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.
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.
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).