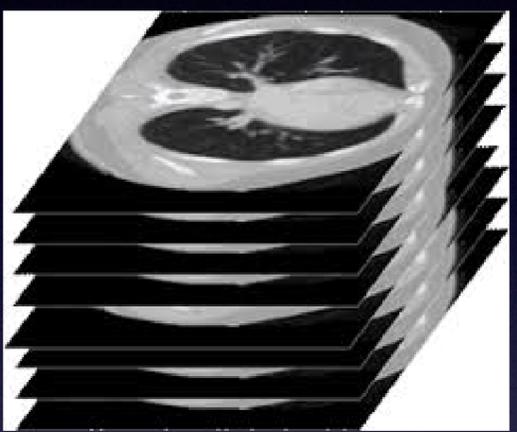
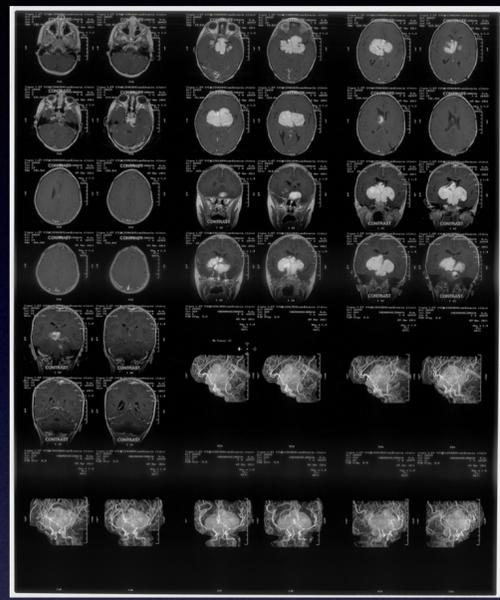
Label a specific anatomical structure

From Imaging to 3D Image Volumes



Scanner

Reconstruction Algorithm



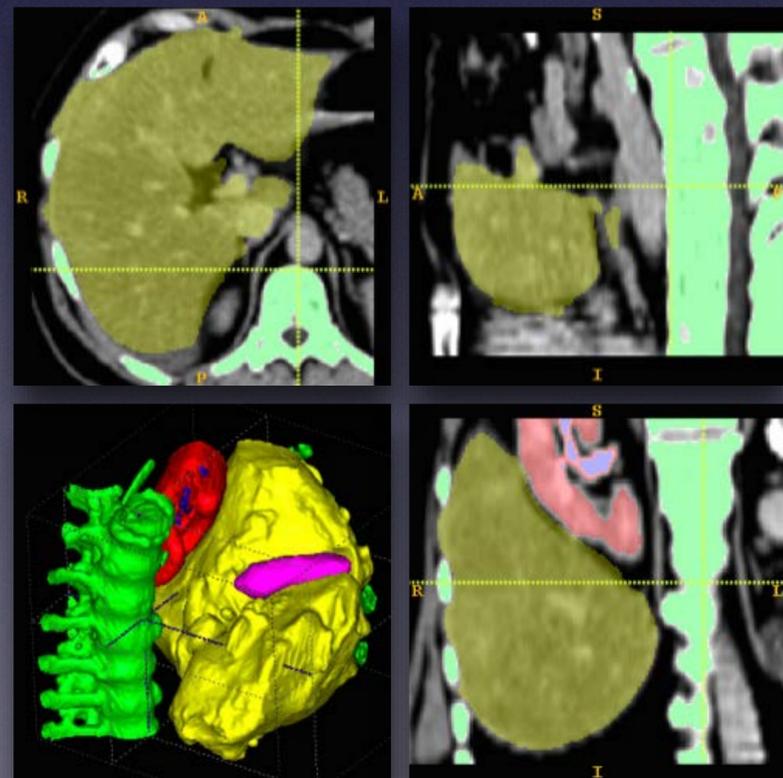
DICOM Images

3D Image(s) Data Array

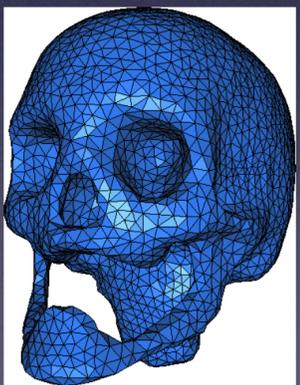
3D Label Data Array



3D Image File



itkSNAP Overlay

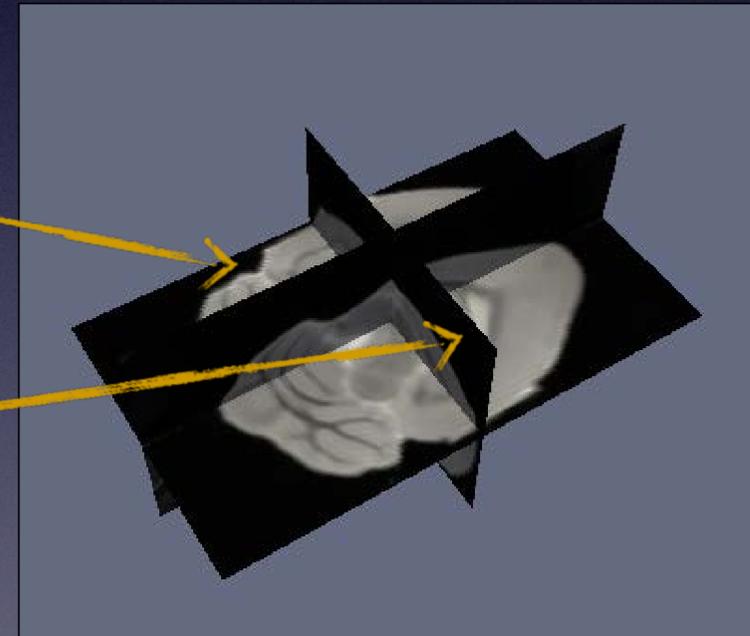
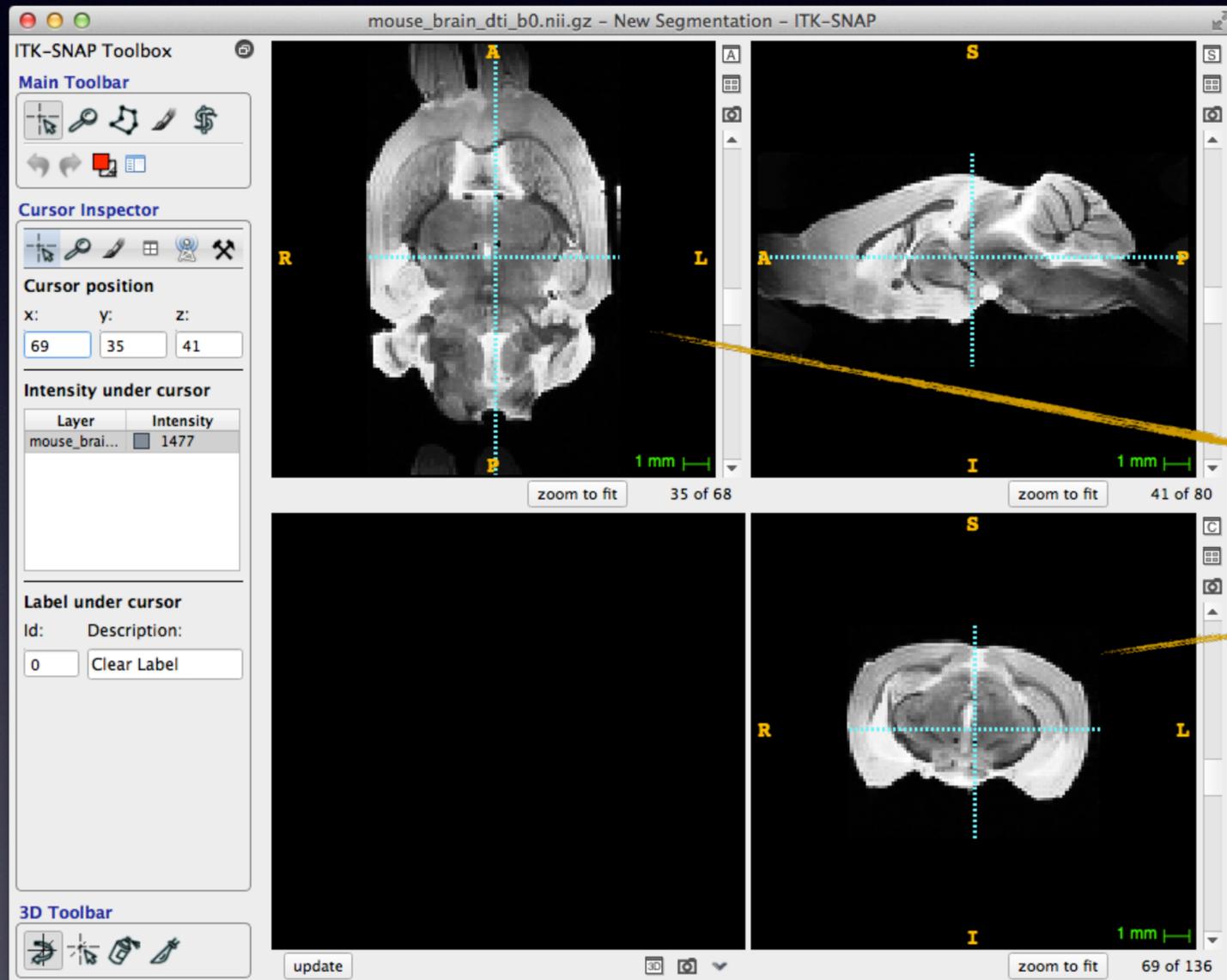


itkSNAP Surface Meshes

Label Name	Voxel Count	Volume (mm3)	Intensity Mean ± SD
0 Clear Label	7154452	7.154e+06	3967.4164 ± 4507.2114
1 Label 1	444096	4.441e+05	18401.5378 ± 1576.9358
2 Label 2	744795	7.448e+05	14462.4326 ± 2175.9097
3 Label 3	186678	1.867e+05	7860.1345 ± 2320.6923

itkSNAP Statistics

ITK-SNAP shows three orthogonal cuts through the image volume



Using Navigation Tools

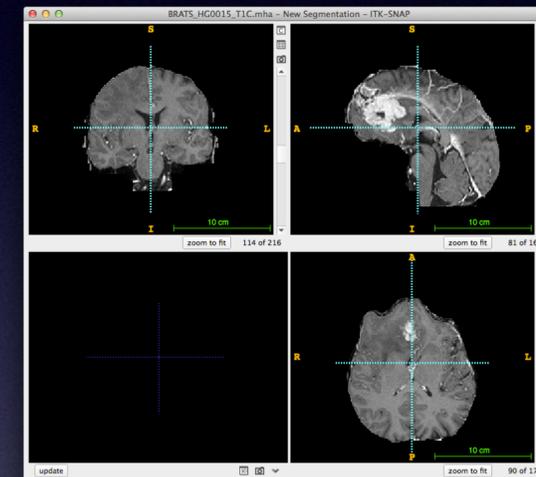
“Crosshairs Tool”



In-plane



Out-of-plane



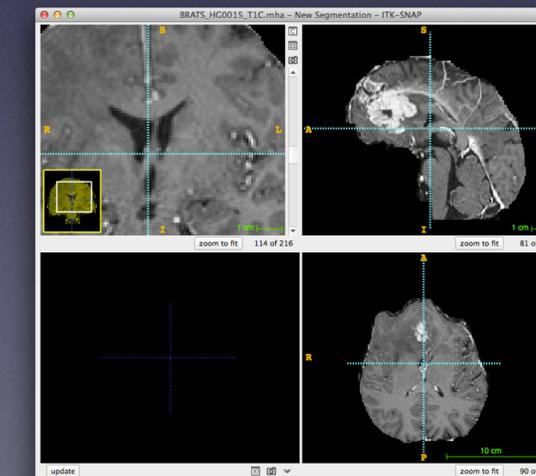
“Zoom/Pan Tool”



Pan



Zoom



Window and Level

Linear Contrast Adjustment:

Minimum: Level:

Maximum: Window:

Curve-Based Contrast Adjustment:

Selected control point:
Id: x: y:

ITK-SNAP Toolbox

BRATS_HG0015_T1C.mha - New Segmentation - ITK-SNAP

Main Toolbar

Zoom Inspector

Linked zoom
Maintains a common zoom factor in all slice views.

Common zoom factor:

1x 2x 4x

3D Toolbar

1300

400

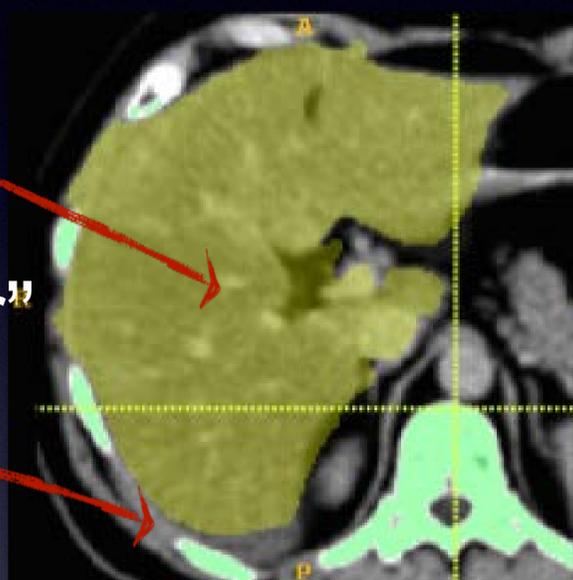
800

zoom to fit 114 of 216

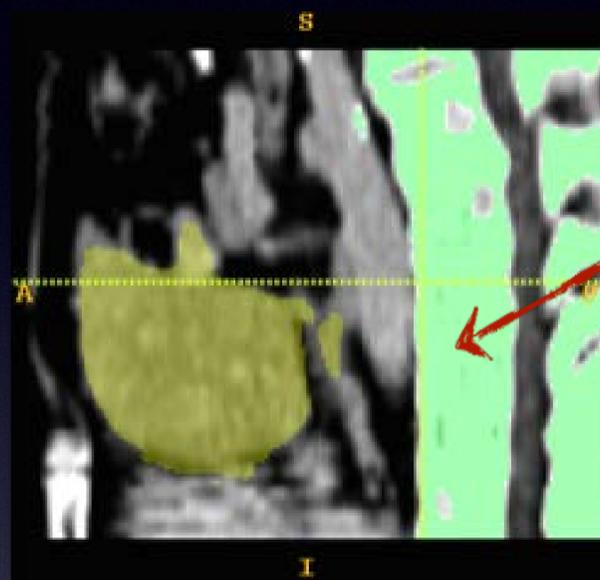
Segmentation in ITK-SNAP

5: liver

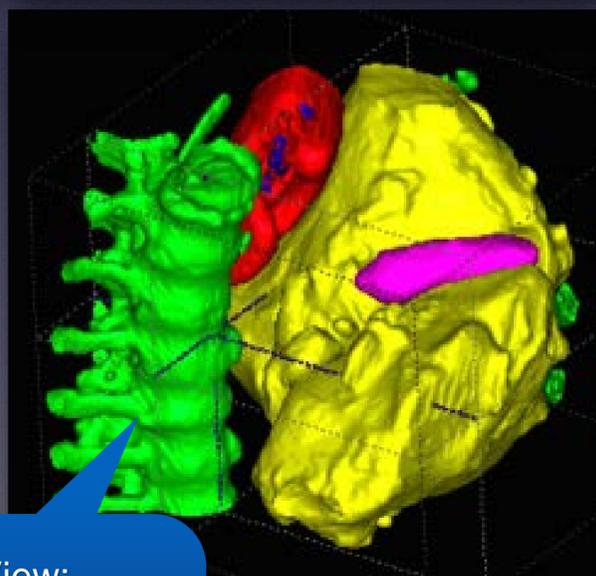
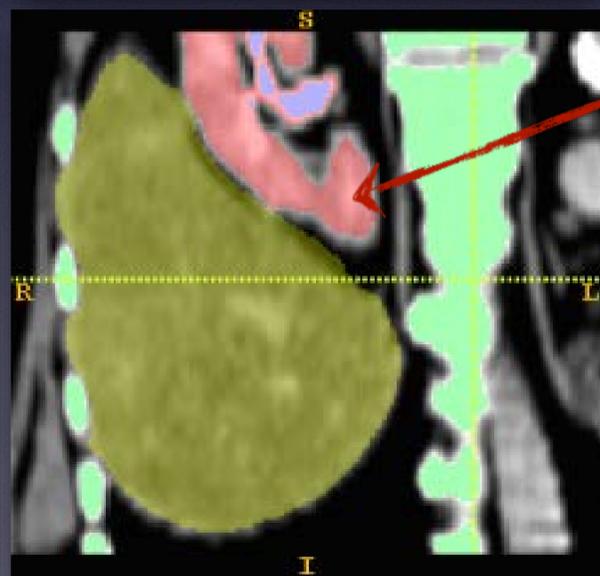
0: "clear"
label



2: bone



1: kidney



3D View:
Interact with 3D objects
extracted from image

Image:
3D voxel array

12	31	224	...
234	123	434	...
234	453	23	...
...

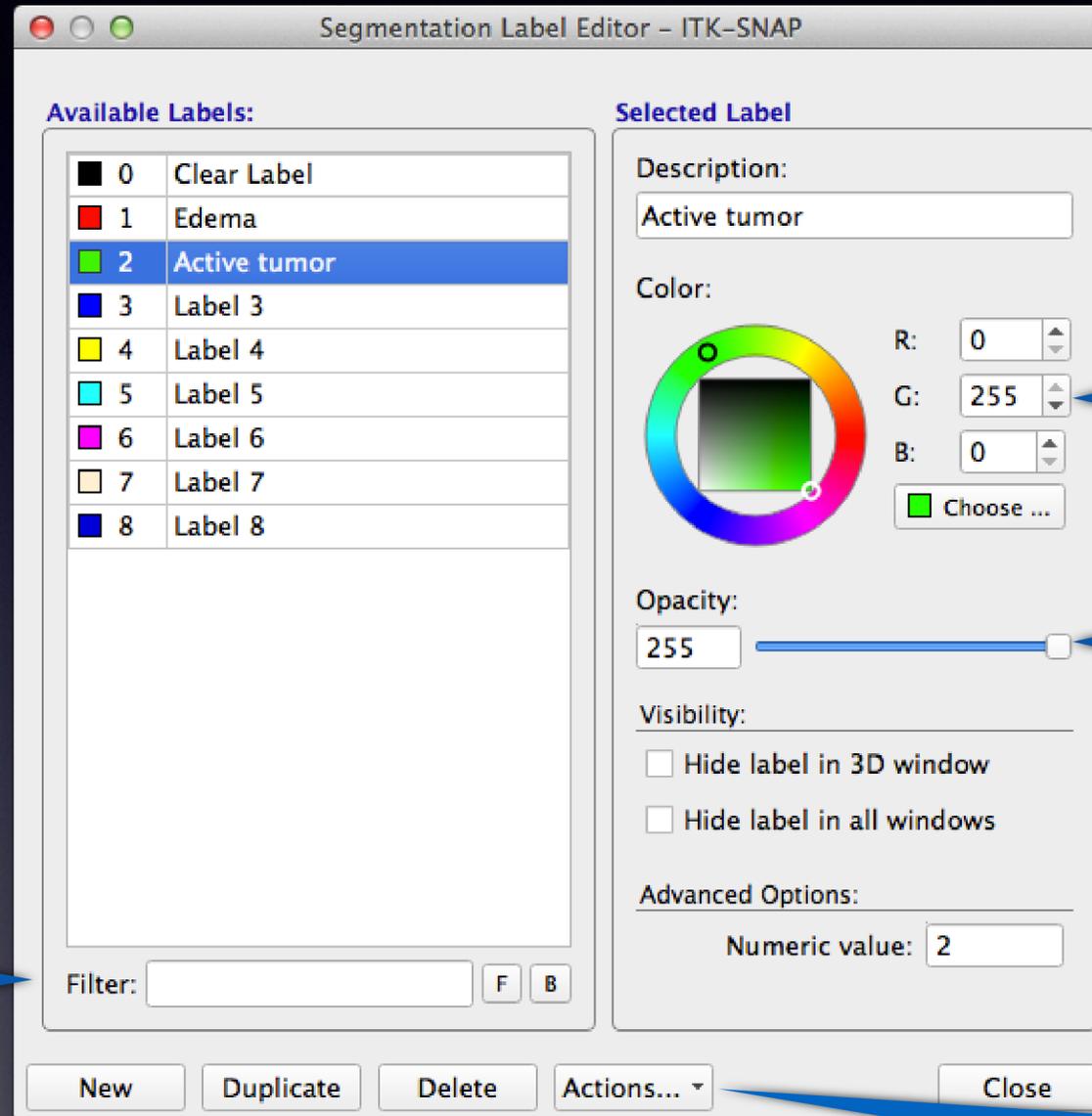
Segmentation:
3D array of labels

0	2	2	...
0	2	5	...
5	5	5	...
...

A separate label description file is used to describe what the numbers in the segmentation image mean

0	Background
2	Bone
5	Liver

Label Editor

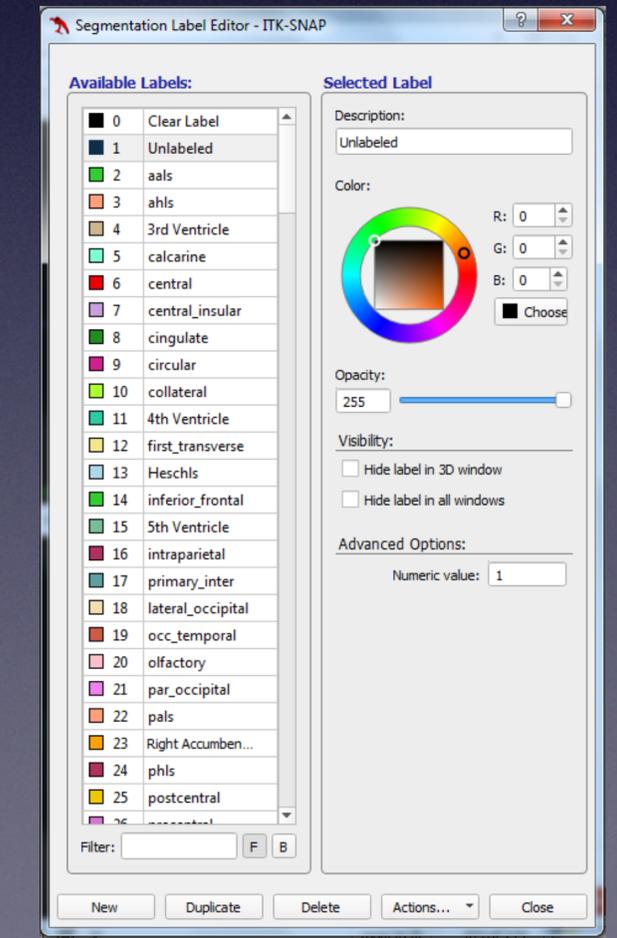
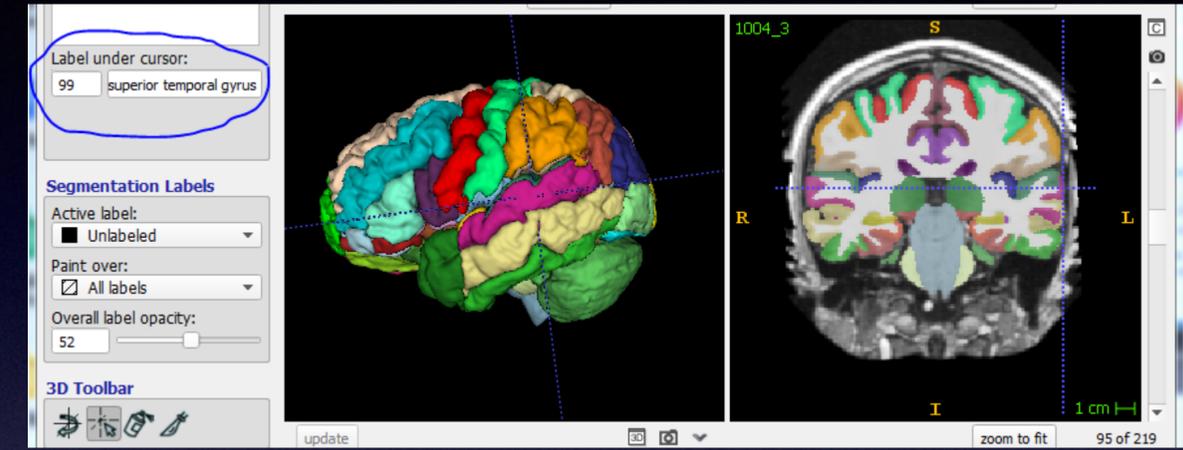


Search box
(for large label sets)

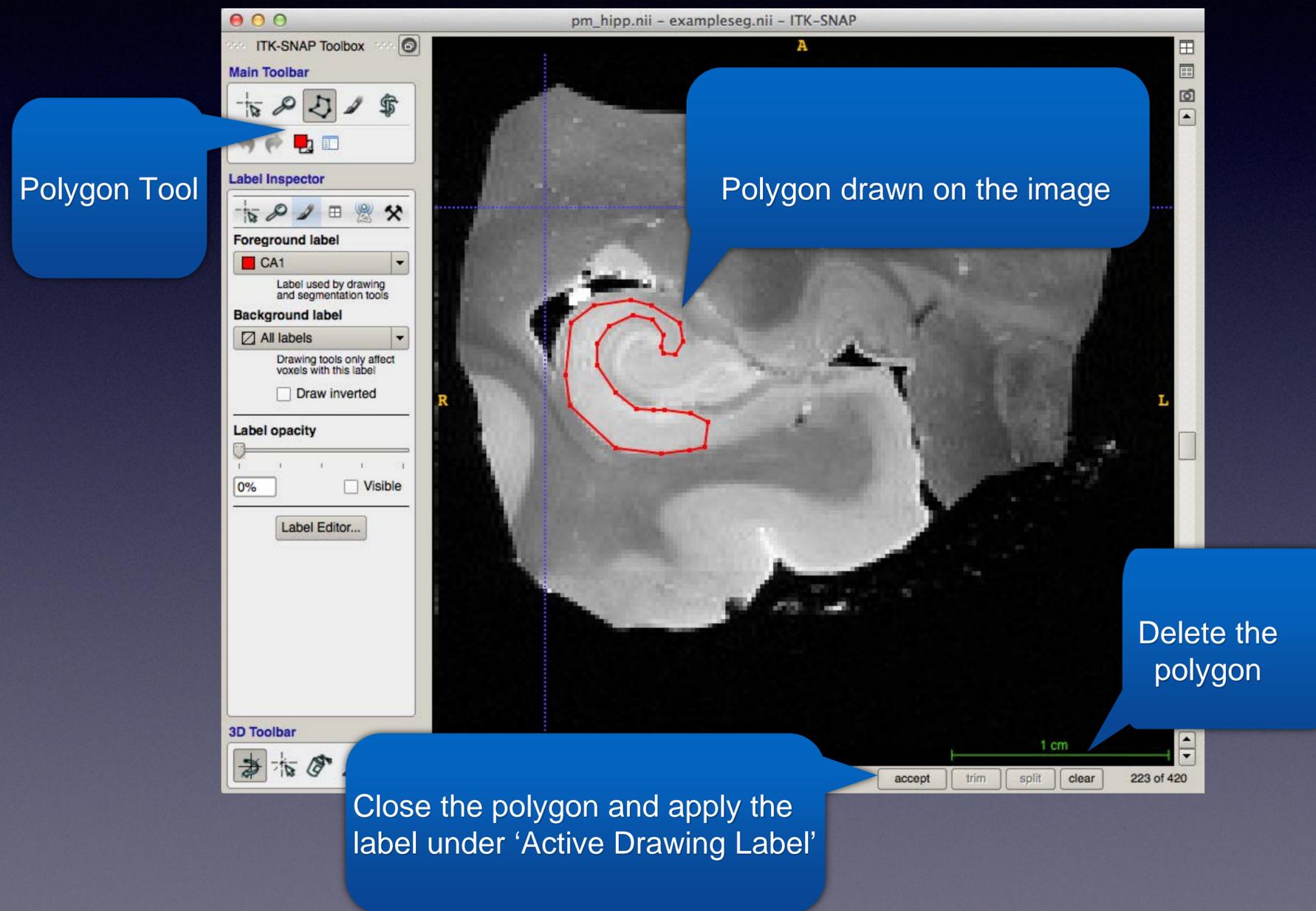
Color of the
selected label

Opacity for the
selected label

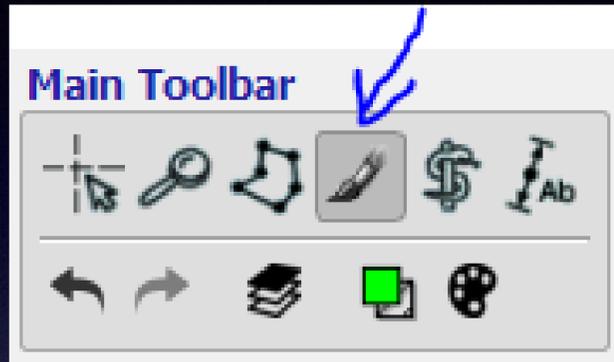
Save/load label
sets (also in app menu)



Polygon Segmentation Tool



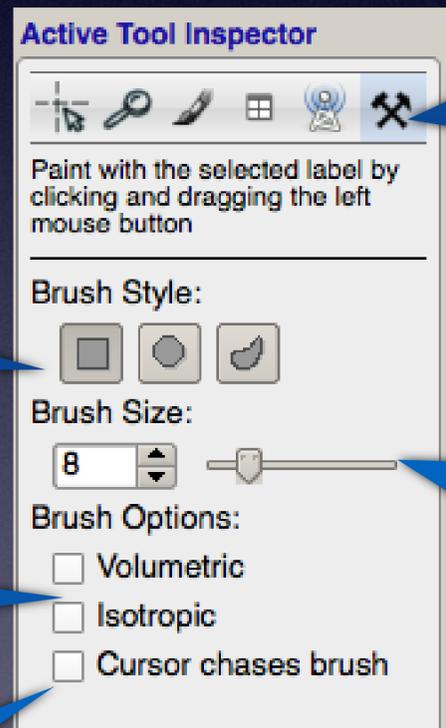
Paintbrush Segmentation Tool



Shape of the paintbrush:
square, round, or adaptive

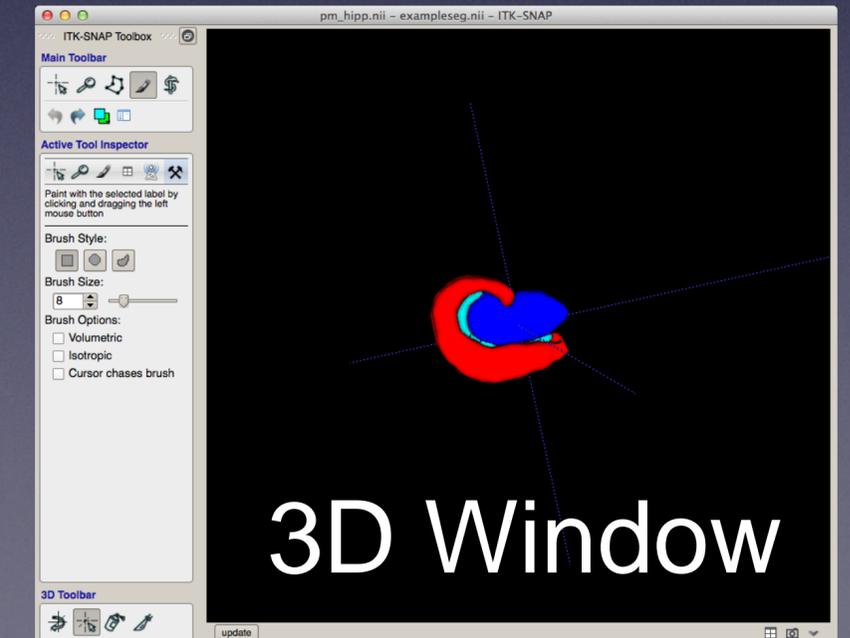
Draw in 3D; draw across planes
simultaneously

Crosshair follows paintbrush



Brush Options

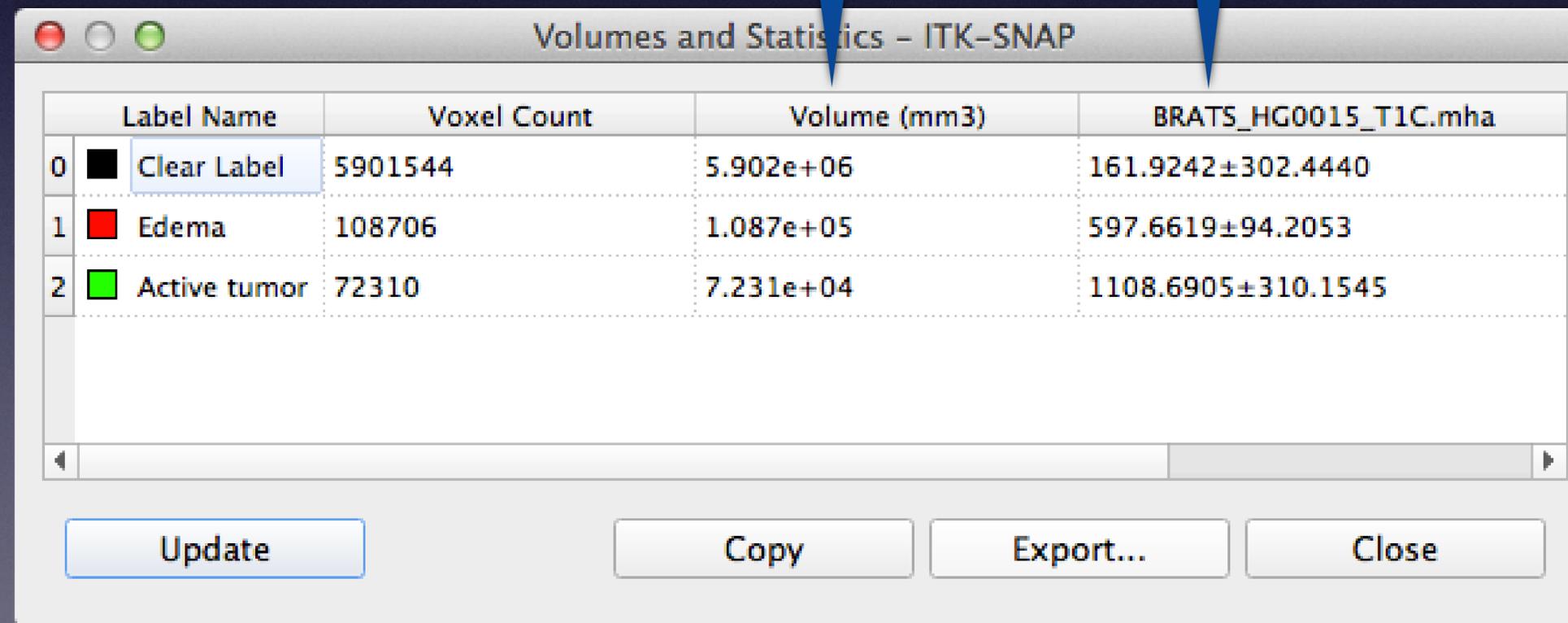
Size of the brush
(slider and button)



Volumes and Statistics

Volume of all voxels
assigned each label

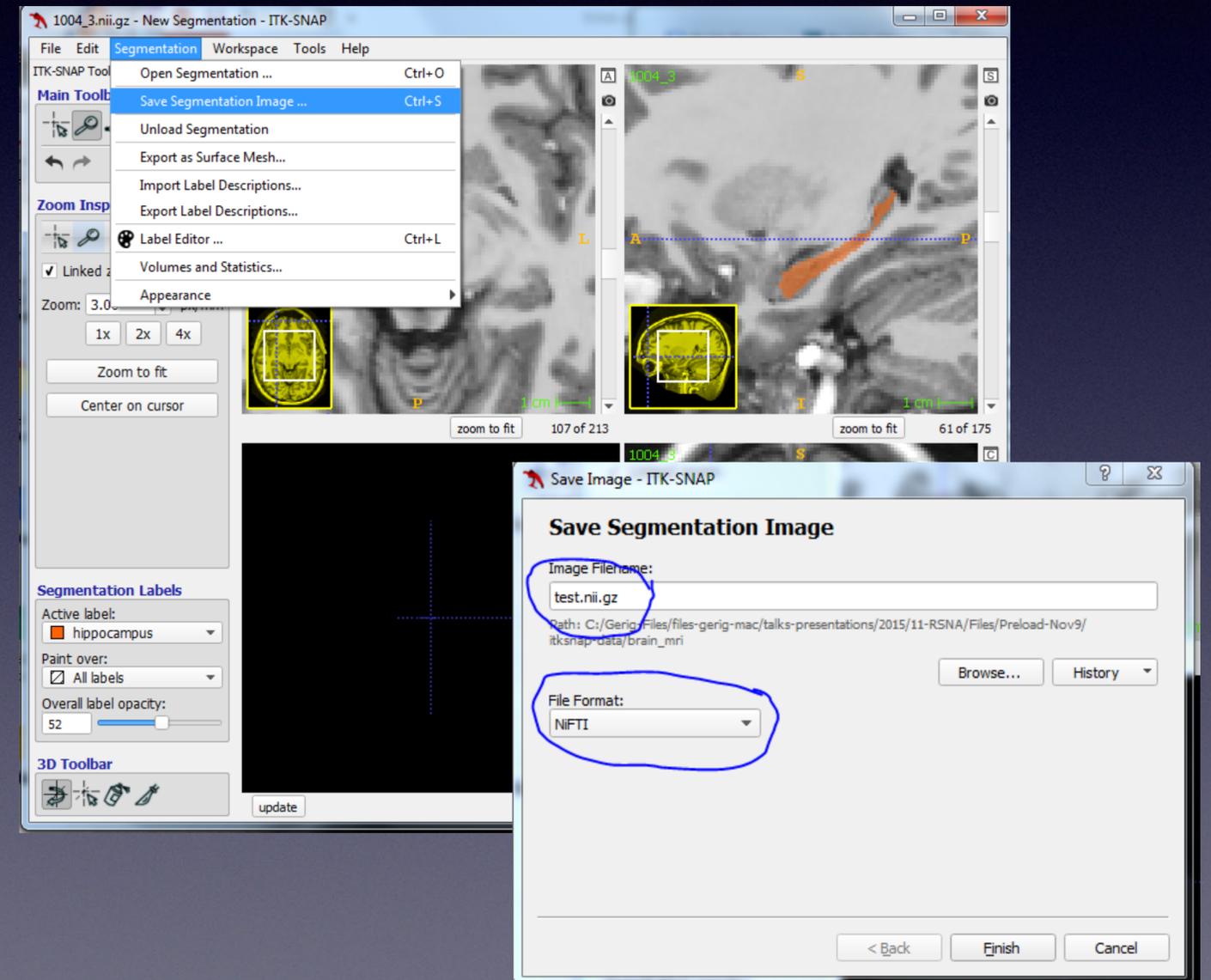
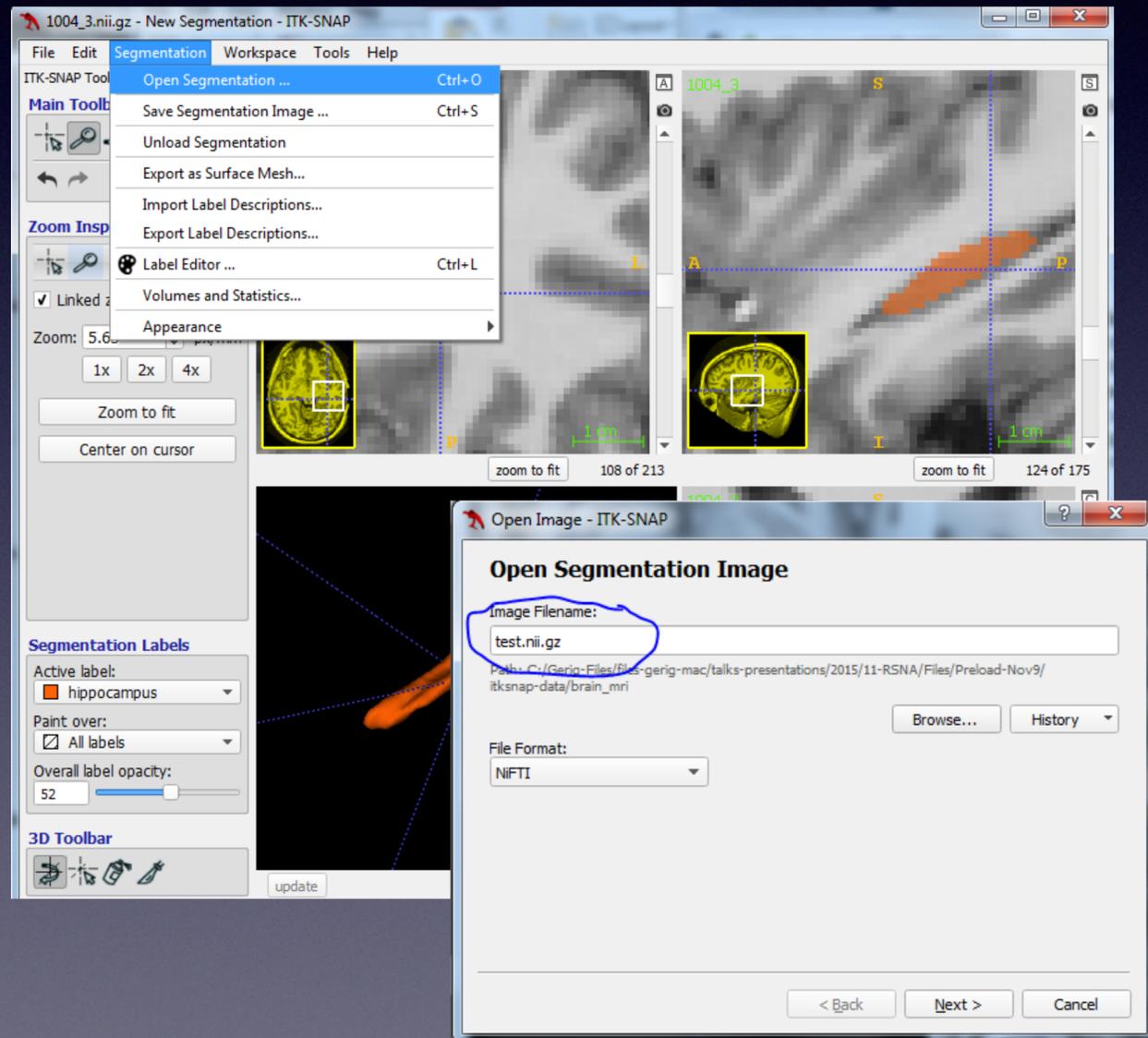
Statistics of image
intensity in the voxels
assigned each label



	Label Name	Voxel Count	Volume (mm3)	BRATS_HG0015_T1C.mha
0	Clear Label	5901544	5.902e+06	161.9242±302.4440
1	Edema	108706	1.087e+05	597.6619±94.2053
2	Active tumor	72310	7.231e+04	1108.6905±310.1545

Update Copy Export... Close

Loading & Saving 3D Segmentation Volumes



Live Demo: Manual Capabilities