

GEO/EVS 427 / EVS 527

Exercise 8: Object-Based Imagery Analysis II

In this exercise, you will continue to use eCognition to extract objects from an image and give them some properties. Again, you will use the flags11 project you started last week, but this week instead of defining classes by color, you will define them by shape. This is significantly more difficult, but it deals with the skills you will need later in the semester.

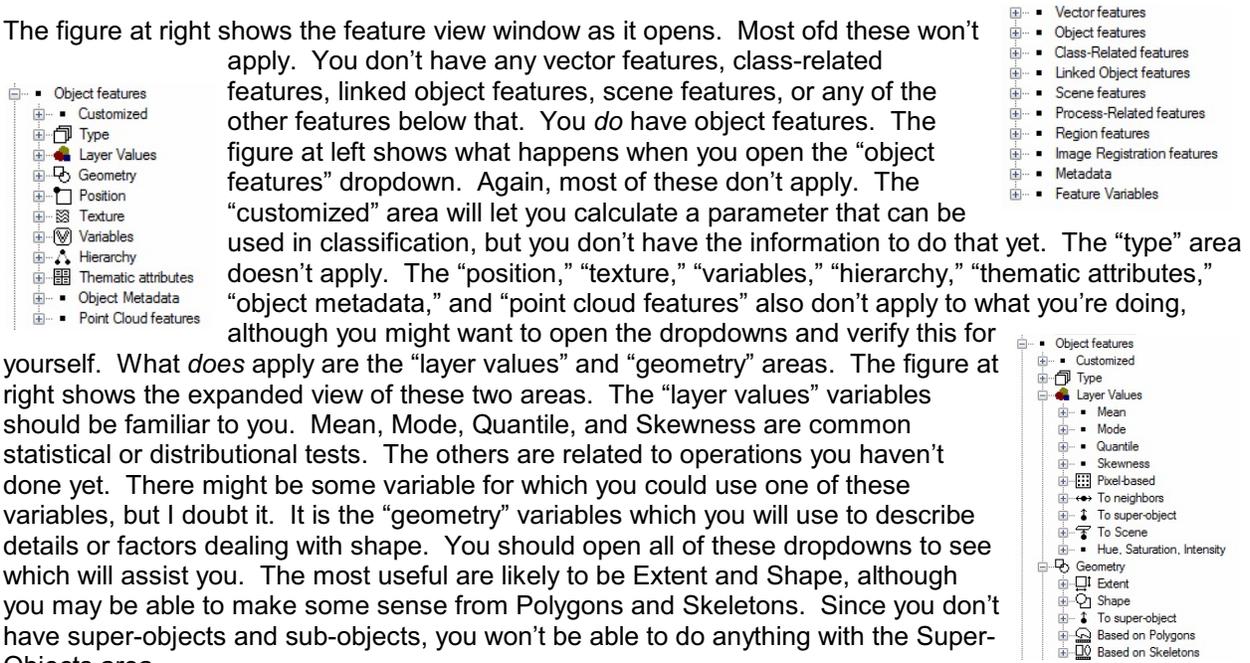
Many different types of objects can be identified in these flags: stars, bars, triangles, a shield, a maple leaf, a circle, trapezoids, and so forth. You may or may not be able to discriminate among all of these shape objects, but you should try.

The figure at right shows the feature view window as it opens. Most of these won't apply. You don't have any vector features, class-related features, linked object features, scene features, or any of the other features below that. You *do* have object features. The figure at left shows what happens when you open the "object features" dropdown. Again, most of these don't apply. The "customized" area will let you calculate a parameter that can be used in classification, but you don't have the information to do that yet. The "type" area doesn't apply. The "position," "texture," "variables," "hierarchy," "thematic attributes," "object metadata," and "point cloud features" also don't apply to what you're doing, although you might want to open the dropdowns and verify this for yourself. What *does* apply are the "layer values" and "geometry" areas. The figure at right shows the expanded view of these two areas. The "layer values" variables should be familiar to you. Mean, Mode, Quantile, and Skewness are common statistical or distributional tests. The others are related to operations you haven't done yet. There might be some variable for which you could use one of these variables, but I doubt it. It is the "geometry" variables which you will use to describe details or factors dealing with shape. You should open all of these dropdowns to see which will assist you. The most useful are likely to be Extent and Shape, although you may be able to make some sense from Polygons and Skeletons. Since you don't have super-objects and sub-objects, you won't be able to do anything with the Super-Objects area.

You will probably find it most useful to look at the Image Object Information and the Samples Editor to determine how any of the shapes you need to deal with record numbers that you can use. If you want to find out more about how the various indices used to describe issues of shape, you should consult the eCognition Reference Manual (Start -> Trimble -> eCognition Developer 9.0 -> User Documents -> Reference Book).

Your next step will be to insert classes into your Class Hierarchy window. You should insert all of the classes you think will be needed and then begin to describe them. You *can*, if you choose, use the sample editor to select samples and then have eCognition compute the membership functions for you. You are likely to find, however, that you will need more control over the process, and that you will want to develop the class descriptions from scratch, based on the numbers you generate in the sampling process.

When you double-click on a class name in the Class Hierarchy window, the Class Description window (shown in the figure at right) opens. Two things are of interest: the nature of the algorithm you will choose for linking membership functions and the nature of the membership functions themselves. When you right-click on the "and (min)" notation, a window will open inviting you to "Insert new expression," "Edit expression," "Invert expression," or "Expression is



and (min)
 and (*)
 or (max)
 mean (arithm.)
 mean (geom.)
 mean (geom. weighted)

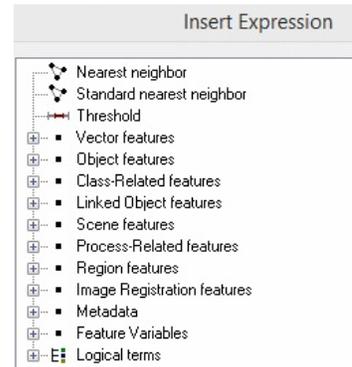
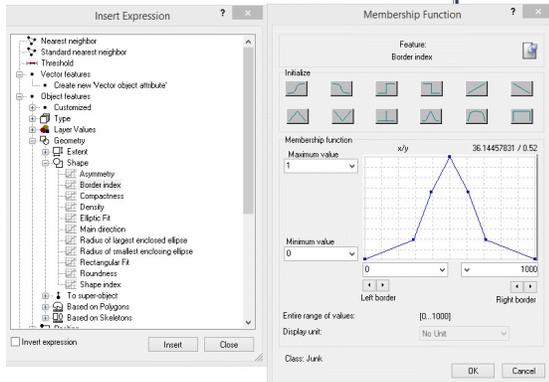
active.” Of these, the “Expression is active” is checked, indicating that the software will use it. If you click on the “Edit Expression” choice, the window at left will open and enable you to choose the algorithm by which you will link the various membership functions you will include in the class description. All of these algorithms assume that you have several membership functions and that you are choosing how you will evaluate them together. “And (min)” means that you will

choose the lowest numeric value from all of the membership functions considered in determining membership in the class. “Or (max)” means that you will choose the highest numeric value from all of the membership functions considered in determining membership in the class. “Mean (arithm)” means that you will take the arithmetic mean of all of the numeric values from the membership functions considered and use that value to determine membership in the class. The two “Mean (geom . . .)” algorithms mean that you will take the geometric mean of all of the numeric values from the membership functions considered and use that value to determine membership in the class. You should probably experiment with several of these to determine which works best for you.

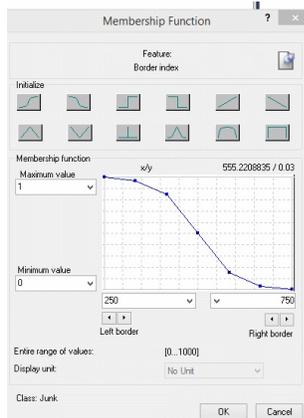
To develop the actual membership functions for each feature you wish to consider for a class, you would click on the “Insert New Expression” choice instead of “Edit

expression.” That will open the window at right and ask you to insert the particular expression or feature you wish to insert. You will have determined this feature using the numbers generated in the Image Object Information and Sample Editor windows.

Let’s assume, for the moment, that you want to insert the Border Index into your class description. You would navigate to the Border Index feature in the “Insert



Function” window opens. These two dialog windows are shown at left. There are several things you need to do in the Membership Function window – these are very important. First, note that a dozen buttons appear in the “initialize” panel on this dialog. These show the shape of the membership function (figure at right). You should click on each of them to see what each does. On the top row, the leftmost two provide a logistic path from the minimum value to the maximum value. The middle two provide a sharp delineation: a membership function value for the feature in question is either 0 or 1. The rightmost two provide a



linear path from minimum to maximum. On the bottom row, the leftmost two provide a V-shaped path, with the maximum value either in the middle or at the ends of the range considered. The third from the left provides that a single value will have the maximum membership function value and all others will have the minimum value. The rightmost 3 provide various versions of a bell-shaped curve. In all cases, the relationships comprise 6-7 ranges, indicated by dots, which can be moved using your mouse to mold a precise shape for the membership function you wish to generate. In the “Membership Function” panel, you can choose the actual value for the minimum and maximum values (which should be between 0 and 1, and which are almost always 0 and 1, respectively). You will probably not want to change the default values. The “Left Border” and “Right Border” are more important – and you are very likely to want to change these. The notion of the “border” refers to the range over which the membership function applies. Let us say, for example, that in your

description of the membership function values for the border index feature, you choose a logistic function with border values of 250 and 750, as shown in the figure at right. This implied that the membership function value for the border index will be '1' if the border index has a value of 250 – *or less*, and that it will have a membership function value of '0' if the border index has a value of 750 – *or more*.

You will want to use several indices to describe each class. When you've defined all of your classes, put the "Classification" process in your process tree (you will probably also want to put the "Remove Classification" process before it) and run your classification. You are very likely to need several iterations in order to get to what you will regard as a satisfactory result.

Portfolio

- 8-1. A picture of your process tree from initial segmentation through the first stage of classification
- 8-2. Your image as classified through the first stage of classification