A Tutorial for RSS in Slicer

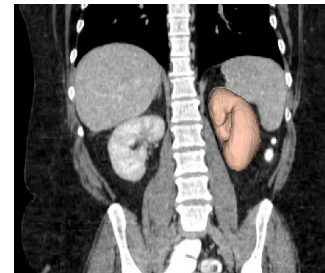Yi Gao[1], Allen Tannenbaum[1], Ron Kikinis[2]
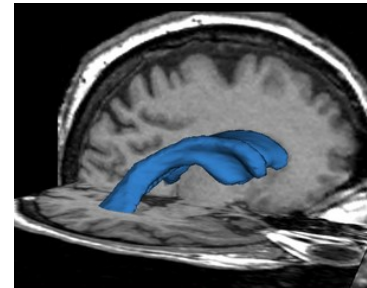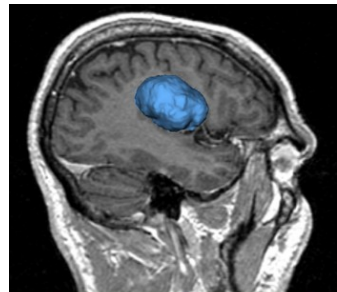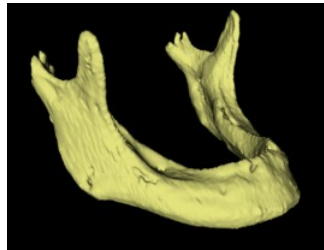
[1]Georgia Tech, [2]BWH

Contact: yi.gao@gatech.edu

NA-MIC Tutorial Contest: Summer 2010

Learning Objective

- How to use:

    RSS (Robust Statistics Segmenter) in Slicer 3.6

Pre-requisite tutorials:

- Slicer3Minute Tutorial
    - by Sonia Pujol
    - at http://www.slicer.org/slicerWiki/images/e/e2/Slicer3.6MinuteTutorial_SoniaPujol.pdf

- Slicer3Visualization Tutorial
    - by Sonia Pujol
    - at http://www.slicer.org/slicerWiki/images/c/c9/3DDataLoadingAndVisualization_Slicer3.6_SoniaPujol.pdf

Material

- This tutorial requires the installation of the **Slicer3.6 release** and the tutorial dataset. They are available at the following locations:

- **Slicer3.6** download page

  http://www.slicer.org/pages/Downloads/

- **Tutorial dataset**:

  http://wiki.na-mic.org/Wiki/images/2/20/RSSData_TutorialContestSummer2010.zip

Disclaimer: *It is the responsibility of the user of Slicer to comply with both the terms of the license and with the applicable laws, regulations, and rules.*

Platform

- Developed on Linux 64

- Tested on
    - Linux 64/32

    - Mac

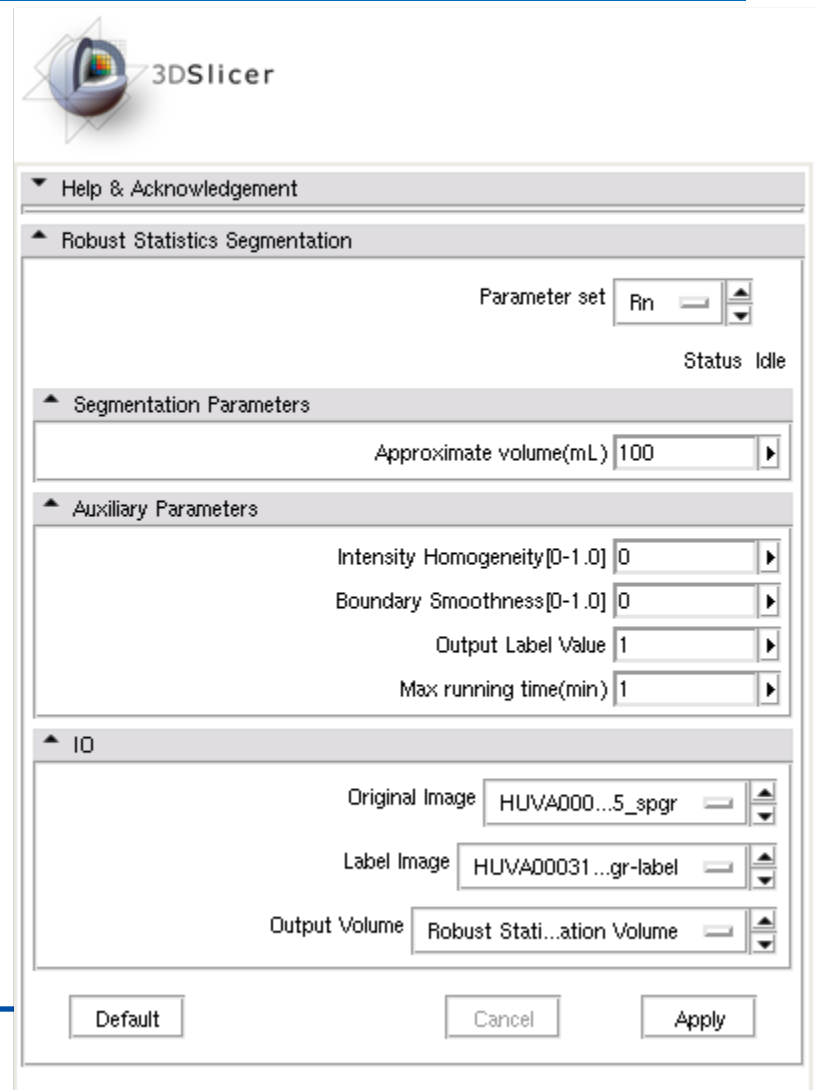   - Windows XP 32 (I don't have Win64 ...)

Overview

- Basic using steps
  - First try
- How to tune it
  - What if not satisfying
- Examples
- What's not for
  - Cases may need other tools

Basic usage, 1/4

- Slicer 3.6

- Module
  - Segmentation
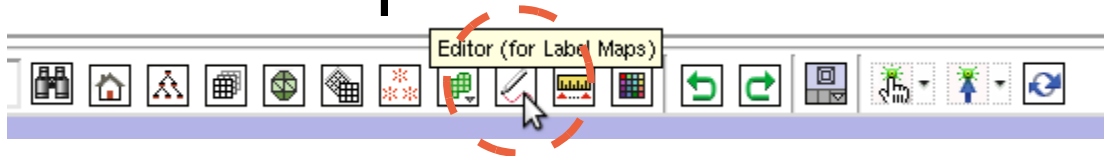 - Robust Statistics Segmentation

- Module panel ⟹

Basic usage, 2/4

- ## Load in target image
  - Slicer3/Applications/CLI/RobustStatisticsSegmenter/grayscale.nrrd
  - http://www.spl.harvard.edu/publications/item/view/1180
    - Tumorbase.zip at page bottom, case 3

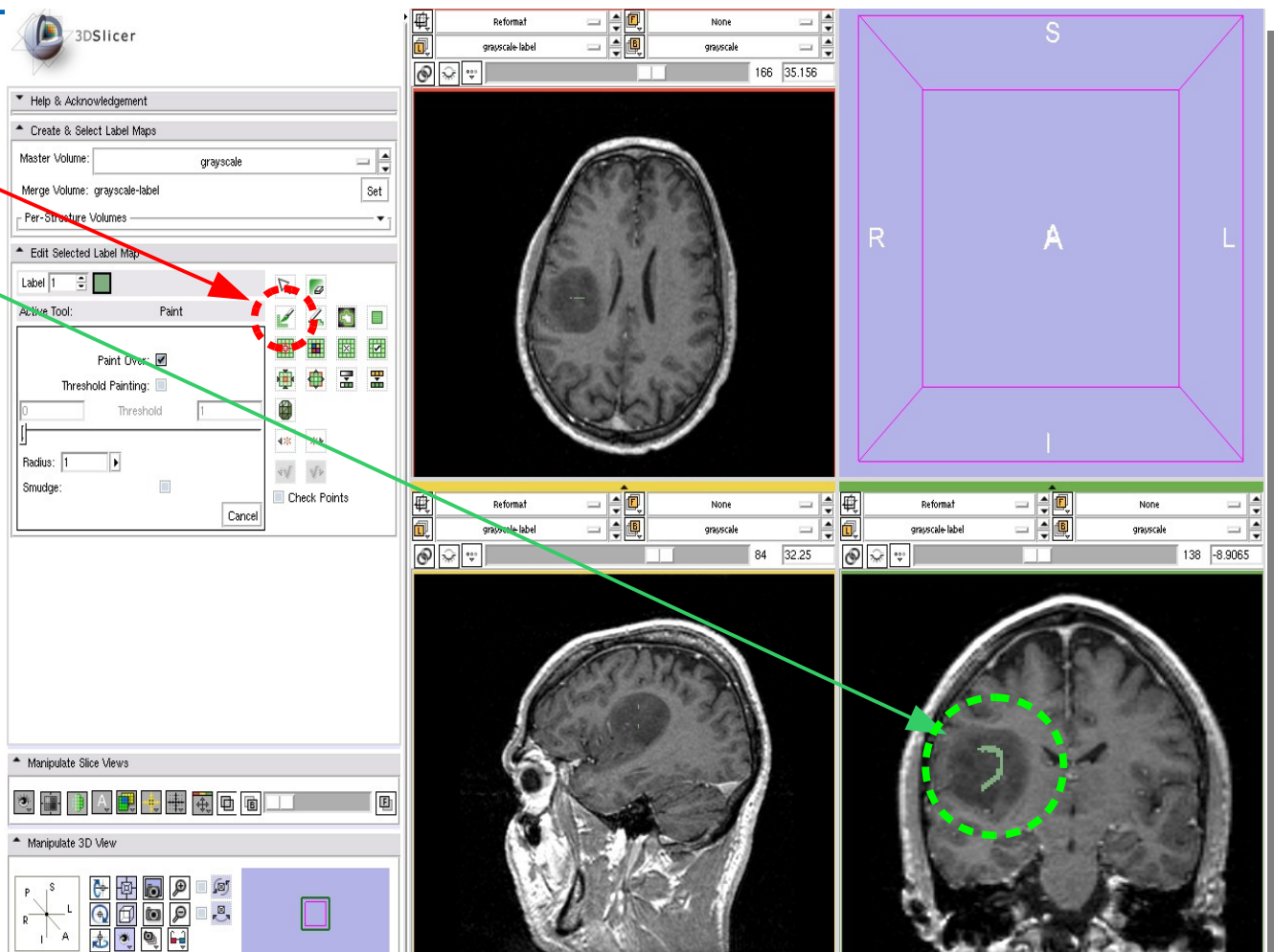- ## Label map in Editor module

- ## In the editor, draw in the object (next page)

Basic usage, 3/4
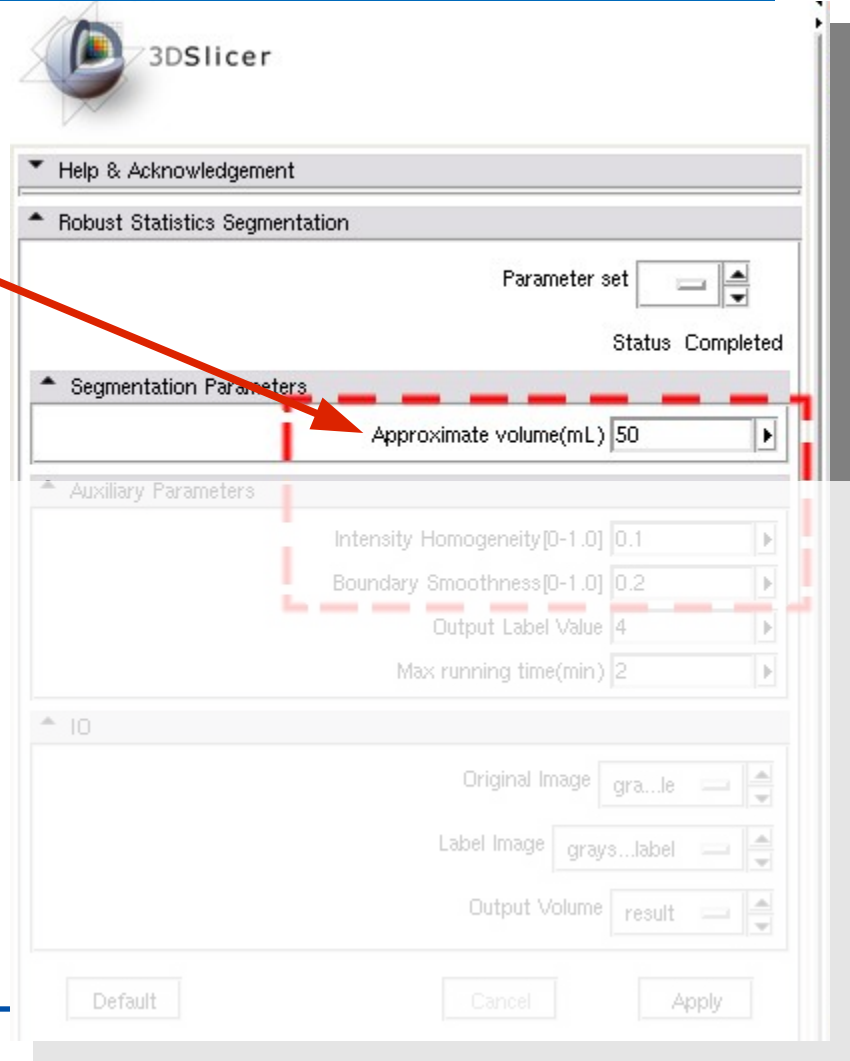

- Use
- Draw

Basic usage, 4/4

- Volume limit

- Intensity homogeneity
- Smoothness

- Target image
- Label image
- "Create new volume"

3DSlicer

▼ Help & Acknowledgement

▲ Robust Statistics Segmentation

Parameter set ▢

Status Completed

▲ Segmentation Parameters

Approximate volume(mL) 50 ▶

▲ Auxiliary Parameters

Intensity Homogeneity[0-1.0] 0.1 ▶

Boundary Smoothness[0-1.0] 0.2 ▶

Output Label Value 4 ▶

Max running time(min) 2 ▶

▲ IO

Original Image gra...le ▢

Label Image grays...label ▢

Output Volume result ▢

Default   Cancel   Apply
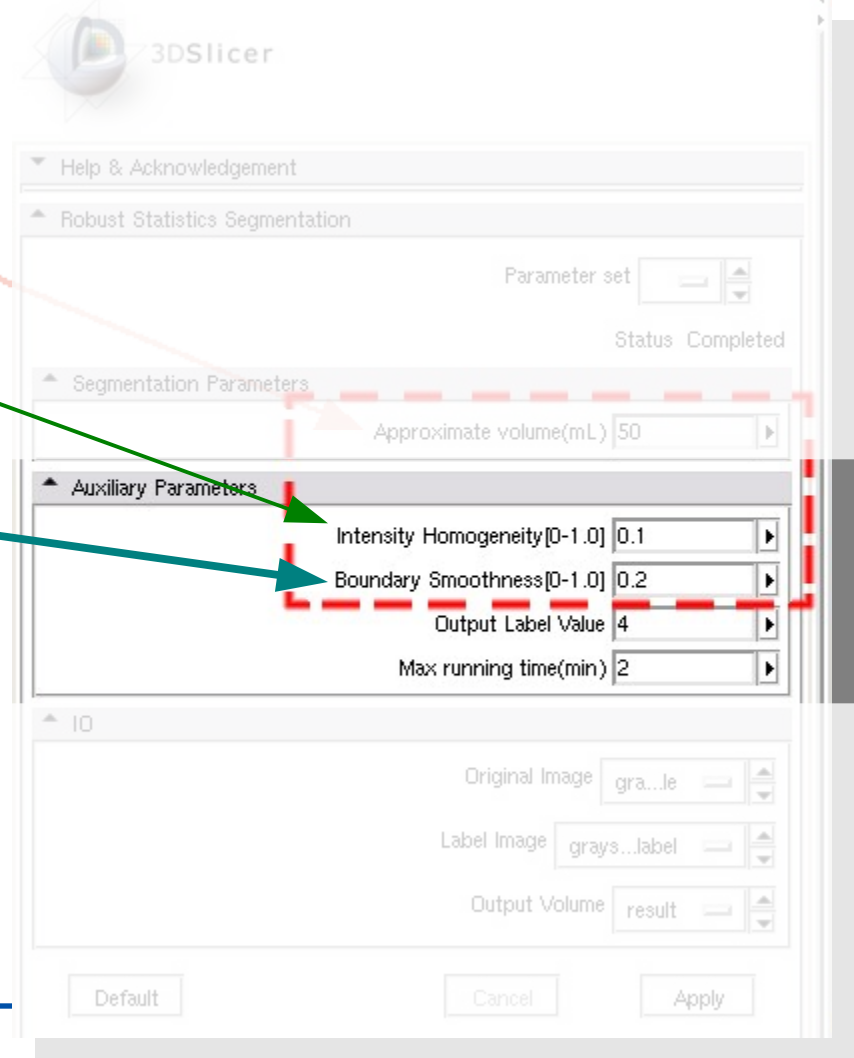
Basic usage, 4/4

- Volume limit

- Intensity homogeneity
- Smoothness

- Target image
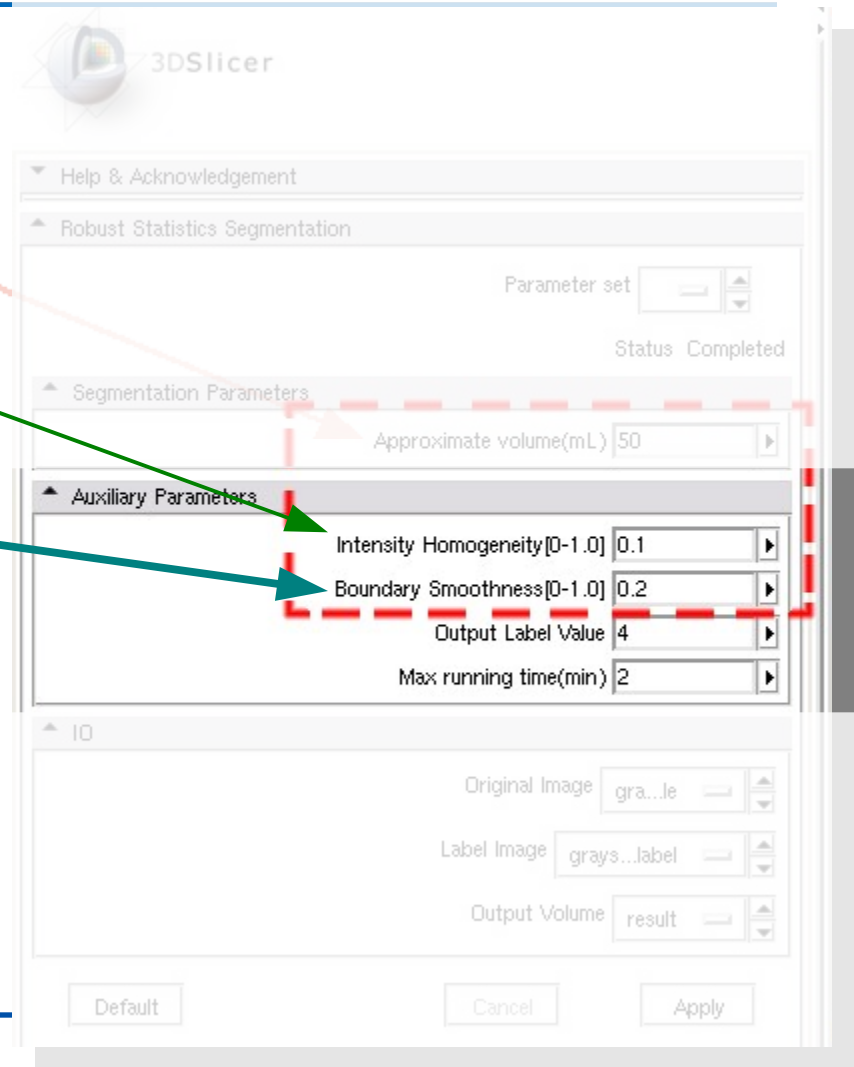- Label image
- "Create new volume"

Basic usage, 4/4

- Volume limit

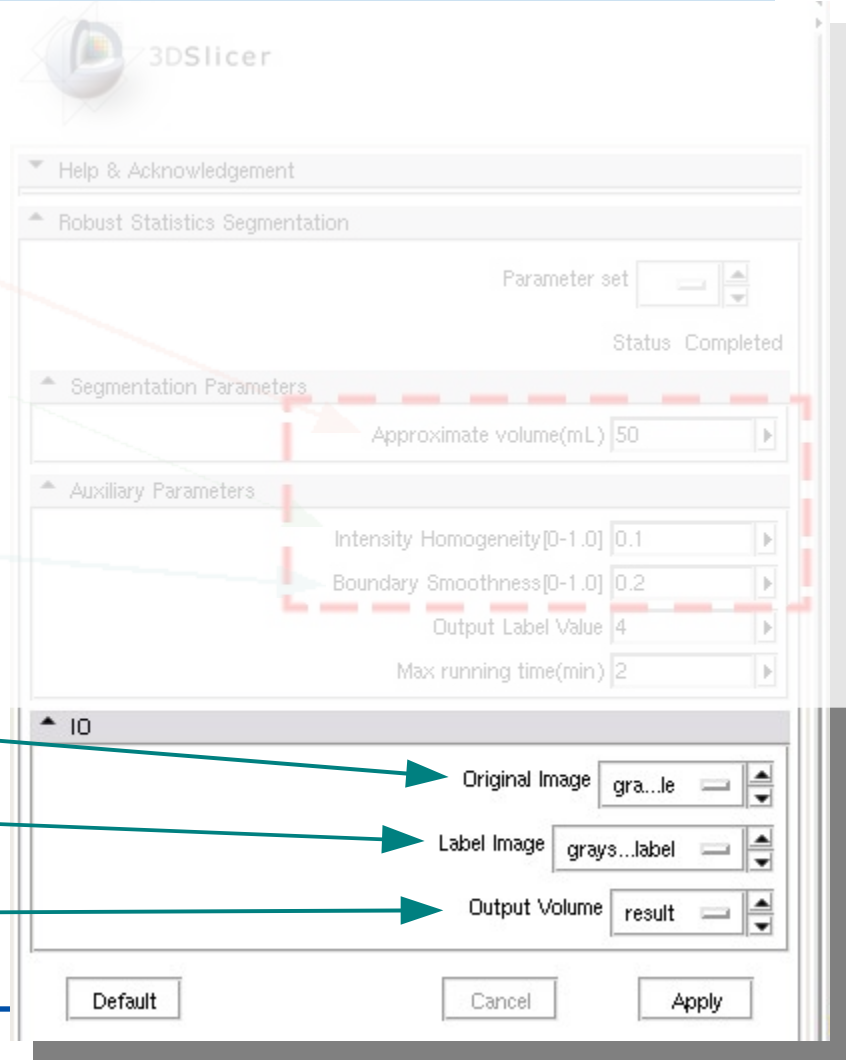- Intensity homogeneity

- Smoothness

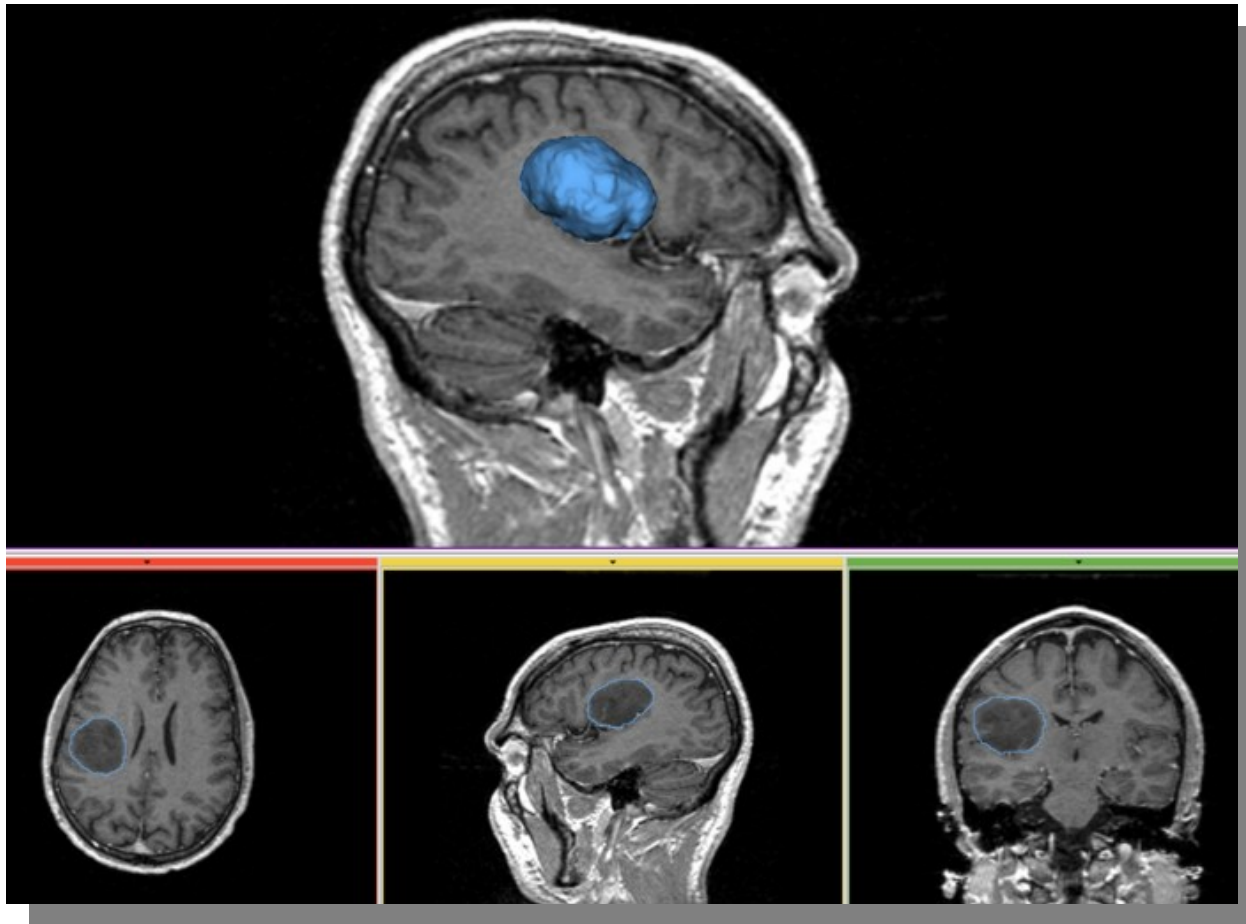 If not sure, use default values (both set to 0). Let it run and adjust later.

Basic usage, 4/4

- Volume limit

- Intensity homogeneity
- Smoothness

- Target image
- Label image
- "Create new volume"

3DSlicer

Help & Acknowledgement

Robust Statistics Segmentation

Parameter set

Status Completed

Segmentation Parameters

Approximate volume(mL) 50

Auxiliary Parameters

Intensity Homogeneity[0-1.0] 0.1

Boundary Smoothness[0-1.0] 0.2

Output Label Value 4

Max running time(min) 2

IO

Original Image gra...le

Label Image grays...label

Output Volume result

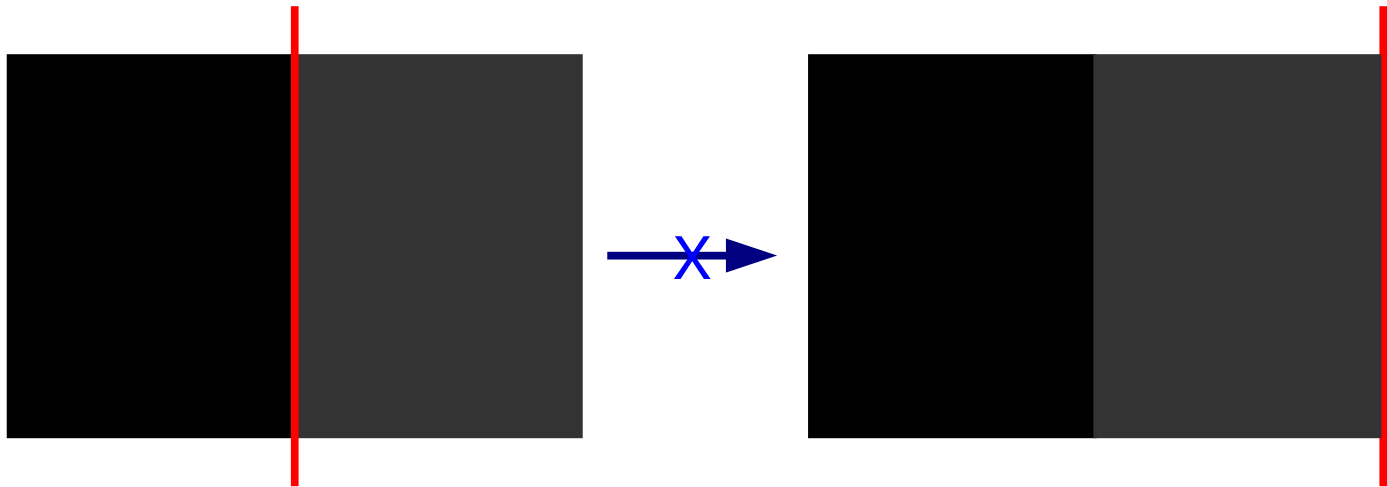Default   Cancel   Apply

Wait 2.5 seconds...
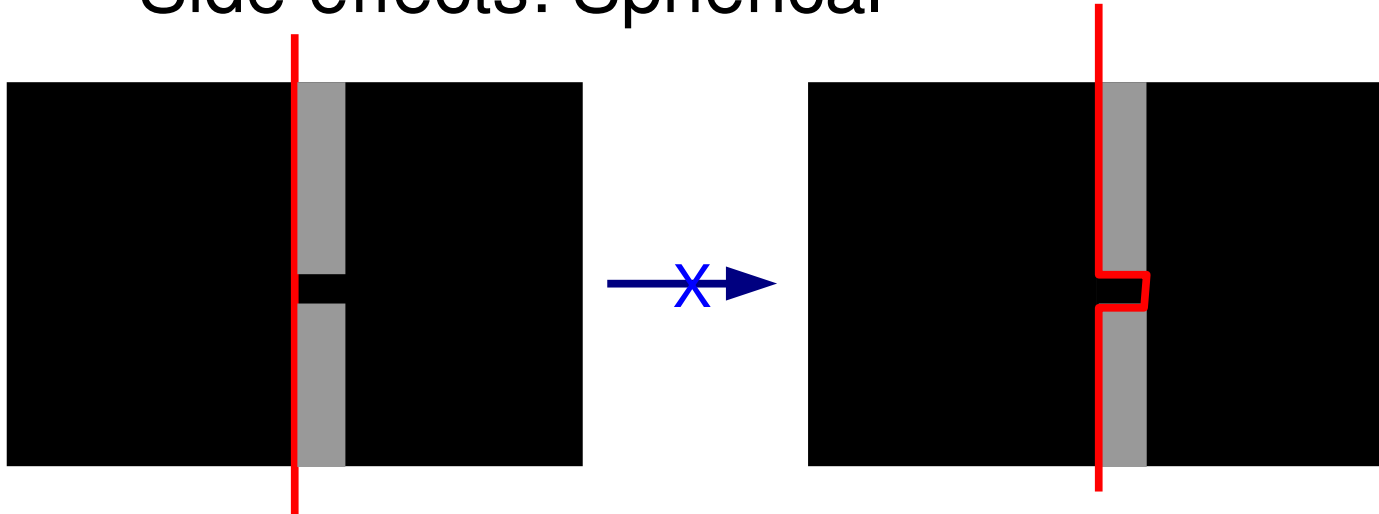
Fine tune, 1/2

- **Intensity homogeneity** ~1 means:
  - Homogeneous intensity in the target
  - Prevent leakage to *similar intensity region*
  - Be strict

Fine tune, 2/2

- **Boundary smoothness** ~1 means:
  - Boundary is smooth
  - Prevent leakage *through a thin gap*
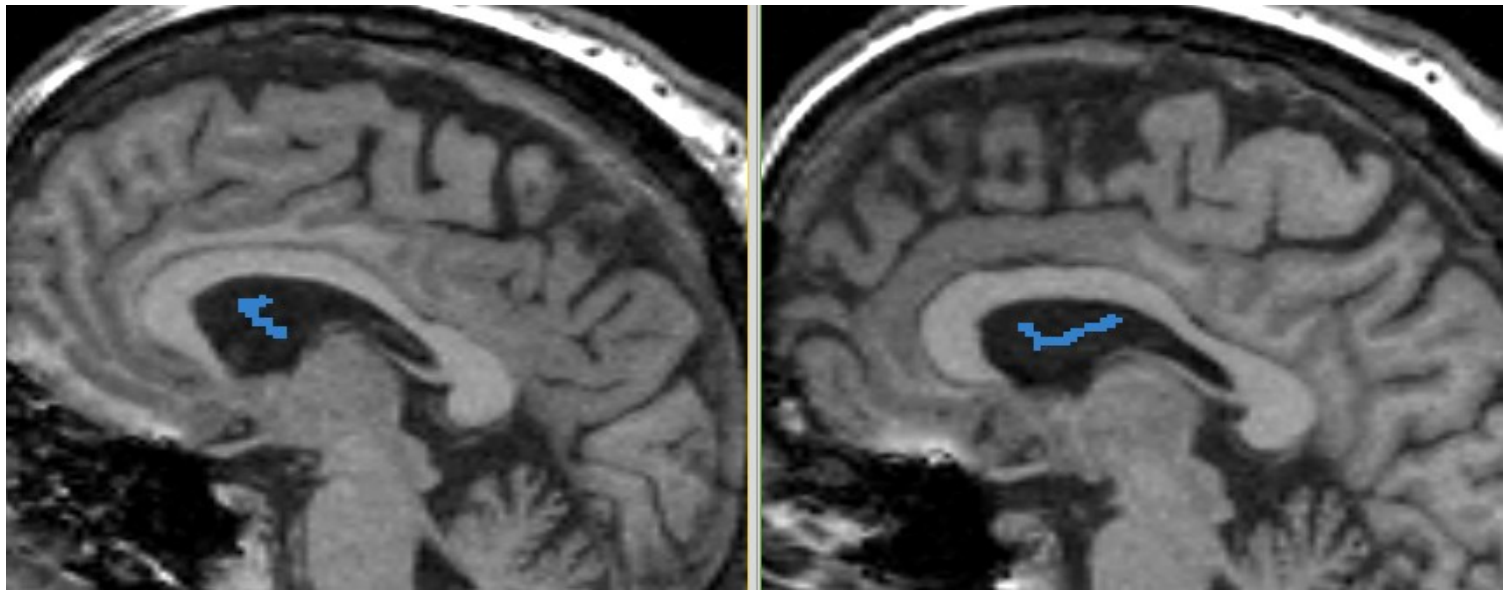 - Side effects: Spherical

Fine tune, summery

- **Small** (~0)
  - IH, BS: encourage growth
- **Large** (~1)
  - IH, BS: discourage growth
  - BS: spherical shape
    - In the following examples, set BS to 0 because the objects (ventricle, aorta, mandible) are not spherical.
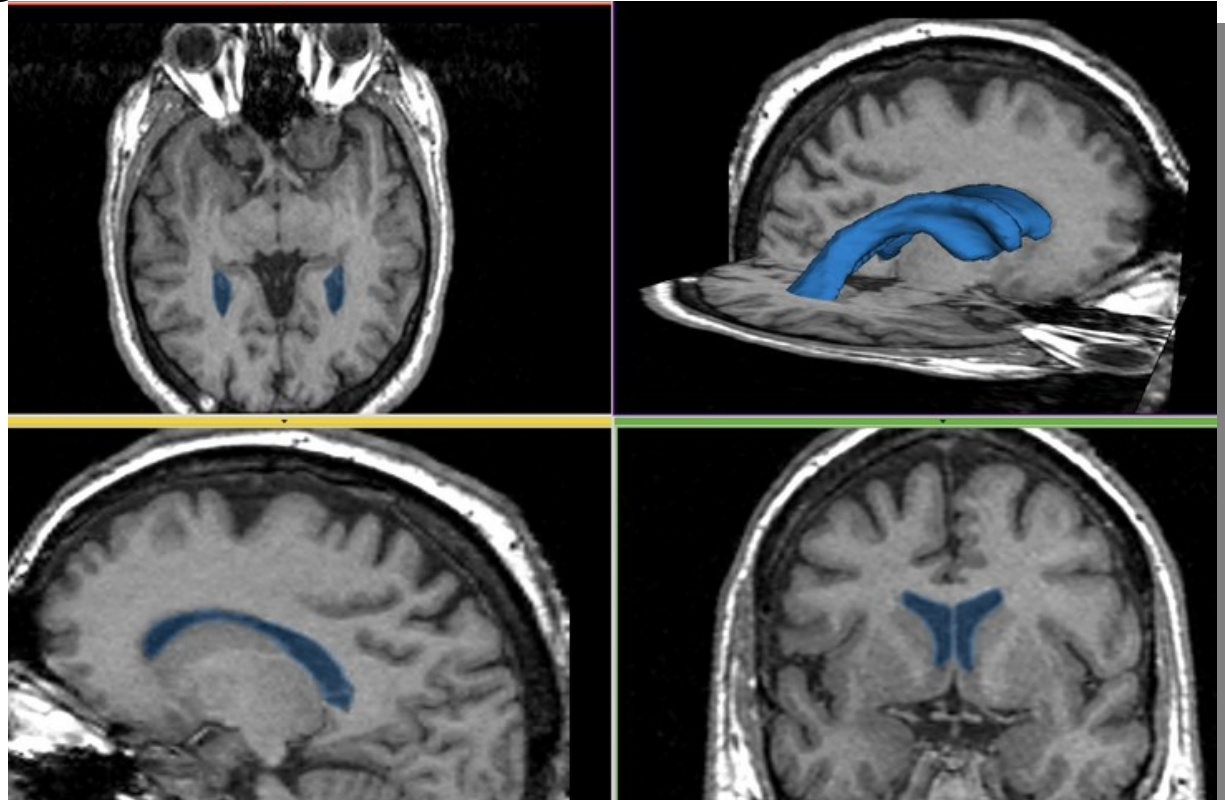
More examples, ventricle

- MRI
  - HUVA12611577_spgr.nrrd
  - Labels: in two sagittal slices

More examples, ventricle

- Parameters
  - Vol: 30ml
  - IH: 0.02
  - BS: 0
- 2.5 sec
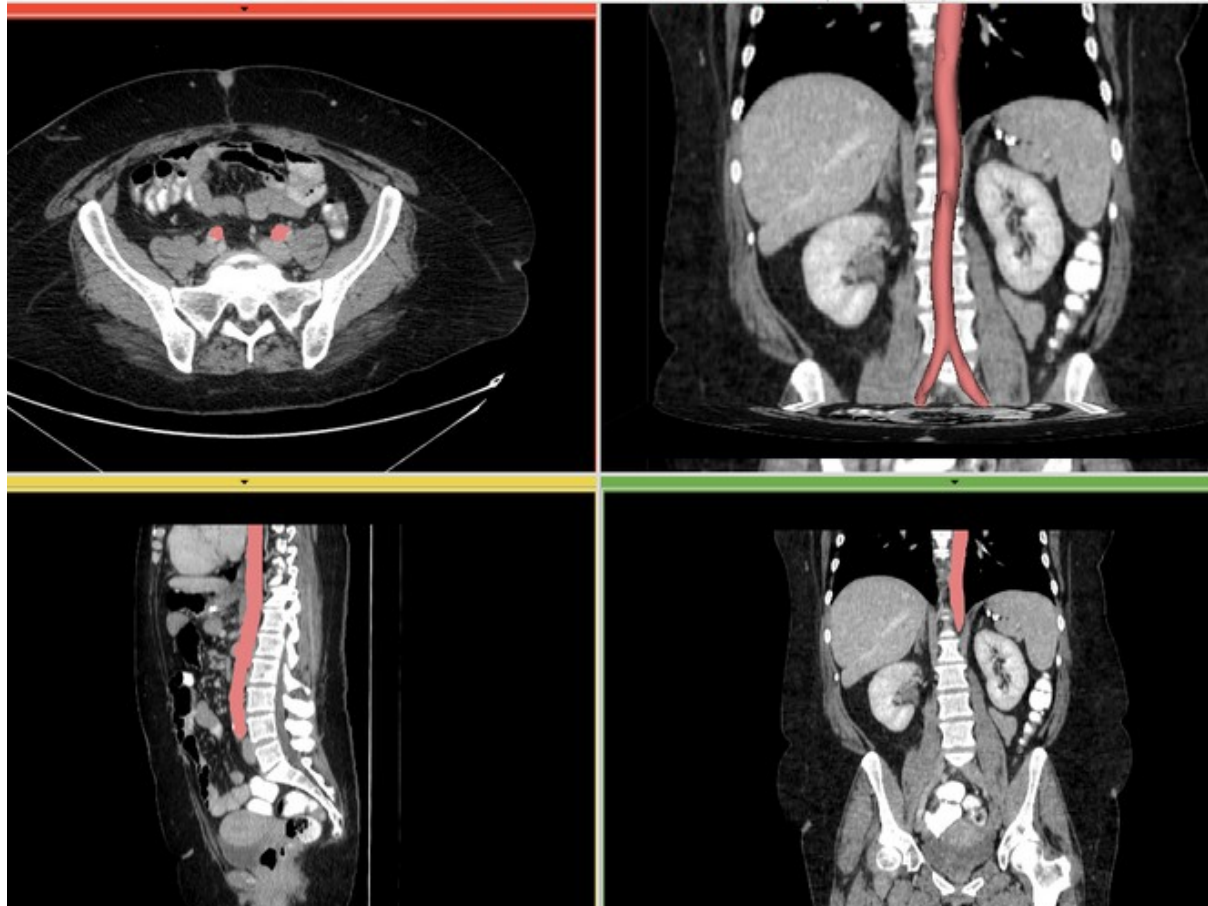
More example, aorta

- CT
  - IMCT.nrrd
- Label
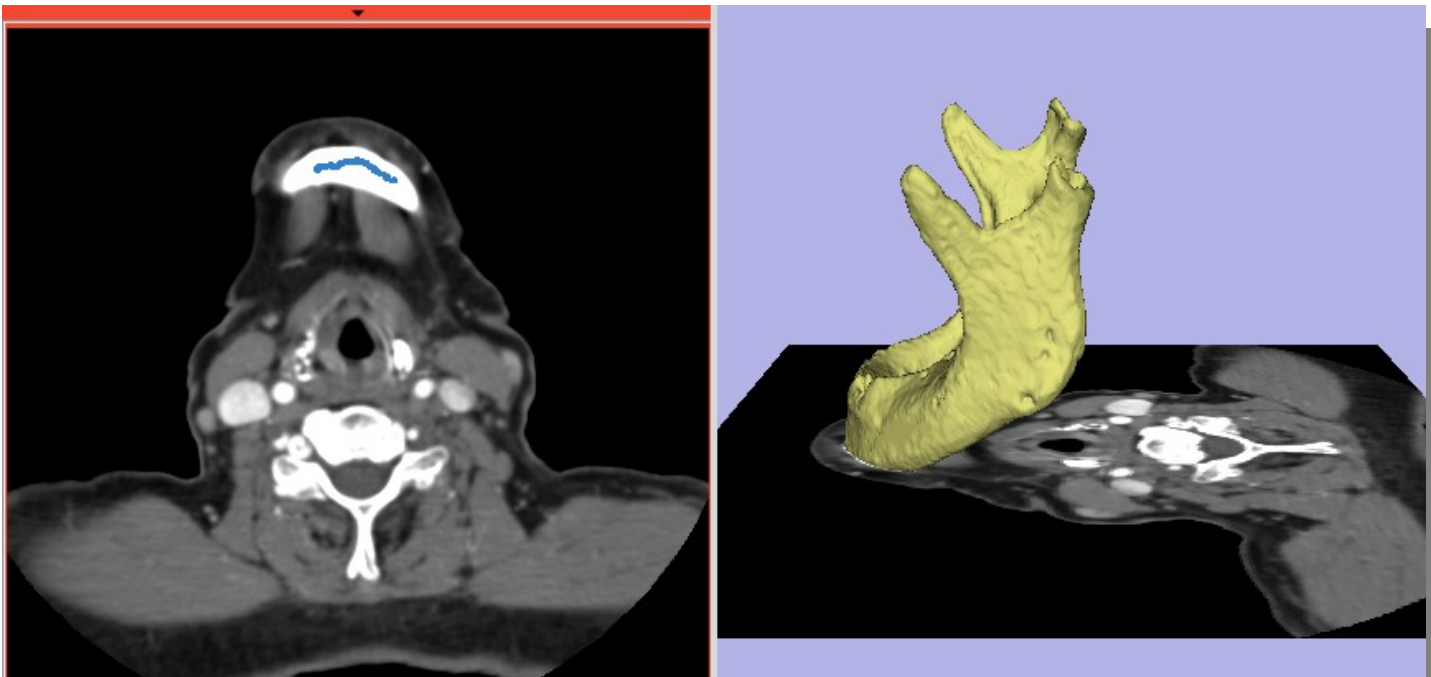 - 1 sagittal slice
  - Along center line

More example, aorta

- Parameters
  - Vol: 60ml
  - IH: 1.0
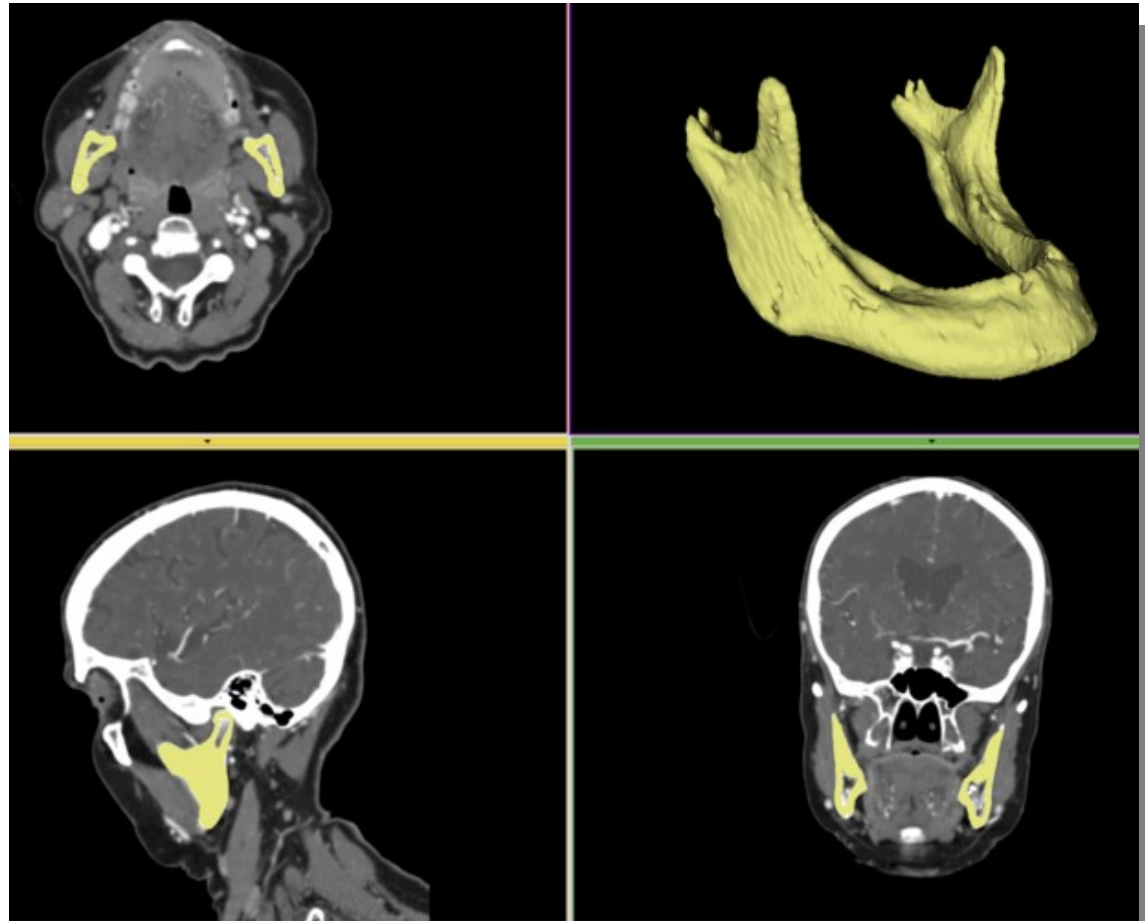 - BS: 0
- 12 sec

More example, mandible

- CT http://pubimage.hcuge.ch:8080/ MANIX data set
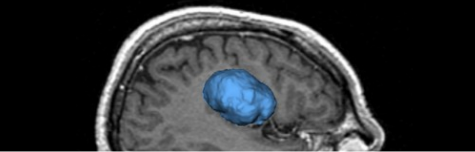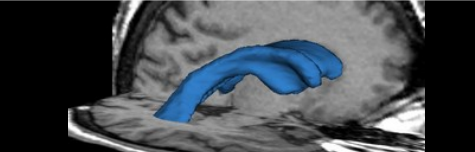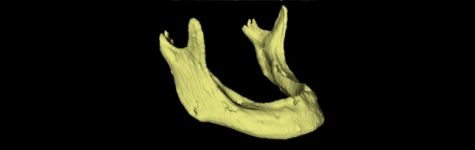- Label: 1 axial slice

More example, mandible

- Parameters:
  - Vol: 100ml
  - IH: 0.5
  - BS: 0.0
- 160 sec

Example summery

	volume limit	homogeneity	smoothness	running time
	50 ml	0.1	0.2	2.5 sec
	30 ml	0.02	0	2.5 sec
	60 ml	1.0	0	12 sec
	100 ml	0.5	0	160

What's not for

- Texture images
  - Seeds cover many intensity levels, also appearing in background

- Intensity range similar to background
  - Similar reason as above

Conclusion

- A new module, RSS, in Slicer3.6

- It's basic usage & How to tune it

- Examples

- Cases RSS won't work well

Acknowledgments

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NIH U54EB005149

• Thank the creator of this template file, who makes tutorial preparation much easier.