

Analyze 10.0

ITK

Exercise 53 : ITK Filters

The ITK Filters module enables the application of ITK smoothing, edge-detection, and feature-extraction filters to image data. This exercise will demonstrate how to apply a filter in the ITK Filters module to your data.

1. Load the **MRI_3D_Head.avw** data set from the **\$(\BIR)\images\TutorialData** directory.
2. Open the **ITK Filters** module (**ITK > Filter**).
3. Open the **Preview Options** window (**Generate > Preview Options**).
4. Select the **Loaded and Preview Volumes** option. This will preview the original data set and a copy of the data set with any filter applied, side-by-side.
5. Open the **Filters** window (**Generate > Filters**).
6. In the Filters window, select the **Bilateral** filter (figure 1).
7. Use the **Slice** slider bar to determine which slice you would like to preview the filter on; set to **Slice 128**.
8. Now, click **Preview**. The main module window will display the filtered slice on the left and original slice on the right (figure 2)
9. Preview several other filters, noting the effect of each.
10. To apply a filter to the data set, simply click **Filter** in the Filters window. A dialog box will be returned stating that the action modifies the loaded volume, click **Change a Copy of the Loaded Volume**.
11. A filtered copy of your volume will be saved to the Analyze workspace.
12. Close the ITK Filters module before proceeding to the next exercise.

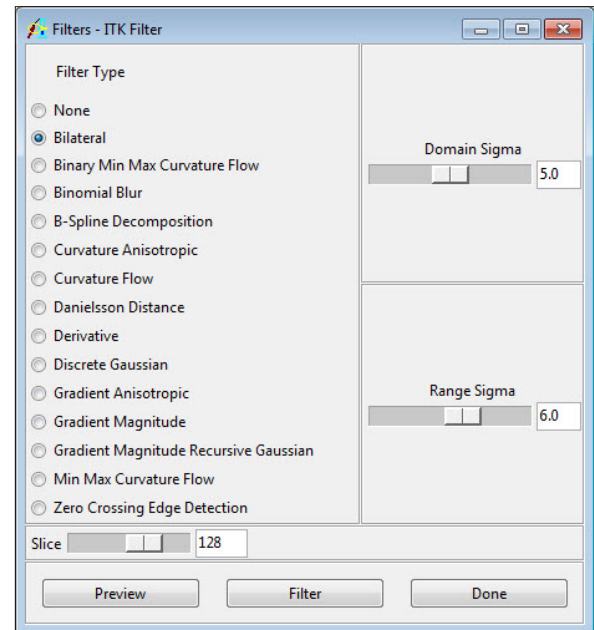


Figure 1

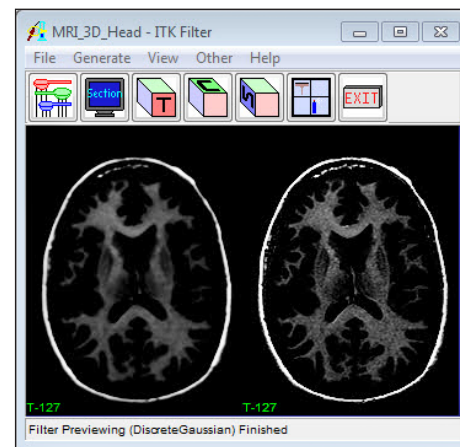


Figure 2

Exercise 54 : ITK Segment 2-D

The ITK Segment 2-D module provides an interactive framework for applying sequential processing steps using ITK functions for segmentation of sets of 2-D slices based on region growing and level set methods. This exercise will demonstrate how to use the ITK Segment 2-D module.

1. Load the **MRI_3D_Head.avw** data set from the `\\BIR\images\TutorialData` directory.
2. Open the **ITK Segment 2-D** module (**ITK > Segment 2-D**).
3. Use the **Slice** slider bar to move to slice **133**, make sure that the image is displayed in the transverse orientation (select the T cube).
4. The **SubRegion** tab allows the user to limit segmentation to a specific region, helping decrease processing time. Check the **Use SubRegion** option and set the following values (figure 1):
 - **X: 63 and 120**
 - **Y: 78 and 152**
 - **Z: 1 and 187**
5. Select the **Smooth** tab. This tab provides several different methods for reducing noise on images. Select the **Gradient Anisotropic Diffusion** type and click the **Default** button.
6. Select the **Edge** tab. This tab provides methods for generating gradient images required for some seed- and mask-based segmentation algorithms. Select the **Gradient Magnitude** edge type.
7. Select the **Seed Based** tab. This tab provides different methods for performing seed-based segmentation on the current volume. Select the **Fast Marching** type.
8. Click once inside of the left ventricle to set a seed point. The right side will no longer be selected, set a second seed point by clicking once inside of the right ventricle (figure 2). Seed points can be reset by right clicking on the image display and selecting Reset Seed(s).
9. Select the **Mask Based** tab. This tab provides options to enhance features found in the 'Seed Based' tab. Select the **Shape Detection** type and set the **Alpha** value to **-2.1**.

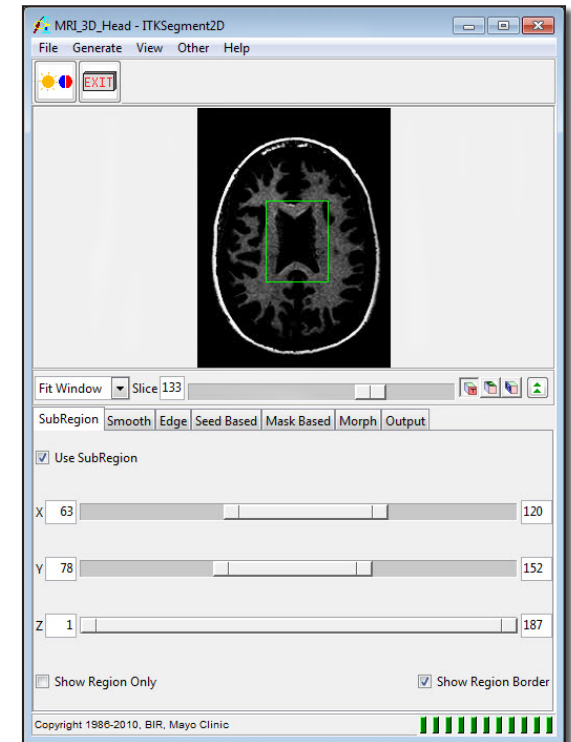


Figure 1

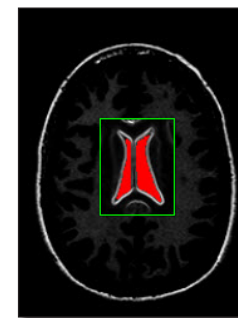


Figure 2

Exercise 54 : ITK Segment 2-D

- At this point, we have exhausted our enhanced ITK functionality, but there are still some built in post-processing steps that can be performed.
- Select the **Morph** tab. This tab allows a number of post-processing steps, for example filling of small holes that still appear in the segmentation. Select the **4-connected** Fill Holes option.
- Select the **Output** tab. This tab provides a number of output parameters. Change the output type to **Binary**. If you wish to save this slice, click **Save Slice** (figure 3). The 'Process Volume' button does apply all steps to the entire volume, but a more successful 3-D segmentation can be performed in the ITK Segment 3-D module (exercise 41).
- Close the ITK Segment 2-D module before proceeding to the next exercise.

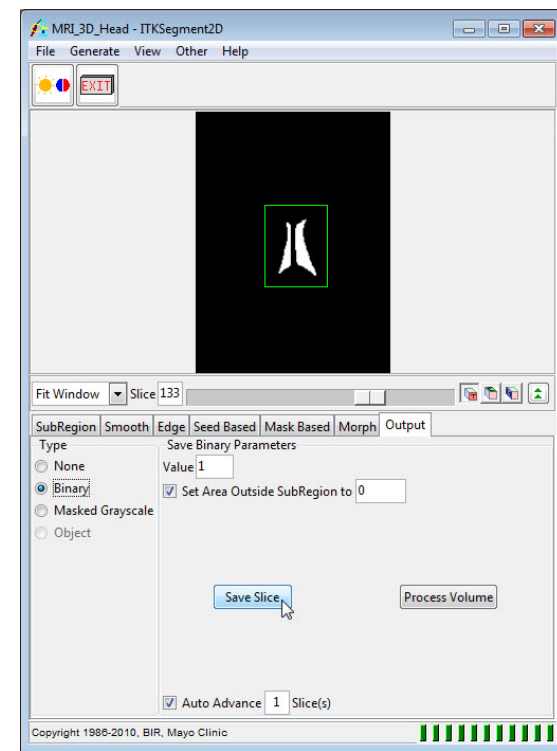


Figure 3

Exercise 55 : ITK Segment 3-D

The ITK Segment 3-D module provides a framework for 3-D segmentation using ITK algorithms. This exercise will demonstrate how to use the ITK Segment 3-D module.

1. Load the **MRI_3D_Head.avw** data set from the `\\BIR\images\TutorialData` directory.
2. Open the **ITK Segment 3-D** module (**ITK > Segment 3-D**).

tip | The module displays the data set in all three orthogonal orientations. To update the display click on one of the display panes and move the cursor—the other two orientations will interactively update.

3. Select the **SubRegion** tab (figure 1). Check the Use SubRegion option and set the following values:
 - **X: 51 and 127**
 - **Y: 36 and 162**
 - **Z: 86 and 144**



4. The subregion can also be specified interactively in the image display with the mouse when the **Adjust Subregion** button (found directly below the image display) is selected. Click **Extract SubRegion**.
5. Select the **Smooth** tab. Select the **Gradient Anisotropic Diffusion** type, and change the **Time Step** value to **0.0625**. Click **Smooth Volume**.
6. Select the **Edge** tab. Select the **Gradient Magnitude** edge type and then click **Detect Edge**.



7. Select the **Seed Based** tab and select the **Fast Marching** algorithm type.
8. Select the **New Seed** button (directly below the image display), and click to set a seed point in each ventricle.
9. Click **Seed Segment** to apply the seed-based segmentation.

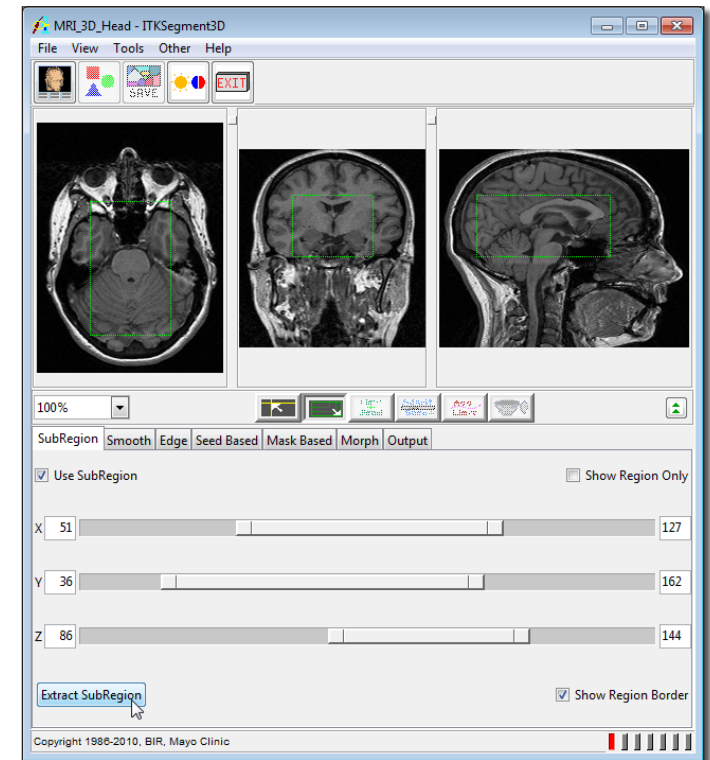


Figure 1

Exercise 55 : ITK Segment 3-D



10. You can review the results of the segmentation with the **Render Tool (Tools > Render)**. Click and drag the rendering to rotate it, or click the direction buttons to quickly change views (figure 2). You can leave this tool open, it will update as we modify our segmentation.
11. Select the **Mask Based** tab. Select the Shape Detection type and set the following and then click Mask Segment.
12. Select the **Morph** tab and choose the **Dilate** option and the **3-pass 2D Fill Holes** option.
13. Click **Apply Morphology**.
14. Select the **Output** tab for options to output the segmentation results.
15. Choose the **Binary** option and click **Output Volume** to create a binary mask of our segmented volume in the Analyze workspace (figure 3).
16. Also try selecting the **Masked Grayscale** option, and use the **Output Volume** button to output the resulting volume in the Analyze workspace.
17. Close the ITK Segment 3-D module before proceeding to the next exercise.

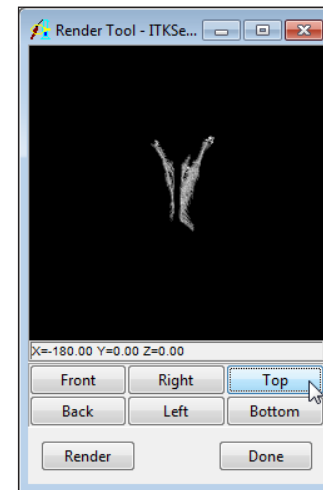


Figure 2

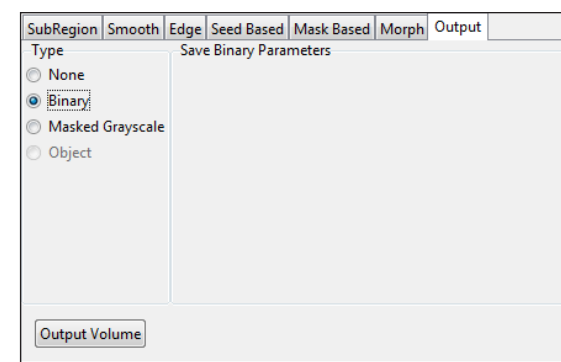


Figure 3

Exercise 56 : ITK Registration

The ITK Registration module functions the same as the Analyze 3-D Registration modules with the exception of ITK function specific parameters. The exercise will provide an overview of the module.

1. Load the **Register_MRI_Base.avw** data set from the **\$_\BIR\images\TutorialData** directory.
2. Next open the **Load As** module (**File > Load As**). Navigate to and select the **Register_MRI_Match.avw** data set from the **\$_\BIR\images\TutorialData** directory. Select the **Resize** tab and check the **Force Cubic** option. Click **Load**.
3. Select the **Register_MRI_Base.avw** data set. Then, while holding down the **<Ctrl>** key, select the **Register_MRI_Match.avw** data set (resulting in both being selected).
4. Open the **ITK Registration** module (**ITK > Registration**).
5. Open the **Blend** window (**Generate > Blend**) and set the Blend Option to **Red-Green** (figure 1).
6. Press the **Register** PowerBar button or choose **Generate > Register**.
7. After registration is complete, evaluate the registration by moving the crosshair in any of the panes to navigate through the image data.
8. If you are satisfied with the registration, save a copy of the transformed match volume (Register_MRI_Match), choose **File > Save Transformed**. The transformed volume can be saved to disk or to the Analyze workspace.
9. If you are unsatisfied with the registration, reset by selecting the Reset Matrix button in the **Manual Registration** tool (**Tools > Manual Registration**). Adjusting the Match position manually and the ITK Registration Parameters (**Generate > Parameters**) (figure 2). For more information about the ITK Registration Parameters, please refer to the ITK Users Guide (www.itk.org/ItkSoftwareGuide.pdf).
10. Close the ITK Registration module.

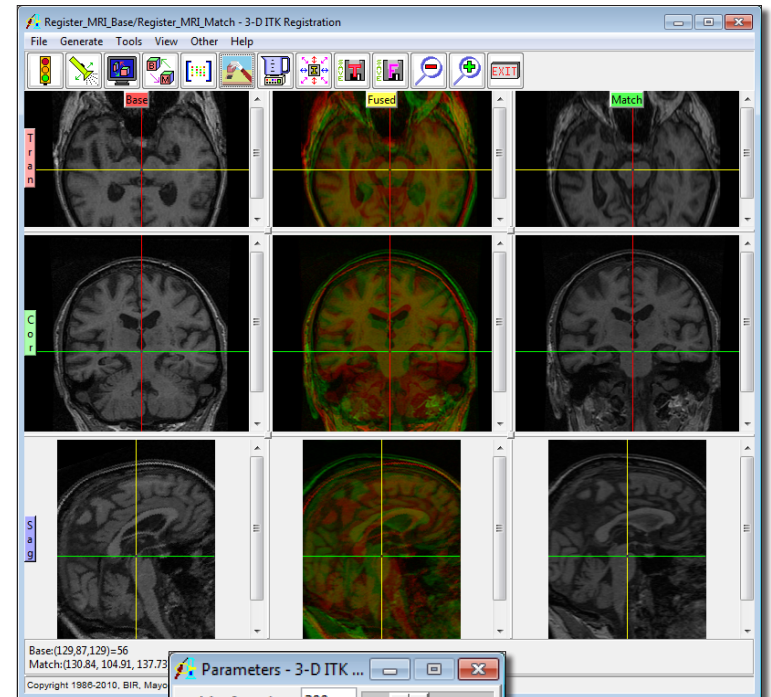


Figure 1

Figure 2