ENVI Tutorial: Classification Methods

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Overview of This Tutorial

This tutorial provides an introduction to classification procedures using Landsat TM data from Cañon City, Colorado. Results of both unsupervised and supervised classifications are examined and post classification processing including clump, sieve, combine classes, and accuracy assessment are discussed.

Files Used in This Tutorial
CD-ROM: Tutorial Data CD #2
Path: `envidata\can_tm`

File	Description
can_tmr.img	Cañon City, Colorado TM reflectance image
can_tmr.hdr	ENVI header for above
can_km.img	K-meansf classification
can_km.hdr	ENVI header for above
can_iso.img	ISODATA classification
can_iso.hdr	ENVI header for above
classes.roi	Regions of interest (ROI) for supervised classification
can_pcls.img	Parallelepiped classification
can_pcls.hdr	ENVI header for above
can_bin.img	Binary encoding result
can_bin.hdr	ENVI header for above
can_sam.img	SAM classification result
can_sam.hdr	ENVI header for above
can_rul.img	Rule image for SAM classification
can_rul.hdr	ENVI header for above
can_sv.img	Sieved image
can_sv.hdr	ENVI header for above
can_clmp.img	Clump of sieved image
can_clmp.hdr	ENVI header for above
can_comb.img	Combined classes image
can_comb.hdr	ENVI header for above
can_ovr.img	Classes overlain on gray scale image
can_ovr.hdr	ENVI header for above
can_v1.evf	Vector layer generated from class #1
can_v2.evf	Vector layer generated from class #2

This dataset is Landsat TM data from Cañon City, Colorado.

Examining a Landsat TM Color Image

This portion of the exercise will familiarize you with the spectral characteristics of the Landsat TM data of Cañon City, Colorado, USA. Color composite images will be used as the first step in locating and identifying unique areas for use as training sets in classification.

Before attempting to start the program, ensure that ENVI is properly installed as described in the Installation Guide that shipped with your software.

1. From the ENVI main menu bar, select **File → Open Image File**.
2. Navigate to the **envidata\can_tm** directory, select the file **can_tmr.img** from the list, and click **Open**. The Available Bands List appears on your screen.
3. Click on the **RGB Color** radio button in the Available Bands List. Red, Green, and Blue fields appear in the middle of the dialog.

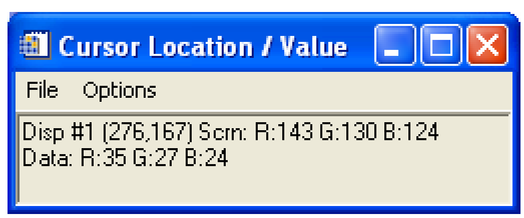
4. Select **Band 4**, **Band 3**, and **Band 2** sequentially from the list of bands at the top of the dialog by clicking on the band names. The band names are automatically entered in the Red, Green, and Blue fields.
5. Click **Load RGB** to load the image into ENVI.
6. Examine the image in the display group.

Reviewing Image Colors

The color image displayed below can be used as a guide to classification. This image is the equivalent of a false color infrared photograph. Even in a simple three-band image, it's easy to see that there are areas that have similar spectral characteristics. Bright red areas on the image represent high infrared reflectance, usually corresponding to healthy vegetation, either under cultivation, or along rivers. Slightly darker red areas typically represent native vegetation, in this case in slightly more rugged terrain, primarily corresponding to coniferous trees. Several distinct geologic and urbanization classes are also readily apparent as is urbanization.

Using the Cursor Location/Value

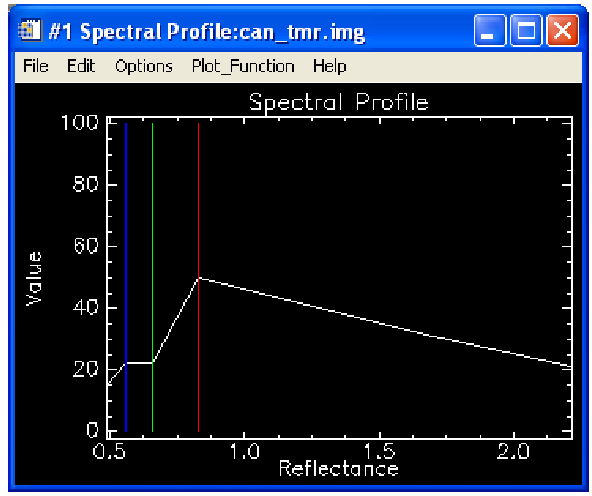
Use ENVI's Cursor Location/Value option to preview image values in the displayed spectral bands.



1. From the Display group menu bar, select **Tools → Cursor Location/Value**. Alternatively, double-click the left mouse button in the Image window to toggle the Cursor Location/Value dialog on and off.
2. Move the cursor around the image and examine the data values in the dialog for specific locations. Also note the relation between image color and data value.
3. From the Cursor Location/Value dialog, select **Files → Cancel**.

Examining Spectral Plots

Use ENVI's integrated spectral profiling capabilities to examine the spectral characteristics of the data.



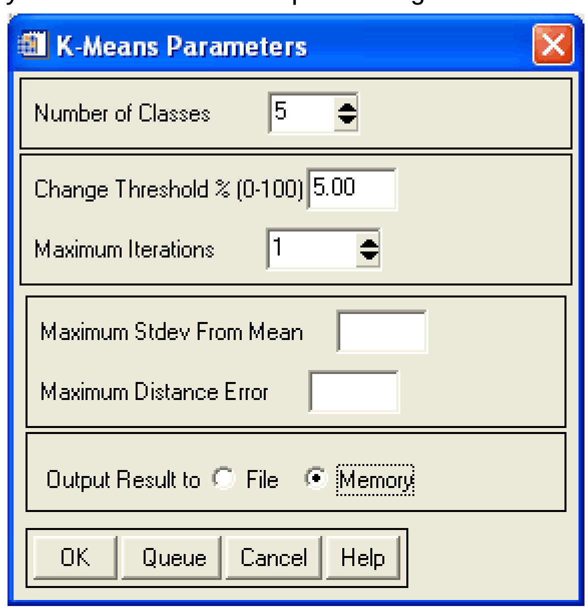
1. From the Display group menu bar, select **Tools → Profiles → Z Profile (Spectrum)** to begin extracting spectral profiles.
2. Examine the spectra for areas that you previewed above using color images and the Cursor/Location Value dialog by clicking the left mouse button in any of the display group windows. Note the relations between image color and spectral shape. Pay attention to the location of the image bands in the spectral profile, marked by the red, green, and blue bars in the plot.
3. From the Spectral Profile dialog menu bar, select **File → Cancel**.

Exploring Unsupervised Classification Methods

Unsupervised classification can be used to cluster pixels in a data set based on statistics only, without any user-defined training classes. The unsupervised classification techniques available are Isodata and K-Means.

Applying K-Means Classification

K-Means unsupervised classification calculates initial class means evenly distributed in the data space then iteratively clusters the pixels into the nearest class using a minimum distance technique. Each iteration recalculates class means and reclassifies pixels with respect to the new means. All pixels are classified to the nearest class unless a standard deviation or distance threshold is specified, in which case some pixels may be unclassified if they do not meet the selected criteria. This process continues until the number of pixels in each class changes by less than the selected pixel change threshold or the maximum number of iterations is reached.

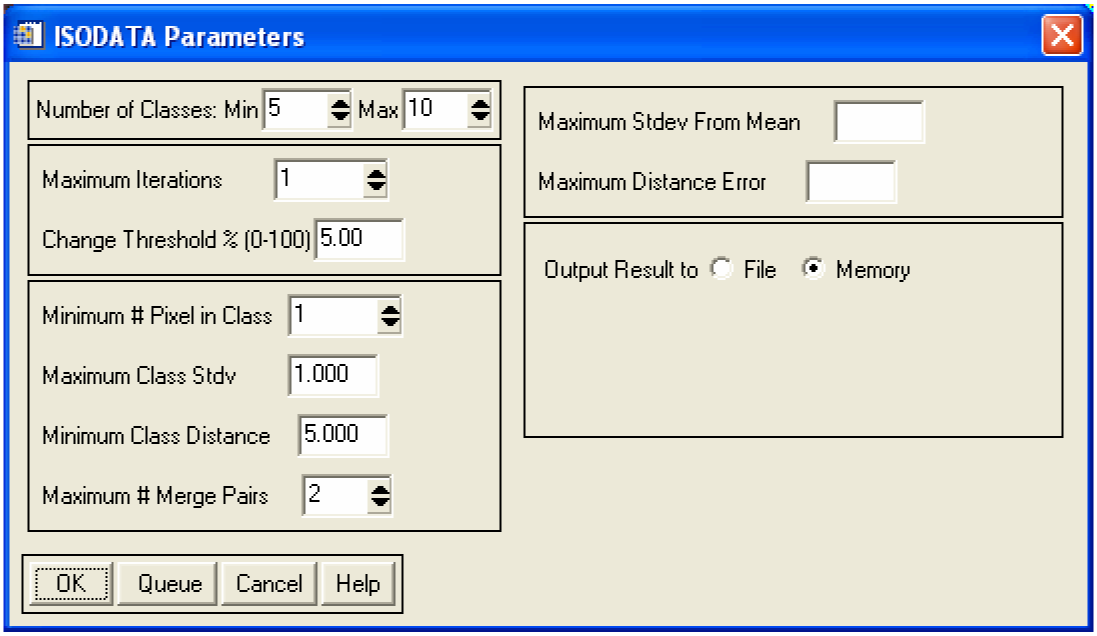


1. From the ENVI main menu, select **Classification → Unsupervised → K-Means** or review the pre-calculated results of classifying the image by opening the `can_km.img` file in the `can_tm` directory
2. Select the **can_tmr.img** file and click **OK**. The K-Means Parameters dialog appears.
3. Accept the default values, select the **Memory** radio button, and click **OK**. The new band is loaded into the Available Bands List.
4. From the Available Bands List, click the **Display #1** button and select **New Display**.
5. From the Available Bands List, select the **K-Means** band and click **Load Band**.
6. From the Display group menu bar, select **Tools → Link → Link Displays** then click **OK** to link the images.
7. Compare the K-MEANS classification result to the color composite image using the dynamic overlay feature in ENVI (click using the left mouse button in the Image window).
8. From the Display group menu bar, select **Tools → Link → Unlink Display** to remove the link and turn off the dynamic overlay feature.
9. If desired, experiment with different numbers of classes, change thresholds, standard deviations, and maximum distance error values to determine their effect on the classification.

Applying Isodata Classification

Isodata unsupervised classification calculates class means evenly distributed in the data space then iteratively clusters the remaining pixels using minimum distance techniques. Each iteration recalculates means and reclassifies pixels with respect to the new means. This process continues until the number of pixels in each class changes by less than the selected pixel change threshold or the maximum number of iterations is reached.

1. From the ENVI main menu bar, select **Classification → Unsupervised → Isodata**, or review the pre-calculated results of classifying the image by opening the `can_iso.img` file in the `can_tm` directory.
2. Select the **can_tmr.img** file and click **OK**. The ISODATA Parameters dialog appears.
3. Accept the default values, select the **Memory** radio button, and click **OK**. The new band is loaded into the Available Bands List.



4. From the Available Bands List, click the **Display #2** button and select **New Display**.
5. Select the **ISODATA** band and click **Load Band**.
6. From the Display group menu bar, select **Tools → Link → Link Displays** and click **OK** in the dialog to link the images.
7. Compare the ISODATA classification result to the color composite image using the dynamic overlay feature in ENVI (click using the left mouse button in the Image window).
8. Toggle the dynamic overlay of the third image by holding the left mouse button down and simultaneously clicking on the middle mouse button. Compare the ISODATA and K-MEANS classifications.
9. If desired, experiment with different numbers of classes, change thresholds, standard deviations, maximum distance error, and class pixel characteristic values to determine their effect on the classification.
10. From the Display group menu bar on the K-Means Image window, select **File → Cancel** to close the image display. Close the ISODATA Image window using the same technique.

Exploring Supervised Classification Methods

Supervised classification can be used to cluster pixels in a data set into classes corresponding to user-defined training classes. This classification type requires that you select training areas for use as the basis for classification. Various comparison methods are then used to determine if a specific pixel qualifies as a class member. ENVI provides a broad range of different classification methods, including Parallelepiped, Minimum Distance, Mahalanobis Distance, Maximum Likelihood, Spectral Angle Mapper, Binary Encoding, and Neural Net. In this tutorial, you will experiment with two methods for selecting training areas, also known as regions of interest (ROIs).

Selecting Training Sets Using Regions of Interest (ROI)

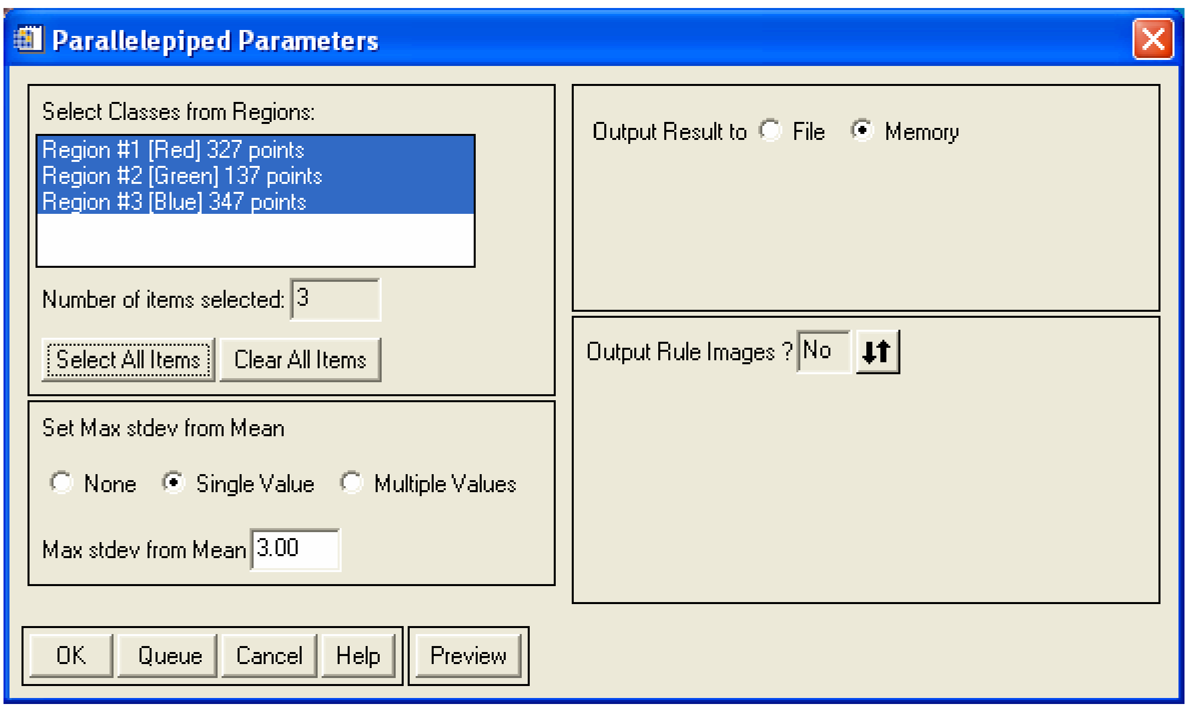
As described in the tutorial, "An Introduction to ENVI" and summarized here, ENVI lets you define regions of interest (ROIs) typically used to extract statistics for classification, masking, and other operations. For the purposes of this exercise, you can either use predefined ROIs, or create your own. In this exercise, you will restore predefined ROIs.

1. From the Display group menu bar, select **Tools → Region of Interest → ROI Tool**. The ROI Tool dialog appears.
2. From the ROI Tool dialog menu bar, select **File → Restore ROIs**.
3. Select the **classes.roi** file and click **Open**. Click **OK** to restore the ROIs.

Applying Parallelepiped Classification

Parallelepiped classification uses a simple decision rule to classify multispectral data. The decision boundaries form an n-dimensional parallelepiped classification in the image data space. The dimensions of the parallelepiped classification are defined based upon a standard deviation threshold from the mean of each selected class. If a pixel value lies above the low threshold and below the high threshold for all n bands being classified, it is assigned to that class. If the pixel value falls in multiple classes, ENVI assigns the pixel to the last class matched. Areas that do not fall within any of the parallelepiped classifications are designated as unclassified.

1. From the ENVI main menu bar, select **Classification → Supervised → Parallelepiped**, or review the pre-calculated results of classifying the image by opening the `can_pcls.img` file in the `can_tm` directory.
2. Select the **can_tmr.img** file and click **OK**. The ISODATA Parameters dialog appears.
3. Click the **Select All Items** button to select the ROIs.
4. Select to output the result to **Memory** using the radio button provided.
5. Toggle the **Output Rule Images** to **No** then click **OK**. The new band is loaded into the Available Bands List.



6. From the Available Bands List, click the **Display #1** button and select **New Display**.
7. Select the **Parallel** band and click **Load Band**.
8. From the Display group menu bar, select **Tools → Link → Link Displays** and click **OK** in the dialog to link the images.
9. Use image linking and dynamic overlay to compare this classification to the color composite image and previous unsupervised classifications.

Applying Maximum Likelihood Classification

Maximum likelihood classification assumes that the statistics for each class in each band are normally distributed and calculates the probability that a given pixel belongs to a specific class. Unless a probability threshold is selected, all pixels are classified. Each pixel is assigned to the class that has the highest probability (i.e., the maximum likelihood).

1. Using the steps above as a guide, perform a **Maximum Likelihood** classification.
2. Try using the default parameters and various probability thresholds.
3. Use image linking and dynamic overlay to compare this classification to the color composite image and previous unsupervised and supervised classifications.

Applying Minimum Distance Classification

The minimum distance classification uses the mean vectors of each ROI and calculates the Euclidean distance from each unknown pixel to the mean vector for each class. All pixels are classified to the closest ROI class unless the user specifies standard deviation or distance thresholds, in which case some pixels may be unclassified if they do not meet the selected criteria.

1. Using the steps above as a guide, perform a **Minimum Distance** classification.
2. Try using the default parameters and various standard deviations and maximum distance errors.
3. Use image linking and dynamic overlay to compare this classification to the color composite image and previous unsupervised and supervised classifications.

Applying Mahalanobis Distance Classification

The Mahalanobis Distance classification is a direction sensitive distance classifier that uses statistics for each class. It is similar to the Maximum Likelihood classification but assumes all class co-variances are equal and therefore is a faster method. All pixels are classified to the closest ROI class unless you specify a distance threshold, in which case some pixels may be unclassified if they do not meet the threshold.

1. Using the steps above as a guide, perform a **Mahalanobis Distance** classification.
2. Try using the default parameters and various maximum distance errors.
3. Use image linking and dynamic overlay to compare this classification to the color composite image and previous unsupervised and supervised classifications.

Exploring Spectral Classification Methods

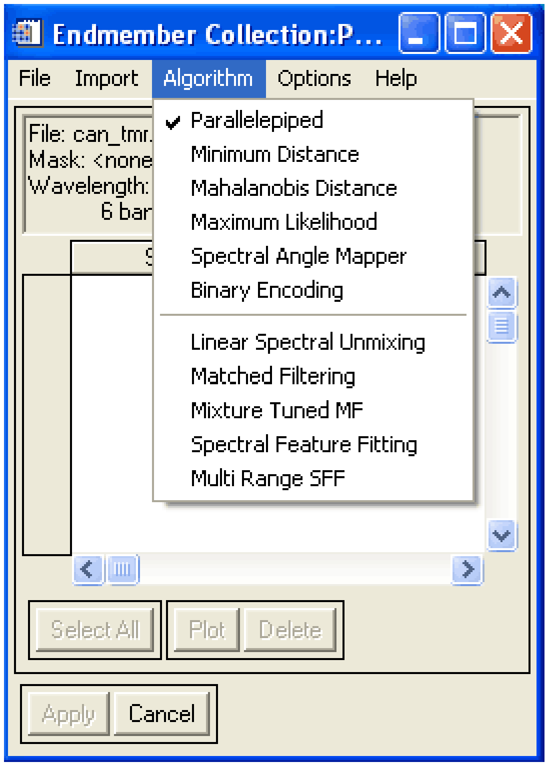
The following methods are described in the ENVI User's Guide. These were developed specifically for use on hyperspectral data, but provide an alternative method for classifying multispectral data, often with improved results that can easily be compared to spectral properties of materials. They typically are used from the Endmember Collection dialog using image or library spectra, however, they can also be started from the **Classification → Supervised** menu option.

Collecting Endmember Spectra

The Endmember Collection:Parallel dialog is a standardized means of collecting spectra for supervised classification from ASCII files, regions of interest, spectral libraries, and statistics files.

1. From the ENVI main menu bar, select **Classification → Endmember Collection**.
2. Click the **Open** drop-down button and select **New File**.
3. Select the **can_tmr.img** file and click **Open**. The `can_tmr.img` file will appear in the Select Input File section of the Classification Input File dialog.
4. Select the **can_tmr.img** file within the Select Input File section of this dialog and click **OK**. The Endmember Collection dialog appears with the Parallelepiped classification method selected by default. The available

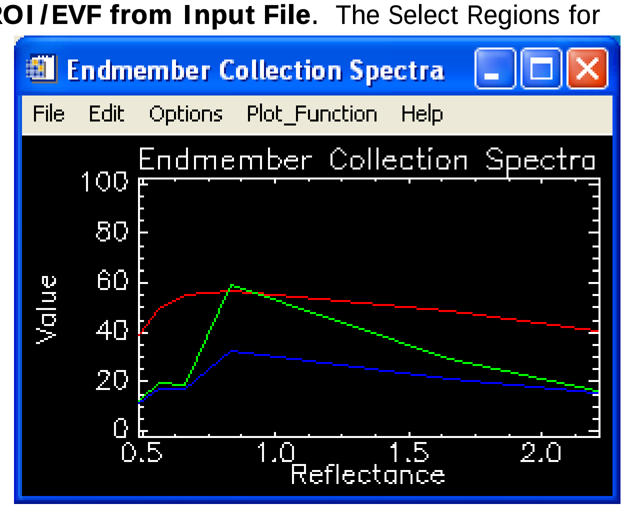
classification and mapping methods are listed under the **Algorithm** menu. You will use this dialog in the following exercises.



Applying Binary Encoding Classification

The binary encoding classification technique encodes the data and endmember spectra into 0s and 1s based on whether a band falls below or above the spectrum mean. An exclusive OR function is used to compare each encoded reference spectrum with the encoded data spectra and a classification image is produced. All pixels are classified to the endmember with the greatest number of bands that match unless the user specifies a minimum match threshold, in which case some pixels may be unclassified if they do not meet the criteria.

1. From the Endmember Collection:Parallel dialog menu bar, select **Algorithm → Binary Encoding** or review the pre-calculated results of classifying the image by opening the `can_bin.img` file in the `can_tm` directory. These results were created using a minimum encoding threshold of 75%.
2. For this exercise, we will use the predefined ROIs in the CLASSES.ROI file. From the Endmember Collection:Parallel dialog menu bar, select **Import → from ROI/EVF from Input File**. The Select Regions for Stats dialog appears.
3. Click the **Select All Items** button, and click **OK**.
4. In the Endmember Collection:Parallel dialog, click **Select All** then click **Plot** to view the endmember spectral plots for the ROIs collected in the Endmember Collections dialog.
5. In the Endmember Collections dialog click **Apply**. The Binary Encoding Parameters dialog appears.
6. In the Binary Encoding Parameters dialog, select to output the result to **Memory** using the radio button provided.
7. Toggle the Output Rule Images to **No**, then click **OK** to start the classification. The new band is loaded into the Available Bands List.



8. From the Available Bands List, select the **Parallel** band and click **Load Band**.

9. Use image linking and dynamic overlay to compare this classification to the color composite image and previous unsupervised and supervised classifications.

Applying Spectral Angle Mapper Classification

The Spectral Angle Mapper (SAM) is a physically-based spectral classification that uses an n-dimensional angle to match pixels to reference spectra. The algorithm determines the spectral similarity between two spectra by calculating the angle between the spectra, treating them as vectors in a space with dimensionality equal to the number of bands. SAM compares the angle between the endmember spectrum vector and each pixel vector in n-dimensional space. Smaller angles represent closer matches to the reference spectrum. Pixels further away than the specified maximum angle threshold in radians are not classified.

1. Using the steps in the last exercise as a guide, perform a **Spectral Angle Mapper** classification, or review the pre-calculated results of classifying the image by opening the `can_sam.img` file in the `can_tm` directory
2. Use image linking and dynamic overlay to compare this classification to the color composite image and previous unsupervised and supervised classifications.

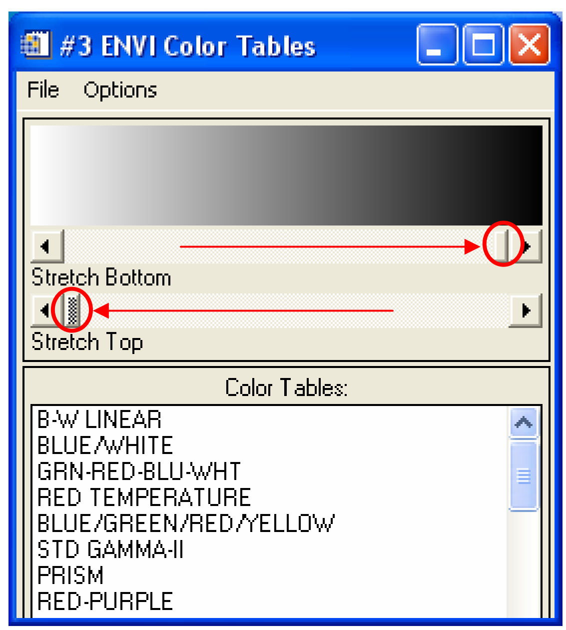
Exploring Rule Images

ENVI creates images that show the pixel values used to create the classified image. These optional images allow users to evaluate classification results and to reclassify if desired based on thresholds. These are gray scale images; one for each ROI or endmember spectrum used in the classification.

The rule image pixel values represent different things for different types of classifications, for example:

Classification Method	Rule Image Values
Parallelepiped	Number of bands satisfying the parallelepiped criteria
Minimum Distance	Sum of the distances from the class means
Maximum Likelihood	Probability of pixel belonging to class
Mahalanobis Distance	Distances from the class means
Binary Encoding	Binary match in percent
Spectral Angle Mapper	Spectral angle in radians (smaller angles indicate closer match to the reference spectrum)

1. From the ENVI main menu bar, select **File → Open Image File**.
2. Navigate to the **envidata\can_tm** directory, select the file **can_rul.img** from the list, and click **Open**. The Available Bands List appears on your screen.
3. Click on the **Gray Scale** radio button in the Available Bands List and open each **Rule** band into its own image window (use the **Display → New Display** button).
4. Use image linking and dynamic overlay to compare the color composite image to the rule images.
5. From the Display group menu bar, select **Tools → Color Mapping → ENVI Color Tables** and drag the Stretch Bottom and Stretch Top sliders to opposite ends of the dialog. Areas with low spectral angles (more similar spectra) appear bright.



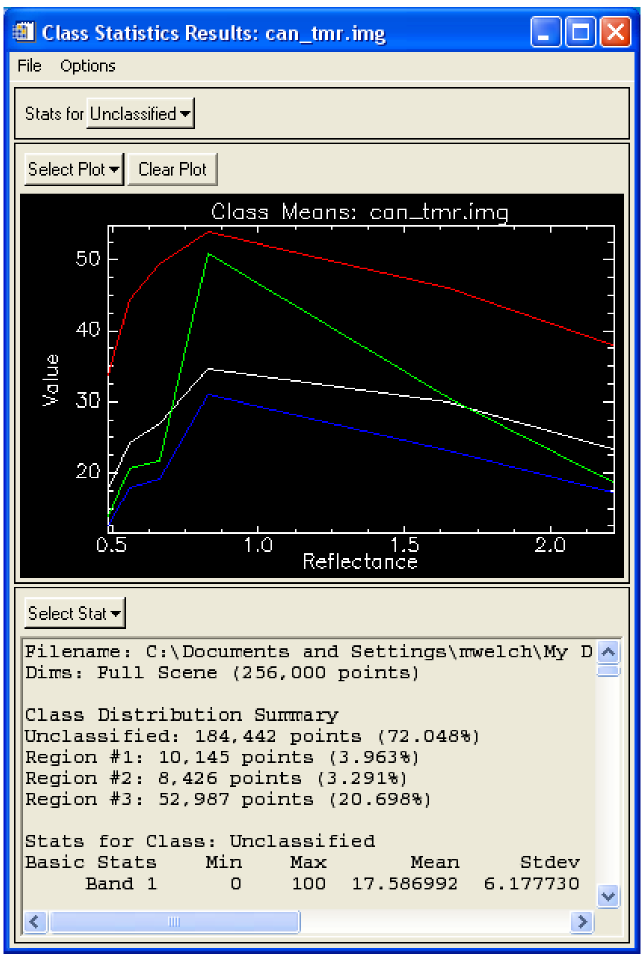
Post Classification Processing

Classified images require post-processing to evaluate classification accuracy and to generalize classes for export to image-maps and vector GIS. Post Classification can be used to classify rule images; to calculate class statistics and confusion matrices; to apply majority or minority analysis to classification images; to clump, sieve, and combine classes; to overlay classes on an image; to calculate buffer zone images; to calculate segmentation images; and to output classes to vector layers. ENVI provides a series of tools to satisfy these requirements.

Extracting Class Statistics

This function allows you to extract statistics from the image used to produce the classification. Separate statistics consisting of basic statistics, histograms, and average spectra are calculated for each class selected.

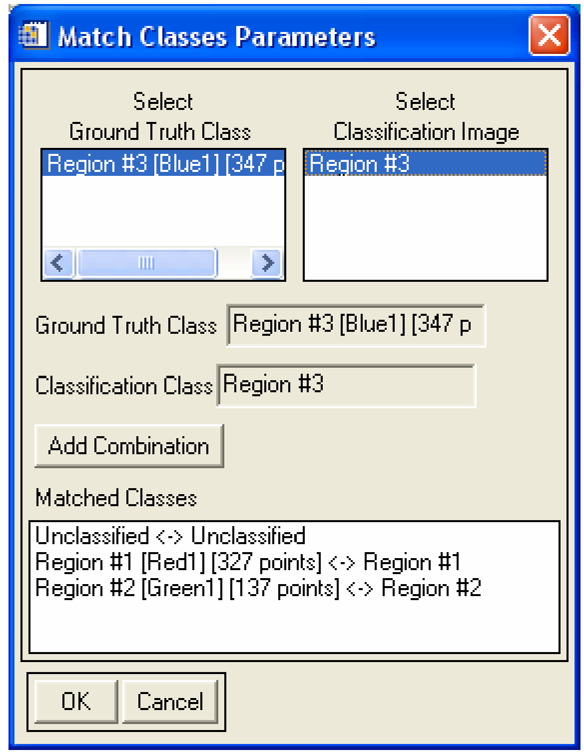
1. From the ENVI main menu bar, select **Classification → Post Classification → Class Statistics**. The Classification Input File dialog appears.
2. Click the **Open** drop-down button and select **New File**.
3. Select the **can_pcls.img** file from the `can_tm` directory and click **Open**. The Statistics Input File appears.
4. Select the **can_tmr.img** file within the Select Input File section of this dialog and click **OK**. The Class Selection dialog appears.
5. Click the **Select All Items** button then click **OK**. The Compute Statistics Parameters dialog appears.
6. Click the **Histograms**, **Covariance**, and **Covariance Image** check boxes in the Compute Statistics Parameters dialog to calculate all the possible statistics.
7. Click **OK** to compute the statistics. The Class Statistics Results dialog appears.



Generating a Confusion Matrix

ENVI's confusion matrix function allows comparison of two classified images (the classification and the "truth" image), or a classified image and ROIs. The truth image can be another classified image, or an image created from actual ground truth measurements. In this exercise, you will compare the Parallelepiped and SAM classification images using the Parallelepiped classification image as the ground truth.

1. From the ENVI main menu bar, select **Classification → Post Classification → Confusion Matrix → Using Ground Truth Image**. The Classification Input File dialog appears.
2. Select the **can_pcls.img** file and click **OK**. The Ground Truth Input File appears.
3. Click the **Open** drop-down button and select **New File**.
4. Select the **can_sam.img** file from the `can_tm` directory and click **Open**.
5. Select the **can_sam.img** file within the Select Input File section of this dialog and click **OK**. The Match Classes Parameters dialog appears.
6. Click the **Select All Items** button then click **OK**. The Compute Statistics Parameters dialog appears.
7. Select **Region #1** from both fields and click **Add Combination**. Continue to pair corresponding classes from the two images in this way then click **OK**. The Confusion Matrix Parameters dialog appears.
8. Click the Output Result to **Memory** radio button then click **OK**.
9. Examine the confusion matrix and confusion images (in the Available Bands List). Determine sources of error by comparing the classified image to the original reflectance image using dynamic overlays, spectral profiles, and Cursor Location/Value.



Clumping and Sieving

Clump and **Sieve** provide means for generalizing classification images. Sieve is usually run first to remove the isolated pixels based on a size (number of pixels) threshold, then clump is run to add spatial coherency to existing classes by combining adjacent similar classified areas.

1. From the ENVI main menu bar, select **Classification → Post Classification → Sieve Classes**. The Classification Input File dialog appears.
2. Select the **can_sam.img** file within the Select Input File section of this dialog and click **OK**. The Sieve Parameters dialog appears.
3. Click the Output Result to **Memory** radio button then click **OK**. The image is loaded into the Available Bands List.
4. You will now use the output of the sieve operation as the input for clumping. From the ENVI main menu bar, select **Classification → Post Classification → Clump Classes**.
5. Select the previously created image file from memory within the Select Input File section of this dialog and click **OK**. The Sieve Parameters dialog appears.
6. Click the Output Result to **Memory** radio button then click **OK**. The image is loaded into the Available Bands List.
7. Compare the three images (**can_sam.img**, **Clump**, and **Sieve**) and reiterate if necessary to produce a generalized classification image.

8. Optional: compare the pre-calculated results in the files can_tm\can_sv.img (sieve) and can_clmp.img (clump of the sieve result) to the classified image can_pcls.img (parallelepiped classification) or calculate your own images and compare to one of the classifications.

Combining Classes

The Combine Classes function provides an alternative method for classification generalization. Similar classes can be combined to form one or more generalized classes.

1. From the ENVI main menu bar, select **Classification → Post Classification → Combine Classes** or review the pre-calculated results of classifying the image by opening the can_comb.img file in the can_tm directory. The Classification Input File dialog appears.
2. Select the **can_sam.img** file within the Select Input File section of this dialog and click **OK**. The Combine Classes Parameters dialog appears.
3. Select **Region #3** from the Select Input Class field, click **Unclassified** from the Select Output Class field, click **Add Combination**, then click **OK**. The Combine Classes Output dialog appears.
4. Click the Output Result to **Memory** radio button then click **OK**. The image is loaded into the Available Bands List.
5. Using image linking and dynamic overlays, compare the combined class image to the classified images and the generalized classification image.

Overlaying Classes

Overlay classes allow you to place the key elements of a classified image as a color overlay on a gray scale or RGB image.

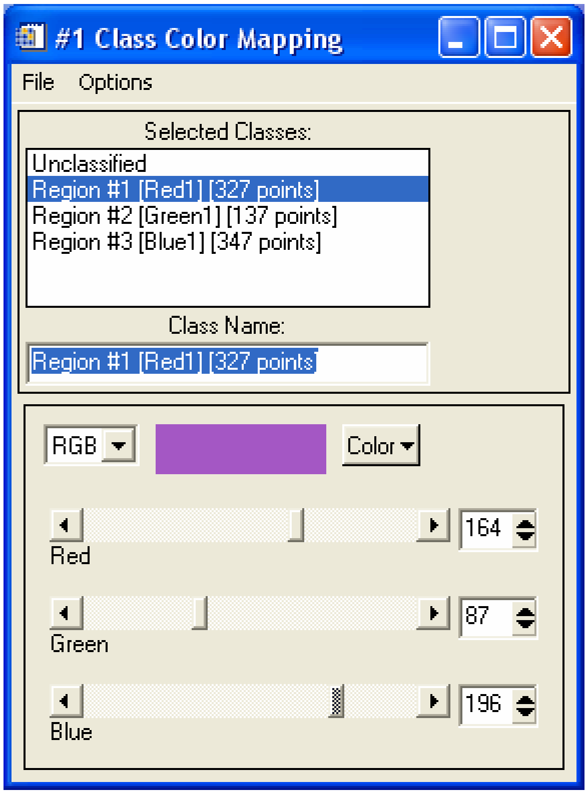
You can examine the pre-calculated image can_tm\can_ovr.img or create your own overlay(s) from the can_tmr.img reflectance image and one of the classified images.

1. From the ENVI main menu bar, select **Classification → Post Classification → Overlay Classes** or review the pre-calculated results of classifying the image by opening the can_comb.img file in the can_tm directory. The Classification Input File dialog appears.
2. Using the can_tmr image in the Available Bands List, select **Band 3** for each RGB band (Band 3 for the *R* band, Band 3 for the *G* band, and Band 3 for the *B* band) and click **OK**.
3. Open the can_tm**can_comb.img**, select it as the classification input in the Classification Input File dialog, and click **OK**.
4. Using the SHIFT key on your keyboard, select **Region #1** and **Region #2** in the Class Overlay to RGB Parameters dialog.
5. Click the Output Result to **Memory** radio button then click **OK**. The image is loaded into the Available Bands List.
6. Load the overlay image into an image window.
7. Using image linking and dynamic overlays, compare this image to the classified image and the reflectance image.

Editing Class Colors

When a classification image is displayed, you can change the color associated with a specific class by editing the class colors.

1. From the Display group menu bar, select **Tools → Color Mapping → Class Color Mapping**. The Class Color Mapping dialog appears.
2. Click on one of the class names in the Class Color Mapping dialog and change the color by dragging the appropriate color sliders or entering the desired data values. Changes are applied to the classified image immediately.
3. To make the changes permanent, select **Options → Save Changes** from the menu bar in this the dialog.



Working with Interactive Classification Overlays

In addition to the methods above for working with classified data, ENVI also provides an interactive classification overlay tool. This tool allows you to interactively toggle classes on and off as overlays on a displayed image, to edit classes, get class statistics, merge classes, and edit class colors.

1. From the Available Bands List, load **Band 4** of `can_tmr.img` as a gray scale image.
2. From the Display group menu bar, select **Overlay → Classification**. The Interactive Class Tool Input File dialog appears.
3. Select the **can_sam.img** file within the Select Input File section of this dialog and click **OK**. The Interactive Class Tool appears with each class listed with its corresponding colors.
4. Click each **On** check box to change the display of each class as an overlay on the gray scale image.
5. Explore the various options for assessing the classification using the Interactive Class Tool **Options** menu.
6. Interactively change the contents of specific classes using the Interactive Class Tool **Edit** menu.
7. From the Display group menu bar, select **File → Save Image As → Image File** to burn in the classes and output to a new file.
8. From the Interactive Class Tool menu bar, select **File → Cancel** to exit the interactive tool.

Overlaying Vector Layers

You can load pre-calculated vector layers onto a gray scale reflectance image for comparison to raster classified images, or convert one of the classification images to vector layers.

1. Load the **can_clmp.img** into a display group.
2. From the Display group menu bar, select **Overlay → Vectors**. The Vector Parameters: Cursor Query dialog appears.
3. From the Vector Parameters: Cursor Query dialog menu bar, select **File → Open Vector File**.
4. Using the SHIFT key on your keyboard, select the **can_v1.evf** and **can_v2.evf** files from the `can_tm` directory and click **Open**. The vectors derived from the classification polygons will outline the raster classified pixels.

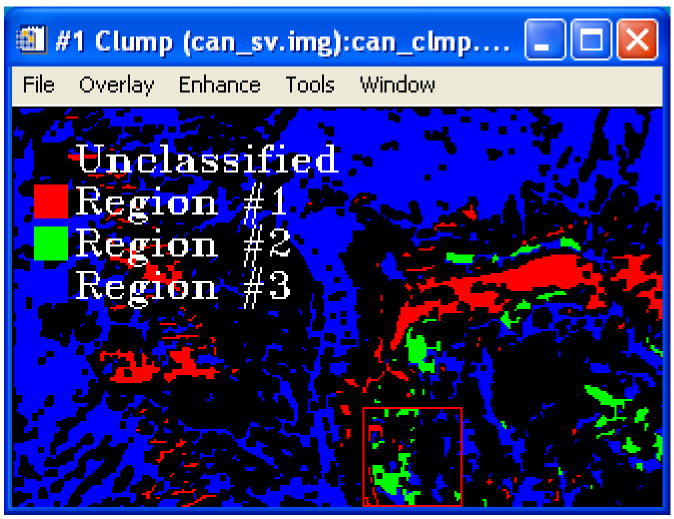
Converting a Classification to a Vector

1. From the ENVI main menu bar, select **Classification → Post Classification → Classification to Vector**. The Raster to Vector Input Band dialog appears.
2. Select the can_clmp.img file **Clump** result within the Select Input File section of this dialog and click **OK**. The Raster to Vector Parameters dialog appears.
3. Using the SHIFT key on your keyboard, select **Region #1** and **Region #2** from the Select Input Class field.
4. In the **Enter Output Filename** field, type **canrty** and click **OK** to begin the conversion. The layers are loaded into the Available Vectors List.
5. Select **Region #1** and **Region #2**s in the Available Vectors List dialog then click **Load Selected**.
6. Select a display number from the Load Vector dialog and click **OK**
7. From the Vector Parameters dialog menu bar, select **Edit → Edit Layer Properties** to change the colors and fill of the vector layers to make them more visible.
8. Using image linking and dynamic overlays, compare the combined class image to the classified images and the Select

Adding Classification Keys Using Annotation

ENVI provides annotation tools to put classification keys on images and in map layouts. The classification keys are automatically generated.

1. From the Display group menu bar, select **Overlay → Annotation** for either one of the classified images, or for the image with the vector overlay.
2. From the Annotation menu bar, select **Object → Map Key** to start annotating the image. You can edit the key characteristics by clicking the **Edit Map Key Items** button in the dialog and changing the desired characteristics.
3. Click once with the left mouse button in the Image window to place the map key in the image window.
4. Click and drag the map key using the left mouse button in the display to place the key.
5. Click in the display with the right mouse button to finalize the position of the key. For more information about image annotation, please see the ENVI User's Guide.



Ending the ENVI Session

You can quit your ENVI session by selecting **File → Exit** from the ENVI main menu.