Section 5: Spatial Enhancement

Section Objective

Spatial Enhancement can be a powerful tool. This Section will review a few of the many Spatial Functions available within IMAGINE; Resample Pixel Size and 'Hyperspherical Color Space' Resolution Merge.

Resample Pixel Size is a common function in image analysis for various reasons. This section will use Resample Pixel Size to reduce spatial resolution of an image. This same image will then be used in a resolution merge. The result of resampling beforehand will produce an exaggerated display of how a resolution merge can improve imagery.

The general concept of a resolution merge is to utilize the spectral resolution of lower spatial resolution imagery (multispectral) and fuse with the higher spatial resolution of a panchromatic image. This results in a finer (spatial) resolution of the multispectral image by utilizing the finer spatial resolution of the panchromatic image.

Tools Used

• Batch Wizard	Turn the basic pan sharpen tool into a batch process
• Convolution	Edge Enhance Kernel image enhancement
• HCS Resolution Merge	One of many Pan Sharpen Methods in IMAGINE
• Pan Sharpen	List of Pan Sharpening methods available in IMAGINE
• Resample Pixel Size	Can Sub-Sample or Super-Sample without Reprojection

Class Notes

Spatial Enhancement

Objective:

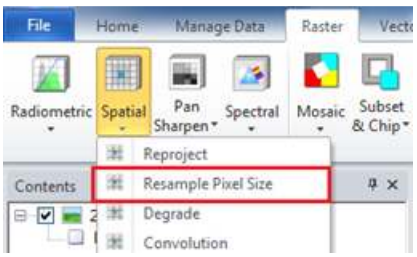
To understand the large range of Spatial Enhancement Algorithms available within ERDAS IMAGINE. To also understand the key tradeoffs. For example some methods may be faster to complete, but at a cost of spectral fidelity. Review the help documentation or notes to understand which Resolution Merge method will best suit the data and requirements.

Task 1: Spatial: Resample Pixel Size

The Resample dialog resamples raster image data to a specified pixel size. Unlike Reproject, this dialog does not transform or project data from one map projection to another.

This task will resample an image to reduce spatial resolution. The output will then be used in a later task in a resolution merge. This is done to exaggerate the visual effect pan sharpening can make.

1. Select **Resample Pixel Size** from **Raster** Tab **| Resolution** Group | **Spatial**



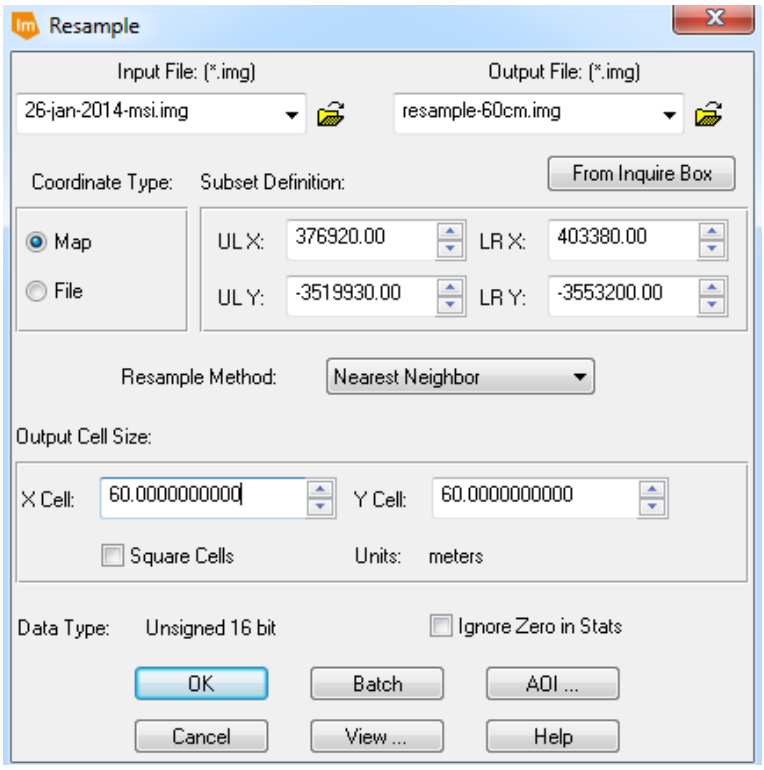
The Resample Dialog will appear

2. Specify the Input File: TrainingData***26-jan-2014-msi.img***
3. Specify the Output File: TrainingData\Output\ ***resample-60m.img***

   We will resample the input image from 30 to 60 metres.

4. Set Output Cell Size as **X: 60.00** and **Y: 60.00** and click **OK**

   As shown on screenshot following:

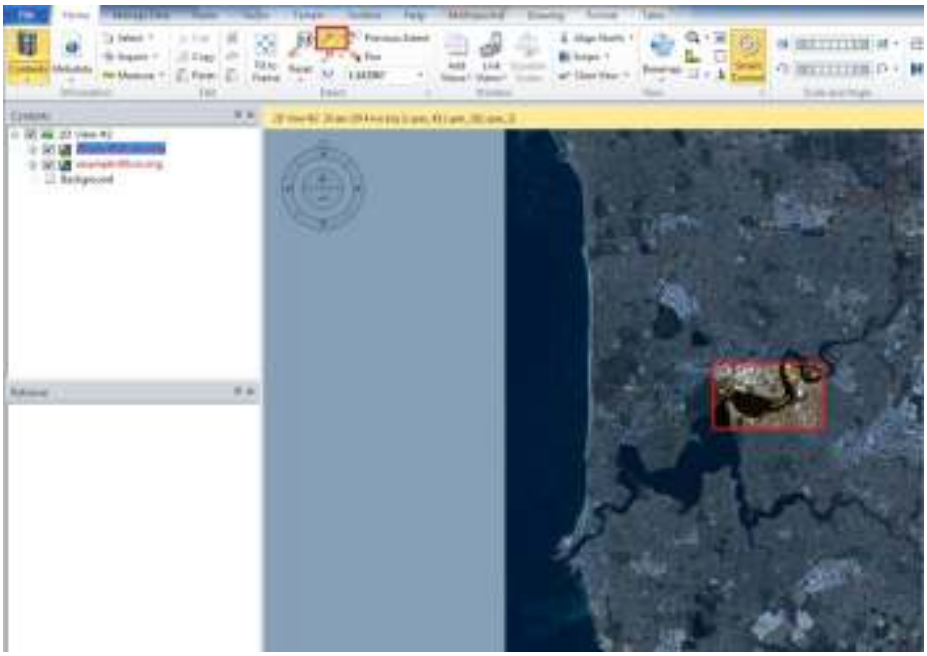


5. Open both images in a new 2D View;

   TrainingData***26-jan-2014-msi.img***

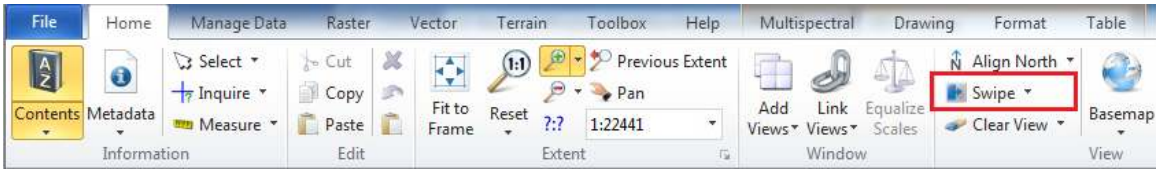
   TrainingData\Output***resample-60m.img***

6. From the Home Tab | Extent Group select the **Zoom In** Icon and draw a box around the CBD to zoom in



7. Ensure you only have two datasets open in the 2D View, ***26-jan-2014-msi.img*** and ***resample-60m.img***.

8. From the Home Tab | View Group select the **Swipe** icon



This will open the Transition Utility Tab we will use to compare Spatial Resolution of the two images

9. Drag the **Transition Extent** from left to right to compare between the images

You should notice the much poorer resolution of your output. This was created to later emphasize the strengths Pan Sharpening can provide in improving your imagery.

10. **Close Transition**

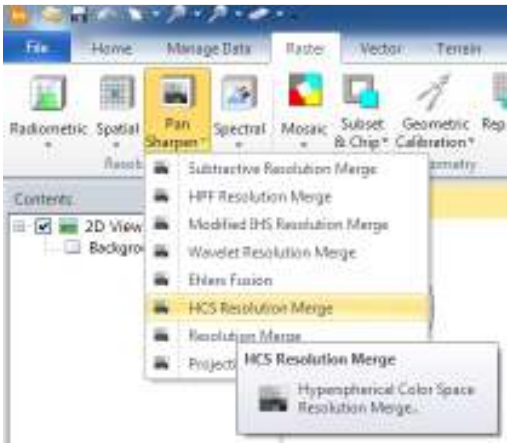
11. **Clear View**

Task 2: Pan Sharpen: HCS Resolution Merge

Combine high-resolution panchromatic data with lower resolution multispectral data using the Hyperspherical Color Sharpening algorithm. This option is designed for WorldView-2 sensor 8-band data, and works with any multispectral data containing 3 bands or more.

Data is transformed from native color space to Hyperspherical color space. The first mode replaces the multispectral intensity component with an intensity matched version of the pan band. The second mode replicates the original multispectral colors.

1. Select **HCS Resolution Merge** from **Raster** Tab | **Resolution** Group | **Pan Sharpen**



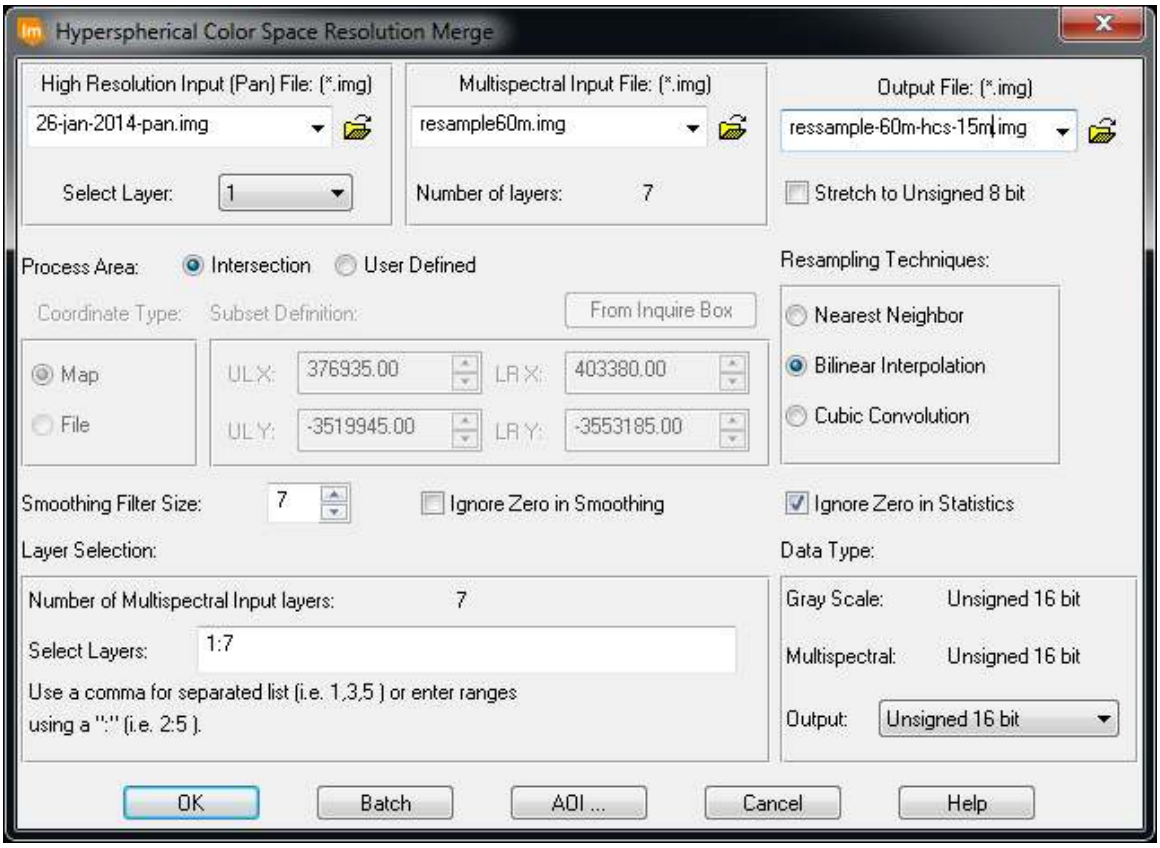
2. Define these settings in the 'Hyperspherical Color Space Resolution Merge" Dialog Box:

   High Resolution Input: ***26-jan-2014-pan.img***

   Multispectral Input: TrainingData\Output***resample-60m.img***

   If you have not already created this resampled image, you can use the copy saved to TrainingData\ExampleOutput Folder

   Output File: TrainingData\Output***resample-60m-hcs-15m.img***

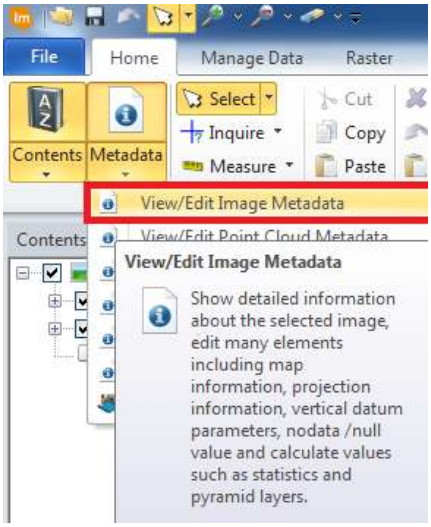


3. Click **OK** to begin
4. Once process is complete, in a clear 2DView open ***resample-60m.img***

   And your HCS output: ***resample-60m-hcs-15m.img***
5. Review your results visually by using the **Swipe** tool in the Home Tab | View Group

Another way of interpreting the results of the resolution merge is to review the actual metadata information

6. From the Home Tab | Information Group Select **View/Edit Image Metadata**



7. Navigate to TrainingData\Output and open ***resample-60m.img*** and click **OK** to open

   If you have not created this dataset earlier, you can use the copy saved to TrainingData\ExampleOutput Folder

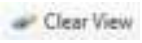
8. Repeat steps 6 & 7 to open a Second Metadata Window, but open TrainingData\Output***resample-60m-hcs-15m.img***

   If you have not created this dataset earlier, you can use the copy saved to TrainingData\ExampleOutput Folder

9. Align both Image Metadata Windows next to each other

   Note the Resolution Merge has improved Spatial Resolution of the Multispectral Image from 60m to 15m

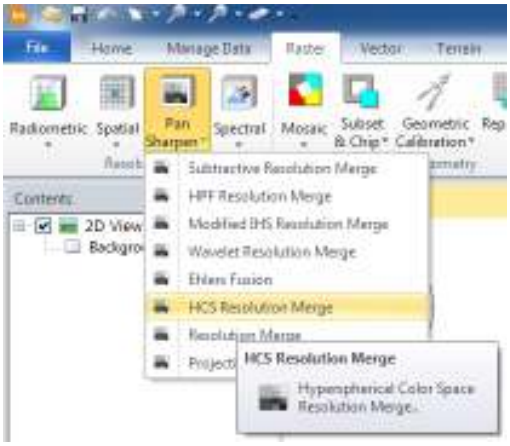
10. **Close** both Image Metadata Windows

11. 

Task 3: Pan Sharpen: Batch Processing

1. Select **HCS Resolution Merge** from Raster Tab | Resolution Group

   The data can be incorporated into many datasets from which the resolution merge can be added.

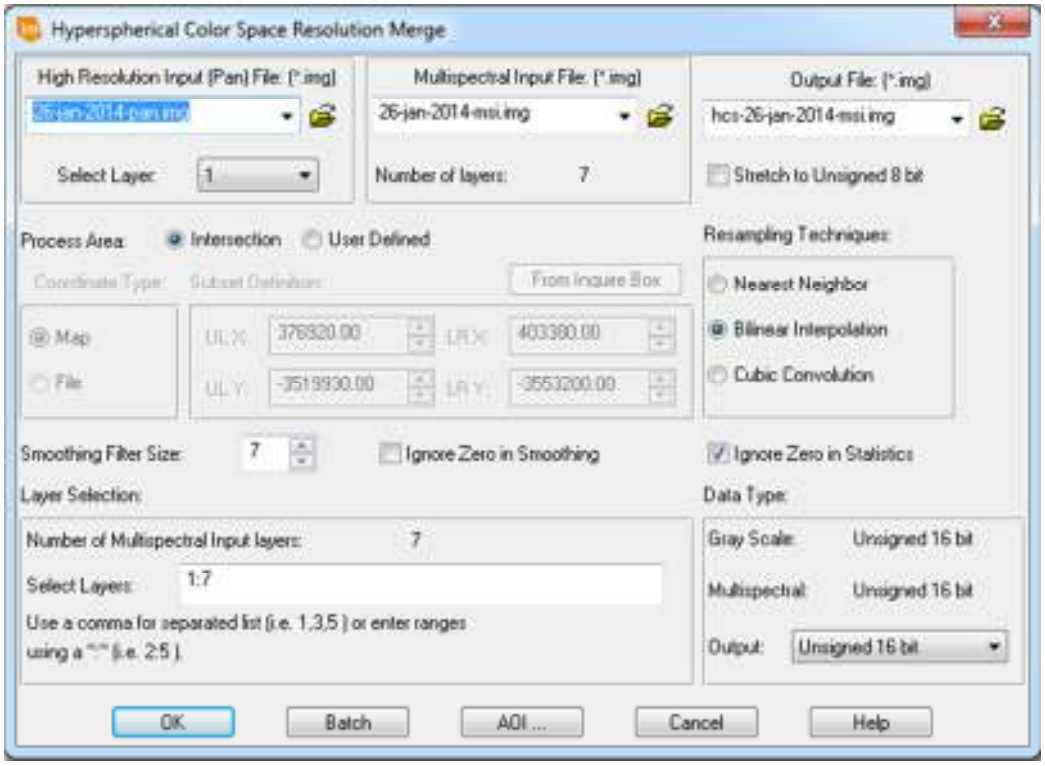


2. Define these settings in the ‘Hyperspherical Color Space Resolution Merge” Dialog Box:

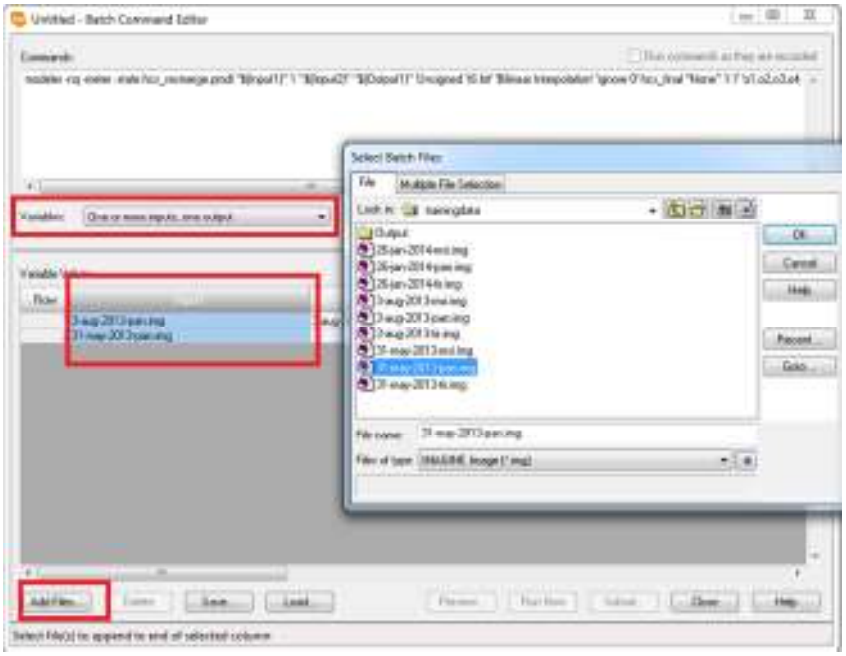
   High Resolution Input: ***26-jan-2014-pan.img***

   Multispectral Input: ***26-jan-2014-msi.img***

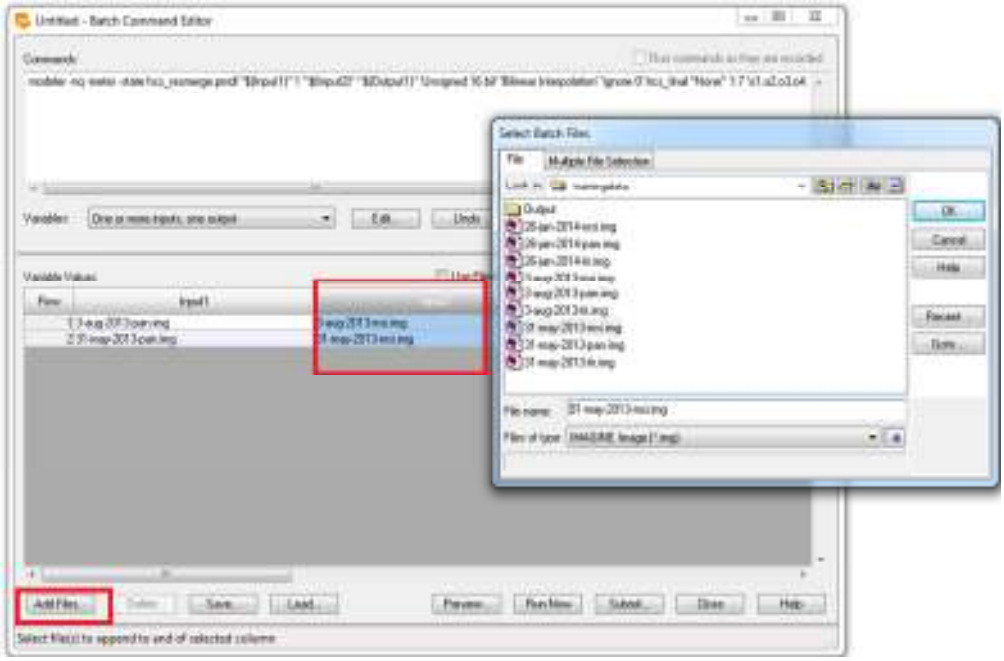
   Output File: TrainingData\Output***hcs.img***



3. Click **Batch** to open Batch Processing Dialog Box
4. Change the Variables to: **One or more inputs, one input**
5. Highlight the **Input1** Column and Select **Add Files**
6. Load ***31-may-2013-pan.img*** Click OK Select Batch Files



7. Highlight the **Input2** Column and Select **Add Files**
8. Load ***31-may-2013-msi.img*** Click OK Select Batch Files



9. On the Batch Command Editor click **Edit** to open the Variable Editor

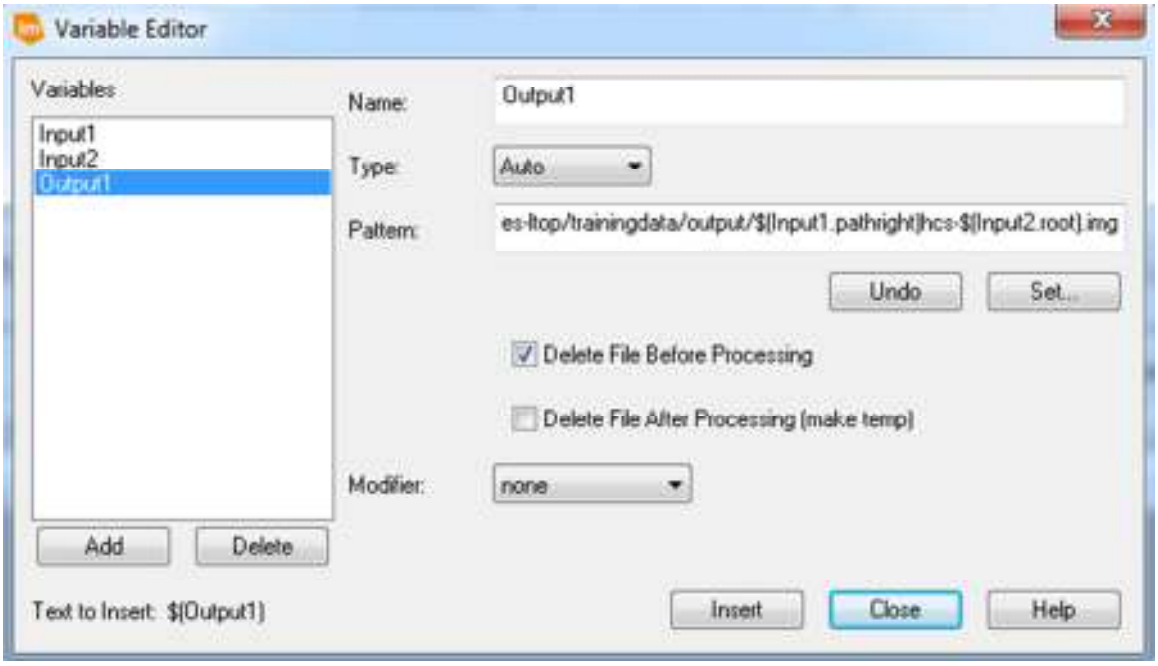
Currently the Batch Command Editor is appending "_hcs.img"to the end of every output image. We will now modify the syntax to append the "hcs-" before the Input2 (multispectral image).

10. On the Variables list, **Highlight Output1**

    Pattern should end with:
    trainingdata/output/$(Input1.pathright)$(Input1.root)_hcs.img
11. Replace this with:

    trainingdata/output/$(Input1.pathright)hcs-$(Input2.root).img

12. Ensure the Syntax is correct and click **Close**



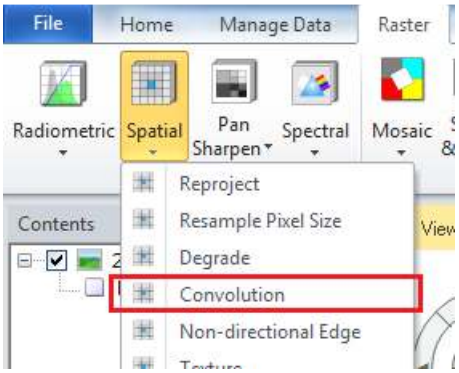
This syntax will append “”hcs-“before the Input2 (Multispectral Image) and use this syntax as the output name. I.e.: *hcs-31-may-2013-msi.img*

13. Click **Run Now**

Task 4: Spatial: Convolution Edge Enhancement

Another common Spatial Operator for image enhancement is Convolution Kernels (filters). A convolution performs image enhancement operations such as averaging, high-pass or low-pass filtering on a raster image and saves it to a new image file. This task will take the HCS Resolution Merge output and perform an Edge Enhancement. This brings out the edges of common groups of pixels – such as enhancing the edge of pixels along a road corridor.

1. Select **Convolution** from the Raster Tab | Resolution Group | Spatial Pull-down list



The Convolution dialog box will appear

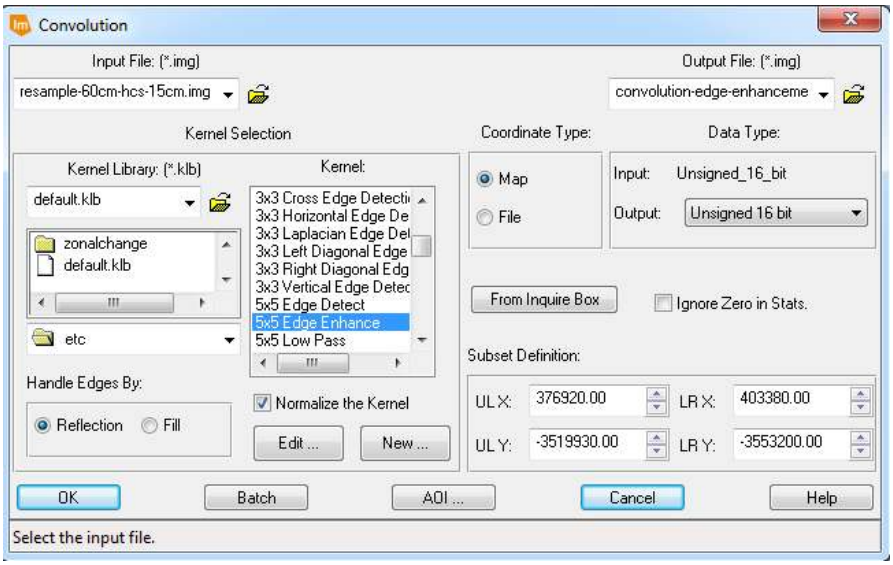
2. Define these settings in the 'Convolution" Dialog Box:

Input File: TrainingData\Output***resample-60cm-hcs-15m.img***

Output File: TrainingData\Output***convolution-edge-enhancement-5x5.img***

Kernel: **5x5 Edge Enhance**

And then Click **OK**



3. Open in a clear 2DView both images;

TrainingData\Output\ ***resample-60m-hcs-15m.img***

TrainingData\Output\ ***convolution-edge-enhancement-5x5.img***

4. From the Home Tab | Extent Group select the **Zoom In** Icon and draw a box around the CBD to zoom in

   Recommended a 1:1 zoom

5. From the Home Tab | View Group select the **Swipe** icon

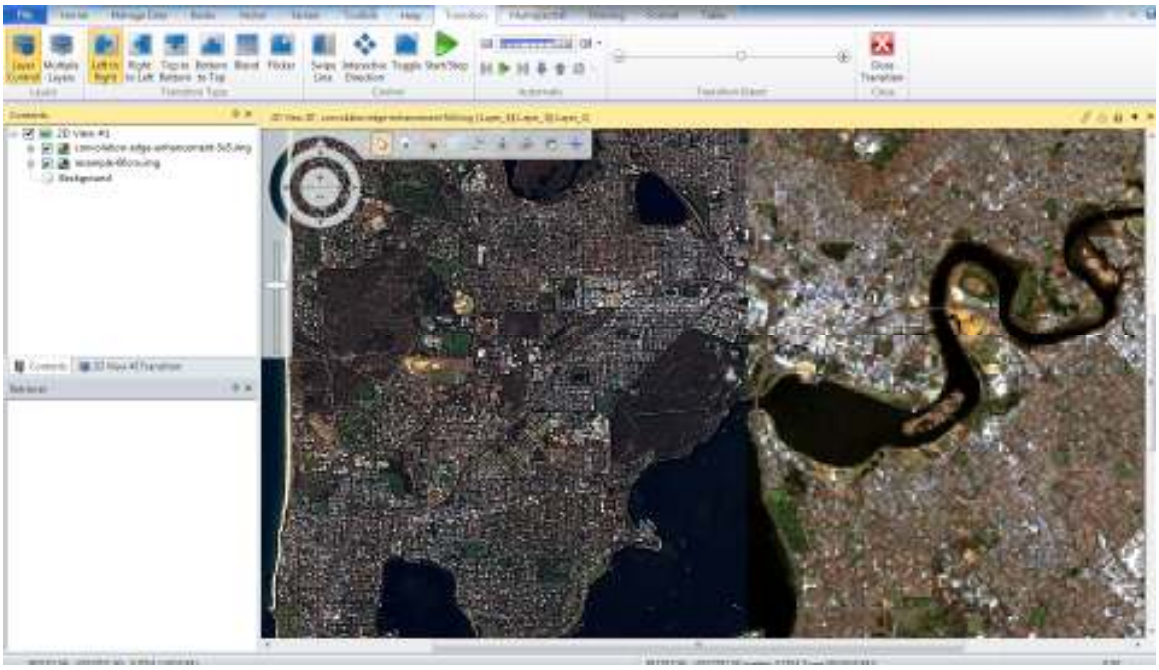
6. Drag the **Transition Extent** from left to right to compare between the images

You should notice the effect a Convolution – Edge Enhancement creates to the raster. Visually, the linear features such as road corridors and edges of buildings become more dominant in the edge enhanced image vs the original input.

Next we will compare the Spatial Enhancements you have performed from the Original Resampled (60cm) Image. Recall this was improved by a simple resolution merge and edge enhancement.

7. **Remove** the ***resample-60m-hcs-15m.img*** image
8. **Open** TrainingData\Output\ ***resample-60m.img***
9. Alter the Transition extent to visualize the enhancements further

A clear indication of the pan sharpening and edge enhancements should be visible as shown:



10. **Close Transition**

11. **Clear View**