



ENVI Tutorials



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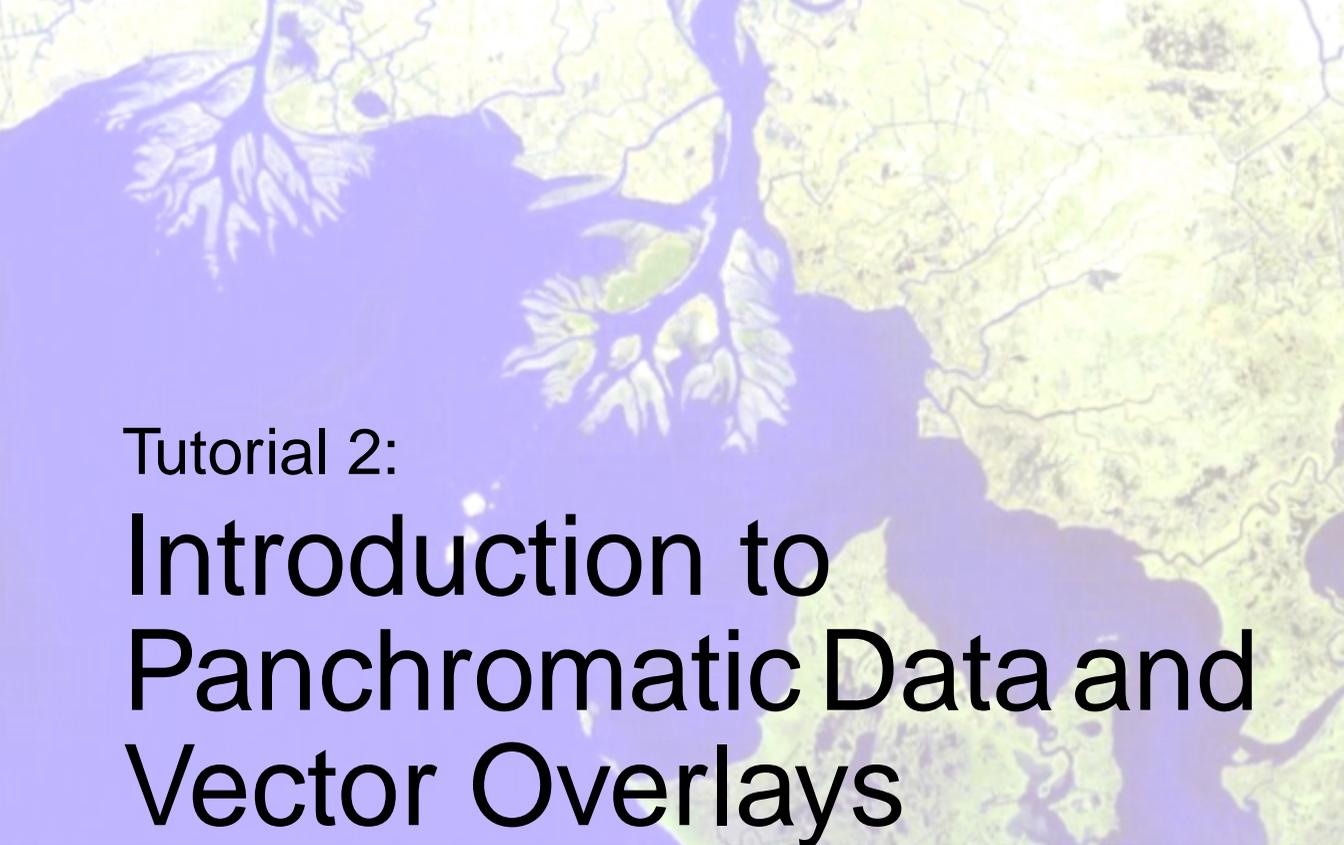
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Tutorial 2: Introduction to Panchromatic Data and Vector Overlays

The following topics are covered in this tutorial:

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Overview of This Tutorial

This tutorial provides an introduction to using ENVI with Panchromatic (SPOT) data, including display, contrast enhancement, basic information about ENVI and some suggestions for your initial investigations of the software. It is designed to introduce first-time ENVI users to the basic concepts of the package and to explore some of its key features. It assumes that you are already familiar with general image-processing concepts. This dataset is a SPOT Panchromatic image and corresponding DXF files of Enfidaville, Tunisia, courtesy of Research Systems International France. These data are Copyright CNES-Spot Image and IGN France.

Files Used in This Tutorial

CD-ROM: *ENVI Tutorial and Data CD No. 1*

Path: `envidata/enfidavi`

File	Description
<code>enfidavi.bil</code>	SPOT Panchromatic Data, Enfidaville, Tunisia
<code>enfidavi.hdr</code>	ENVI Header for above
<code>enfidavi.dsc</code>	GeoSpot Volume Descriptor File
<code>enfidavi.rep</code>	GeoSpot report file (REP/B: GEOSPOT Structure)
<code>enfidavi.rsc</code>	GeoSpot Raster Source Description File
<code>dxs.txt</code>	DXF coding descriptor file
<code>alti.dxf</code>	Spot height DXF file
<code>energy.dxf</code>	Oil or Gas Pipeline DXF file
<code>hydro.dxf</code>	Hydrology DXF file
<code>industry.dxf</code>	Industrial Areas DXF file
<code>physio.dxf</code>	Physiographic areas DXF file
<code>popu.dxf</code>	Urban Features (Population Centers) DXF file
<code>transpor.dxf</code>	Transportation Networks DXF file
<code>copyrite.txt</code>	Data Copyright Notice

Panchromatic Data and Vector Overlays

Start ENVI

Before attempting to start the program, ensure that ENVI is properly installed as described in the installation guide.

- To open ENVI in UNIX, enter `envi` at the UNIX command line.
- To open ENVI from a Windows or Macintosh system, double-click on the ENVI icon.

The ENVI main menu appears when the program has successfully loaded and executed.

Open a Panchromatic (SPOT) Image File

To open an image file:

1. From the ENVI main menu, select **File** → **Open Image File**.

Note that on some platforms you must hold the left mouse button down to display the submenus from the main menu.

An **Enter Data Filenames** file selection dialog appears.

2. In the file selection dialog, navigate to the `enfidavi` subdirectory of the `envidata` directory on the *ENVI Tutorial and Data CD No. 1* just as you would in any other application and select the file `enfidavi.bil` from the list and click **Open** (on Windows) or **OK** (on UNIX).

This is a SPOT Panchromatic image of Enfidaville, Tunisia, courtesy of RSI France. The data in this file is copyrighted as Copyright CNES-Spot Image and IGN France.

The **Available Bands List** dialog appears on your screen. This list allows you to select spectral bands of the image for display and processing. You have the choice of loading either a gray scale or an RGB color image of the available bands.

Select and Load an Image Band

1. Select the band listed at the top of the dialog by clicking on the band with the left mouse button.

The band you have chosen is displayed in the field marked **Selected Band:**.

2. Click the **Load Band** button to load the image into a new display.

ENVI has many interactive functions, and the mouse button combinations and actions are different for each one. The **Mouse Button Descriptions** dialog is provided to tell you what the mouse buttons do in each graphics window.

3. To bring up the **Mouse Button Descriptions** dialog, select **Window** → **Mouse Button Descriptions** from either the ENVI main menu or the Main Image display menu bar.

Spatially Browse the Image

1. Move the Scroll window indicator box around the scroll image to display different portions of the image in the Main Image display at full resolution.

Another method for scrolling the full resolution image is to add scroll bars to the Main Image window. You can easily do this using the Zoom window controls. In Zoom window position the cursor over the right-most control in the lower left corner of the window. Double-click the right mouse button to activate scroll bars in the Main Image window.

2. Now look at the image in greater detail. To do this, click and drag the Zoom box around in the Main Image display using the left mouse button. When the Zoom box is over an area of interest, release the mouse button and you'll see the image in greater detail in the Zoom window. You can also click and release the left mouse button anywhere in the Main Image display to reposition the Zoom box.
3. Position the Zoom box at various locations in the Main Image window and examine the data.

Perform Interactive Contrast Stretching

Interactive contrast stretching plots a histogram and allows you to interactively control the contrast of the displayed image. Many different types of stretches can be applied. By default, a linear 2% stretch is applied to the data when it is first displayed.

- To access ENVI's interactive contrast stretching functions, select **Enhance** → **Interactive Stretching** from the Main Image window menu bar.

An **Interactive Stretching** dialog for the displayed band appears. This dialog allows you to change the contrast stretch of the displayed image (Figure 2-1). Two histogram plots display the color or gray scale range of the input image (left) and the output image after contrast stretching (right). Initially, the input

and output histograms reflect the default stretch applied to the data when the image was displayed.

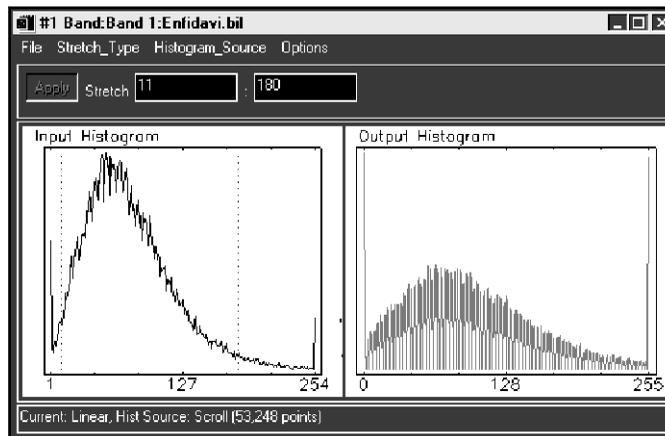


Figure 2-1: The Interactive Stretching Dialog.

- The **Stretch_Type** pull-down menu at the top of the histogram has a variety of contrast-stretching options. Try applying the methods described below and observe the results in the Main Image window.
- Also, try selecting both **Histogram_Source** → **Zoom** and **Histogram_Source** → **Scroll** from the **Interactive Stretching** menu bar and note the differences in the histograms and stretches of the Zoom window and Scroll window.

Linear

When images are loaded into the Main Image window, a 2% linear contrast stretch is applied by default.

Note

This default can be set by selecting **File** → **Preferences** → **Display Defaults** from the ENVI main menu. You can edit the **Display Default Stretch** in the **Preferences: Display Defaults** dialog which appears.

1. In the Main Image display, select **Enhance** → **Interactive Stretching**. An **Interactive Stretching** dialog appears.
2. In the menu bar of the new dialog, choose **Stretch_Type** → **Linear**.

Note

Two vertical dotted lines appear in the input histogram plot—these bars can be repositioned to control the minimum and maximum value used in the contrast stretch.

3. Position the mouse cursor on the left bar and hold down the left mouse button as you drag the bar from side to side.

As the left mouse button is pressed and the dotted vertical bar is moved across the plot, numbers appear on the status bar of the dialog. Whenever the left mouse button is clicked over the histogram plot, the status bar displays the current data value, the number of pixels and the percentage of pixels that have that value, and the cumulative percentage of pixels with values less than or equal to the current value.

4. Since you'll be changing the stretch conditions, it may be helpful to have the changes automatically applied. To do this, select **Options** → **Auto Apply On** from the **Interactive Stretching** dialog menu bar.

If you don't wish the changes to be made until after you're finished, then select **Options** → **Auto Apply Off**, and use the **Apply** button on the dialog to apply the stretch and observe the results.

5. Try positioning the left bar so that a cumulative percentage of pixels equaling approximately 5% is selected. Now move the right bar so that the cumulative percentage is approximately 95% of the pixels.

You can also position the bars by entering a minimum and maximum value in the **Stretch** text fields of the dialog. You can enter either data values or percentages.

6. Enter 4% in the left text field and 96% in the right text field and press the **Enter** key.

The % values are converted to digital numbers and the left and right bars in the display are updated with the data values at 4% and 96%, respectively.

Equalize

1. Select **Stretch_Type** → **Equalization** and note the change in the **Output Histogram** plot in the dialog.
2. Again, you can choose to have the stretch automatically applied to the image display group by ensuring the **Options** → **Auto Apply On** is selected from the **Interactive Stretching** dialog menu.

If you don't wish the changes to be made until after you're finished, then select **Options** → **Auto Apply Off**, and use the **Apply** button on the dialog to apply the stretch and observe the results.

Gaussian

1. From the **Interactive Stretching** dialog, select **Stretch_Type** → **Gaussian**.
2. Set the standard deviation by selecting **Options** → **Set Gaussian Stdv**.
3. The **Set Gaussian Stdv** dialog appears. You can adjust the standard deviation value and see the effect when the new setting is applied to the image display group.
4. Again, you can choose to have the stretch automatically applied to the image display group by ensuring the **Options** → **Auto Apply On** is selected from the **Interactive Stretching** dialog menu.

If you don't wish the changes to be made until after you're finished, then select **Options** → **Auto Apply Off**, and use the **Apply** button on the dialog to apply the stretch and observe the results.

5. Select **File** → **Cancel** to close the contrast stretching dialog.

Color Mapping

ENVI provides tools for quickly color slicing gray scale images.

1. Select **Tools** → **Color Mapping** → **ENVI Color Tables** from the Main Image window menu bar. The **ENVI Color Tables** dialog appears.

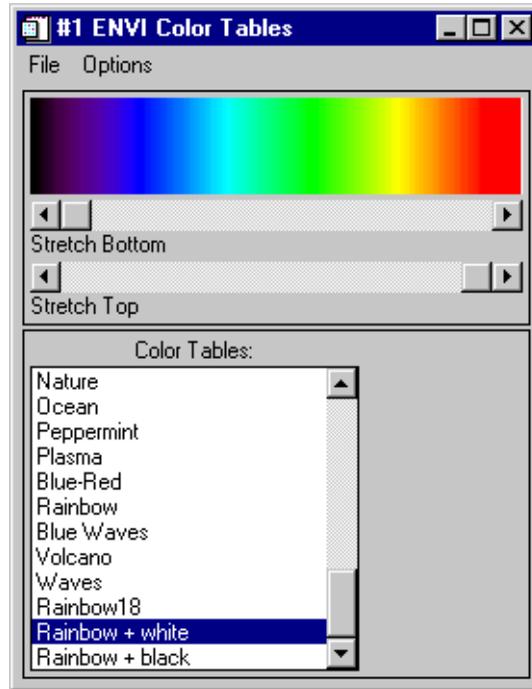


Figure 2-2: The ENVI Color Tables dialog.

2. Apply quick stretches to the displayed image by sliding the **Stretch Bottom** and **Stretch Top** sliders back and forth and observe the stretched image.
3. Click on several of the color table names in the **Color Table** list in the **ENVI Color Tables** dialog and observe the color-coded image. Change the stretch as in the previous step.
4. Select **Options** → **Reset Color Table** in the **ENVI Color Tables** dialog to return to the original stretch and gray scale color table.
5. Select **File** → **Cancel** to close the **ENVI Color Tables** dialog.

Pixel Locator

The Pixel Locator dialog allows exact positioning of the cursor and displays the screen and data values of the selected pixel.

1. Select **Tools** → **Pixel Locator** from the Main Image display menu bar to display the **Pixel Locator** dialog.

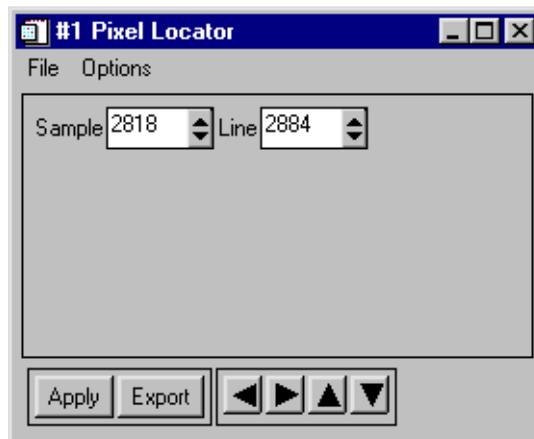


Figure 2-3: The Pixel Locator dialog allows exact positioning of the cursor and displays the screen and data values of the selected pixel.

2. Move and set the cursor in any of the three image displays to observe the dialog as it reflects the pixel location for the current pixel.
3. The **Pixel Locator** dialog shows the pixel location in pixel coordinates by default. To see the location in map coordinates, select **Options** → **Map Coordinates** from the **Pixel Locator** menu bar.
4. Use the **Proj:/Datum:** spin box controls to toggle between true map coordinates and latitude/longitude geographic coordinates. You can change the selected projection by clicking on the **Change Proj...** button.
5. Close the **Pixel Locator** dialog by selecting **File** → **Cancel** from the dialog menu.

Display the Georeferenced Cursor Location

Use ENVI's cursor location/value function to view image values and geographic location.

1. To display the cursor location and value, select **Tools** → **Cursor Location/Value** from the Main Image window menu bar. You can also display

it from the ENVI main menu by selecting **Window** → **Cursor Location/Value**.

The **Cursor Location / Value** dialog box appears displaying the location of the cursor in the Main Image, Scroll, or Zoom windows (Figure 2-4). The dialog also displays the screen value (color) and the actual data value of the pixel underneath the crosshair cursor.

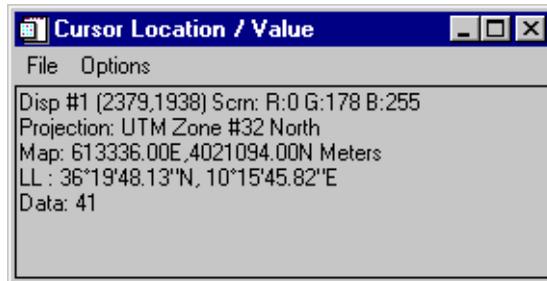


Figure 2-4: The Cursor Location dialog displays the screen and data values of the selected pixel.

2. To dismiss the dialog, select **File** → **Cancel** from the dialog pull-down menu.

Apply an Interactive Filter

ENVI gives you the ability to apply several different pre-defined or user-defined filters to a display (file-based filtering is also available and is accessed via the Filter menu on the ENVI main menu). The following example shows you how to apply a pre-defined filter to the image in the Main Image window.

Choose a Filter

1. From the Main Image window menu bar, select **Enhance** → **Filter** and choose the desired filter type from the pull-down filter menu to apply to the displayed image.
2. Try the different sharpening, smoothing, and median filters on the displayed image.

Display Image in a Second Display and Apply a Different Filter

1. From the **Available Bands List**, select the **Display #1** → **New Display** from the pull-down menu button at the bottom of the dialog to create a second display group.
2. Select the image band to be displayed in the second display group, and click **Load Band** to load the image into the second display.
3. From the Main Image window of Image #2, choose **Enhance** → **Filter** and select a filter different from that applied to Image #1 from the pull-down filter menu.

Compare Images Using Dynamic Overlays

1. Select **Tools** → **Link** → **Link Displays** from the menu bar of either of the Main Image windows and click **OK** to link the images.
2. Use the middle mouse button to resize the dynamic overlay and the left mouse button to move the region for comparison. Note that the overlay area is defined from the lower left corner of the display.

Review GeoSpot Map Information

To review the GeoSpot Map information in the ENVI Header file:

1. From the ENVI main menu, select **File** → **Edit ENVI Header**.
2. In the **Edit Header Input File** dialog, select `enfidavi.bil` as the input file, and click **OK**.

The **Header Info** dialog appears.



Figure 2-5: The Header Info dialog.

3. Click the **Edit Attributes** button and select **Map Info** from the pull-down menu. The **Map Information** dialog appears. Note that the data are in UTM projection, Zone 32 utilizing the NAD27 datum.
4. Click **Cancel** in the **Map Information** dialog and **Cancel** in the **Header Info** dialog.

Open and Overlay DXF Vector Files

1. From the ENVI main menu, select **File** → **Open Vector File** → **DXF**. A standard file selection dialog called **Enter DXF Filenames** appears.
2. In the file selection dialog, navigate to the *ENVI Tutorial and Data CD No. 1* `envidata/enfidavi` directory. Set the file filter to `*.dxf` and select all of the files with the `.dxf` extension. Click **Open** at the bottom of the file selection dialog on Windows and Macintosh or click **OK** on UNIX to open the **Import DXF File Parameters** dialog.
3. Midway down the **Import DXF File Parameters** dialog is the selection list of projections. Select UTM as the Output Projection. This field refers to the map units that the imported vector data is in.
4. Click the **Datum** button to bring up the **Select Geographic Datum** dialog. Highlight the **Mexico (NAD27)** datum in the list and click **OK**.
5. In the **Import DXF File Parameters** dialog enter the UTM Zone as **32 North**.
6. Click **OK** to load the DXF files and convert to `.evf` (ENVI Vector Files).
7. The **Available Vectors List** dialog appears. Click on the **Select All Layers** button. Next, click on the **Load Selected** button.
8. A **Load Vector** dialog appears which lists all of the available Main Image windows. Select **Display #1** from the list.
9. The **#1 Vector Parameters** dialog appears showing the named vector layers.
10. Click **Apply** to load the vectors onto the display.
11. Click on one of the layer names in the **#1 Vector Parameters** dialog. In the Main Image display click and drag the left mouse button to move the cursor in the image and observe map coordinates for the selected vectors in the **#1 Vector Parameters** dialog.

Basic Map Composition

Add Grid Lines

Add a grid to your image:

1. To overlay grid lines on your image, select **Overlay** → **Grid Lines** from the Main Image window menu bar. An image border is automatically added when you overlay grid lines.
2. You can adjust the grid lines by setting the line thickness and color and the grid spacing using the **Options** pull-down menu.
3. When you have added a satisfactory grid, click **Apply** in the **Grid Line Parameters** dialog.

Annotate the Image with a Map Key

ENVI's flexible annotation features allow you to add text, polygons, color bars, and other symbols to your plots and images.

1. To annotate the image, select **Overlay** → **Annotation**. The **#1 Annotation: Text** dialog appears.
2. To annotate a map key corresponding to the DXF overlays, select **Object** → **Map Key** in the **#1 Annotation: Text** dialog.
3. Edit the map key characteristics by clicking the **Edit Map Key Items** button in the dialog. The **Map Key Object Definition** dialog appears.
4. You can change the names, colors, and fill (for polygons) using the **Map Key Object Definition** dialog. Click **OK** to return to the **#1 Annotation: Text** dialog.
5. Add a background color by selecting the color pull-down menu next to the **Back** color swatch in the **#1 Annotation: Text** dialog.
6. Click the left mouse button to place the map key in the Main Image window. Reposition the map key by clicking, or by clicking and dragging with the left mouse button. Set the map key by clicking the right mouse button in the image.

Saving and Restoring Annotation

1. You can save your image annotation by selecting **File** → **Save Annotation** in the **#1 Annotation: Text** dialog.

Note

If you do not save your annotation in a file, it will be lost when you close the Annotation dialog (you will be prompted to save the annotation if you close without first saving).

2. You can also restore saved annotation files by selecting **File** → **Restore Annotation** in the dialog.

Suspending the Annotation Function Temporarily

1. To suspend annotation operations and return to normal ENVI functionality temporarily, select the **Off** radio button at the top of the **Annotation: Text** dialog.
2. This allows you to use the scroll and zoom features in your display without losing your annotations.
3. To return to the annotation function, select the radio button for the window you are annotating.

Save and Output an Image (Burn-In)

ENVI gives you several options for saving and outputting your filtered, annotated, gridded images. You can save your work in ENVI's image file format, or in several popular graphics formats (including Postscript) for printing or importing into other software packages. You can also output directly to a printer.

Save your Image in GEOTIFF Format

To save your work as a GEOTIFF:

1. Select **File** → **Save Image As** → **Image File** in the Main Image window.
The **Output Display to Image File** dialog appears.
2. Click on the **Output File Type** button and select **TIFF/GeoTIFF** output from the pull-down menu.
If you have left your annotated and gridded color image on the display, both the annotation and grid lines will be automatically saved.
3. If output filename shown is not the one you want, enter an output filename in the text box; otherwise, click **OK** to save the image.
 - Because this is a georeferenced image, ENVI automatically saves it as a GEOTIFF.

Note

If you select other graphics file formats from the **Output File Type** button, your choices will be slightly different.

End the ENVI Session

This concludes the Tutorial. You can quit your ENVI session by selecting **File** → **Exit (Quit on UNIX)** on the ENVI main menu, then click **OK** to exit IDL. If you are using ENVI RT, quitting ENVI will take you back to your operating system.

