Analyze 15.0

Brain Tumor Segmentation

AnalyzeDirect

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Introduction

Segmentation and volume measurement of brain tumors allows visualization of the size and position of a tumor within the brain, and also provides for comparison of pre-operative and post-operative images or visualization of changes in a tumor's size and shape through a treatment time period.

The gold standard of brain tumor segmentation has long been manual segmentation, which is time-consuming and labor-intensive, and thus unsuitable for large studies. Much research has been done to attempt to fully or partially automate the process of tumor segmentation.

This guide outlines a semi-automated technique for segmentation of brain tumors from T1-weighted, contrast-enhanced MR data using Analyze 15.0. The segmentation step requires a user-defined seed point and threshold range. It then uses an object extraction algorithm to define the tumor. The tumor volume can easily be measured once the segmentation step is complete.

Loading Data

- Open Input/Output.
- Navigate to and select the MRI_ Tumor data set.
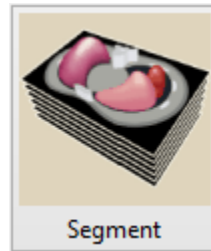- Click Load Volume.
- Close Input/Output.

Input/Output
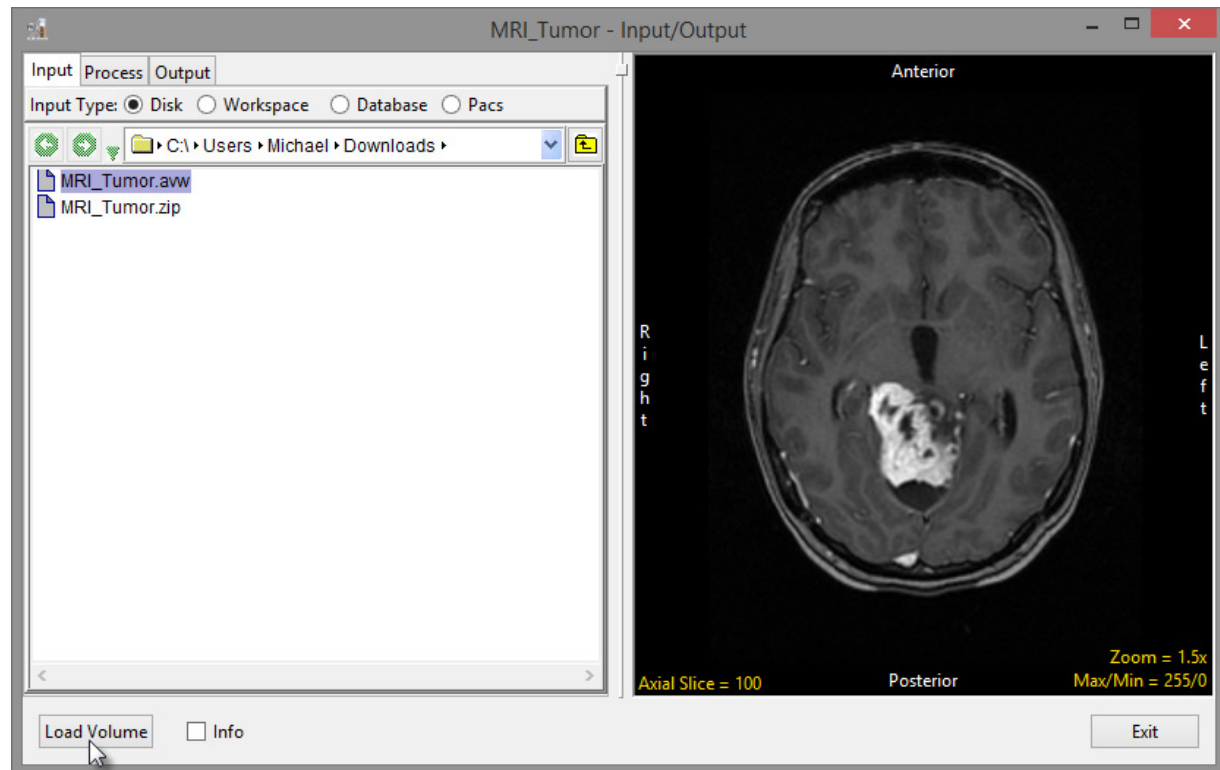
Tumor Segmentation

- Select the MRI_Tumor data set.
- Open Segment.
- Set the Primary display to Axial.

- Disable the Cursor Link tool by clicking the Toggle Cursor Link button in the top right corner of the window.

- If the data set appears dark, the image intensity display range can be adjusted.

- Click Max/Min in the bottom right corner to adjust the display range:

  · Lower the maximum value until the structures are lightened and easier to see. To do this, hold down the Shift key and move the mouse downwards.

 · For this data set, a Max/Min range of 180/0 works well.
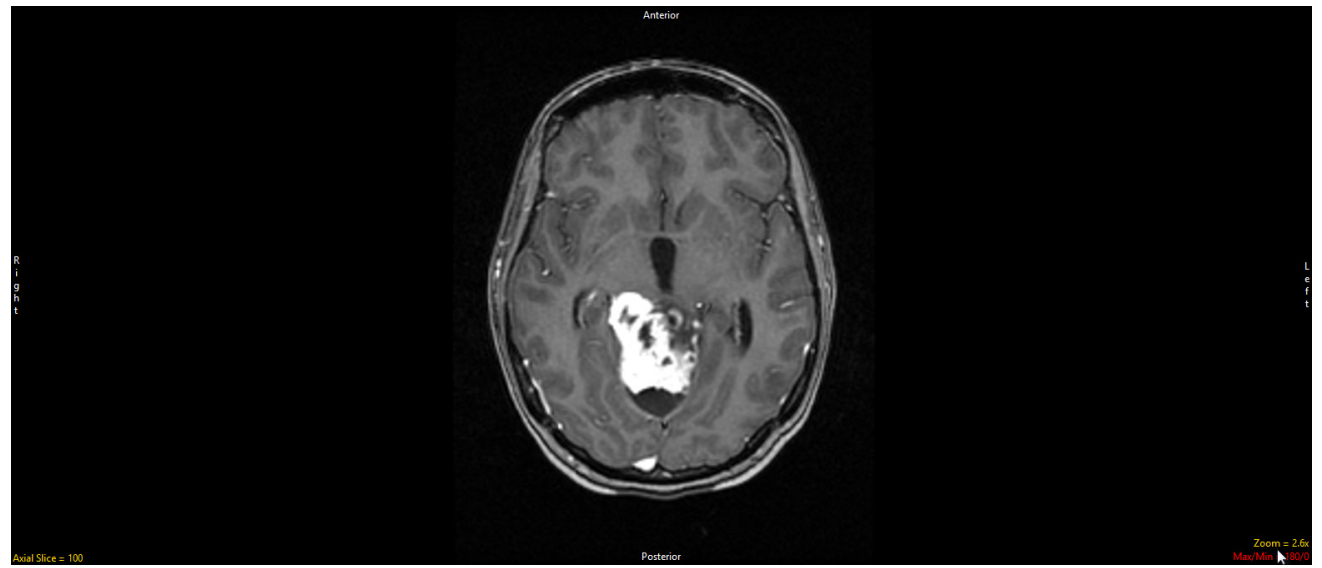
- Click on the Semi-Automatic tab and select the Object Extractor option.
- Using the middle scroll wheel, navigate to a slice where the tumor is spatially connected and click in the tumor to set a seed point.
  · In this example, the seed point was set on axial slice 99.
- Once the seed point has been chosen, adjust the threshold bar to define the tumor.

In this contrast-enhanced data set, the tumor appears hyperintense, so the maximum threshold level should be set to the highest possible value. The minimum threshold value should be adjusted until the tumor is defined by the dotted line.
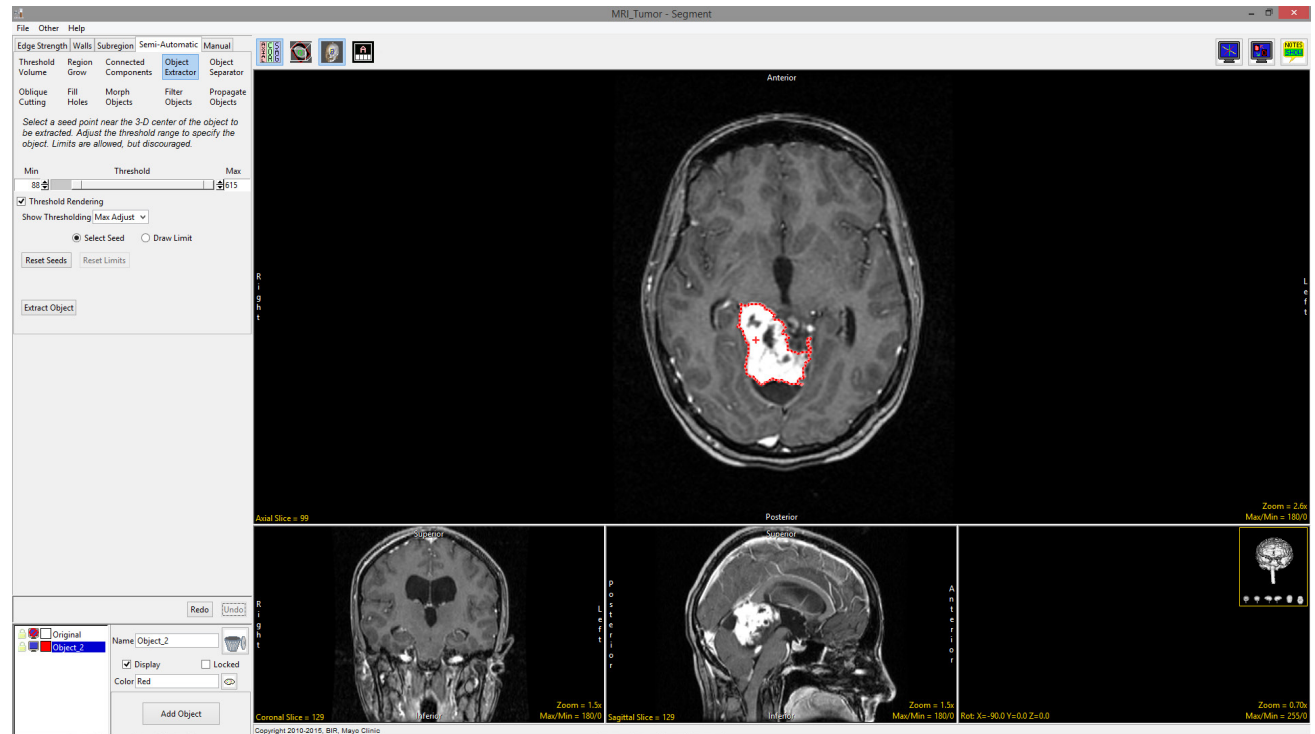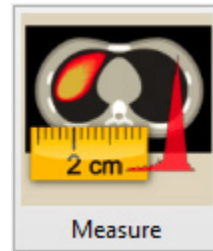
- Once the threshold range has been established, click the Extract Object button to extract the tumor.
- The tumor object will be defined in all three orthogonal orientations, as well as shown as a 3D rendering in the render display window.
- Rename the object to Tumor.
- Save the object map to disk (File > Save Object Map) according to your naming conventions.
- This object map will be used with the MRI data in Measure to determine the volume of the tumor.
- Close Segment.
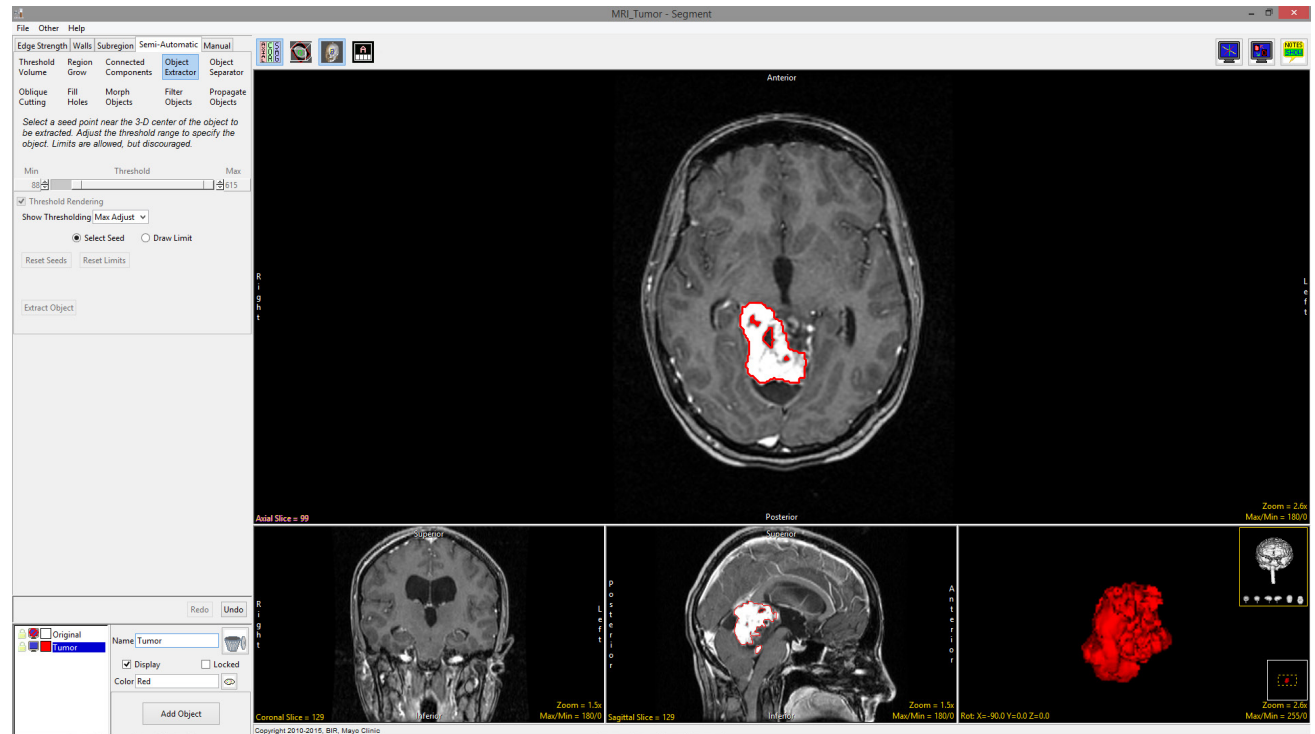
Tumor Volume Measurement

- Select the MRI_Tumor data set and open Measure.
- The object map created for the data set may load automatically. If it does not, use File > Load Object Map to load the object map.
- Set the Sample Type to 3D and then choose Selected Object.
- Select the Size Intensity tab and make sure Volume is checked.
- Check the Auto Log Stats option and then click on the Tumor object in the image display window.
- The selected stats for the tumor object will be reported below the display of the image data. The stats can be saved as a .csv file by right-clicking anywhere in the stats tab.
- Close Measure.

This concludes the Analyze 15.0 Brain Tumor Segmentation guide. To view our complete set of Analyze 15.0 resources, or to download a trial copy of Analyze 15.0, please visit our website at www.analyzedirect.com.