

ITK-SNAP User Training I) Manual Capabilities 2) Automatic Capabilities

- itksnap.org
- **RSNA ITK-SNAP Courses** 1/28 and 12/1, 2016

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-'14: ITK-SNAP maintained by Paul Yushkevich and colleagues at Penn with funding from NIBIB
- '12-'16: ITK-SNAP 3.x with a new user interface and support for multi-modality data developed (Penn/Utah)
- '07-'16: Command-line tool Convert3D developed to provide functionality complementary to ITK-SNAP



NIBIB

- 2,500+ downloads per month
- 30+ contributors
- I 47,000 lines of code
- 3 funding NIH grants/ contracts

- Interactive tool for labeling structures in 3D medical image volumes
- Open-source C++ software with binaries provided for Windows, MacOS and Linux
- **ITK-SNAP** vision:
 - Easy to learn and use for clinicians and non-computer researchers
 - Limit features to those that directly support image segmentation
 - Minimize "feature creep"

What is ITK-SNAP?





• itksnap.org Downloads • Test Data • Video Tutorials • Convert3D



Website / Downloads

ITK-SNAP Downloads



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 Objectives

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

Course Organization 11/28

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

- First session (Philip A. Cook)
 - 15' Introduction and overview 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

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What is Segmentation?

separating them from other structures and the background



The process of locating structures of interest in an image and



From Imaging to 3D Image Volumes



Scanner



DICOM Images

From Imaging to 3D Image Volumes



Scanner



DICOM Images



ITK-SNAP shows three orthogonal cuts through the image volume



Using Navigation Tools

"Crosshairs Tool"





"Zoom/Pan Tool"





Out-of-plane









Image navigation with linked cursors



Image navigation with linked cursors



Window and Level



Polygon Segmentation Tool

Paintbrush Segmentation Tool

Manual segmentation

Polygon

Paintbrush

Smart brush

Manual segmentation

Polygon

Paintbrush

Smart brush

Segmentation in ITK-SNAP

0:"clear" label

5: liver

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

2: bone

I: kidney

Image: 3D voxel array

Segmentation: 3D array of labels

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

0	Background
2	Bone
5	Liver

	O O Segmenta	ation Label Editor - ITK-SNAP
	Available Labels:	Selected Label
	0 Clear Label	Description:
	1 Edema	Active tumor
	2 Active tumor	
	3 Label 3	Color:
	4 Label 4	R: 0
	5 Label 5	G: 2
	6 Label 6	В: О
	7 Label 7	
	8 Label 8	
Search box (for large label sets)	Filter:	Opacity: 255 Visibility: Hide label in 3D window Hide label in all window Advanced Options: Numeric value: F
	New Duplicate D	elete Actions

sets (also in app menu)

	00	Segmer	tation Label Ed	itor – ITK–SNAP	
	Available	Labels:		Selected Label	
	0	Clear Label		Description:	
	1	Edema		Active tumor	
	2	Active tumor		Color	
	3	Label 3		Color:	
	4	Label 4		R :	0
	5	Label 5		G:	255
	6	Label 6		B:	0
	7	Label 7			Choose
	8	Label 8			
				Opacity: 255 Visibility:	
				Hide label in 3D wi	ndow
				Hide label in all wir	ndows
				Advanced Options:	
				Numeric value:	2
(for large label sets)	Filter:		FB		
	New	Duplicate	Delete Acti	ions •	Close

Label under cursor:

Opacity for the selected label

Save/load label sets (also in app menu)

Available Labels: Selected Label Description: 0 Clear Label Unlabeled 1 Unlabeled 2 aals Color: 3 ahls 4 3rd Ventricle 5 calcarine 6 central 2 7 central_insular 8 cingulate 9 circular Opacity: 10 collateral 255 11 4th Ventricle Visibility: 12 first_transverse 13 Heschls 14 inferior_frontal 15 5th Ventricle 16 intraparietal 17 primary_inter

FB

Delete

Actions... *

Duplicate

Segmentation Label Editor - ITK-SNAP

18 lateral_occipital 19 occ_temporal 20 olfactory

21 par_occipital

23 Right Accumben..

25 postcentral

D 26

22 pals

24 phls

Filter:

New

L 1 cm H 95 of 219	
? ×	
R: 0 + G: 0 + B: 0 + Choose	
ndow	
dows	
: 1	
Close	

Volumes and Statistics

		Volum assign	e of all voxels ed each label	Statistics of image intensity in the voxels assigned each label
0	0	Volume	s and Statis ics - ITK-SN	AP
L	abel Name	Voxel Count	Volume (mm3)	BRATS_HG0015_T1C.mha
	Clear Label	5901544	5.902e+06	161.9242 ± 302.4440
	Edema	108706	1.087e+05	597.6619±94.2053
	Active tumor	72310	7.231e+04	1108.6905±310.1545

Loading & Saving 3D Segmentation Volumes

Hands-on Training: Manual Capabilities (30')

Complete Module I in handout (Exercises I and 2)