

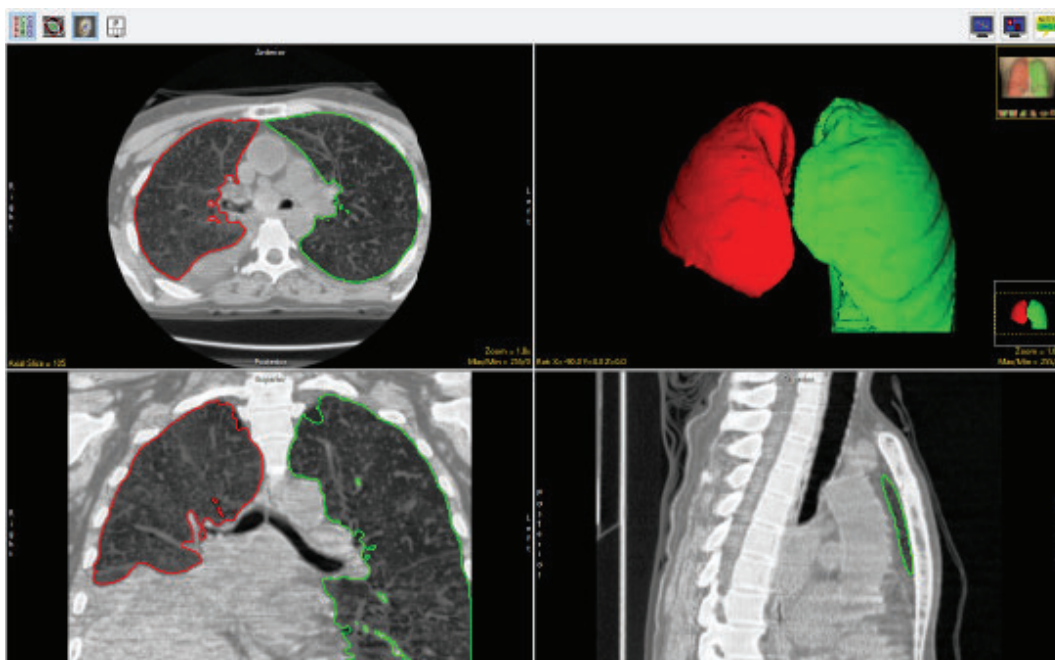


Object Extractor

The Object Extractor tool enables the user to define and extract objects from image data using a combination of thresholding, region growing and morphological operations.

First, a seed point is manually set on a structure of interest. Next, a threshold range is established by the user to define the structure. The region defined by a given threshold range is shown on the 2D slice containing the seed point using a 2D auto trace mechanism. This region updates interactively as the threshold range is adjusted, allowing the user to determine the threshold range that properly defines the region of interest. The Object Extractor segmentation routine is ready to be started once the seed point and threshold range define the structure on the initial slice.

The algorithm first applies a global threshold to the data set, using the minimum and maximum values specified by the user. Next a 3D binary erosion is performed on the binary result of the global threshold. The erosion attempts to break connections between the target structure and neighboring regions which have similar intensity values. The erosion is followed by a 3D 6-neighbor region grow, which uses the initial seed point. The processed target slice on which the initial seed point was set is compared to the initial auto trace from the user-defined seed point and threshold range. The erosion and region growing steps are repeated until the set of voxels on the processed target slice are a subset of the initial auto trace. Next, the processed data is conditionally dilated until 99% of the voxels in the auto traced region on the processed target slice are recovered. Once the extraction process is complete, the resulting object is rendered and displayed over the 2D slice data.





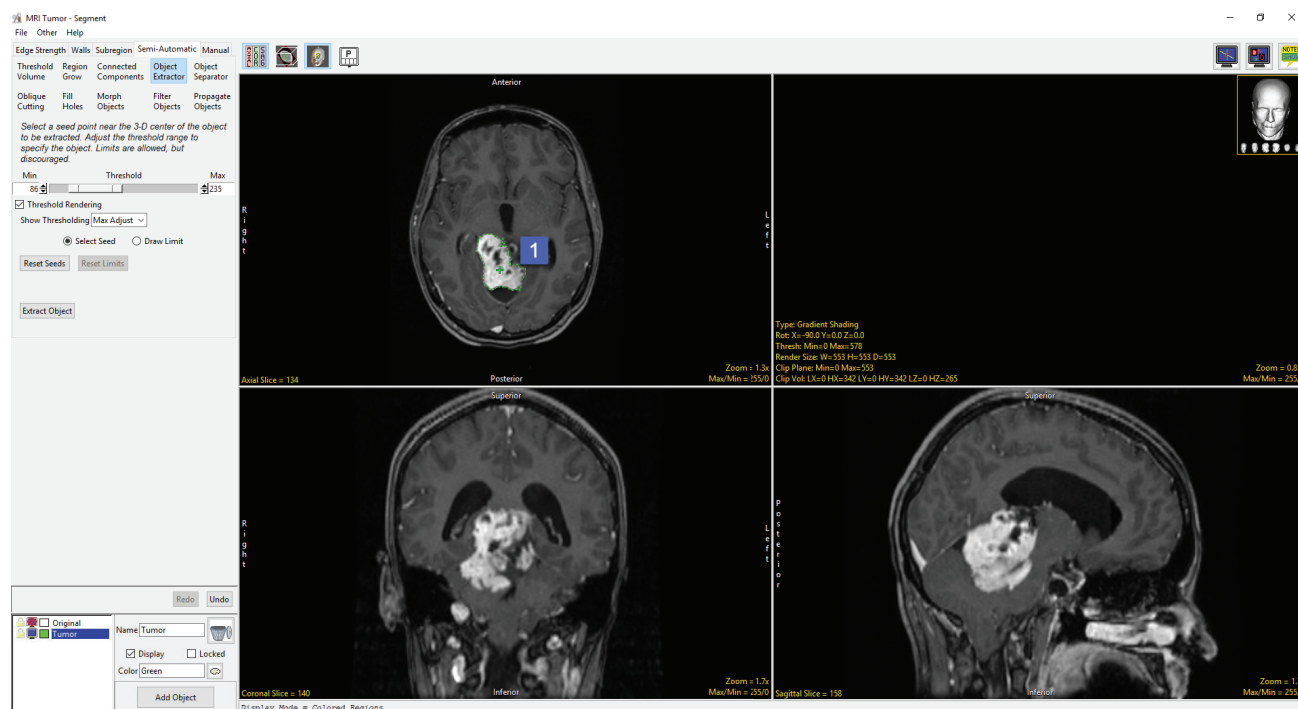
Object Extractor Options

As with the Region Grow tool, a seed point must be set on the structure you wish to segment [1] before the Object Extractor options are enabled. Note, multiple seeds can be selected for the simultaneous segmentation of multiple structures with the same threshold parameters, for example the segmentation of both the left and right lungs. When the seed is set the following options become available:

Threshold slider: The Threshold double-ended slider bar allows users to specify a range of threshold values using the minimum and maximum ends of the threshold slider. For a full description of the threshold slider including right click options, please refer to the Threshold Volume section.

Min and Max: The minimum and maximum input field allows users to manually enter the minimum or maximum threshold value. There are also arrow up and down buttons the right of the input fields to increase or decrease the currently value by 1.

Threshold Rendering: This option allows users to disable and enable to 3D preview of the selected voxel range. It is recommended to disable this option by unchecking the checkbox when working with large data sets.





Object Extractor Options (continued)

Show Thresholding: When the minimum and maximum threshold values are selected the adjustment is previewed on the 2D slice data. By default, the Show Thresholding option is set to Max Adjust. Adjusting the minimum threshold value will display as a update of the outer boundaries of the object only {x} while adjusting the maximum will display as a filled preview. To enable the filled preview the following options are available.

Max Adjust: Only adjusting the maximum threshold level will preview with the filled region.

Min Adjust: Selecting Min Adjust will reverse the default preview display so that adjusting the minimum threshold value will show a filled region while adjusting the maximum threshold values will display the outer boundaries of the object only.

Any Adjust: Will set the filled preview display when adjusting either the minimum or maximum threshold value.

Never: Disables the filled preview display. Both minimum and maximum threshold adjustment will display the outer boundaries of the object only.

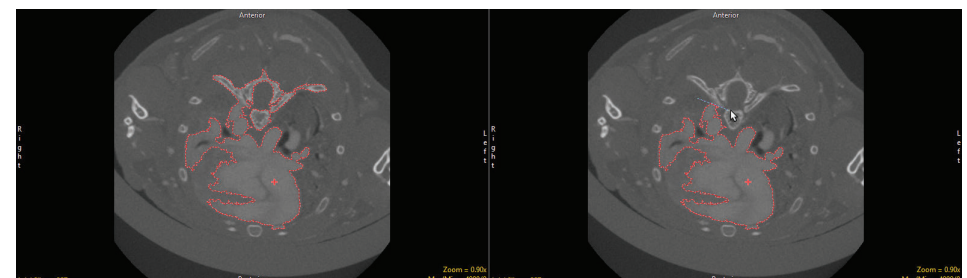
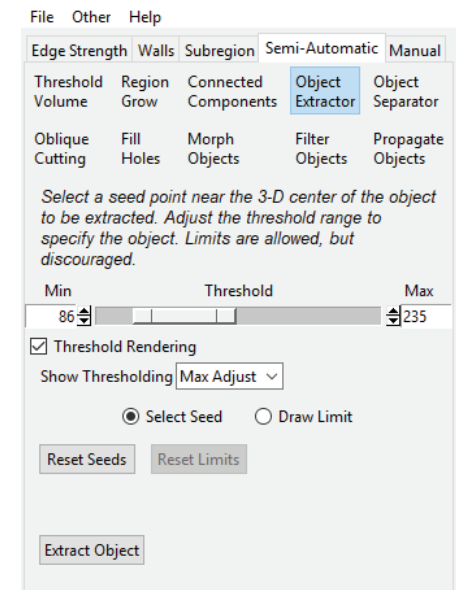
Select Seed: Switches to seed selection mode.

Draw Limit: Switches to limit definition mode. Allowing users to define limits on the image data to prevent the defined region from leaking into surrounding structures.

Reset Seeds: Resets the user defined seed(s). Note, you can delete a seed point by right-click on the seed and choosing Delete. Seeds can also be moved by left-clicking on the seed and then dragging to a new location.

Reset Limit: Resets all user defined limits.

Extract Object: Initiates the Object Extraction segmentation process.

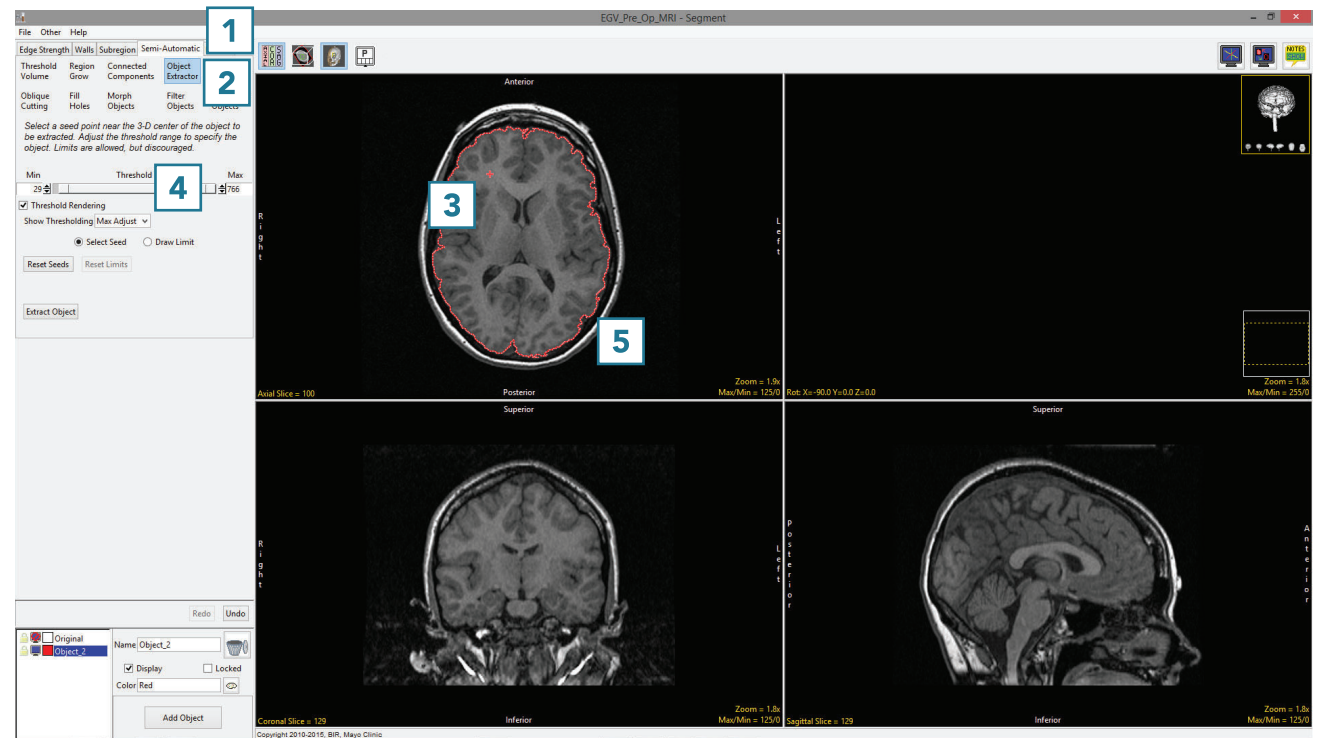


Segmentation of a Single Object Using Object Extractor

Here we will use Object Extrator to segment a single object in a dataset.

To follow along, download the data set EGV_MRI from analyzedirect.com/data and load into Analyze using Input/Output.

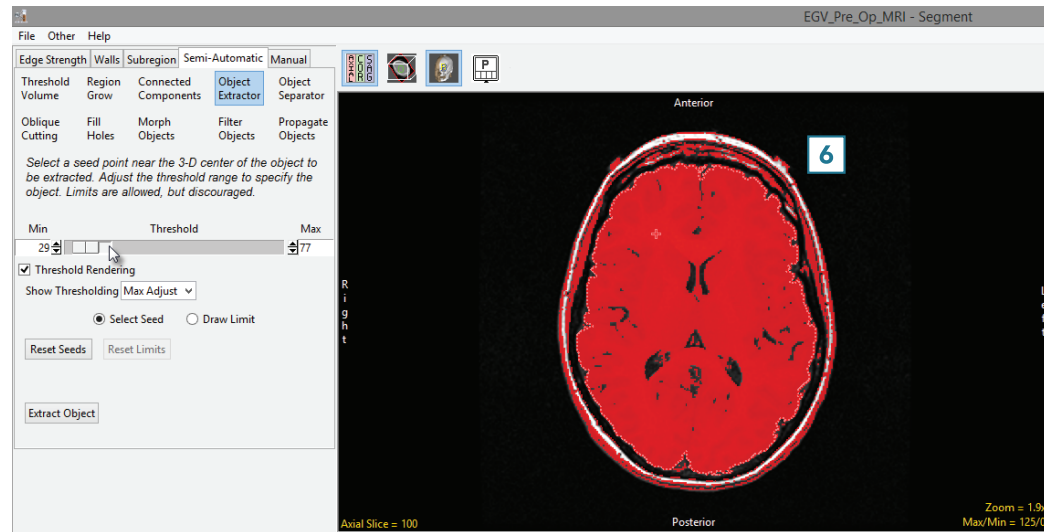
- Select the data set and open Segment.
- Select Semi-Automatic [1] and choose Object Extractor [2].
- Click on the image data to set a seed point in the object you would like to isolate [3].
- Adjust the minimum threshold value [4] until the auto trace defines the object [5].



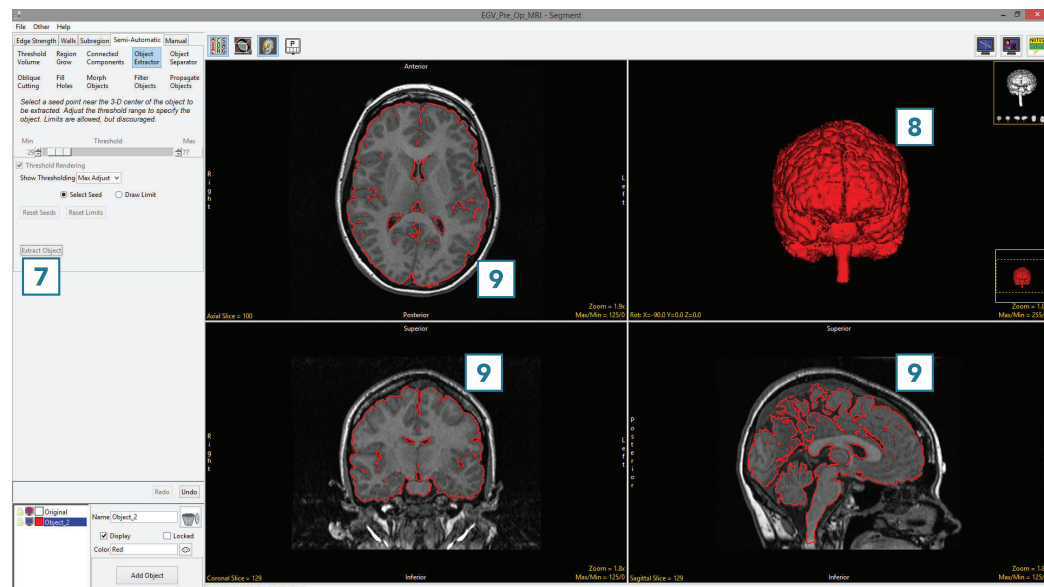


Segmentation of a Single Object Using Object Extractor (continued)

- Adjust the maximum threshold level and note that the red binary mask will interactively update.
- Lower the maximum threshold value until holes start to appear in the red binary mask in the structures surrounding the brain, but not in the brain [6].



- Click Extract Object [7].
- Once segmentation is complete, the object map will be rendered [8] and overlaid on the slice data [9].
- Save your work by selecting File > Save Object Map.



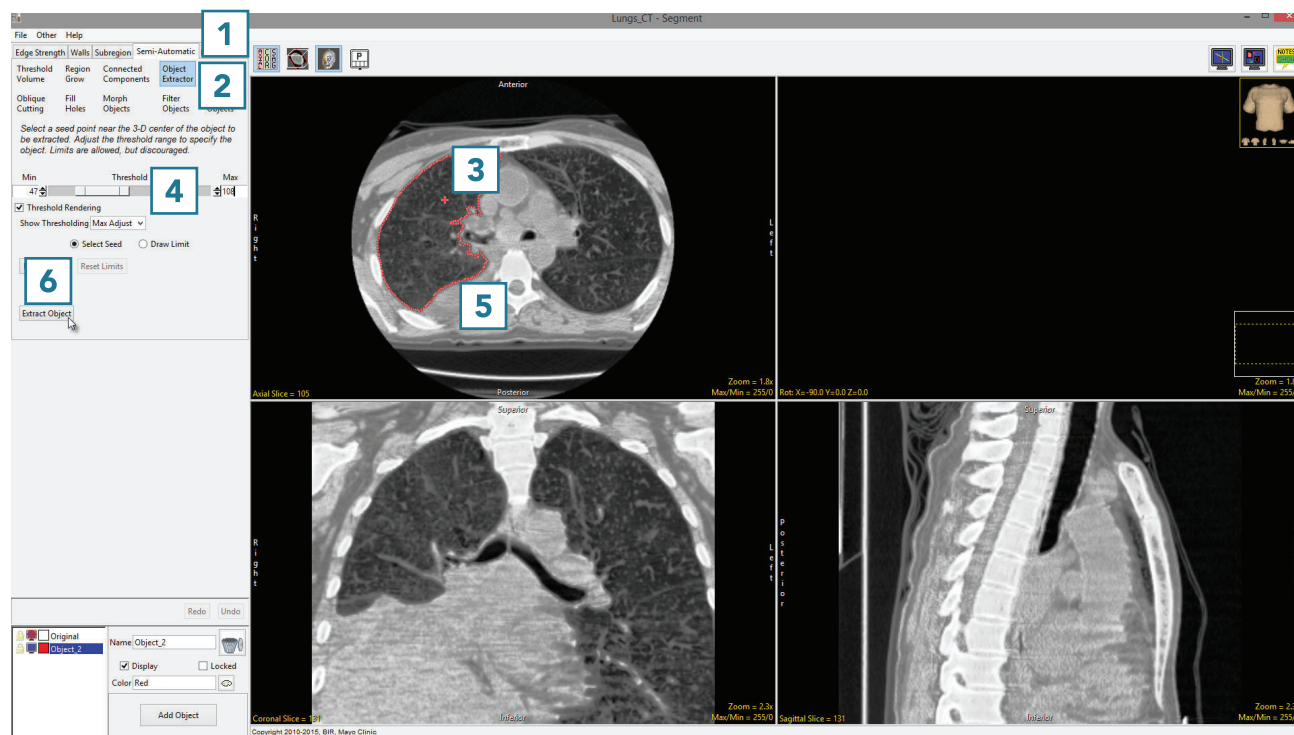


Segmentation of Multiple Objects Using Object Extractor

Here we will use Object Extrator to segment multiple objects in a dataset.

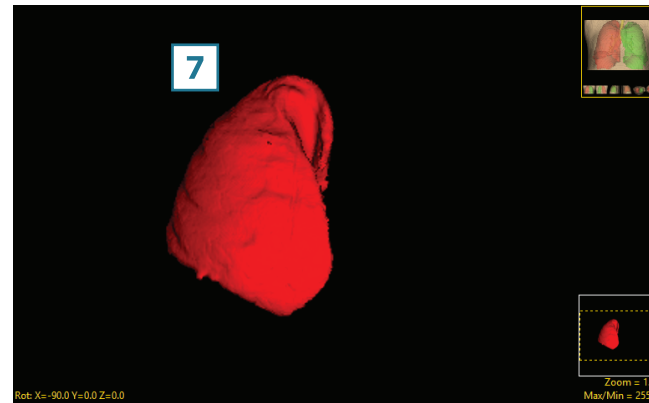
To follow along, download the data set CT_Lungs from analyzedirect.com/data and load into Analyze using Input/Output.

- Select the data set and open Segment. [1]
- Select Semi-Automatic [1] and choose Object Extractor [2].
- Click on the image data to set a seed point in the object you would like to isolate. [3].
- Adjust the minimum and maximum threshold values [4] until the auto trace defines the object. [5].
- Select Extract Object. [6]



Segmentation of Multiple Objects Using Object Extractor (continued)

- Once the segmentation process is complete, the object will be rendered [7].



- Rename the object [8]. Add a new object [9] and rename [10].
- Set a seed point in the next object [11] and select Extract Object [12].
- Once the segmentation process is complete, the object will be rendered [13].
- Save your work by selecting File > Save Object Map.

