Lab14.1 Classification

Requirements

使用不同方法对土地利用进行分类。

提交作业内容如下：

1. 提交分类之后的土地利用图（在 ArcMap 中出图）；

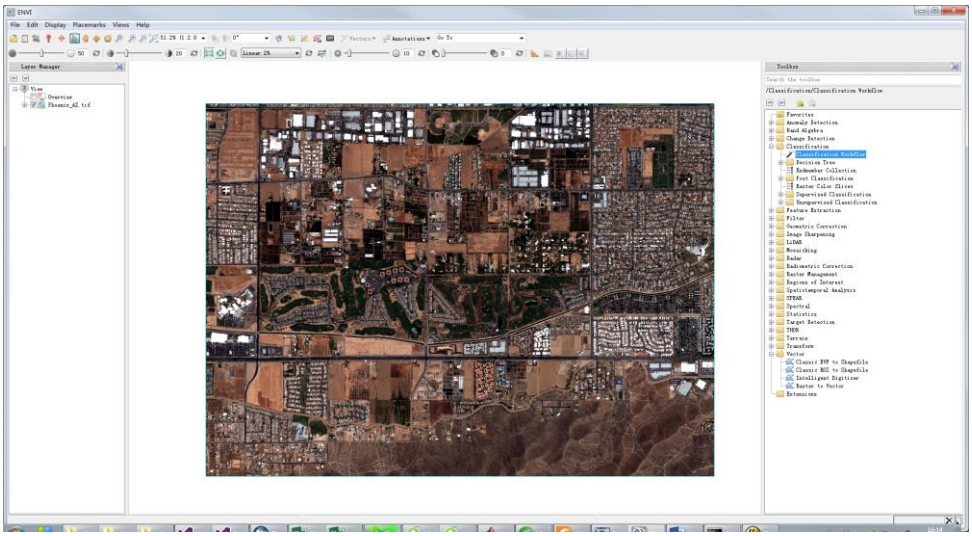
Background

In the first part of the tutorial, you will perform an unsupervised classification with no training data. Unsupervised classification clusters pixels in a dataset based on statistics only, without any user-defined training classes.

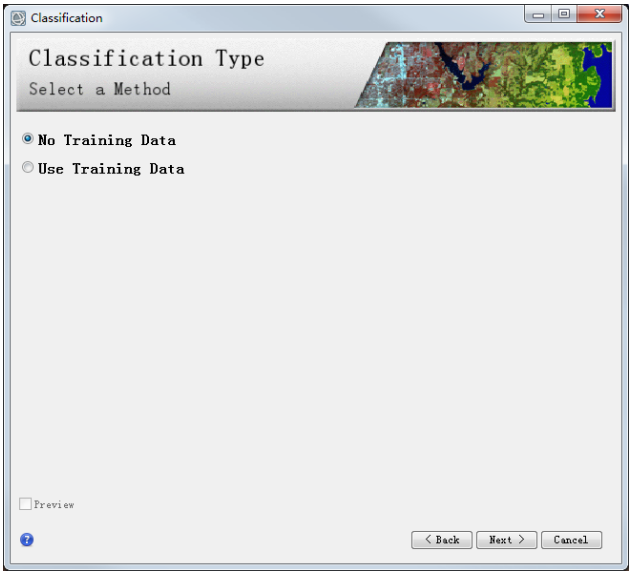
In the second part of the tutorial, you will create training data interactively in the dataset and use it to perform a supervised classification. Supervised classification clusters pixels in a dataset into classes based on training data that you define. Then you can select the classes that you want mapped in the output.

Tutorial 1. Performing Unsupervised Classification

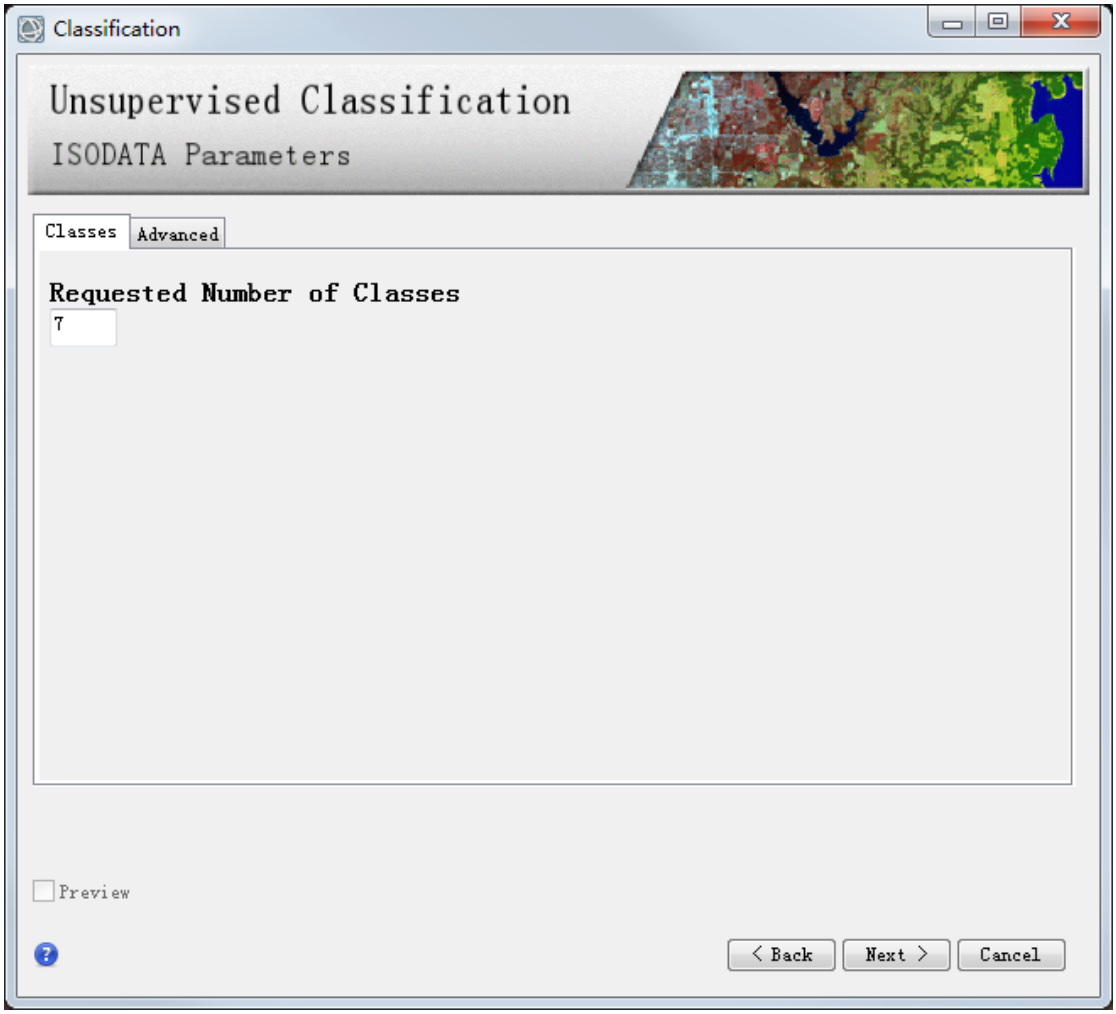
1. Start ENVI.
2. From the menu bar, select File > Open. Navigate to Classification, and select the file Phoenix_AZ.tif, click Open：



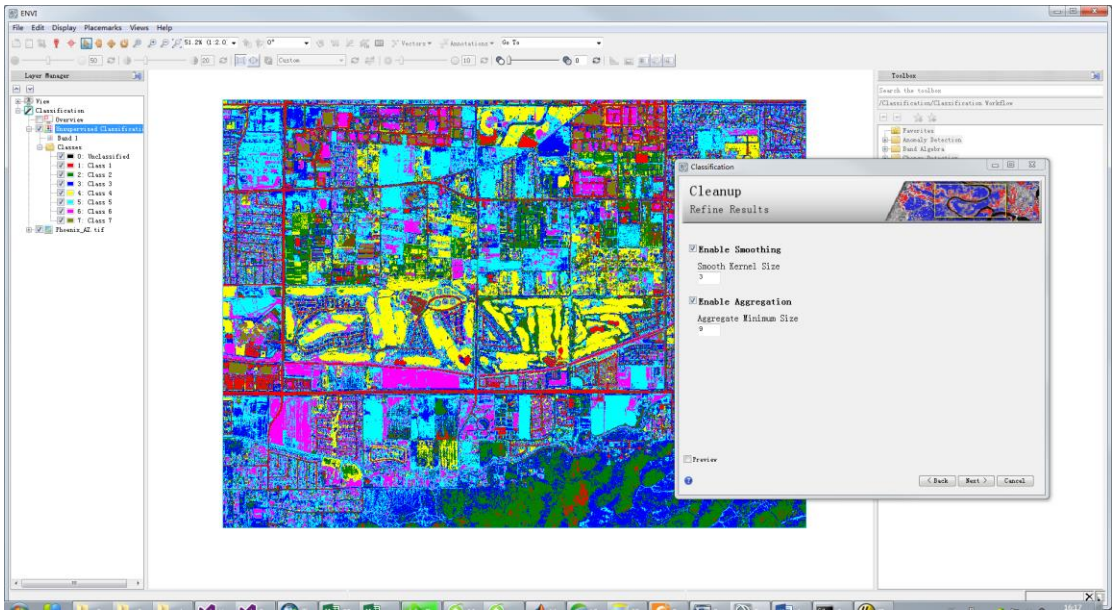
3. From the Toolbox, select Classification > Classification Workflow. The Phoenix_AZ.tif already exists in the Raster File field
4. File Selection panel appears.
5. Click Next in the File Selection dialog. The Classification Type panel appears.
6. Select No Training Data, which will guide you through the unsupervised classification workflow steps.



7. Click Next. The Unsupervised Classification panel appears.
8. Enter 7 as the Requested Number of Classes to define. You do not need to change any settings on the Advanced tab, so click Next to begin classification.

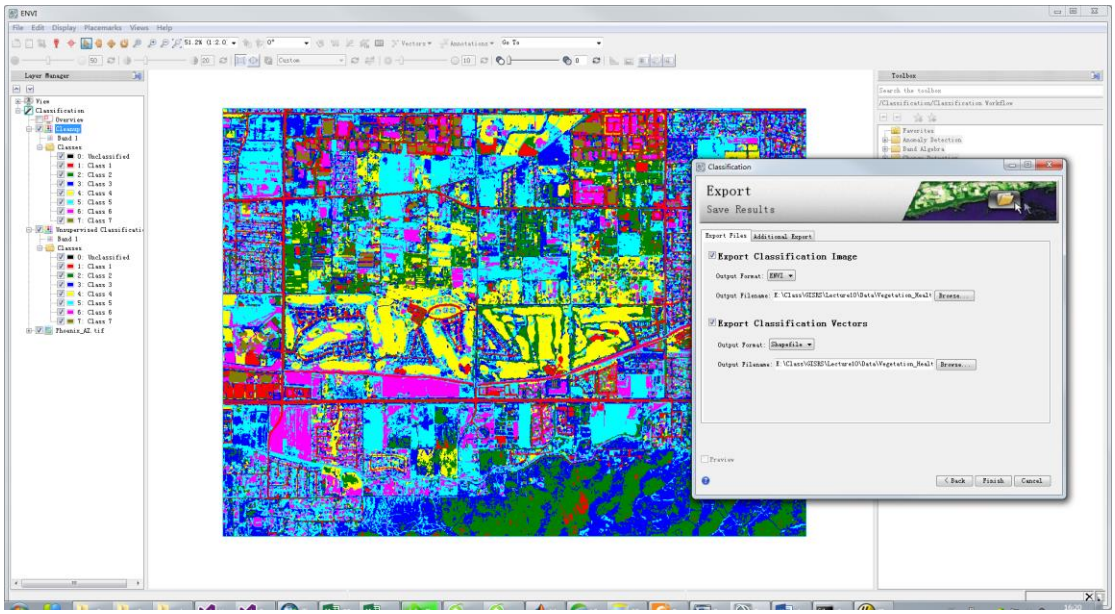


When classification is complete, the classified image loads in the view and the Cleanup panel appears. The following is a sample of the unsupervised classification results from part of the image. Your results may be slightly different. Notice the amount of speckling that occurs within the residential areas:

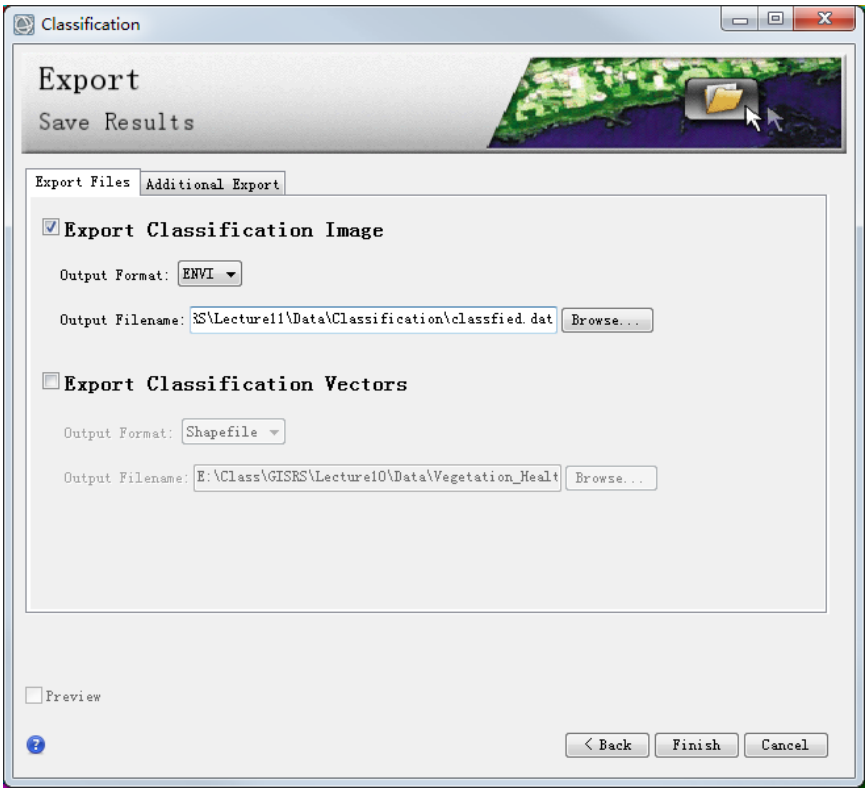


9. Cleanup is an optional step, but you will use it in this exercise to determine if the classification output improves. The cleanup options are smoothing, which removes speckling, and aggregation, which removes small regions. In the Cleanup panel, keep the default settings.
10. Enable the Preview option. A Preview Window opens, showing you what the classification cleanup will look like with the current settings. Click on the Preview Window using the Selection tool (the arrow icon located in the main toolbar), and drag it around the image to see how areas will be affected by cleanup step.

The image below shows that the classification will benefit from using the Cleanup step. You can see that much of the speckling noise has been replaced with smoother regions.



11. Click Next. The Export panel appears.
12. Enable only the Export Classification Image check box. Use the default output image type of ENVI, and enter a path and filename for the classification image.



13. Click Finish.

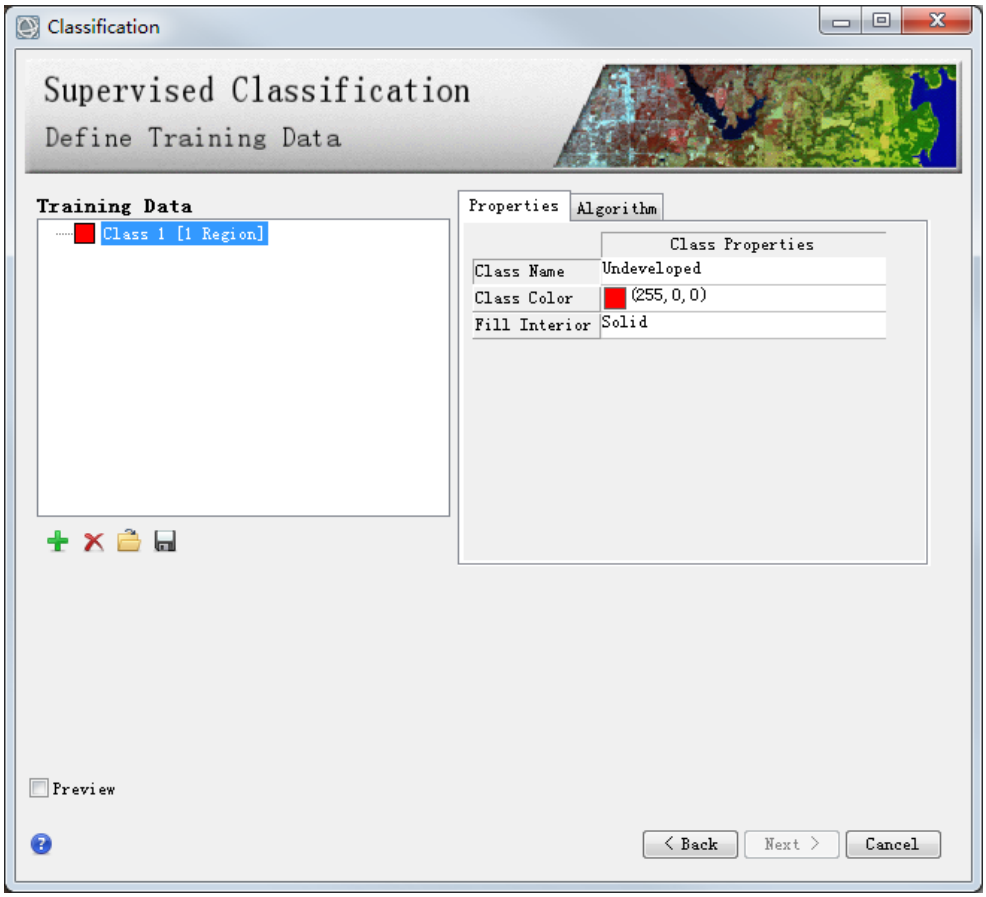
Tutorial 2. Performing Supervised Classification

Supervised classification methods include Maximum likelihood, Minimum distance, Mahalanobis distance, and Spectral Angle Mapper (SAM). In this tutorial, you will use SAM.

1. Double-click the Classification tool to start it. The File Selection panel appears, with Phoenix_AZ.TIF as the raster input file.
2. Click Next in the File Selection panel to proceed. The Classification Type panel appears.
3. Select Use Training Data, which will guide you through the supervised classification workflow steps.
4. Click Next. The Supervised Classification panel appears.
5. Under the Algorithm tab, select Spectral Angle Mapper from the drop-down list provided. The SAM method is a spectral classification technique that uses an n-D angle to match pixels to training data. This method determines the spectral similarity between two spectra by calculating the angle between the spectra and treating them as vectors in a space with dimensionality equal to the number of bands. Smaller angles represent closer matches to the reference spectrum. The pixels are assigned to the class with the smallest angle. When used with calibrated reflectance data, the SAM method is relatively insensitive to illumination and albedo effects.
6. You can define training data from an existing vector file, but for this exercise, you will use ENVI's Polygon Annotation tool to interactively create your own polygons of training data.
7. Interactively Defining Training Data

When you selected Use Training Data, the Polygon Annotation button was enabled and a new layer named Training Data was added to the Layer Manager. You will define two classes with at least one region per class. This is the minimum number of classes required to perform supervised classification.

a) In the Supervised Classification panel, click the Properties tab and change the Class Name from Class 1 to Undeveloped. Leave the Class Color as red.



b) Locate different areas in the image that are undeveloped. They should not contain buildings or grass, and they should not be roads. Draw polygons inside three of these areas. To draw a polygon, click in an undeveloped area and hold down the mouse button while drawing. As you approach your starting point, double-click to accept the polygon. The polygon annotation is added to the Layer Manager under the training data layer tree

The following is an example of one polygon.

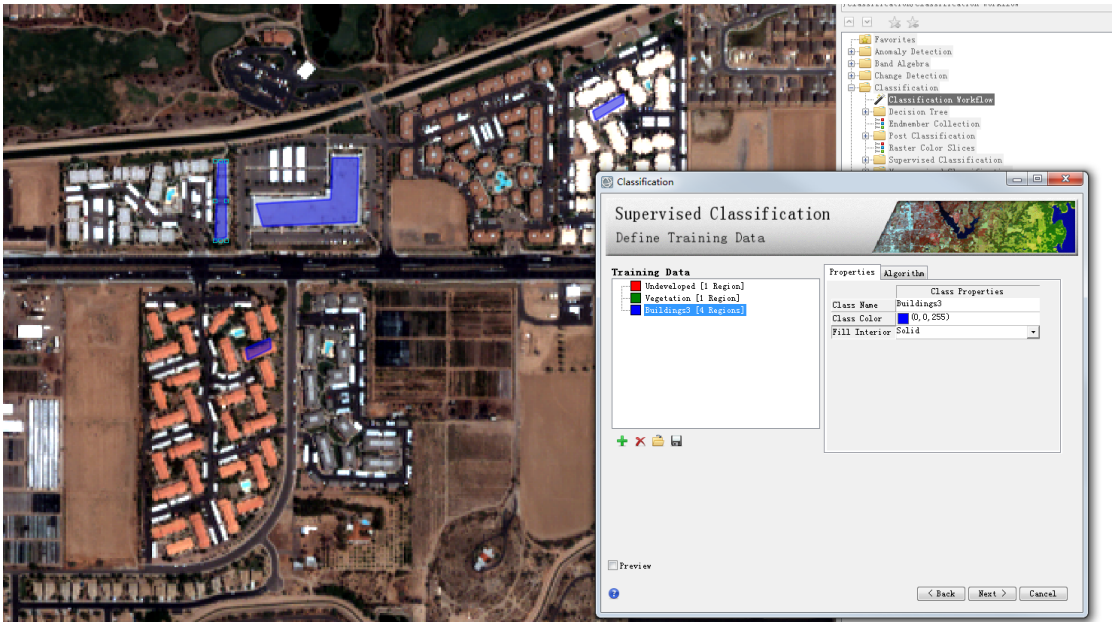
c) Click the Add Class button  to create a second class.

d) Change the Class Name from Class 2 to Vegetation. Leave the Class Color as green.

e) Locate different areas in the image that display healthy vegetation such as golf courses, trees, lawns, etc. Draw polygons inside three of these areas. The following zoomed-in image shows an example

f) Click the Add Class button to create a third class.

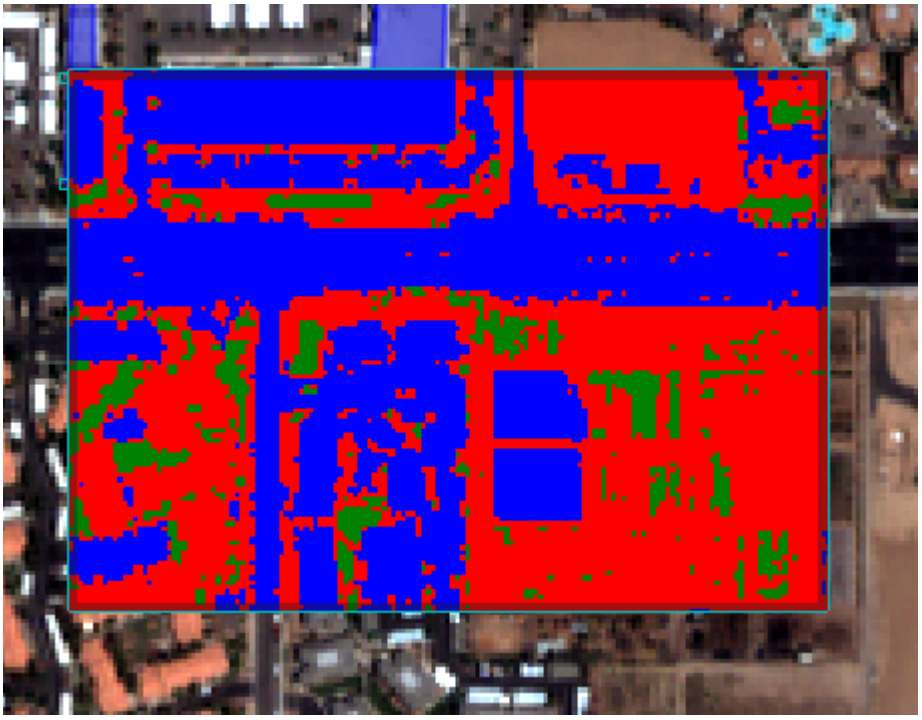
g) Change the Class Name from Class 3 to Buildings. Leave the Class Color as blue.



h) Next you will preview the classification results, based on the training data you provided.

8. Previewing the Classification

a) Enable the Preview option to open a Preview Window that shows the classification result using the training data that you created. The following figure shows an example.



The Preview Window shows that roads are being classified as buildings. You will need to add a fourth class for roads.

b) Disable the Preview option.

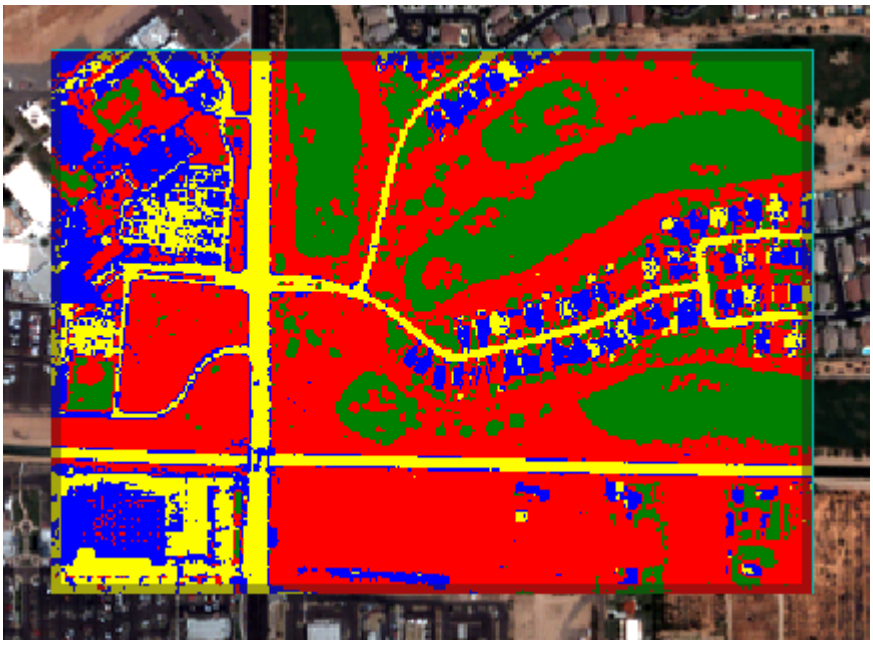
c) Click the Add Class button.

d) Change the Class Name from Class 4 to Roads. Leave the Class Color as yellow

e) Use the Polygon Annotation tool to draw polygons within three different road types, including a freeway. You may need to use the Zoom tool in the main toolbar to zoom in enough to draw a polygon inside a road.

f) Enable Preview again.

g) The Roads training region seemed to do a good job of classifying the roads, but it also reclassified some rooftops that were a shade of gray similar to the highway. the following image shows an example.



Next, you will delete the Roads region, rename the Buildings region to Developed, and add three road training regions to Developed

h) Select the Roads class, and click the Delete button. The Preview Window updates the view.

i) Select the Buildings class, and change its Class Name to Developed.

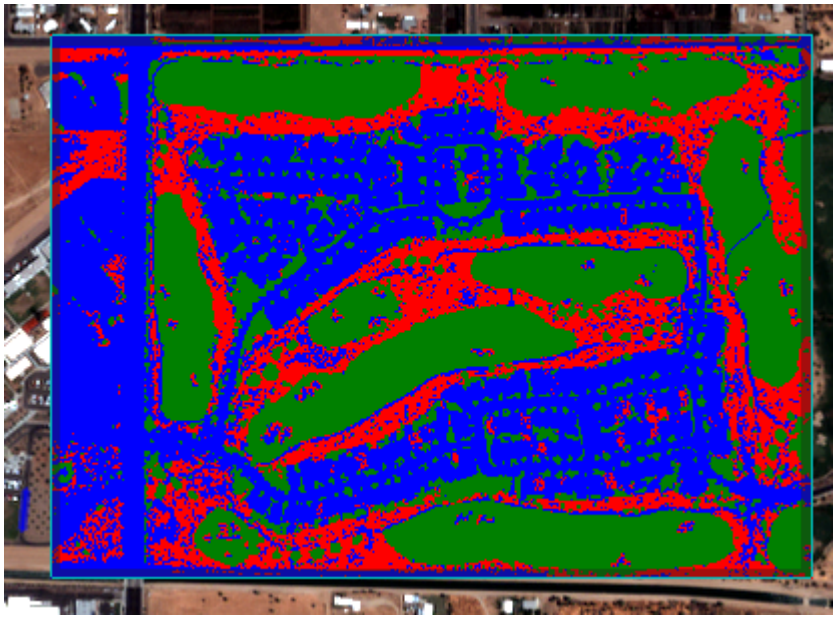
j) Use the Polygon Annotation tool to draw polygons within three road sections, being sure to mark at least one section of a highway.

k) Enable Preview. The Preview Window should show that roads and buildings are part of the new Developed class.

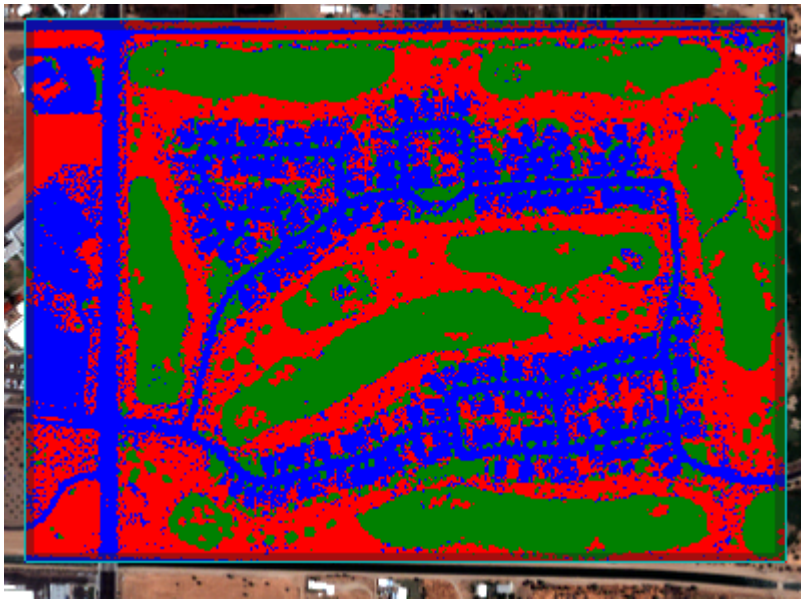
9. Comparing Methods

With the Preview option enabled, try each of the classification methods under the Algorithm tab. For more detailed information on each method, see the references at the beginning of this tutorial. Here is a brief summary

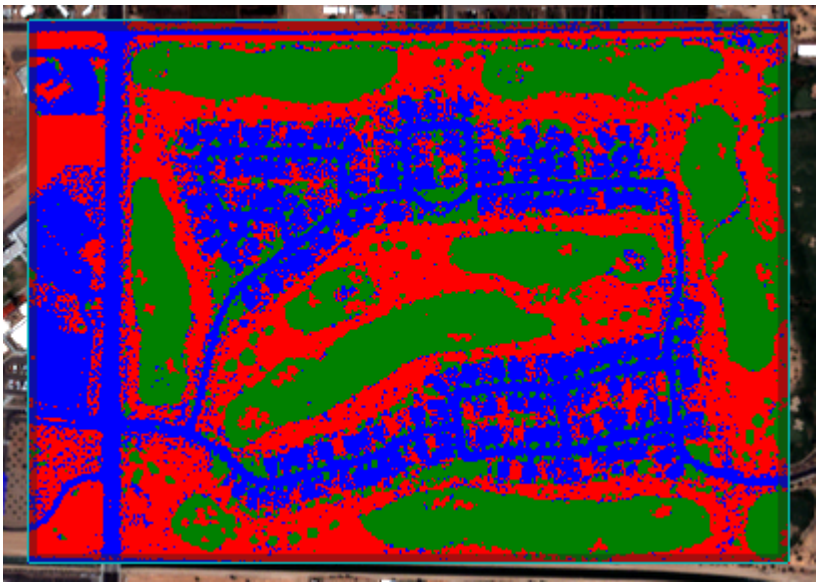
- Maximum Likelihood assumes that the statistics for each class in each band are normally distributed and calculates the probability that a given pixel belongs to a specific class. Each pixel is assigned to the class that has the highest probability (that is, the maximum likelihood).



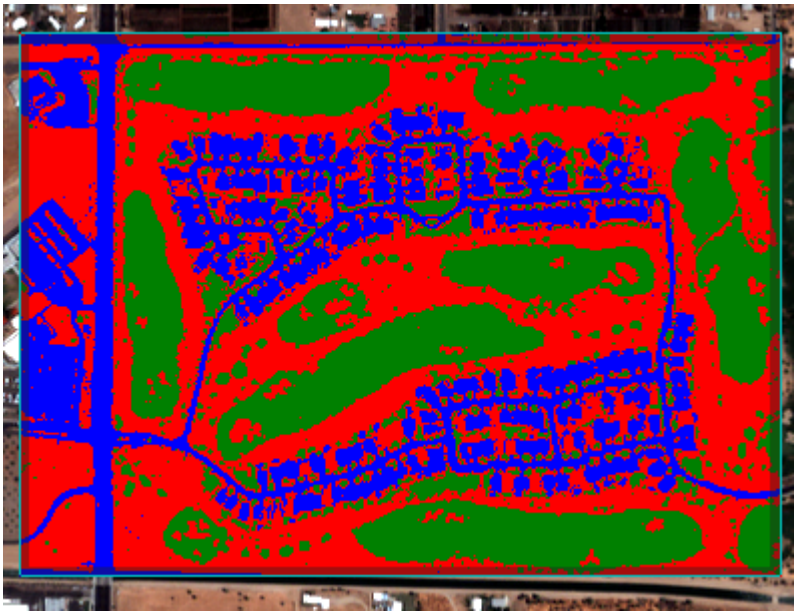
- Minimum Distance uses the mean vectors for each class and calculates the Euclidean distance from each unknown pixel to the mean vector for each class. The pixels are classified to the nearest class.



- Mahalanobis Distance is a direction-sensitive distance classifier that uses statistics for each class. It is similar to the maximum likelihood classification, but assumes all class covariances are equal, and therefore is a faster method. All pixels are classified to the closest training data.



- Spectral Angle Mapper (SAM)



10. Cleaning Up Supervised Classification Results

When supervised classification is complete, the classified image loads in the Image window, and the Cleanup panel appears. Cleanup is an optional step, but you will use it in this exercise to determine if the classification output improves. The cleanup options are smoothing, which removes speckling, and aggregation, which removes small regions

a) In the Cleanup panel, disable the Enable Smoothing option. Select and keep the default setting for Enable Aggregation.

b) The Preview Window should still be open, showing you a view of what

the classification cleanup will look like with the current settings. Click on the Preview Window, and drag it around the image to see how areas will be affected by cleanup step.

c) Click Next. When the classification process is finished, the Export panel appears.

11. Exporting Classification Results

In the Export panel, you can save the classification results to an image, the class polygons to a shapefile, and statistics to a text file.

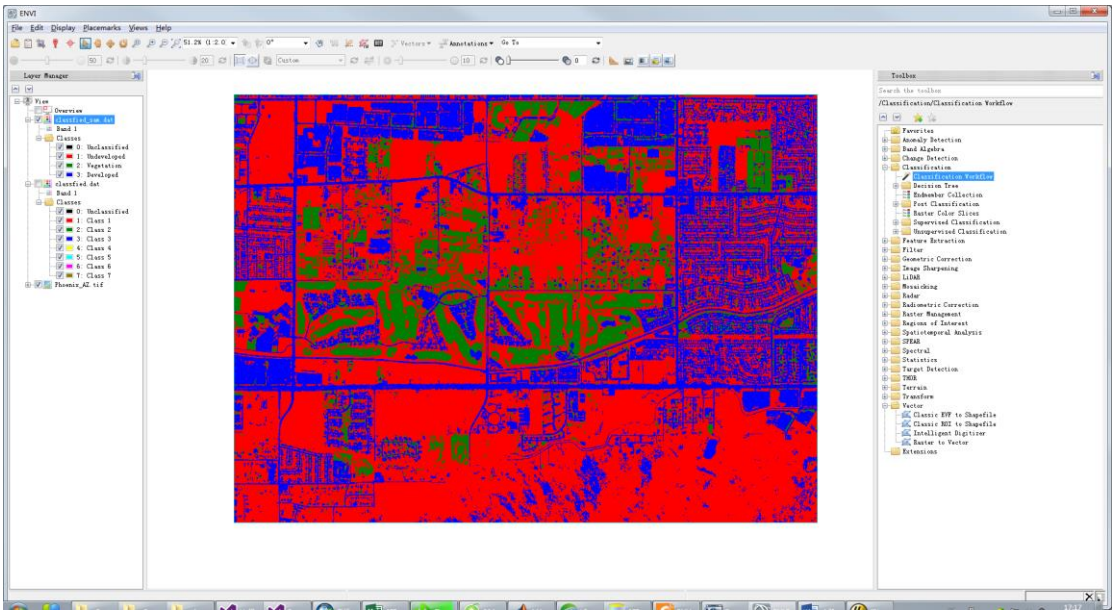
To export results:

a) Under the Export Files tab, enable the Export Classification Image option and keep ENVI as the output image type. Enter a valid path and filename for the classification image (classified_sam.dat).

b) Enable the Export Classification Vectors option and keep Shapefile as the output vector file type. Enter a valid path and filename for the shapefile (classified_sam.shp).

c) Under the Additional Export tab, enable the Export Classification Statistics option. Enter a valid path and filename for the statistics text file.

d) Click Finish. ENVI creates the output, opens the classification and vector layer in the Image window, and saves the files to the directory you specified. You ca view the statistics by opening the file in a text editor.



e) Select File > Exit to close ENVI.

f) Open ArcMap, add classified_sam.dat, set symbology and layout, export the map to PNG file.