

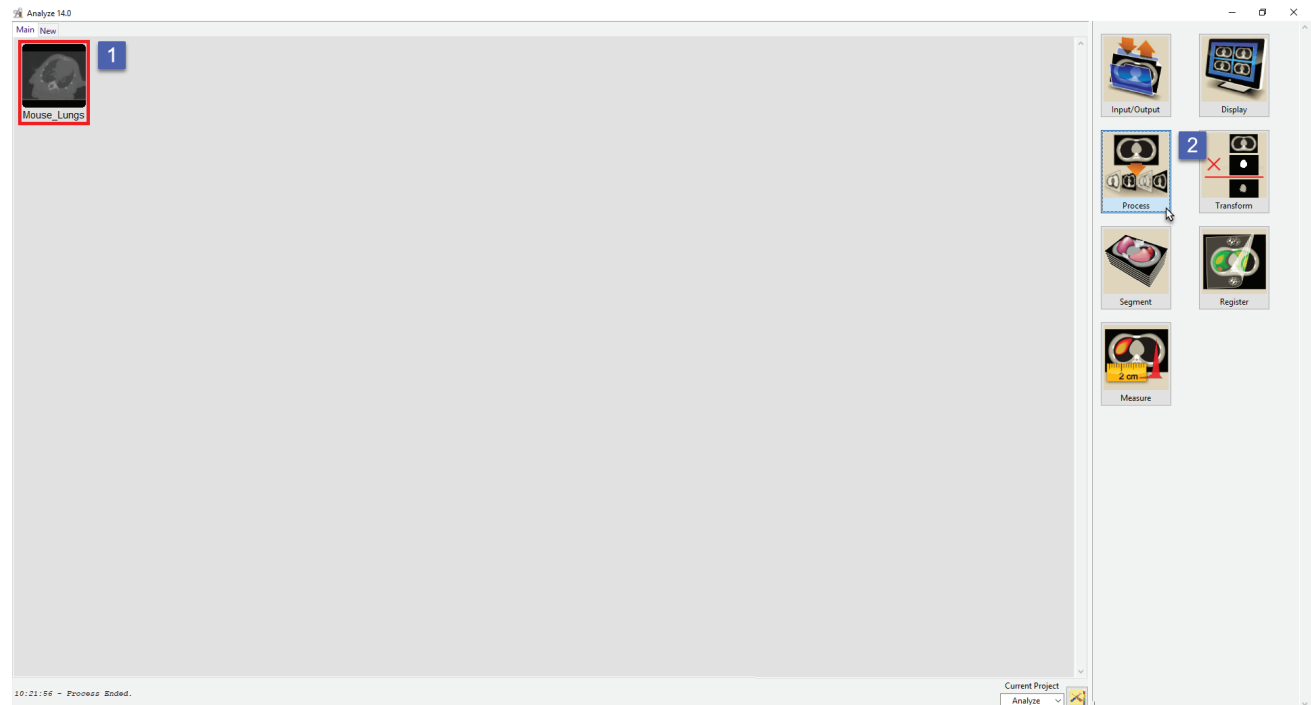
Applying Morphological Operators to Data

Download the Mouse_Lungs.avw data set to follow along, from <https://analyzedirect.com/data>.

This exercise will show how to apply a series of morphological operations to a data set to isolate an object of Interest while removing as much unwanted tissue as possible. This will prepare the data for further analysis. In this example we will isolate the lungs from a preclinical micro-CT data set by using various morphological operations including thresholding, eroding, and opens.

Use the Input/Output module to load the Mouse_Lungs.avw data set into the software.

Select the data set [1] and open Process [2].



Applying Morphological Operators to Data (continued)

The first step in this process is to eliminate the background noise.

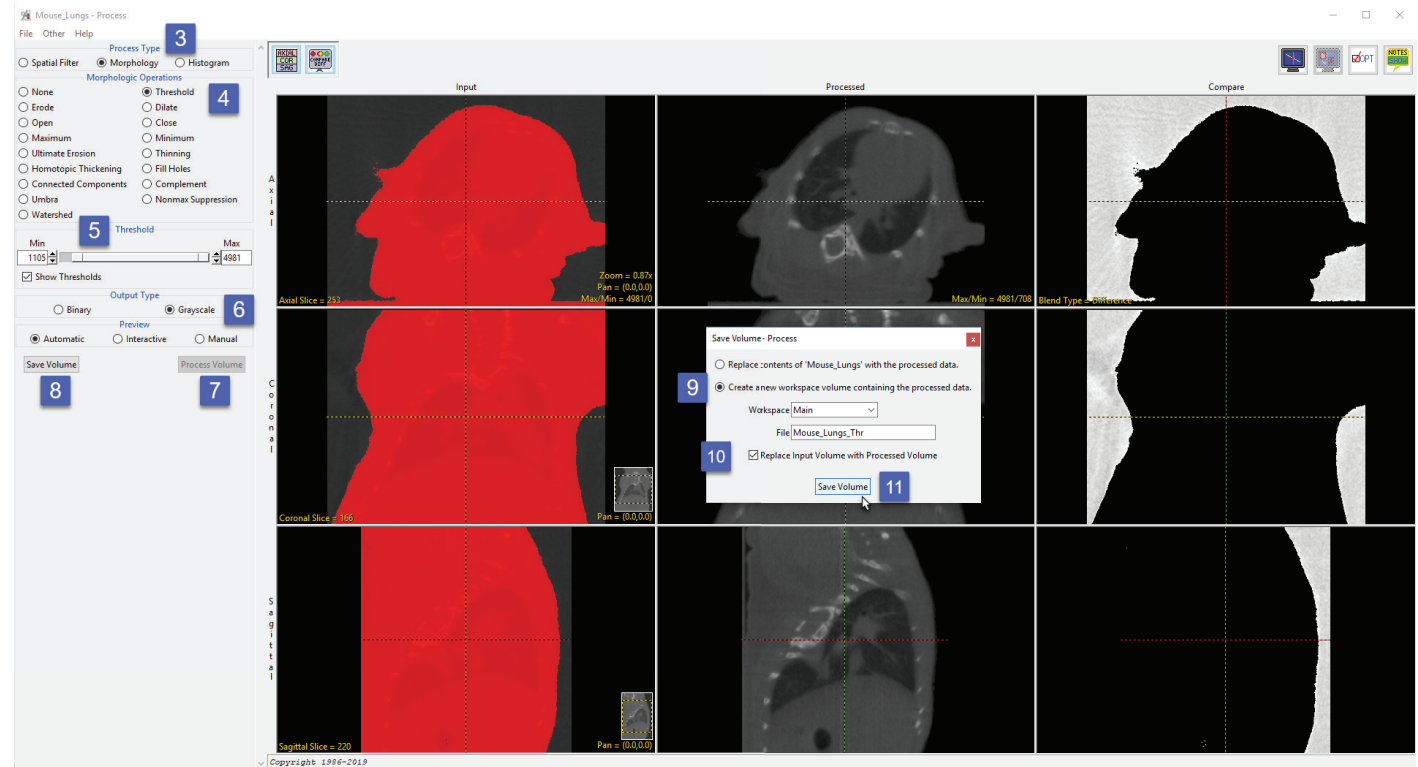
Choose Morphology as the Process Type [3].

Choose the Threshold option as the Morphological Operation [4].

Set the Minimum Threshold level to 1105 [5]. Note that this will eliminate the background single.

Set the Output Type to Grayscale [6].

Next, click Process Volume [7].



When processing is complete click Save Volume [8].

In the Save Volume window ensure the 'Create a new workspace volume containing the processed data.' option is selected [9].

Also, ensure the 'Replace Input Volume with Processed Volume' option is checked [10].

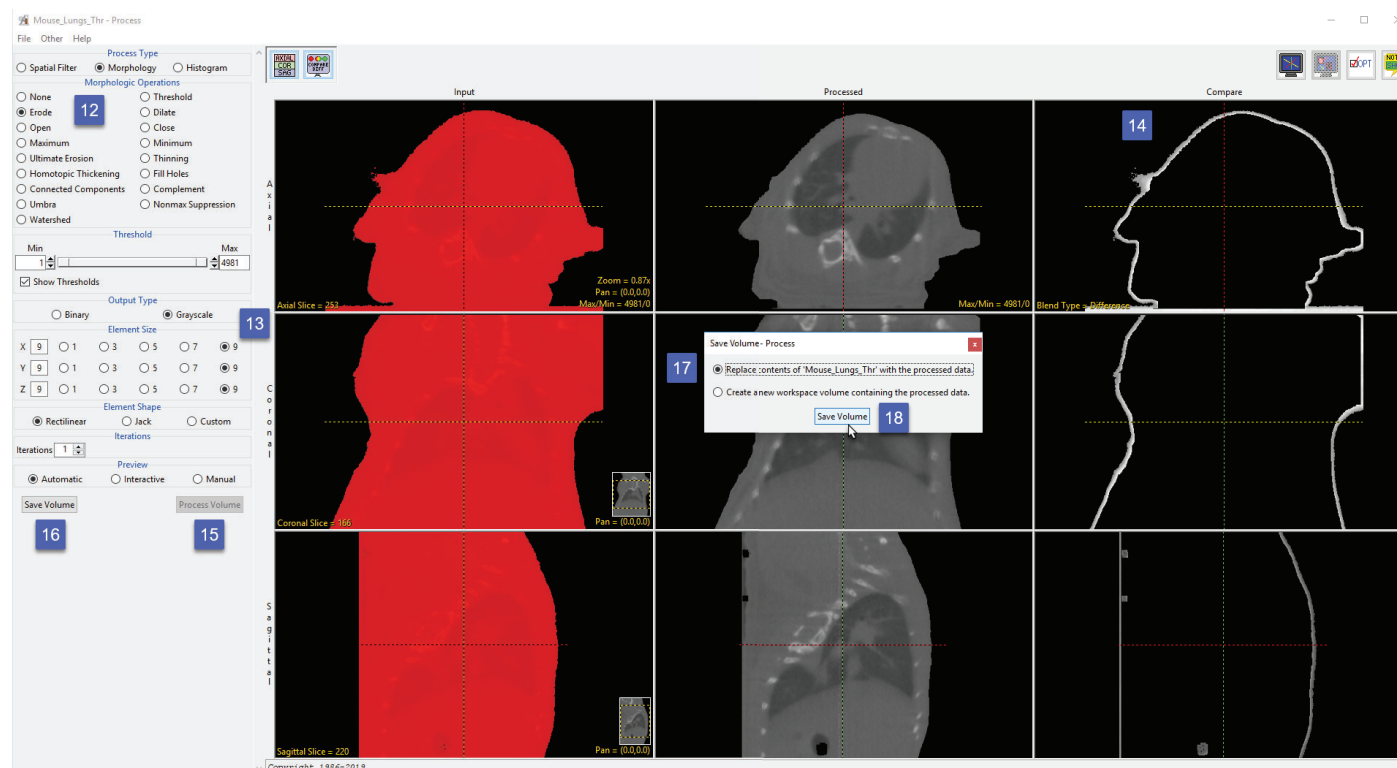
Click Save Volume [11]. The processed data will be saved as a new volume in the workspace and will also be set as the Input Volume for Process.

Applying Morphological Operators to Data (continued)

The next step is to remove a layer of voxels from the outer surface of the body. This step is completed in order to prevent these voxels from being included when we use thresholding in the next step to isolate the lungs.

Select the Erode option from the Morphological Operations menu [12].

Set the Element Size to 9 by 9 [13]. The voxels that will be eroded from the data can be seen in the Compare column [14].



Next, click Process Volume [15] and when processing is complete click Save Volume [16].

This time in the Save Volume window check the 'Replace contents of 'Mouse_Lung_Thr' with processed data.' option [17]. This will overwrite the volume and prevent an additional volume being written to the workspace.

Click Save Volume [18]. The processed data will be saved over the input volume and also be set as the Input volume.

Applying Morphological Operators to Data (continued)

Now we will use Thresholding to isolate the lung parenchyma.

Choose the Threshold option from the Morphological Operation menu [19].

Set the Minimum Threshold level to 1 and the Maximum Threshold level to 1639 [20].

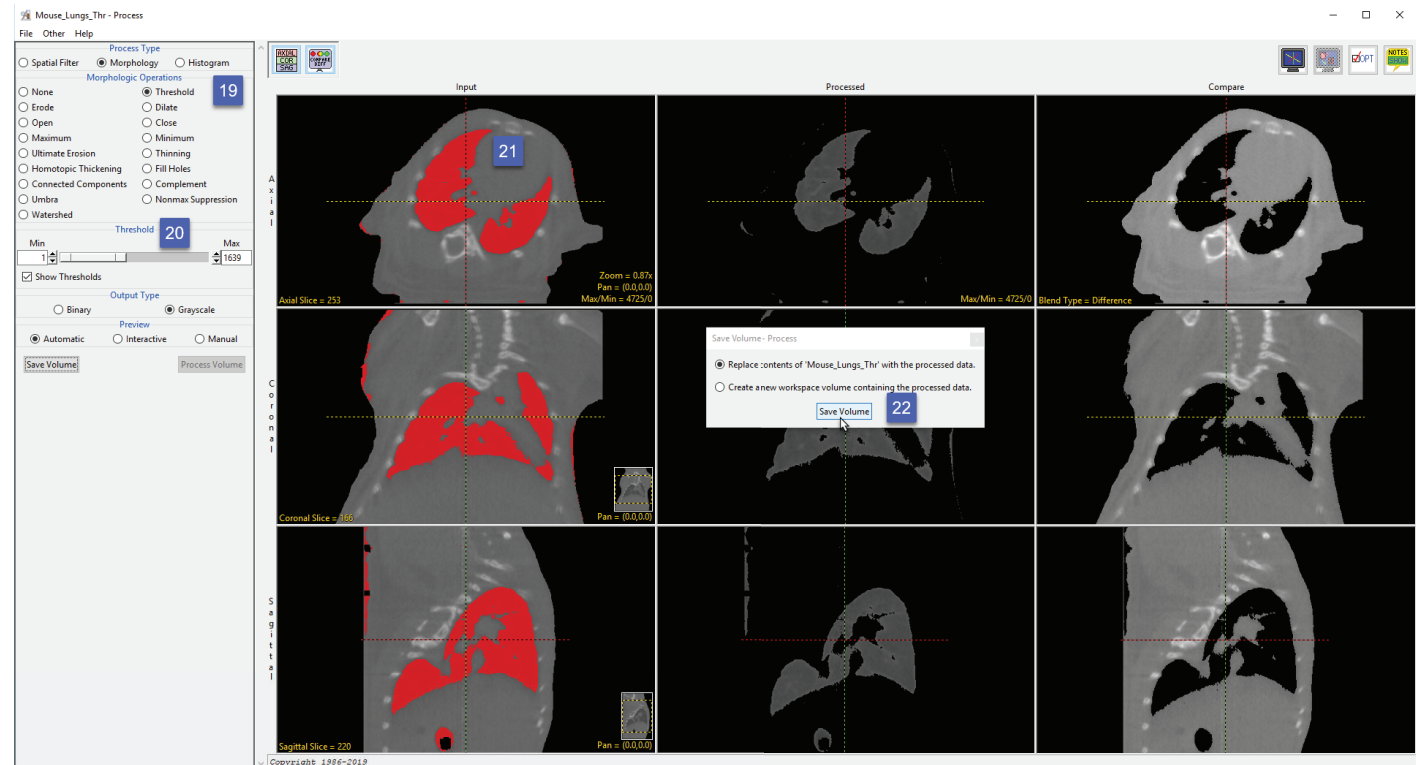
Note that this threshold range will isolate the lungs [21].

Next, click Process Volume and when processing is complete click Save Volume.

In the Save Volume window

leave the option set to 'Replace contents of 'Mouse_Lung_Thr' with processed data.'

Click Save Volume [22]. The processed data will be saved over the input volume and be set as the Input.



Applying Morphological Operators to Data (continued)

The final step to process this data set is to conduct a morphological Open operation on the image data. An Open operation is an erode followed by a dilation. The erode will take away layers, removing areas of noise. The dilate operation will then add back layers of voxels removed from the lung.

Set the Morphological Operation to Open [23].

Set the Element Size to 7 by 7 by 7 [24].

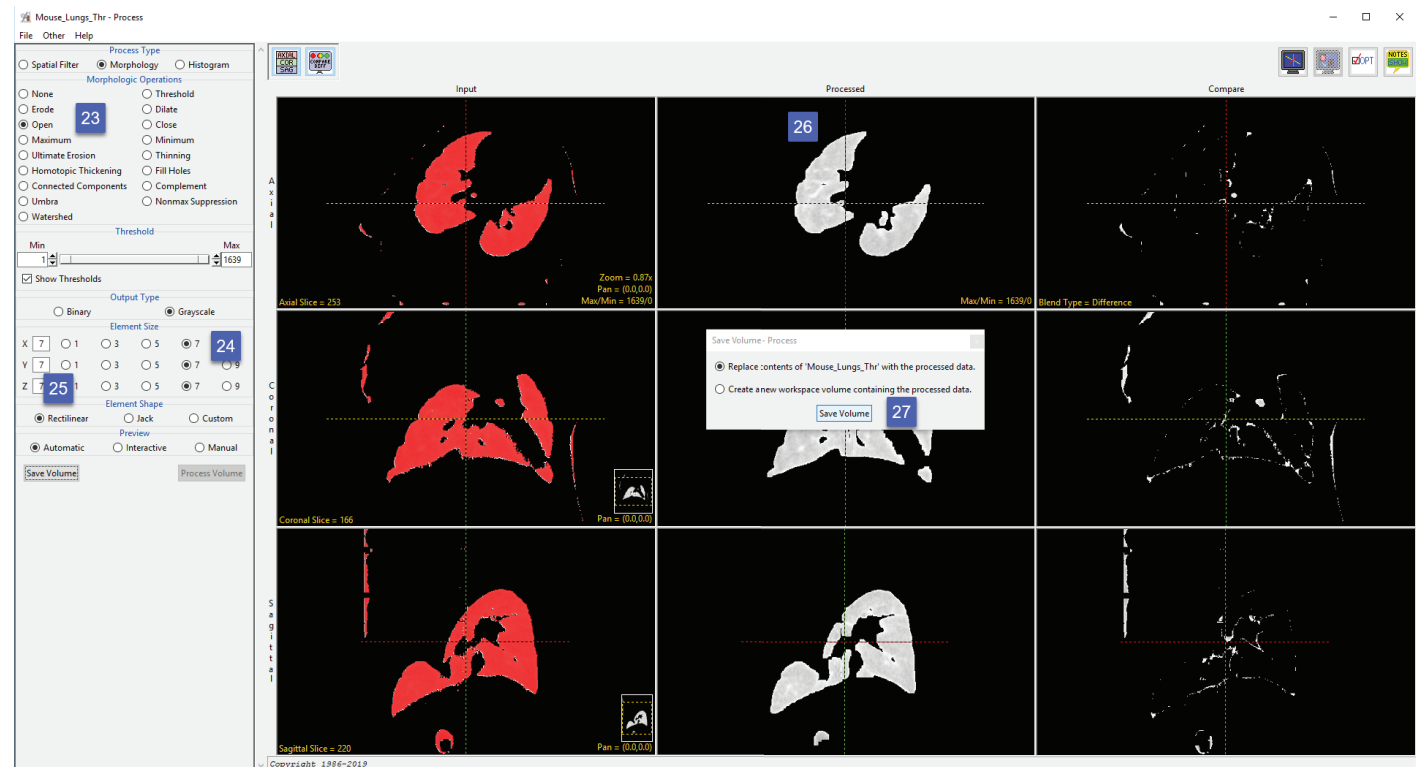
Ensure the Element Shape is set to Rectilinear [25]. Note the preview of the final isolated lung data set [26].

Next, click Process Volume and when processing is complete click Save Volume.

In the Save Volume window leave the option set to 'Replace contents of 'Mouse_Lung_Thr' with processed data.'

Click Save Volume [27]. The processed data will be saved over the input volume and be set as the Input.

Close the Process module.



Applying Morphological Operators to Data (continued)

Select the processed image data 'Mouse_Lung_Thr' from the workspace and view it using the Display module [28].

In four easy steps we have isolated the lungs with a minimal amount of surrounding noise. This data is ready for visualization, volume measurement, or further segmentation.

