ENVI

ENVI Tutorial: Mosaicking in ENVI

Mosaicking in ENVI

This tutorial is designed to give you a working knowledge of ENVI's image mosaicking capabilities. For additional details, please see ENVI Help.

Files Used in this Tutorial

ENVI Resource DVD: `Data/avmosaic`

File	Description
dv06_2.img (.hdr)	AVIRIS Scene 02
dv06_3.img (.hdr)	AVIRIS Scene 03
dv06a.mos	Mosaic template for end-to-end AVIRIS mosaic
dv06b.mos	Mosaic template for feathered overlapping AVIRIS mosaic
dv06_fea.img (.hdr)	Feathered mosaic

File	Description
lch_01w.img (.hdr)	Warped, histogram-matched image
lch_01w.ann	Cut-line feathering annotation for above
lch_02w.img (.hdr)	Warped, histogram matched image
lch_a.mos	Mosaic template for georeferenced image mosaicking
lch_mos1.img (.hdr)	Georeferenced mosaic result

File	Description
mosaic1_equal.dat (.hdr)	Subset of a Landsat-7 ETM image with a histogram equalization stretch independently applied to each band
mosaic_2.dat (.hdr)	Another subset from the same Landsat-7 ETM image, without any stretching applied

The Mosaicking Process in ENVI

Mosaicking involves combining multiple images into a single composite image. ENVI provides interactive capabilities for placing non-georeferenced images within a mosaic, and automated placement of georeferenced images within a georeferenced output mosaic. ENVI also provides transparency, histogram matching, and automated color balancing. ENVI's Virtual Mosaic allows you to create and display mosaics without creating large output files.
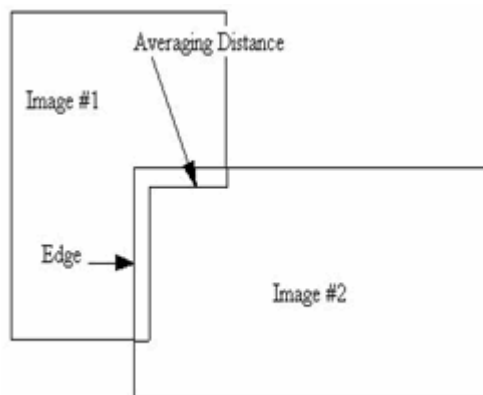
The following sections provide useful information about mosaics in ENVI before you start the exercises. The actual exercises are in "Pixel-Based Mosaicking Example" on page 5.

Feathering

To blend or blur the seams between mosaicked images, you can feather the edges of overlapping areas using either edge feathering or cut-line feathering over a specified distance. To use feathering when mosaicking images, import the bottom image without feathering. Then import the overlapping images with edge or cut-line feathering.
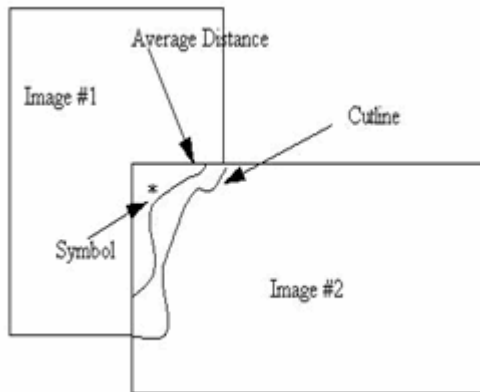
Edge Feathering

Edge Feathering uses a pixel distance you specify to blend the seams along the edges of the mosaicked image. The edge is blended using a linear ramp that averages the two images across the specified distance. For example, if the specified distance is 20 pixels, 0% of the top image is used in the blending at the edge and 100% of the bottom image is used to make the output image. At 20 pixels from the edge, 100% of the top image is used to make the output image and 0% of the bottom image is used. At 10 pixels from the edge, 50% of each image is used to make the output image.

Cutline Feathering

Cut-line Feathering uses a pixel distance and annotation file you specify to blend the image boundaries. You must define cut-lines using the annotation tools prior to mosaicking. The annotation file must contain a polyline defining the cut-line that is drawn from edge-to-edge, and you must place a symbol in the region of the image that will be cut off. The cut-line distance is used to create a linear ramp that averages the two images across that distance from the cut-line outwards. For example, if the specified distance is 20 pixels, 100% of the top image is used in the blending at the cut-line and 0% of the bottom

image is used to make the output image. At 20 pixels from the cutline, 0% of the top image is used to make the output image and 100% of the bottom image is used. At 10 pixels from the cutline, 50% of each image is used to make the output image.
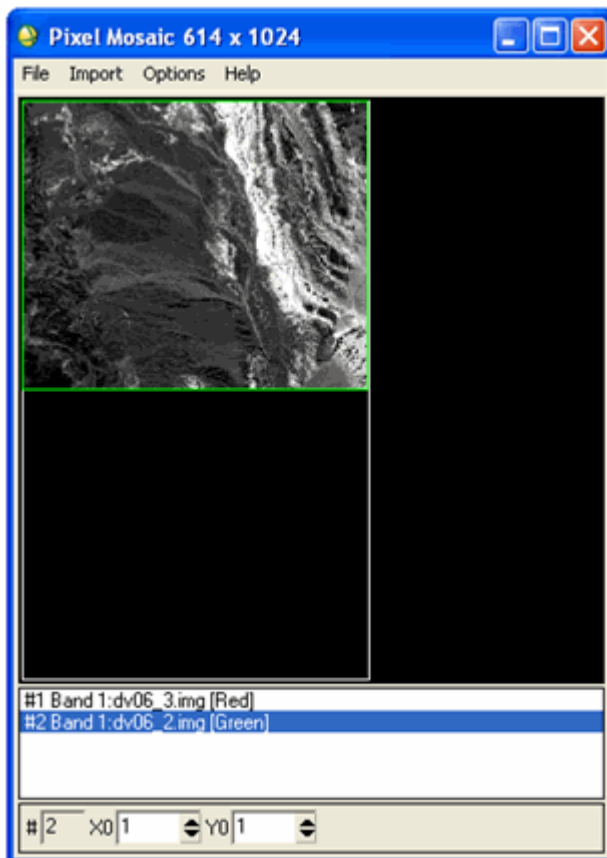

Virtual Mosaics

You can use a mosaic template file to construct a "Virtual Mosaic," one that can be displayed and used by ENVI without actually creating a mosaic output file. You cannot use feathering when creating a Virtual Mosaic in ENVI.

After creating a mosaic, save the template file by selecting **File > Save Template** from the Image Mosaicking dialog menu bar. This creates a small text file describing the mosaic layout.

To use the Virtual Mosaic, select **File > Open Image File** from the ENVI main menu bar and open the mosaic template file. All of the images used in the mosaic are opened and their bands are listed in the Available Bands List. Display or process any of the bands in the Virtual Mosaic, and ENVI treats the individual images as if they were an actual mosaic output file. The new processed file has the specified size of the mosaic, and the input files are in their specified positions within the mosaic.

Pixel-Based Mosaicking Example

1. From the ENVI main menu bar, select **Map > Mosaicking > Pixel Based**. The Pixel Based Mosaic dialog appears.

2. From the Pixel Based Mosaic dialog menu bar, select **Import > Import Files**. The Mosaic Input Files dialog appears.

3. Select **Open > New File**. Navigate to `Data\avmosaic` and select `dv06_2.img`. Click **Open**.

4. Repeat Step 3 for `dv06_3.img`.

5. In the Mosaic Input Files dialog, click **Shift** to select both images. Click **OK**. The Select Mosaic Size dialog appears.

6. In the **Mosaic Xsize** field, enter **614**. In the **Mosaic Ysize** field, enter **1024**. Click **OK**. A Pixel Mosaic dialog appears:

7. The bottom of the Pixel Mosaic dialog lists the current position of the images. Select `dv06_3.img`, enter **513** in the **Y0** field, and press **Enter**. The file `dv06_3.img` is placed directly below `dv06_2.img`.

8. From the Pixel Mosaic dialog menu bar, select **File > Apply**. A Mosaic Parameters dialog appears.

9. In the **Enter Output Filename** field, enter `dv06.img` and click **OK** to create the mosaic.

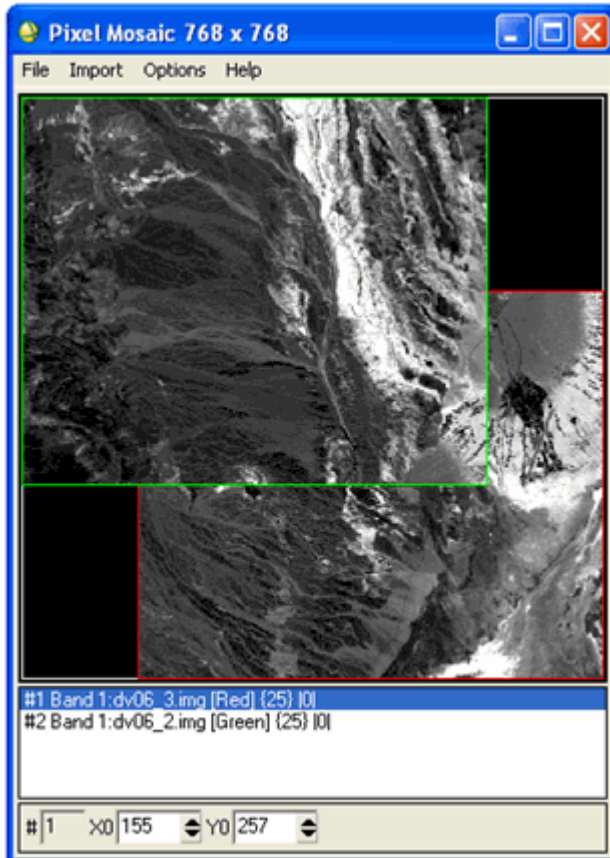10. To create a Virtual Mosaic instead of a new mosaic file, select **File > Save Template** from the Pixel Based Mosaic dialog menu bar. When the Output Mosaic Template dialog appears, enter the output filename `dv06a.mos`.

11. In the Available Bands List, select **Mosaic (Band 1)** under `dv06.mos` (or `dv06a.mos` from Step 9) and click **Load Band**.

Other Methods for Positioning Images

The second part of this example shows you how to position the two images into a composite mosaic image by entering X0 and Y0 values, or by dragging the images to the desired locations within the Pixel Mosaic dialog. The example also includes edge feathering.

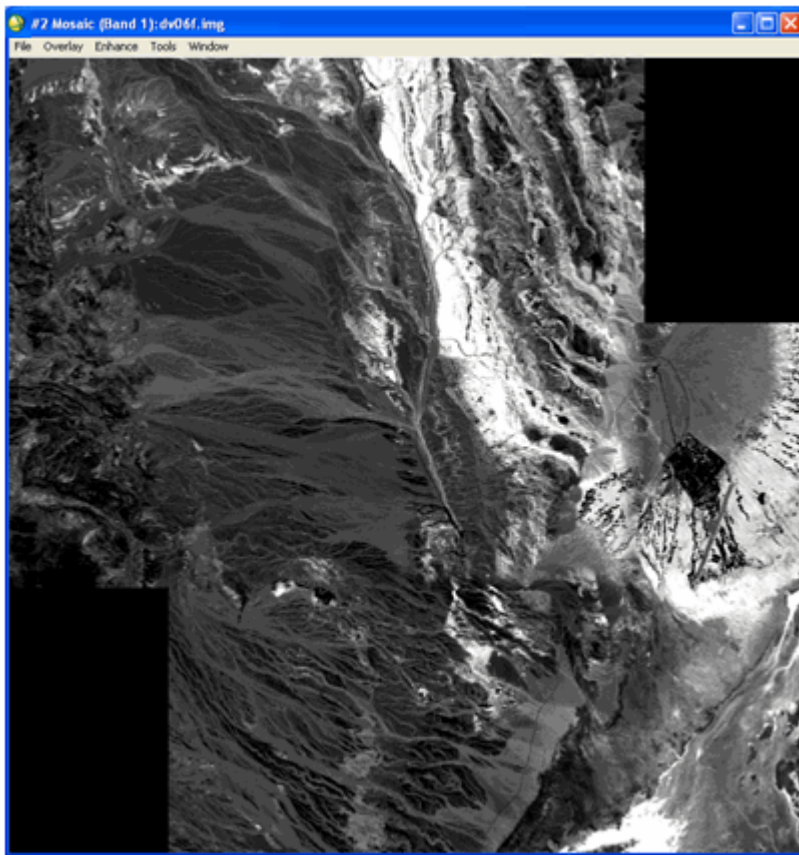1. In the Pixel Mosaic dialog, select **Options > Change Mosaic Size**. The Select Mosaic Size dialog appears.

2. In the **Mosaic Xsize** and **Mosaic Ysize** fields, enter **768**. Click **OK**.

3. In the Pixel Mosaic dialog, click the image surrounded by a green box (`dv06_2.img`) and drag it to the lower-right corner of the dialog.

4. Right-click inside this image and select **Edit Entry**. An Entry: dialog appears.

5. In the **Data Value to Ignore** field, enter **0**.

6. In the **Feathering Distance** field, enter **25**.

7. Leave the default values for other fields and click **OK**.

8. Click the image surrounded by a red box (`dv06_3.img`) and drag it to the upper-left corner of the dialog. Then, repeat steps 4-7 for this image.

9. From the Pixel Mosaic menu bar, select **File > Save Template**. An Output Mosaic Template dialog appears.

10. In the **Enter Output Filename** field, enter `dv06b.mos`. Click **OK**.

11. In the Available Bands List, select **Virtual Mosaic (Band 1)** and click **Load Band**. No feathering is performed with a Virtual Mosaic.

12. Make the same image as a feathered mosaic by creating an output file. From the Pixel Mosaic dialog menu bar, select **File > Apply**. A Mosaic Parameters dialog appears.

13. In the **Enter Output Filename** field, enter `dv06f.img`.

14. In the **Background Value** field, enter **255**. Click **OK**.

15. In the Available Bands List, click **Display #1** and select **New Display**.

16. Select **Mosaic (Band 1)** under `dv06f.img` and click **Load Band**. If you cannot see the entire image in the Image window, click and drag a corner of the Image window to resize it.

17. Compare the Virtual Mosaic and the feathered mosaic using image linking and dynamic overlays. The following figure shows the feathered output mosaic produced by overlapping the two AVIRIS scenes.

18. From the Available Bands List menu bar, select **File > Close All Files**.
19. Close the Pixel Mosaic dialog and all display groups.

Map-Based Mosaicking Example

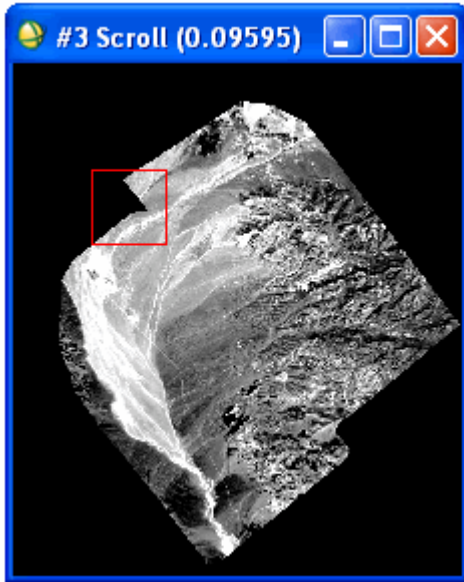Follow these steps to create a map-based mosaic image:

1. From the ENVI main menu bar, select **Map > Mosaicking > Georeferenced**. A Map Based Mosaic dialog appears.

2. From the Map Based Mosaic dialog menu bar, select **File > Restore Template**. A file selection dialog appears.

3. Navigate to `Data\avmosaic` and select `lch_a.mos`. Click **Open**. This opens the files associated with the mosaic template and restores the mosaic parameters necessary for a georeferenced, feathered mosaic.

   You can also individually import georeferenced images and set the feathering options by selecting **Import > Import Files** from the Map Based Mosaic dialog menu bar. Images will automatically be placed in their correct geographic locations. The location and size of the georeferenced images will determine the size of the output mosaic.

View the Top Image, Cut-line and Virtual, Non-Feathered Mosaic

1. In the Available Bands List, select **Warp** under `lch_01w.img` and click **Load Band**.

2. Right-click in the Image window and select **Toggle > Display Scroll Bars**. Click the horizontal scroll bar until a good portion of the image is visible.

3. From the Display group menu bar, select **Overlay > Annotation**. An Annotation dialog appears.

4. From the Annotation dialog menu bar, select **File > Restore Annotation**. A file selection dialog appears.

5. Select `lch_01w.ann` and click **OK**. The display group shows a red cut-line used to blend the two images in this mosaic.

6. In the Available Bands List, click **Display #1** and select **New Display**.

7. Select **Warp** under `lch_02w.img` and click **Load Band**.

8. Can you identify the relationship between the cut-line and this image?

9. From the ENVI main menu bar, select **File > Open Image File**. A file selection dialog appears.

10. Select `lch_a.mos` and click **Open**.

11. In the Available Bands List, click **Display #2** and select **New Display**.

12. Select **Virtual Mosaic** under `lch_a.mos` and click **Load Band**.

13. Examine the non-feathered edge between the two images that were used to create the mosaic:

Create the Output Feathered Mosaic

1. From the Mosaic dialog menu bar, select **File > Apply**. A Mosaic Parameters dialog appears.

2. In the **Enter Output Filename** field, enter `lch_mos.img` and click **OK** to create the feathered mosaic.

3. Close Display #1 (`lch_01w.img`) and Display #2 (`lch_02w.img`).

4. In the Available Bands List, click **Display #3** and select **New Display**.

5. Select **Warp** under `lch_01w.img` and click **Load Band**.

6. Compare the feathered mosaic to the non-feathered mosaic using image linking and dynamic overlays.
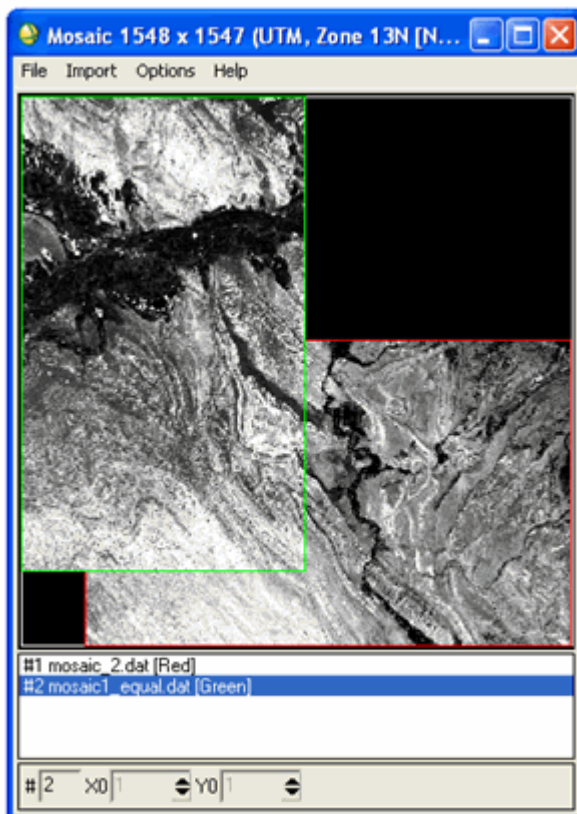
Color Balancing During Mosaicking

This tutorial describes the procedure for creating a georeferenced mosaic using automated color balancing. For this exercise, you will use two overlapping subsets from a Landsat-7 ETM image.

Create the Mosaic Image without Color Balancing

First, you will create a mosaic without color balancing. You will start by importing both of the images without any feathering so you can clearly see the seams between the images.

1. From the ENVI main menu bar, select **Map > Mosaicking > Georeferenced**. A Map Based Mosaic dialog appears.

2. From the Map Based Mosaic dialog menu bar, select **Import > Import Files**. A Mosaic Input Files dialog appears.

3. In the Mosaic Input Files dialog, click **Open** and select **New File**. Navigate to `Data\avmosaic` and select `mosaic1_equal.dat`. Click **Open**. A histogram equalization stretch was independently applied to each band in this image.

4. Repeat Step 3 for `mosaic_2.dat`.

5. In the Mosaic Input Files dialog, Click **Shift** to select `mosaic_2.dat` and `mosaic1_equal.dat`. Click **OK**. The two images are automatically placed in their correct geographic locations in the Mosaic dialog. By default, a 2% contrast stretch is applied to the images.

RGB Mosaic Preview

1. Right-click inside the image surrounded by a green box (`mosaic1_equal.dat`) and select **Edit Entry**. An Entry: dialog appears.

2. Click the **Mosaic Display** toggle button to select **RGB**.

3. In the **Red** field, enter **1**. In the **Green** field, enter **2**. In the **Blue** field, enter **3**.

4. Click **OK**. The file `mosaic1_equal.dat` is now displayed in color in the Mosaic dialog.

5. Repeat steps 1 through 4 for the other file in the mosaic (`mosaic_2.dat`).

By default, ENVI automatically creates an RGB composite in the Mosaic dialog using the first band as red, the second band as green, and the third band as blue. If an image has more than three bands, the Mosaic dialog only shows a gray scale version of Band 1.

Output the Mosaic Without Color Balancing

You should remember that what you see in the Mosaic dialog is not necessarily what you will see in the final mosaic. In the Mosaic dialog, the two images are stretched independently. If the images are mosaicked into one image and displayed, ENVI calculates a contrast stretch from the two images combined.

1. From the Mosaic menu bar, select **File > Apply**. A Mosaic Parameters dialog appears.

2. In the **Enter Output Filename** field, enter `mosaic_unbalanced.dat` and click **OK**.

3. In the Available Bands List, click **RGB Color**. Select **Band 1**, **Band 2**, and **Band 3**, and click **Load RGB**. The seams between the two images are quite obvious.

Output the Mosaic With Color Balancing

You will now apply the mosaic again, this time using color balancing to minimize the contrast between the two images in the final mosaic.

1. In the Mosaic dialog, right-click inside the image surrounded by a green box (`mosaic1_equal.dat`) and select **Edit Entry**. An Entry: dialog appears.

2. Click the **Adjust** radio button. The contrast of this image will be adjusted to match the other image. Click **OK**.

3. In the Mosaic dialog, right-click inside the image surrounded by a red box (`mosaic_2.dat`) and select **Edit Entry**. An Entry: dialog appears.

4. Click the **Fixed** radio button. The contrast of this image will not change. The other image will be adjusted to match this image. Click **OK**.

5. From the Mosaic dialog menu bar, select **File > Apply**. A Mosaic Parameters dialog appears with a **Color Balance** option near the bottom. Leave the default value "stats from overlapping regions." Color balancing is usually better when based on statistics calculated from only the overlapping regions. The other option (stats from complete files) is used when the mosaicked images have little or no overlap between them.

6. In the **Enter Output Filename** field, enter `mosaic_balanced.dat` and click **OK**.

7. In the Available Bands List, click **RGB Color**. Under `mosaic_balanced.dat`, select **Band 1**, **Band 2**, and **Band 3**, and click **Load RGB**. The seams between the two images are nearly invisible now.

8. When you are finished, select **File > Exit** from the ENVI main menu bar.