Accuracy Assessment

ERDAS Imagine 2016

Accuracy Assessment

Accuracy assessment is the procedure used to quantify the reliability of a classified image. The standard accuracy assessment procedure is to construct an "error matrix." This is a square matrix in which the rows and columns represent the land cover classes from the classified image. So, if you have 5 classes, you will have an error matrix with five rows and five columns. The matrix is filled with counts taken from a sample. For every point in the sample you determine the "ground truth" and you know the image classification. In many situations the "ground truth" is determined from higher resolution air photos. Because the sample is not always acquired from the ground, it is often called "reference data" and it is assumed to be correct. Even if the reference data points are found by actual field visits, it is rarely done at the same time the satellite is flying overhead. So, even data from the field should be called reference data. For each point in the sample you have that point's reference data and its image classification. If the reference data shows class "i" and the image classification shows class "j", that sample point will increase the count in the "i,jth" element of the error matrix. Filling the error matrix and then deriving some estimates from the matrix will become more clear as we work through an example. You should also check out Lillesand and Kiefer's section 7.14 and/or Jensen's Chapter 8, starting on page 247. In this lab we will use the classified St. Paul campus scene similar to what you created in the Supervised classification lab.

The classification is a rather simple seven class system:

Class Name	Class Number
Unclassified	0
Streets/Parking lots	1
Sidewalks	2
Grass	3
Bare Soil	4
Bushes & Low Vegetation	5
Tree Canopy	6
Buildings	7

The reference data will be derived from the NAIP imagery we used during the classification. (Why is this not an ideal reference data source?) We will use the Imagine "Accuracy Assessment" module to randomly select the sample points. Imagine will automatically record the image class for each point in this sample. We will then use the viewer to determine the reference class for each point. Once we enter the reference class for each sample point we can use Imagine to construct the error matrix and derive some accuracy estimates.

Imagine Accuracy Assessment Procedures

The first step is to open the classified image that has been prepared for this lab. It is available on Moodle as: **StPCampusSupv.img** *Copy this image and its .rrd file from Moodle to a location on you student drive where you have write access*. Then load the image into your 2D View from your student drive and apply **Fit to Frame**. The image should look like this:
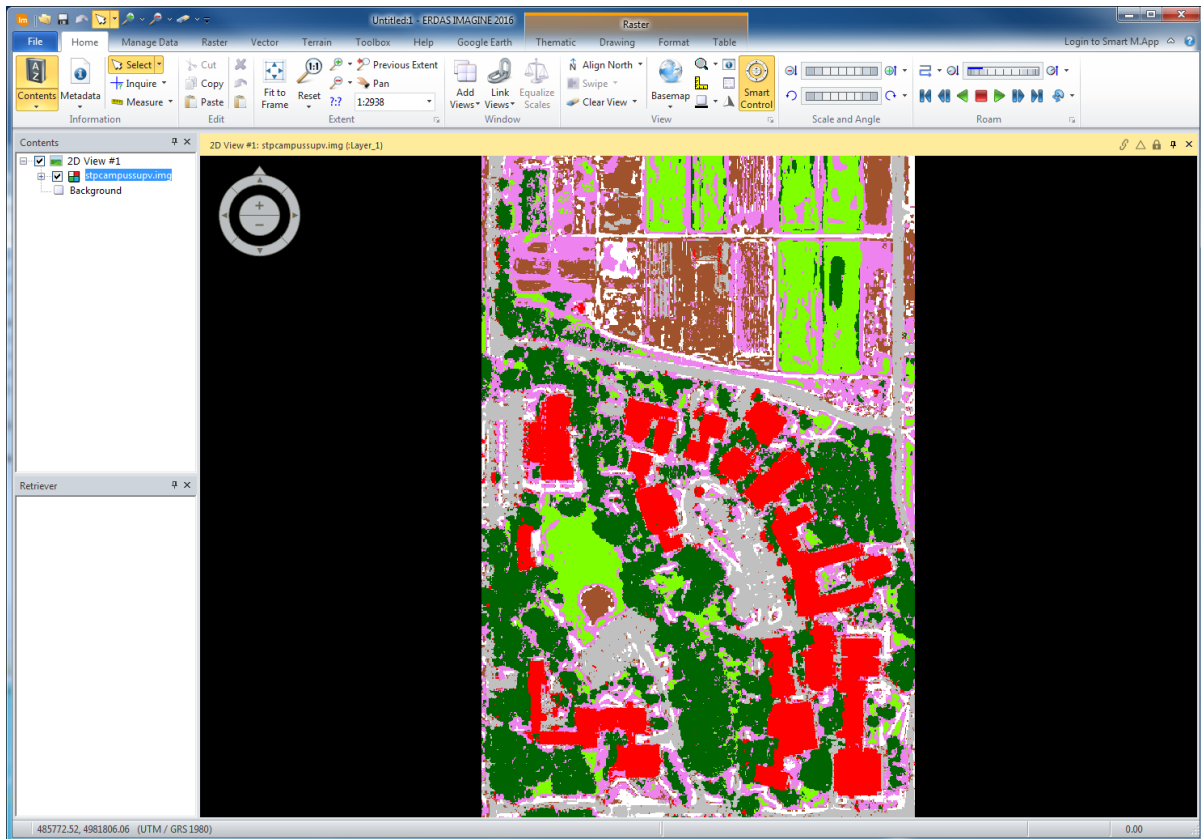

where the colors represent the following:

Streets/Parking Lots	= Gray
Sidewalks	= White
Grass	= Bright Green
Bare Soil	= Light Brown
Bushes & Low Veg	= Violet
Tree Canopy	= Dark Green
Buildings	= Red

Once you have the classified image file open in a viewer, select:
Raster > Raster > Supervised > Accuracy Assessment

from the main Imagine toolbar. This will give you the "Accuracy Assessment" Dialog box:
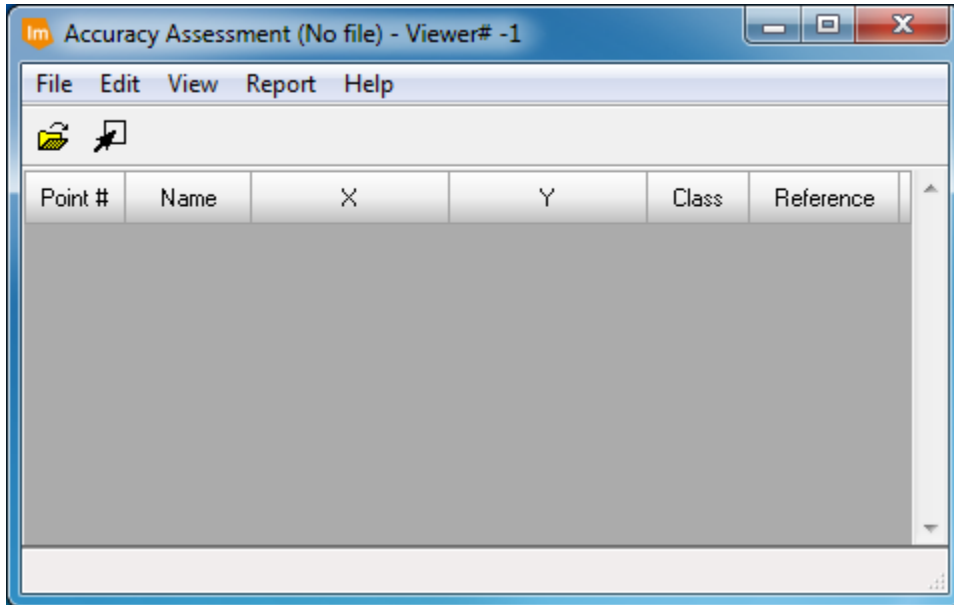

This will be the main window used throughout the accuracy assessment process. In this window we will specify a sample to be placed on the classified image, link a viewer containing the classified image, type in the reference data, and produce an accuracy assessment report. So, let's get started. First, from the Accuracy Assessment (nofile) window menu, select **View > Select Viewer** in the Accuracy Assessment window. A Pop up will appear requesting you to click in a viewer:
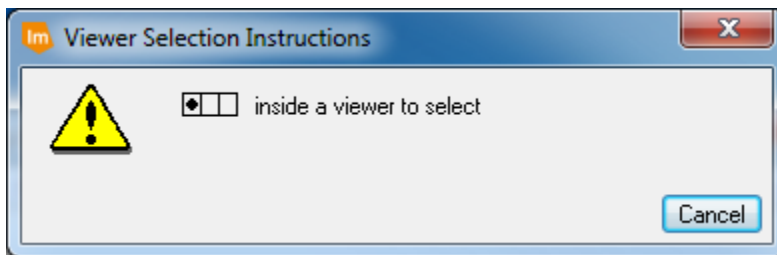

Click somewhere inside the 2D View containing the classified scene. Now the accuracy assessment window is linked to the viewer showing the classified scene.

The classified image file must be opened within the accuracy assessment window as well. The Accuracy window may have become minimized; if so make sure the Accuracy window is in view and from its menu bar select **File > Open** and choose the same **StPCampusSupv.img** file copied to your student drive from Moodle. The next step is to generate a set of sample points randomly placed over the classified image. This is done by selecting **Edit > Create/Add Random Points...** To create/add random points you will need to specify how the points will be collected:
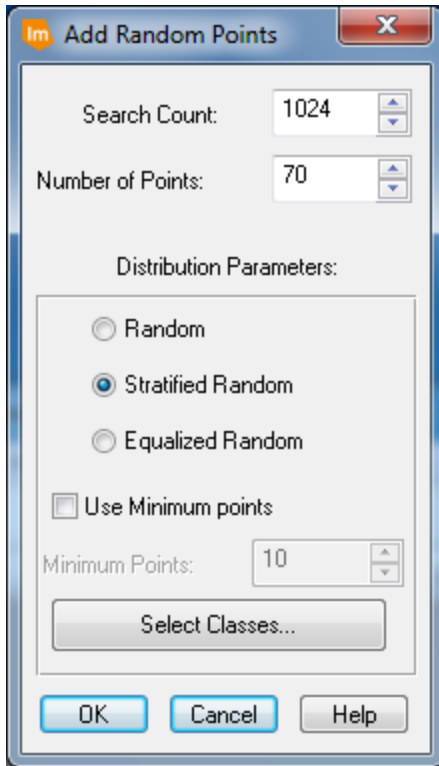
The "Distribution Parameters" refer to how the sample points are placed over the classified scene. For this lab we will select **70** points, distributed by a **Stratified Random** sample. Leave the **Use Minimum points** unchecked. This is a somewhat small number of points per class. In practice, it is recommended that you have a minimum of 50 points per class.

Then click on the **Select Classes...** button
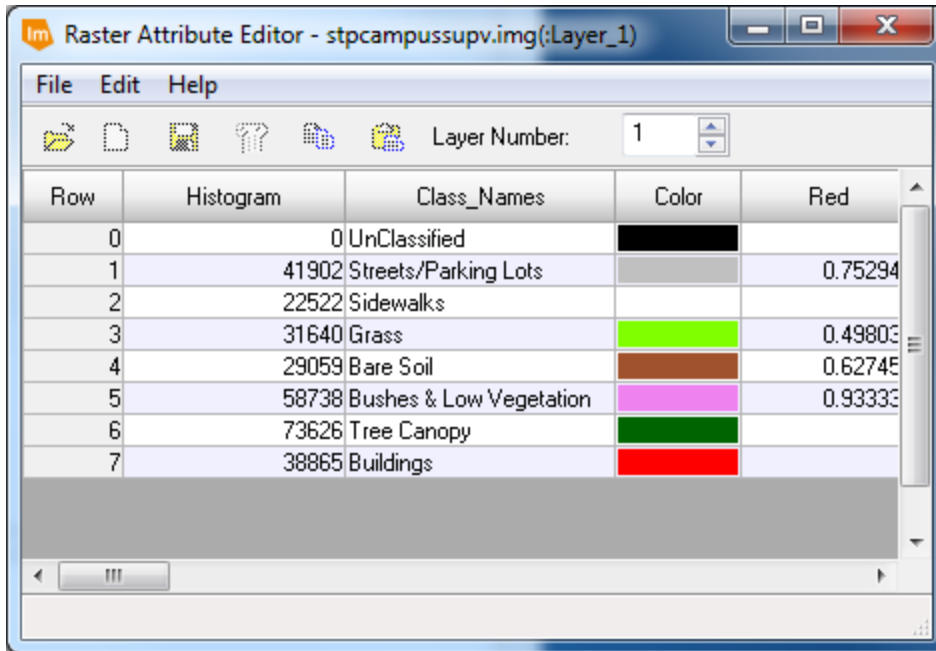
Select classes 1 through 7 by shift-clicking on each row to highlight it as shown above and **_leave this window open_**. (Be sure to omit class 0 so we ignore the unclassified regions in our assessment)

Once these parameters are specified, you click on **OK** on the Add Random Points window to conduct the sample. You **may** get a message window that looks something like this:
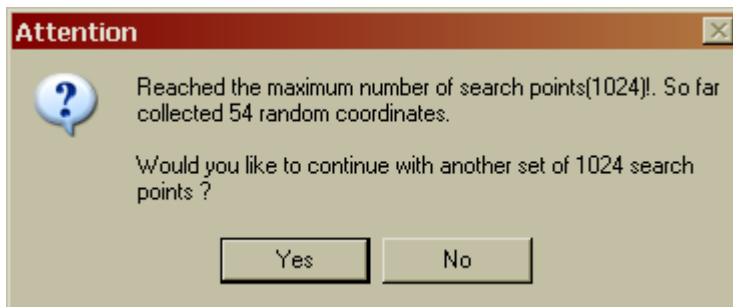
This means that Imagine was not able to collect at least 10 points in each class out of the maximum number of random points you specified. You can click **Yes** to let it search again. It may take several tries before you have 70 points. If you have trouble, feel free to stop with fewer than 70 points. Your table should now appear something like:

Use **File > Save Table** to save the points so that you can come back to them later. Be sure to save the table in your own directory. You should notice that the Accuracy Assessment dialog box has information in the first three columns. Select **Edit > Show Class Values** to see the classified values for each point in the Class column. Do not leave these showing during the reference data interpretation. Note: Imagine will put some points outside the boundary of the image and call them class zero if you don't omit them in the Raster Attribute Editor window above. If you forgot that step, delete those points now because they will bias your accuracy results. Just select each row that has a class of zero (you can select multiple rows using the shift key and clicking), then right click and chose **Delete selection**.

To see more clearly the sample points you can select **View > Change Color** and specify a color other than white for "points with no reference." The "Reference" column in the accuracy assessment table needs to be filled in by the analyst (you). As mentioned earlier, the reference data will be collected using the 5 layer stack image which matches the classified image data area. You can also have a single point displayed on the screens by selecting an entire row in the Accuracy Assessment table and selecting **View > Show Current Selection.** You can see all of the table entries by selecting **View > Show All** but it is hard to determine where the point is amongst all 70. We recommend you **View > Show Current Selection** for ease of locating the point in question.
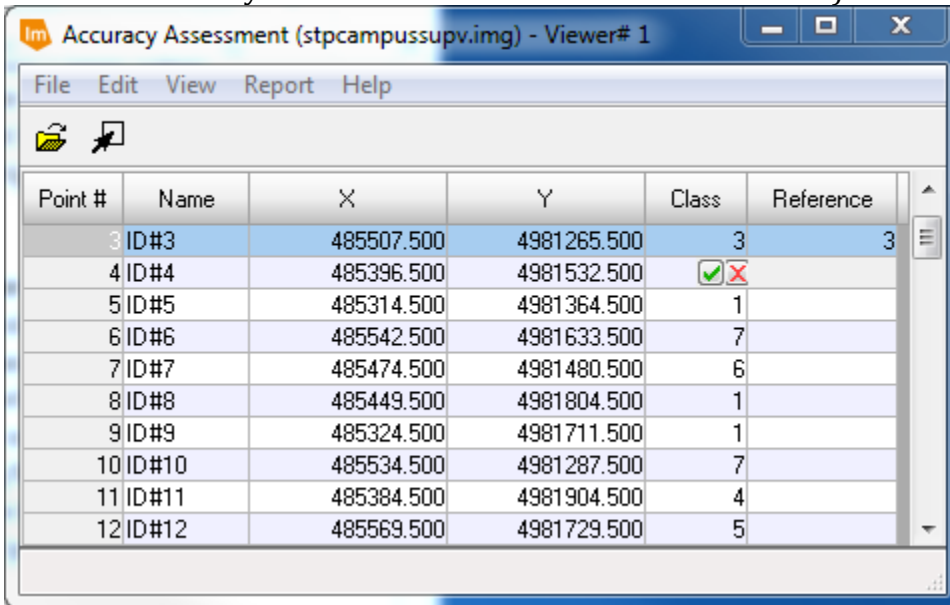
Collecting the Reference Data

To collect the reference data, open **StPCampusStack.img** in another viewer. You may want to change the colors being displayed by the raster bands. Then open a **Raster > Home > Inquire Cursor** in the new viewer and select **Raster > Home > Link All Views** to link the two views together. In the classified image viewer there should be a cursor

and a box. The box indicates the areas shown in the reference window relative to the classified image. The recommended work flow is:
- Select a row in the accuracy assessment window
- Click View > Show Current Selection to see the location of the point
- Zoom to the location of the point (or scroll your mouse to zoom)
- Determine which of the seven reference classes best describe the point
- Enter this value in the **Reference** column in the accuracy assessment window.
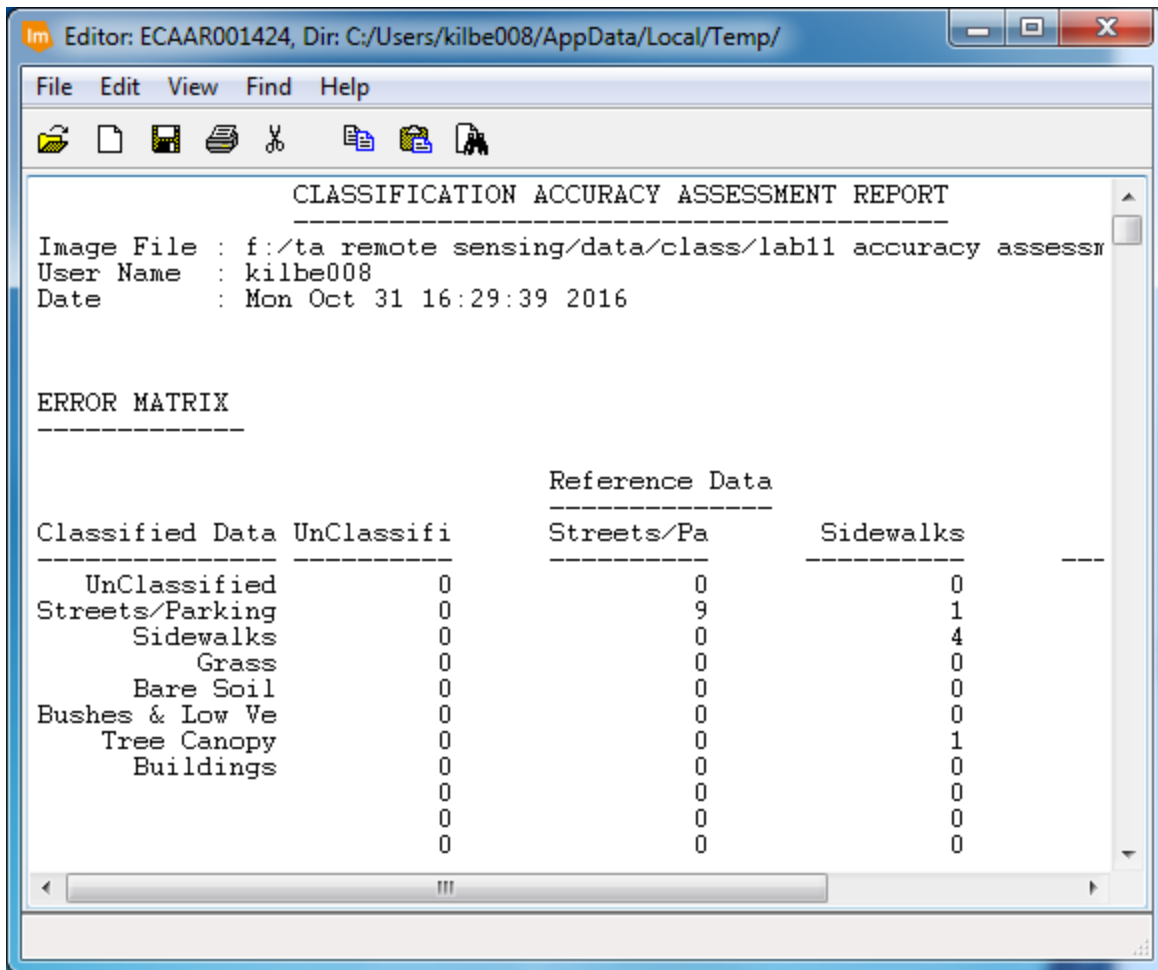- Proceed to the next point and repeat until all 70 points have been assessed

Note that looking at the point's classified values before determining the reference class can bias your interpretation of the reference data. That is, since there is a natural human desire to have your classification be correct, you may be inclined to interpret the reference data so that it matches the classified data. For this reason, to have a statistically defensible accuracy assessment, you must select **Edit / Hide Class Values** in the accuracy assessment window.   (In ERDAS 2016 the system actually x's out the Class value when you click in the reference column as below:)

Point #	Name	X	Y	Class	Reference
3	ID#3	485507.500	4981265.500	3	3
4	ID#4	485396.500	4981532.500	✔✗	
5	ID#5	485314.500	4981364.500	1	
6	ID#6	485542.500	4981633.500	7	
7	ID#7	485474.500	4981480.500	6	
8	ID#8	485449.500	4981804.500	1	
9	ID#9	485324.500	4981711.500	1	
10	ID#10	485534.500	4981287.500	7	
11	ID#11	485384.500	4981904.500	4	
12	ID#12	485569.500	4981729.500	5	

Accuracy Assessment (stpcampussupv.img) - Viewer# 1
File   Edit   View   Report   Help

Producing an Accuracy Assessment Report

Once all of the reference data are collected, Imagine can generate an accuracy assessment report. From the accuracy assessment window, select Report / Options to see the different items you can select to be included in the accuracy assessment report. To actually produce the report, select
Report / Accuracy Report. This will open a text editor window with an accuracy assessment report:

```
 Im  Editor: ECAAR001424, Dir: C:/Users/kilbe008/AppData/Local/Temp/          —  □  x

 File   Edit   View   Find   Help

                   CLASSIFICATION ACCURACY ASSESSMENT REPORT
                   -------------------------------------------
 Image File : f:/ta remote sensing/data/class/lab11 accuracy assessm
 User Name  : kilbe008
 Date       : Mon Oct 31 16:29:39 2016



 ERROR MATRIX
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                                   Reference Data
                                   --------------
 Classified Data UnClassifi        Streets/Pa          Sidewalks
 --------------- ----------        ----------          ----------        ---
      UnClassified        0                 0                  0
   Streets/Parking        0                 9                  1
         Sidewalks        0                 0                  4
             Grass        0                 0                  0
         Bare Soil        0                 0                  0
   Bushes & Low Ve        0                 0                  0
       Tree Canopy        0                 0                  1
         Buildings        0                 0                  0
                          0                 0                  0
                          0                 0                  0
                          0                 0                  0

 ◄                        III                                        ►
```

This will be in the form of a standard error matrix and other measures that we have discussed in the lab lecture. Similar to the change matrices we did in a previous lab, this report can (and should) be cut and pasted into Excel and then formatted for more appealing and useful information.

Accuracy Assessment Review Questions:

1. Produce an accuracy assessment report for the StPCampusSupv image and convert it into an Excel spreadsheet. Discuss your interpretation of the error matrix. In particular: which class seems to be classified the best, which is classified the worst, are any classes "confused"?

2. After analyzing the error matrix, describe one use of this classified image with which you would be comfortable. Also describe one use of this classified image with which you would NOT be comfortable.

3. We used the NAIP data as reference data. Comment on possible advantages and disadvantages of using the NAIP data as reference. (That is, describe ways in which the NAIP data may or may not be "ground truth".)

4. What is the Kappa statistic, and what does it tell you?

5. What complications are involved when you are doing accuracy assessment of change images such as those produced in the last lab?