

Exercise 33 : Object Extractor Automated Brain Segmentation

The Object Extractor module applies thresholding, morphology erosion and dilation, and region growing steps in an attempt to automatically segment an object within a volume. This exercise will demonstrate how to use this module.



1. Load the **MRI_3D_Head.avw** data set from the `$(BIR)\images\TutorialData` directory.
2. Open the **Object Extractor** module (**Segment > Object Extractor**).
3. Open the **Define Region** window (**Generate > Define Region**) to begin the segmentation process.
4. To define an auto trace on any slice of the volume, first specify a starting slice using the 'Slice' slider bar. **Slice 141** is an excellent starting point for this data set. Note that the orientation can be changed using the **Extract Options** directly below the slider bar.
5. In order to define a threshold range for the auto trace, a seed point must be set. Position the cursor near the center of the brain and click to set a seed point.
6. The Define Region window will automatically update (figure 1) to display auto trace parameters. Use the double-ended slider bar [A] now available to set the **Threshold Minimum** to **49** and the **Maximum** to **140**.
7. Click **Extract Object** to start the object extraction process. The grayscale copy of the extracted object will automatically be saved to the Analyze workspace.
8. Once the process is complete, a rendering of the extracted object will be displayed in the main Object Extractor window. The **Render Tool** will also automatically be returned, allowing you to view the object from different orientations (figure 2).
9. The resulting extraction can be further examined in the Compare window (**Generate > Compare**). The Compare window will allow the user to compare the original and segmented volume slice-by-slice.
10. If the extraction is not satisfactory, the data may be re-segmented by clearing the regions in the Define Region window (**Generate > Define Region**) and selecting a new seed point and threshold range.
11. Close the Object Extractor module before proceeding to the Additional Tasks.

note Click the Clear Regs button [B] at any time to remove all traces and limit ranges. A new starting slice may also be defined if required by clicking the Target Slice button [C].

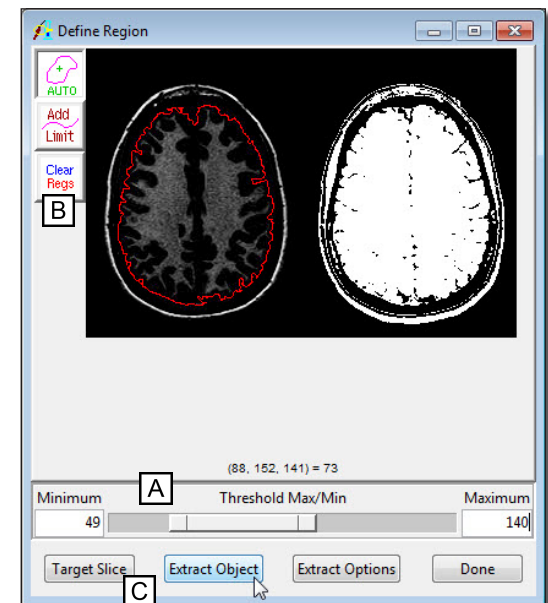


Figure 1

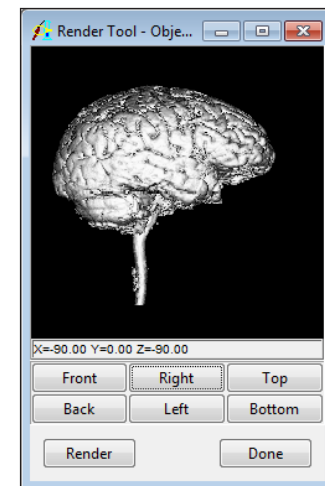


Figure 2

1. Extract Options - Creating an Object Map

As introduced in earlier exercises, an object map is a special image file used by Analyze to partition and identify structures as belonging to a particular segmented object. Voxels in the image volume correspond directly, on a one-to-one basis, with a voxel in the object map, whose value assigns the voxel to a particular segmented object. Since object map files can also be loaded into other Analyze modules, the same objects within an image volume can be referenced for a variety of purposes (see Exercise 47: Region of Interest Measuring Objects in Object Maps). This exercise will demonstrate how to create an object map in Object Extractor.



1. Select the **MRI_3D_Head.avw** data set loaded in the Analyze workspace and open the **Object Extractor** module (**Segment > Object Extractor**).



2. Open the **Define Region** window (**Generate > Define Region**) and set the **Target Slice** to 141.

3. Click inside the brain to set a seed point. Set the **Threshold Minimum** to 49 and the **Maximum** to 140.

4. Click **Extract Options** and set the **Result** to **Object** (figure 1). A dialog box will be returned asking if you would like to create an object map, click **Yes** (figure 2). Click **Done** to dismiss the Extract Options window.

5. In the **Define Region** window, click **Extract Object** to start the object extraction process.

6. Once the extraction process is complete the object will be displayed overlaid on the original image data in the main **Object Extractor** window (figure 3). The Render Tool will also automatically be returned, allowing you to view the object from different orientations.

7. The object map will not be automatically saved, if you wish to save the object map choose **File > Save Object Map**.

8. Close the Object Extractor module. To learn how to create a binary object with the Object Extractor proceed to the next Additional Task.

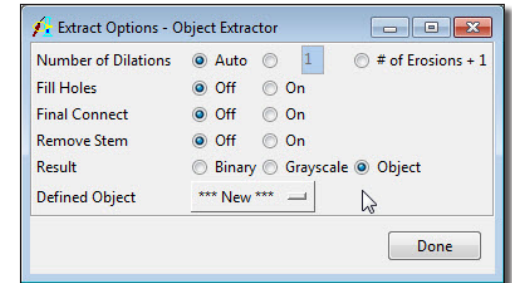


Figure 1

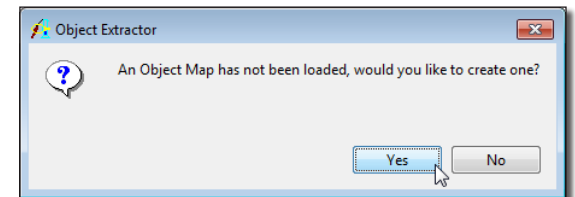


Figure 2

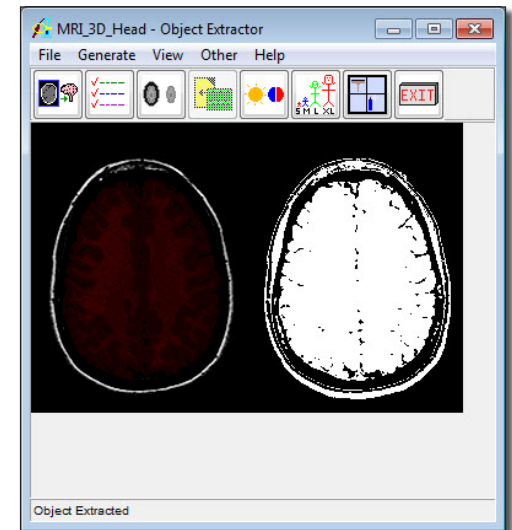


Figure 3

2. Extract Options - Creating a Binary Object

Occasionally it is necessary to save the segmented object as a binary object, as opposed to a grayscale object like in the first part of this exercise. This additional task will demonstrate how to achieve this.



1. Select the **MRI_3D_Head.avw** data set in the Analyze workspace and then open the Object Extractor module (**Segment > Object Extractor**).



2. Open the **Define Region** window (**Generate > Define Region**) and set the **Target Slice** to **141**.
3. Click inside the brain to set a seed point. Set the **Threshold Minimum** to **49** and the **Maximum** to **140**.
4. Click **Extract Options** and set the **Result** to **Binary** (figure 1). Click **Done** to dismiss the Extract Options window.
5. In the Define Region window, click **Extract Object** to start the object extraction process.
6. Once the process is complete, a rendering of the extracted object will be displayed in the main Object Extractor window. The Render Tool will automatically be returned again, allowing you to view the object from different orientations. The segmented binary brain will be automatically saved to the Analyze workspace and can now be used with any other Analyze module.
7. Close the Object Extractor module before proceeding to the next Additional Task.

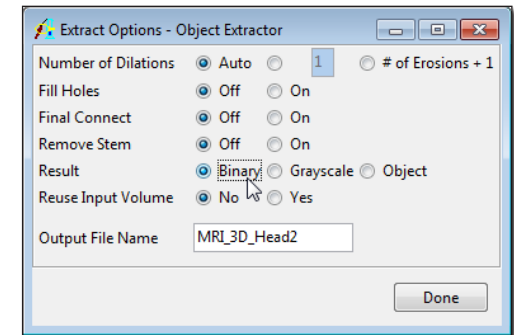


Figure 1

3. Extract Options - Automatic Brain Stem Removal

The Object Extractor module now provides the option to automatically remove the brain stem from your segmented brain. This task will demonstrate how to segment and remove the brain stem.



1. Select the **MRI_3D_Head.avw** data set in the Analyze workspace and then open the **Object Extractor** module (**Segment > Object Extractor**).



2. Open the **Define Region** window (**Generate > Define Region**) and set the **Target Slice** to 141.

3. Click inside the brain to set a seed point. Set the **Threshold Minimum** to 49 and the **Maximum** to 140.

4. Click **Extract Options** and set the **Remove Stem** option to **On** (figure 1). Click **Done** to dismiss the Extract Options window.

5. In the Define Region window, click **Extract Object** to start the object extraction process.

6. Once the process is complete, a rendering of the extracted brain with the brain stem removed will be displayed in the main Object Extractor window. The **Render Tool** will also automatically be returned (figure 2), allowing you to view the object from different orientations. The segmented grayscale brain will be automatically saved to the Analyze workspace and can now be used with any other Analyze module.

7. Close the Object Extractor module before proceeding to the next exercise.

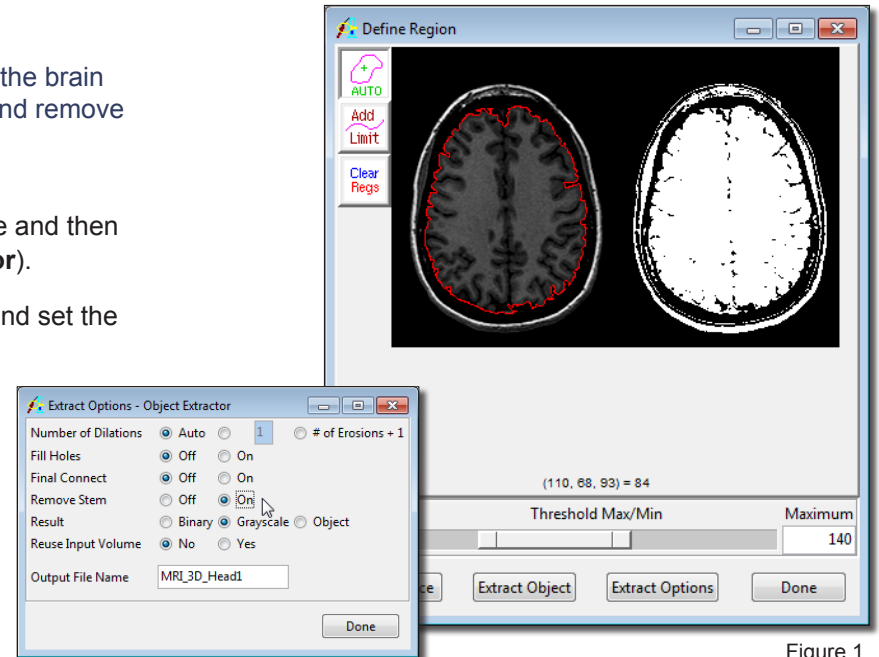


Figure 1

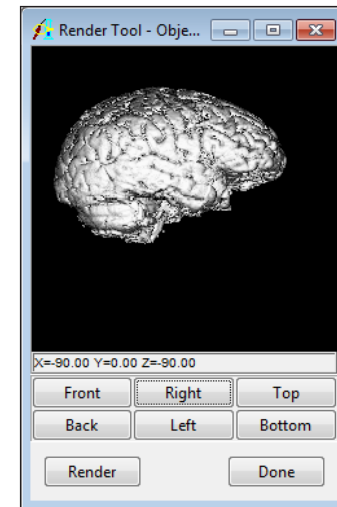


Figure 2