2D Non-Rigid Registration

The 2D Non-Rigid Registration module applies local Normalized Mutual Information (NMI) image registration in a grid of subregions. The optimized local registration transformations are then interpolated across the image to effect a continuous non-rigid transformation. This exercise will demonstrate how to register two adjacent sections to correct for the difference stretching forces each section has been subjected to.

1. Load the **AdjacentSections** data set from the **C:/BIR/images/TutorialData** folder.

2. Open the **2D Non-Rigid Registration** module (**Register > 2D Non-Rigid**).

3. Open the **Control Window** (**Generate > Control**) (figure 1). Two Registration Modes are provided, Sections or Slabs.

   - **Sections**: allows for each image to be non-rigidly registered to the next.

   - **Slabs**: registration will only be performed at Interfaces between slabs, during transformation the non-rigid transformation is relaxed through the slab.

4. Set the **Registration Mode** to **Sections**. You can now choose between a Sequential or Single Reference registration.

   - **Sequential**: specifies that each section will register sequentially to its neighbor.

   - **Single Reference**: will register each slice to one base slice, the To Section slider is used to select the base.

5. Select **Sequential** (figure 2). Do not close the **Control** window.

6. Open the **Cursor Link** tool (**Tools > Cursor Link**). The Cursor Link window displays two sections; the Base and Match, in their current registration, as well as the two sections overlaid. Right click in the overlay window and select a Blend option from the Blend Mode menu.
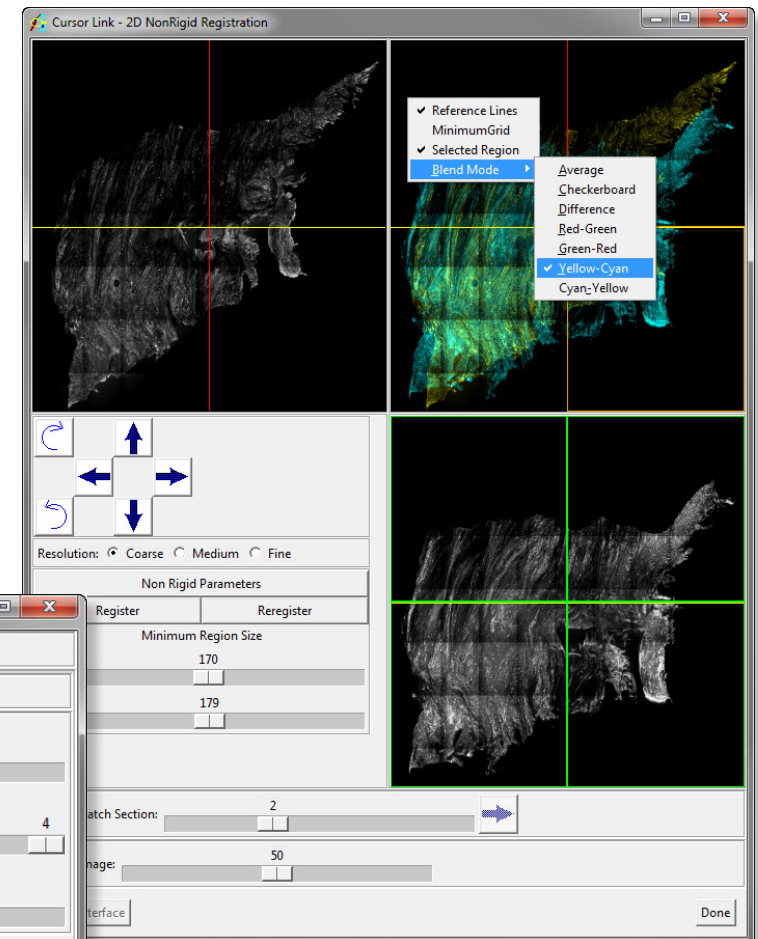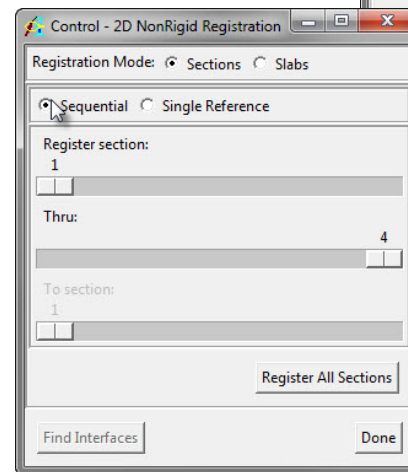

Figure 1

Figure 2

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2D Non-Rigid Registration

7. By default, the Match section displays the current minimum region grid (the grid of subregions the local NMI is applied to), shown in green. Note there are 4 regions, to adjust the region size use the Minimum Region Size X and Y sliders To increase the number of regions from 4 to 9, set the **X slider** to **112** and the **Y slider** to **119**.

8. Note the orange box in the overlay window shows the current selected region. To switch this on in the Base and Match windows right-click and select the **Selected Region** option (figure 3).

9. Manual transformations and rotations can be applied to the current selected region in the Match image using the **Manual Adjustment** buttons. Because the regional displacements are interpolated across the image, some transformations may also affect adjacent areas of the image. The **Resolution** options (Coarse, Medium or Fine) below the Manual Adjustment buttons control the amount of displacement. Note, **Fine** resolution is a one pixel translation or one degree rotation, **Coarse** is approximately ten.

10. Click on the **Non Rigid Parameters** button.

11. In the Non-Rigid Match window (figure 4), review the following options:

    • **Threshold**: Check the Show Thresholding option and note the update in the image display as you adjust the threshold range. Only voxels displayed as white will be considered for the registration.

    • **Samples**: specifies the minimum and maximum sampling density.

    • **Process**: these options set limits of confidence on the registration procedure.

12. To Register the sections sequentially click the **Register All Sections** button in the Control window.

13. After registration is complete select **Generate > Transform Slices** from the main 2D Non-Rigid Registration window. In the **Transformation** window returned, set the **Destination** to **Analyze Workspace** and set the **Interpolation** option to **Linear** (default), next click **GO**. The transformed image data will be saved to the Analyze workspace.

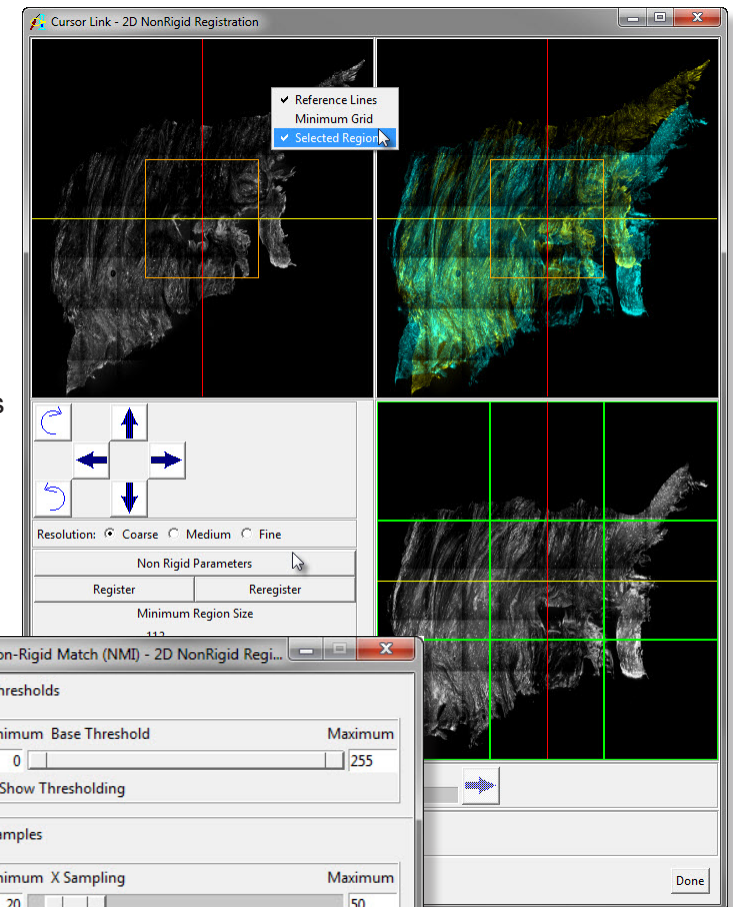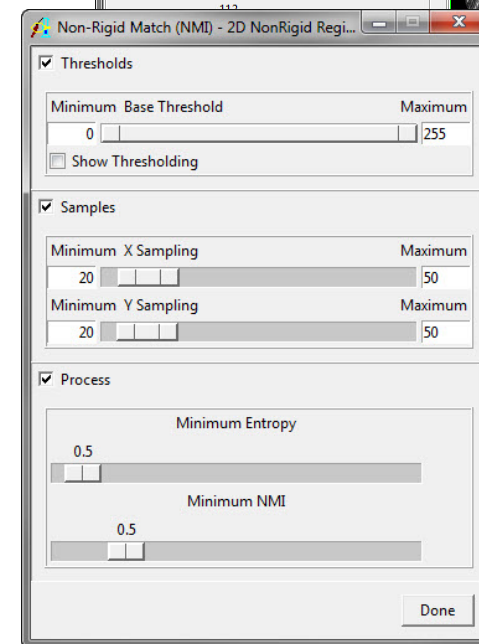14. Close the 2D Non-Rigid Registration module.

Figure 3

Figure 4

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2D Non-Rigid Registration

15. Review the original data and then the registered data (Match2D_out) using the Multiplanar Sections module. Observe the difference in the slice data between the two data sets, specifically slices 2 and 3 in the registered data set (figure 6).
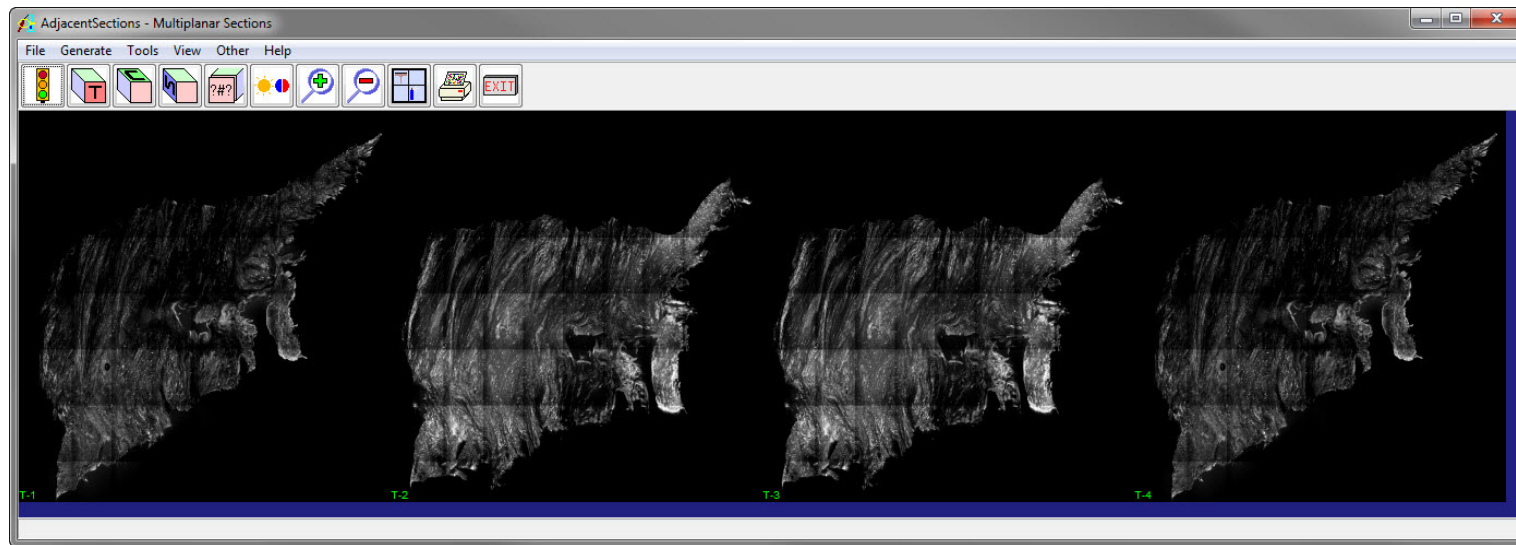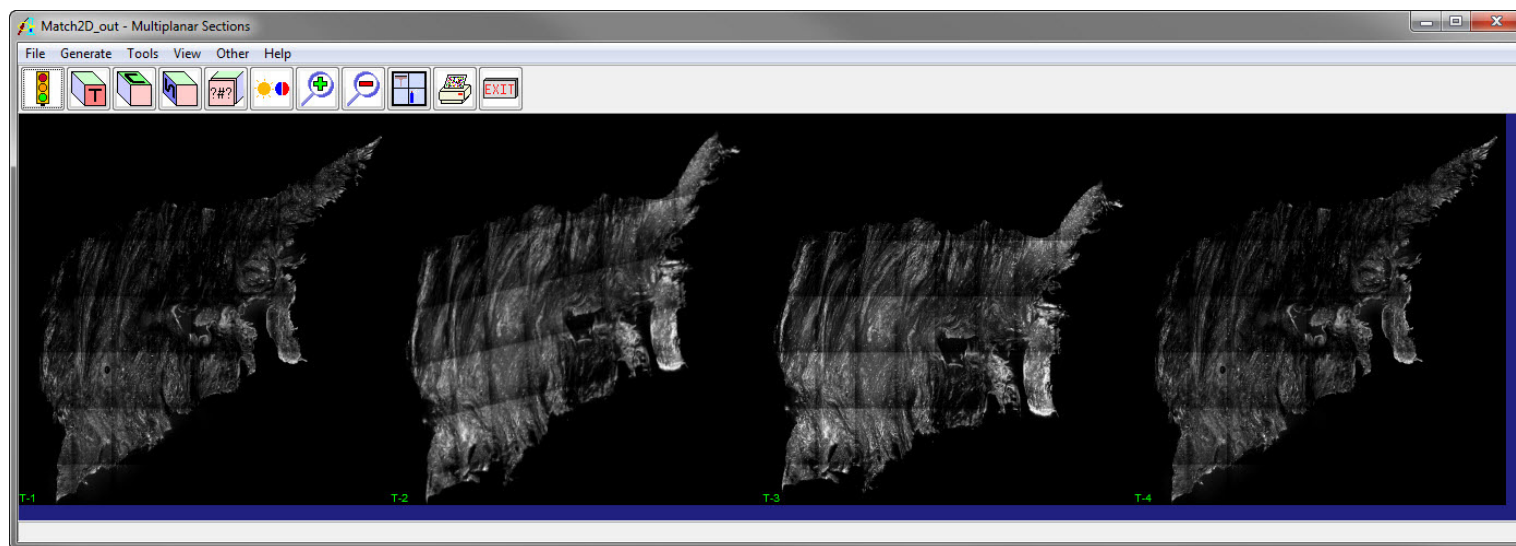

Figure 5

Figure 6

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