

Exercise 49 : SISCOM

Epilepsy Seizure Focus Localization with SISCOM (Subtraction Ictal SPECT CO-registered to MRI) automates the technique for advanced imaging of epilepsy patients that was developed with Analyze at the Mayo Foundation. This method uses a combination of SPECT and MRI imaging for improved diagnosis of areas of regional activation in the brain during a seizure. The SISCOM technique requires acquisition of ictal (during the seizure) and interictal (resting, or between seizures) SPECT images and an MRI volume spanning the entire brain. This exercise will demonstrate how to use the SISCOM module within Analyze.

1. Load the data sets **SISCOM_Ictal_SPECT.avw**, **SISCOM_Interictal_SPECT.avw**, and **SISCOM_MRI.avw** from the `$(\BIR\images\TutorialData` directory.
2. Select the data sets in the following order (hold down the <CTRL> key to select multiple data sets, or click using the middle mouse button):
 - **SISCOM_Ictal_SPECT.avw**
 - **SISCOM_Interictal_SPECT.avw**
 - **SISCOM_MRI.avw**Note the selection order: Ictal, Interictal, MRI. If the data is not loaded in this order the SISCOM procedure will fail to run correctly.
3. Open the **SISCOM** module (**Apps > SISCOM**).
4. Open the **Register SPECT** option (**Process > Register SPECT**) to compute an activation map.
 - i. Set the Interictal SPECT minimum Cerebral Activity Threshold level to 75 [A]. Note the change in the binary image.
 - ii. Ensure that the Interictal Transformation Type is set to Linear [B].
 - iii. Use the Activation Level slider bar to set the standard deviation to 2.0 [C].
 - iv. Next, select the Register and Map button. The Register SPECT tool will automatically register, normalize, subtract, select the statistically significant voxels of activation, and output the activation map based on the parameters specified above. Note that the tool will update, displaying the Activation Map [D].
5. Select **Next** to continue onto the next step of the SISCOM procedure, MRI brain extraction.

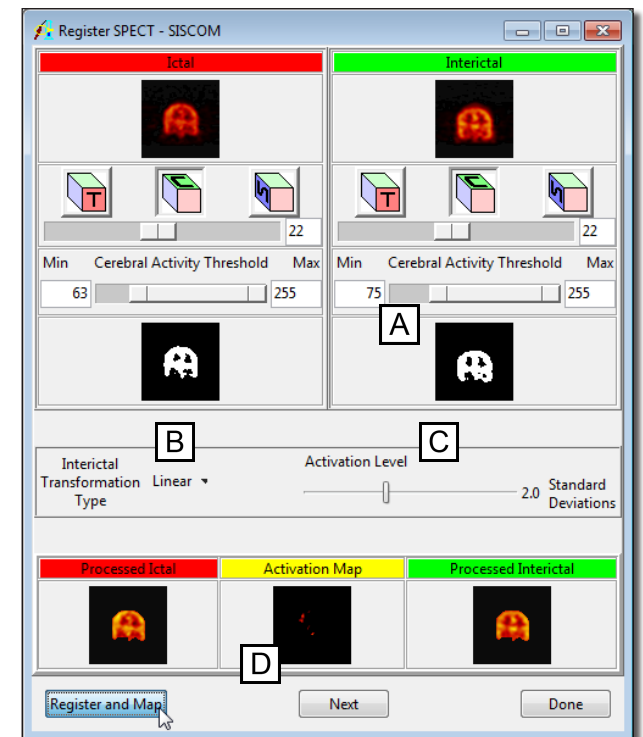


Figure 1

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- The Extract MRI Brain tool allows for segmentation of the brain for SPECT-MRI registration.
- Right-click in the MRI data display window and select the Intensities option. In the Intensity (MRI) window returned, change the **Maximum** to **101** then click Done to close the Intensity Tool.
- Use the slider bar to adjust the minimum and maximum threshold values to obtain the best definition of the cortical boundary as possible. In this case, the threshold values do not need to be adjusted.
- Select **Extract Brain** to segment the brain. After segmentation is complete, the extracted brain is automatically displayed in the **Extract MRI Brain** tool. The segmentation can be reviewed using the Slice slider bar (figure 2).
- Select **Next** to continue to the next step, registration of the SPECT data sets to the MRI data sets.
- The **Fuse SPECT & MRI** tool will automatically open and immediately run the Match Surfaces process, registering the SPECT data sets to the MRI data set and displaying the Activation Map overlaid on the MRI data set. The activation map and MRI can be reviewed using the orthogonal orientation buttons and the slice slider bar (figure 3).
- Select Fuse Volumes. The activation map and MRI will be fused and automatically be saved to the Analyze workspace. Select **Done** to close the Fuse SPECT & MRI tool. Also close the Extract MRI Brain and Register SPECT tools.

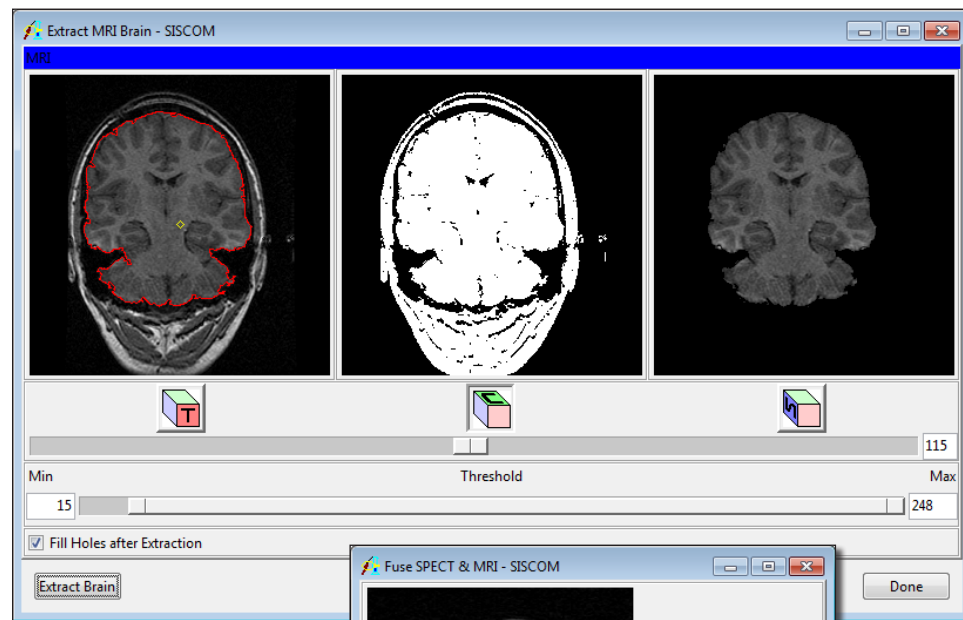


Figure 2

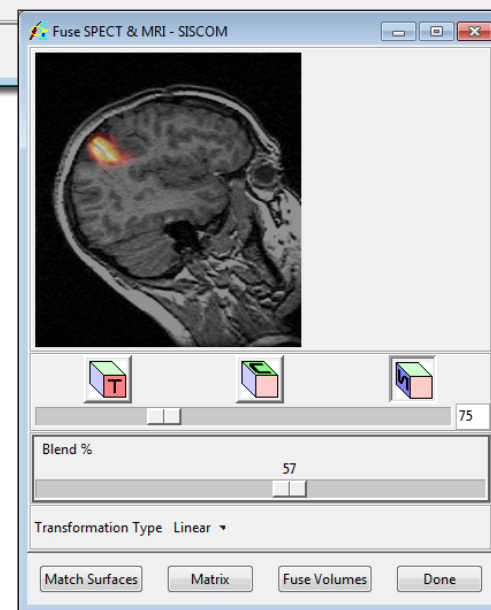


Figure 3

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13. Select the **Compare Tool** option (**Process > Compare Tool**). The Compare Tool provides an interface for users to display and visually inspect the accuracy of the registration and fusion of the volumes created in the SISCOM process. Use the drop down menu options under each image [A] to select the volumes to compare (figure 4). Select Done when review is complete.
14. Select the **Create Object Map** option from the **File** menu to generate an object map based on the areas of activation.
15. Select **Output Object Map**. The object map will be automatically saved to the location specified using the **File** option. The Render tool (figure 5) will automatically open, allowing for interactive review of the object map.
16. Close all windows related to the SISCOM module before proceeding to the next exercise.

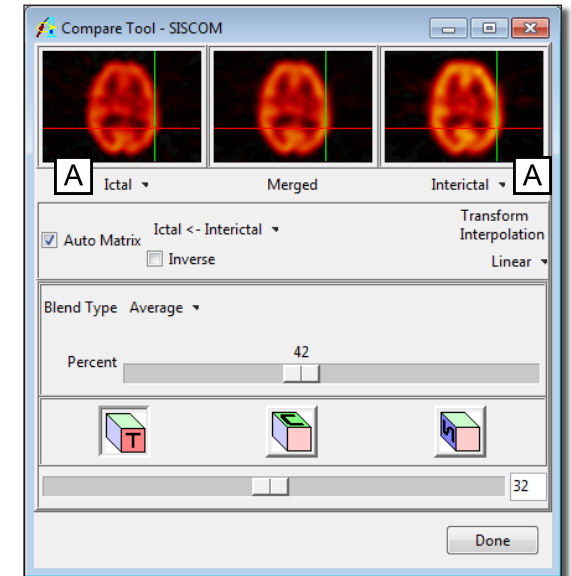


Figure 4

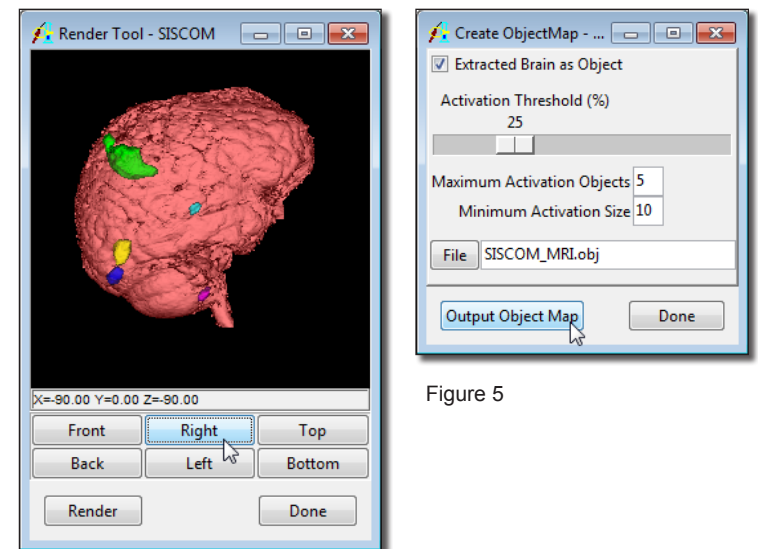


Figure 5