Exercise #5B

Image Classification

(Signatures)

Objective

- **Learn the concept of supervised classification of an image.**
- **Generate class signatures using different methods.**
- **Edit and Save Spectral Signatures.**

Note: There is nothing to turn in from this exercise, but you will need your signature files that you create below for the following exercises.

Supervised Classification

In supervised classification you select the pixels that you recognize or can identify and you use these to train the computer to associate certain spectral signatures with certain land cover classes. The first step is the creation of a signature file which defines which spectral signatures are associated with which classes. There is more than one way to do this. These exercises will show you how to do this in some different ways. You can combine methods or use only one or two. We will use the subsetted image that we created in the previous exercise.

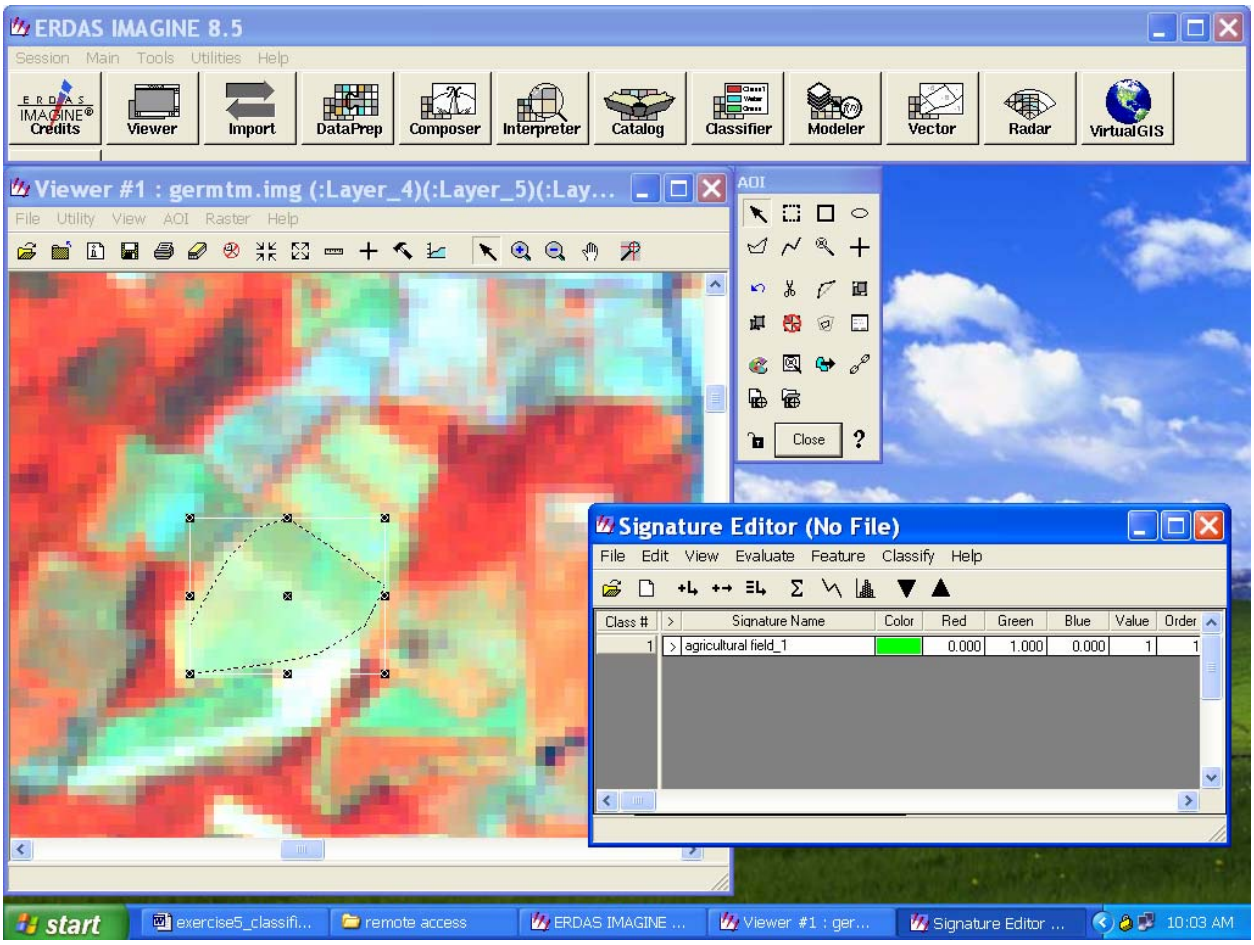
Start by opening up the file (los_angeles_subset.img or <yourfile_subset.img>) in a raster layer with layers 4, 3 and 2 as RGB (or you can use any other combination of three bands). Then, open up the signature editor so you can see which signatures are being added. (Classifier icon -> signature editor).

Using AOI tools to delineate an area

In this option you mark out an area in the image with which you are familiar and you instruct the computer how to classify that particular area. Open up the AOI (Area of Interest) tools (Viewer menu bar: AOI -> Tools).

Identify five different land covers (eg. water, grass, concrete/urban, sand, chaparral, soil, agricultural field, roof, forest, desert etc.) in your image that you know yourself. You will define signatures for these as described below. Your signature file should be called los_angeles_subset_aoi.sig (or something similar, <yourfile_subset_aoi>.sig).

Zoom in on an area in your file in the Viewer which contains a known land cover. Choose the polygon tool in the AOI tool palette. Draw an area around one of the land cover areas (see figure below). Double-click to finish. An AOI box will appear around the area indicating that it is selected. In the Signature editor select Edit -> Add. Give the class the name, eg. grass and press Enter. Color it appropriately.



Now do the same thing for each of your other land cover areas, giving each an appropriate name and color.

Now save your signature definitions (In the Signature Editor choose File -> Save As. Enter the filename, <yourfile_subset_aoi>.sig)

We will use them later to classify the image.

After you have finished with AOIs you can get rid of them by choosing View -> Arrange Layers. Then right click on the AOI layer at the top, Delete Layer, Apply, Close.

Note that you now have signatures defined which categorize certain areas in an image as being representative of certain land cover types. At this point you have not done the classification of your image – you have just defined the "signatures".

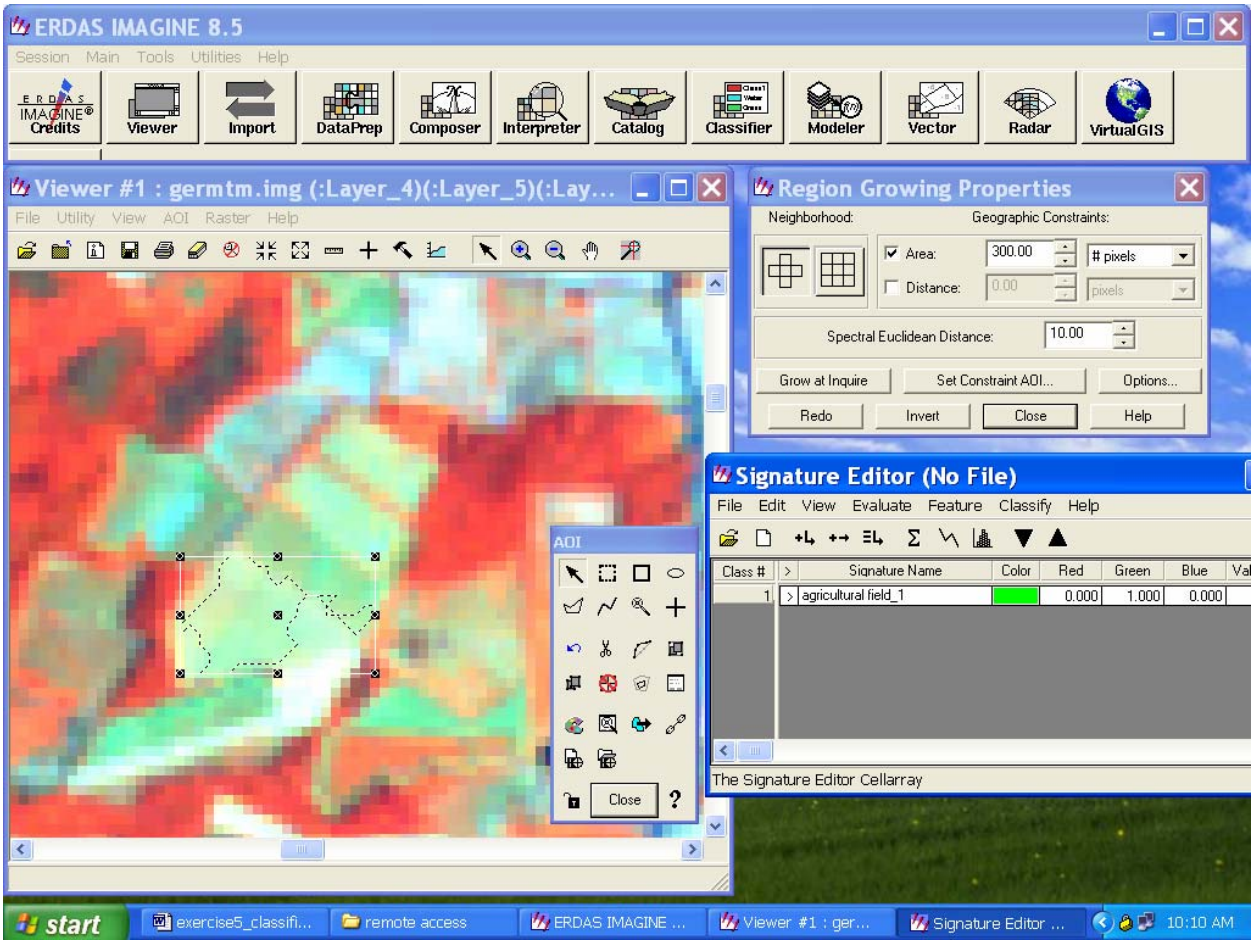
Using Seeds and Region Growing (This exercise is not necessary to complete the rest of exercise 5.)

This section describes a different way of defining the pixels that go into a signature definition. In this method instead of drawing out the area yourself, you tell the computer where to start and it draws out the area. To do this you choose a point on the image which corresponds to a particular land cover that you can classify, and you then instruct the computer to find others near to that one which have similar spectral properties. The computer then essentially performs the polygon drawing that you did manually above.

First define which pixels the computer can look at in marking out the area. Select AOI -> Seed Properties (Viewer menu bar). The Region Growing Properties dialog opens. Enter an area of 300 – this means that a maximum of 300 pixels are going to be in the polygon that the computer draws. Choose the definition of "contiguous", which defines the pixels that the computer will consider. There are 2 options (the pixels above, below and to the sides – 4 pixels; or the pixels also diagonal – 8 pixels). Choose the first of these. Now enter 10.00 in the Spectral Euclidean Distance. Click on Options and make sure "Include Island Polygons" is checked. Close the Options box. Open the AOI tools palette. Choose the Region Grow icon (it's like a magnifying glass). Zoom in on the image and click on the same land cover area that you started with in section 2 above. The computer will draw a polygon. Now investigate the effect of changing the area and spectral distances in the Region Growing Properties (and then press Redo) and see how the polygon changes. What happens when you increase the spectral distance? How close is the area defined to the one you defined manually?

Put the signature from this polygon in a new Signature file (open the Signature Editor and Edit -> Add the class). Give it the same name as you used above and color it appropriately.

Repeat for the other areas you defined above. (eg. water, grass, concrete etc.) Now save your signature definitions in a new file (In the Signature Editor choose File -> Save As. Enter the filename, los_angeles_subset_seed.sig or, <yourfile_subset_seed>.sig)

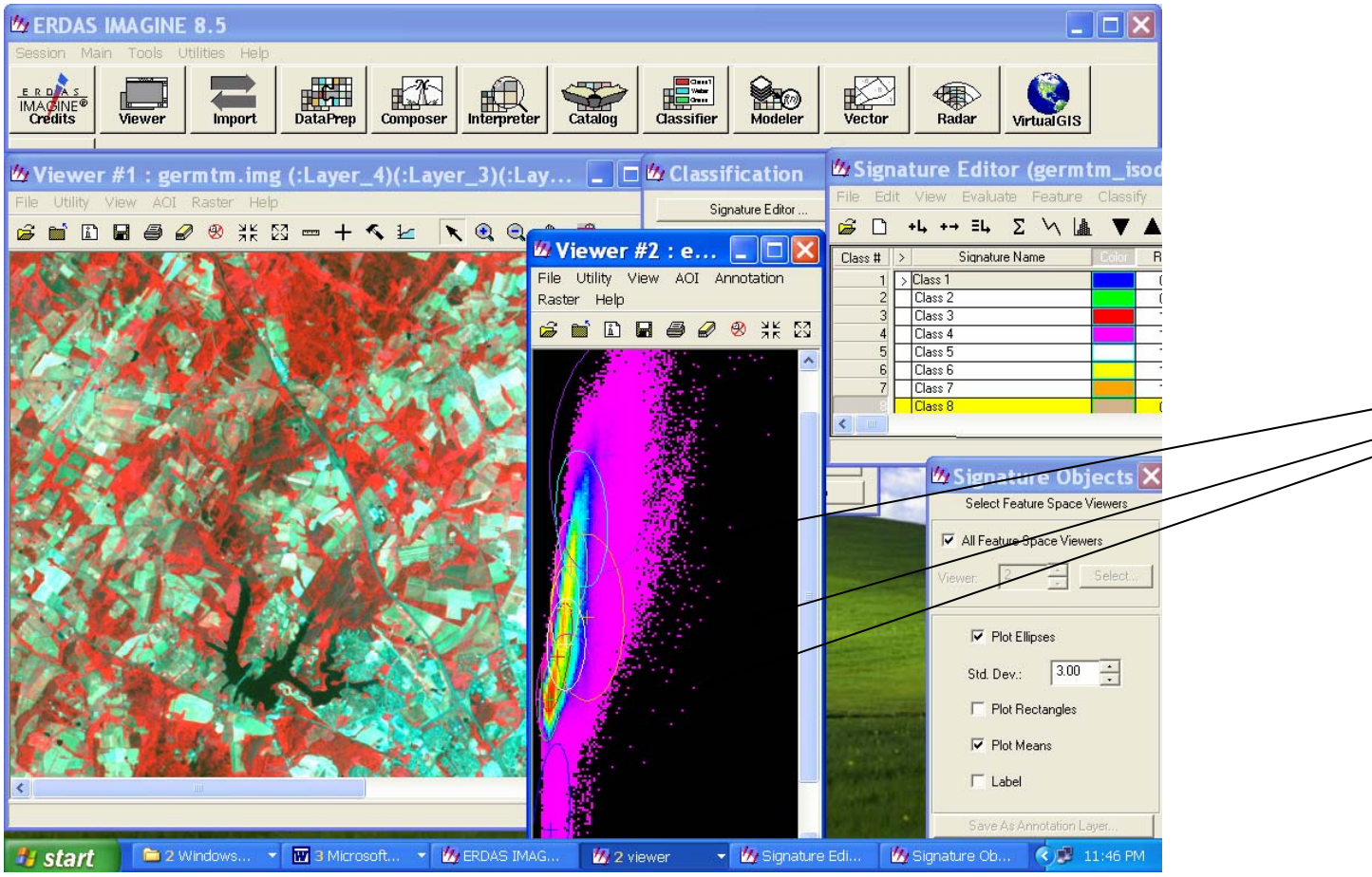


Plot the signatures in feature space

To investigate the spectral properties of each signature (or class) you can plot its spectral information in feature space. This can be illustrated by a rectangle or ellipse superimposed on the feature space of your image. To do this, the next step is to open the Signature Editor (under the Classification menu) with the *.sig file you created above (use los_angeles_subset_aoi.sig or <yourfile_subset_aoi>.sig). Select all the classes by clicking and dragging the mouse over them (they should all be highlighted in yellow). In the Signature Editor main menu select Feature->Objects. This will display a Signature Objects dialog box that allows you to tell Imagine which viewer you want to receive the information about the signatures of the clusters. In this case we want the viewer in which you have displayed the feature space image.

NOTE: If you do not have a feature space file open in one of the Viewers you will need to open one before you proceed further. To do this open a new viewer (say #2) and open a raster layer in it. Open one of the feature space plots you made for this .img file (like los_angeles_subset_2_5.fsp.img**)**.

Select the viewer # for the feature space in the Signature Objects space provided. Select Plot Ellipses and Plot Means (you can also try the rectangles). Leave everything else in its default state and click OK. Selected classes in the Signature Editor window will be drawn.



Use the feature space images to see which classes are most distinct from each other, and which you may want to consider merging.

You can see what areas of the feature space your signatures correspond to by using a mask. To do this, select the Feature menu from the signature editor header, then Masking, then Image to Feature Space. A pop-up box will be displayed. Select the Viewer number for your feature space viewer. Then click Apply. In the feature space viewer you will see colored pixels displayed that correspond to the signature definition highlighted in the signature editor. You can move to a different signature and use the same procedure to view the pixels in the feature space that correspond to those you used to define your signatures from the AOIs in your im**age.**

Defining signatures in feature space (This exercise is not necessary to complete the rest of exercise 5)

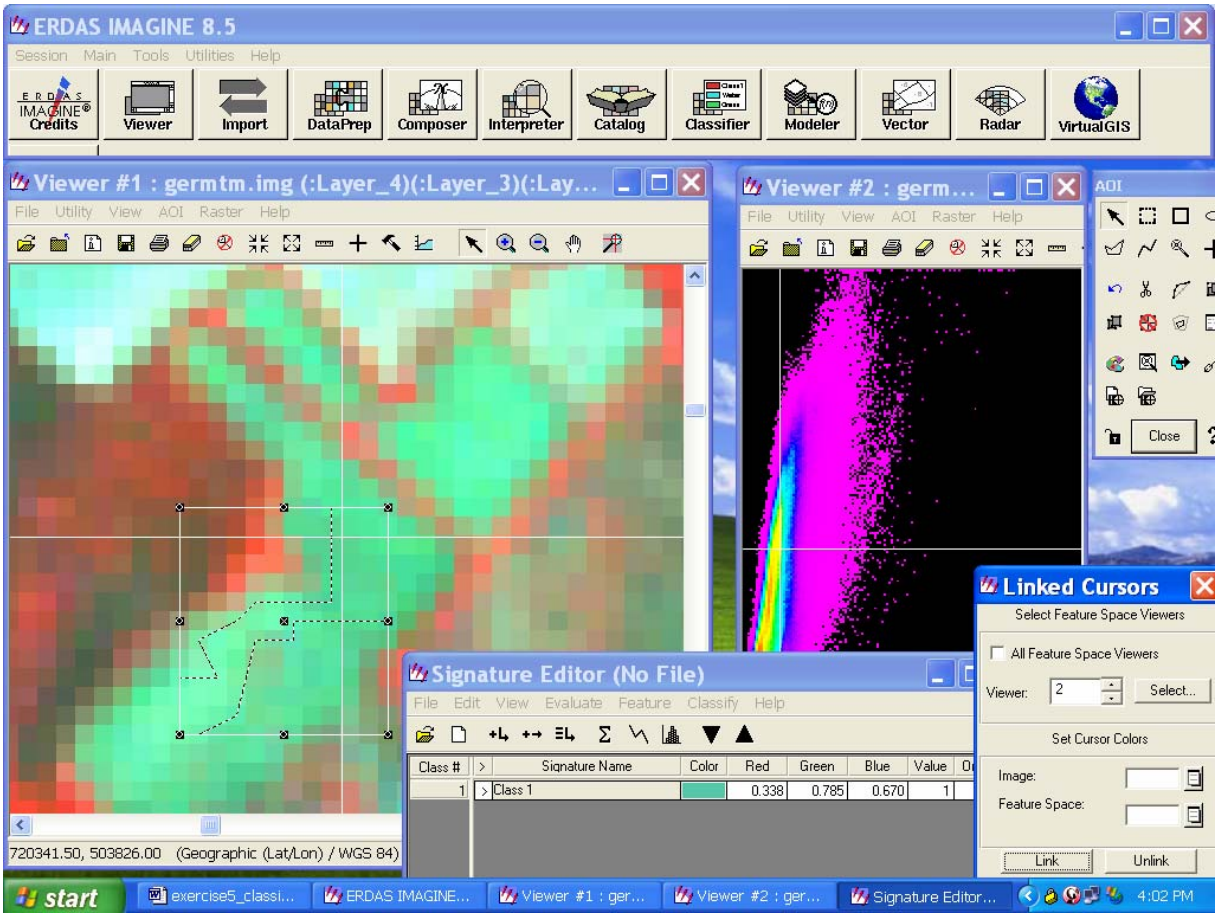
You could also define the signatures to be associated with a particular land cover in feature space (spectral space) itself, rather than defining a polygon area in the image. When you define your classes using Feature Space they are non-parametric and are not associated with the statistics of what is in the image. (This has some implications for the tools that can be used to evaluate the signatures later.)

Open up your image file in Viewer 1. Then follow the instructions under Ex 5A to display the feature space for bands 2 and 5. (If you saved this file before you can just open it in Viewer 2.)

You can define an AOI in feature space just as you did for the image space. Open up AOI tools from the feature space viewer and draw a polygon inside the feature space. Open up the signature editor with no file defined. Then add the signature from the feature space AOI as a signature in the empty signature table. Give it a color. Do this for some different parts of feature space, adding different signatures. You can see what areas of the image these signatures correspond to by using a mask. To do this, select the Feature menu from the signature editor header, then Masking, then Feature Space to Image. A pop-up box will be displayed. Click Apply. In the image viewer you will see colored pixels displayed that correspond to the signature definition highlighted in the signature editor. You can move to a different signature and use the same procedure to view the corresponding pixels in the image. Now save your signature definitions in a new file (In the Signature Editor choose File -> Save As. Enter the filename, los_angeles_subset_fspace.sig or <yourfile_subset_fspace>.sig).

When you define an AOI 'blindly' in feature space as above, it is not clear to what area of the image it corresponds. You can carry out the process above by first linking the cursors in Feature Space and on the image. (To do this open a blank signature editor, choose Feature -> View -> Linked Cursors, enter the Feature Space Viewer number, and press "Link".) Now when you move the cursor around in the image it should move it around in Feature Space. If you now open up AOI tools from the feature space viewer and draw a polygon in the image, you can add it as a signature in the signature editor as before, but its definition will come from the area defined in feature space. You can see the corresponding pixels in feature space by using a mask. In the signature editor header choose Feature -> Masking -> Image to Feature Space. The signature definition pixels from the image area will be colored in the Feature Space image.

Generate statistics for the Feature Space AOI by selecting Feature -> Statistics from the Signature Editor menu bar.



In this way you can define the 5 signature classes that you used before, and save your signature definitions in a new file (In the Signature Editor choose File -> Save As. Enter the filename, los_angeles_subset_fspace.sig or <yourfile_subset_fspace>.sig). You can now unlink the cursors from the Linked Cursors dialog.

(There is nothing to turn in from this exercise, but you will need your signature files from the first part of this exercise later.)

Last Modified: Jan 7, 2009.
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