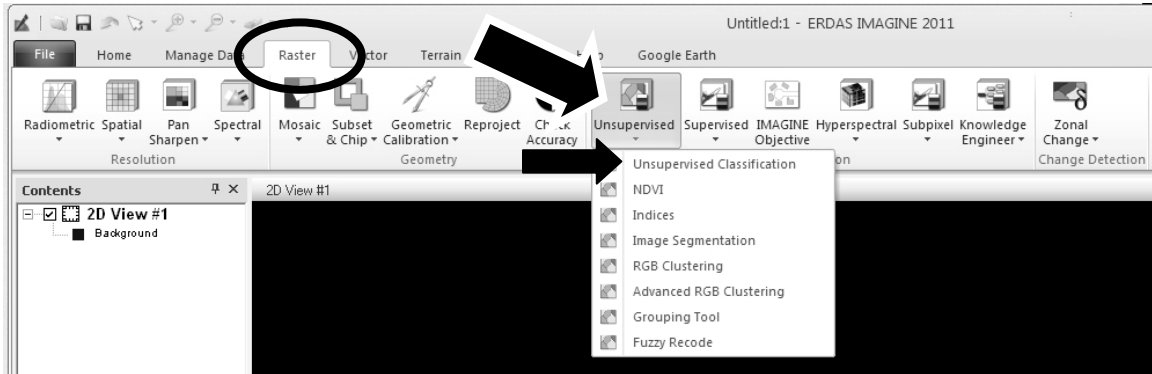


Geo 827 Digital Image Processing and Analysis

Lab 9b. Unsupervised Classification of Imagery

The objectives of this exercise are to introduce you to the procedures for classifying a digital image using the *ISODATA unsupervised classifier*. Previously, you conducted a supervised classification of 30-meter-resolution Landsat-5 TM imagery. In this exercise, you will conduct an unsupervised classification of this same image, so you will be able to compare the unsupervised classification results to those you obtained previously using the supervised Maximum Likelihood classifier and the SAM classifier.

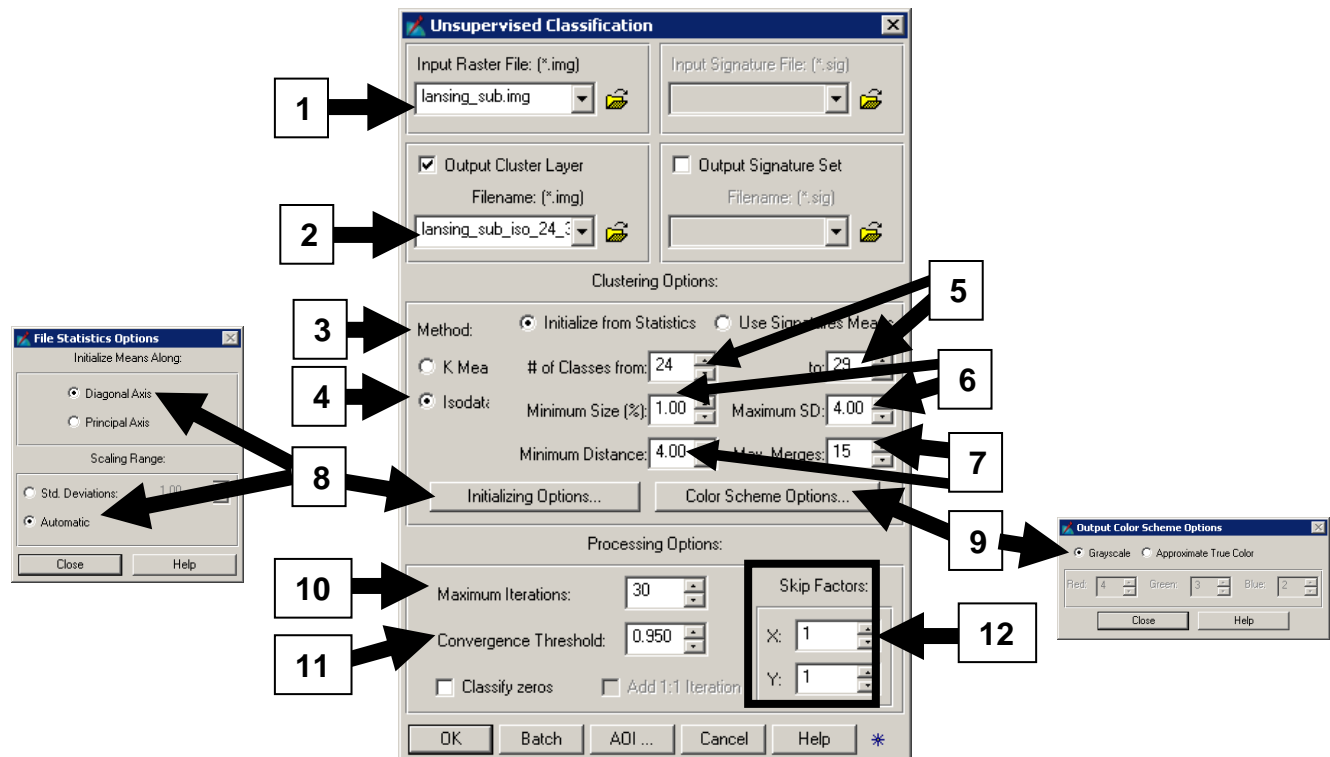
1. **Start** ERDAS Imagine 2014.
2. **Right-mouse-button click** on the “2D View #1” layer in the “Contents” widow and **select Open Raster Layer** from the pop-up menu. Navigate to the file named “**lansing_sub.img**” in your personal folder on the server and click **OK**. **Change the band combination** to whatever **false-color image** you prefer (**5,4,3 or 4,3,2**). **Contrast stretch** this image to your liking for maximum interpretability.
3. From the **Raster** tab, click on the **Unsupervised** button and **select Unsupervised Classification** from the drop-down menu that opens.



4. Enter the following in the **Unsupervised Classification (ISODATA)** dialog window:
 - (1) Input File: **“lansing_sub.img”**
 - (2) Output Cluster Layer File: **lansing_sub_iso_24-30-95.img**
(*save to your personal folder on the server*)
 - (3) Method = ***Initialize from statistics***
 - (4) Method = **Isodata**

- (5) Number of Classes from: **24** to: **29**
- (6) Minimum Size (%): **1.0** Maximum SD (standard deviation): **4.0**
- (7) Minimum Distance: **4** Maximum merges: **15**
- (8) Initializing options: **select Diagonal axis** and **Automatic**
- (9) Set output color scheme to **Grayscale**
- (10) Maximum Iterations: **30**
- (11) Convergence Threshold: **0.95**
- (12) Skip Factor X: **1**
Y: **1** (*i.e.*, don't skip any pixels)

Click **OK** to start the process.



Click **Close** in the Process window when the job is done.

Investigating the Performance of ISODATA

- View the session log to verify the convergence of the ISODATA program: **click** the **File** tab, **click** on **Session** and then **click** on **View Session Log**. After the first iteration, of course, the initial cluster assignments have just been made, so no pixels could move from one cluster to another. After the second iteration, however, 36.5% of the pixels in the scene stayed in their originally-assigned clusters and all 29 allowable clusters were utilized. The convergence percentage increased after the third iteration (29 clusters were utilized), increased again after iteration 4. Record the convergence percentage after each of the iterations 3 – 20 in the table below:

	Convergence %		Convergence %
Iteration 2	36.5	Iteration 12	_____
Iteration 3	_____	Iteration 13	_____
Iteration 4	_____	Iteration 14	_____
Iteration 5	_____	Iteration 15	_____
Iteration 6	_____	Iteration 16	_____
Iteration 7	_____	Iteration 17	_____
Iteration 8	_____	Iteration 18	_____
Iteration 9	_____	Iteration 19	_____
Iteration 10	_____	Iteration 20	_____
Iteration 11	_____		

Note that the ISODATA program stopped on the 16th iteration, because it reached or exceeded the specified convergence threshold of 0.95 (*i.e.*, no more than 5% of the pixels in the scene moved between clusters during the 16th iteration).

Inspecting and labeling the Unsupervised Classification

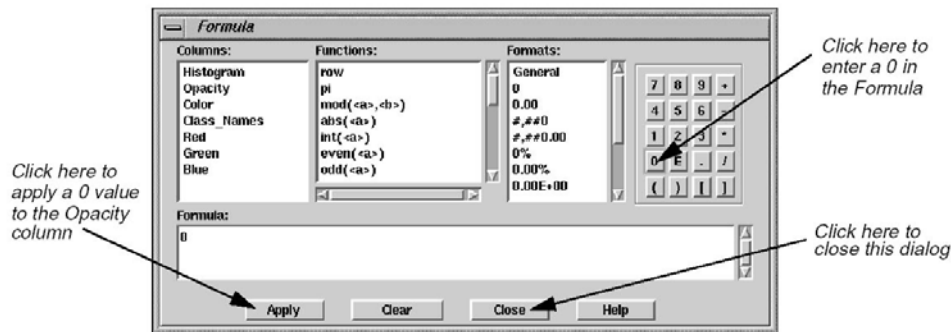
- In order to evaluate the clusters you just created on top of your favorite color composite displayed in “2D View #1”, **right-click** inside the Viewer and **select Open Raster Layer**. **Navigate to** and **open** the “**lansing_sub_iso_24-30-95.img**” file from your personal folder. Since every pixel has been assigned to one of the 29 clusters, the ISODATA classification file totally covers the Landsat image.

In order to effectively evaluate the land cover/use content of each of the 29 clusters, you will need to view each class (*i.e.*, cluster) **displayed individually** on top of the image. To facilitate this type of inspection, the **opacity** of all but one of the classes must be **set to zero**, so that they **become invisible** (*i.e.*, transparent) on top of the color composite.

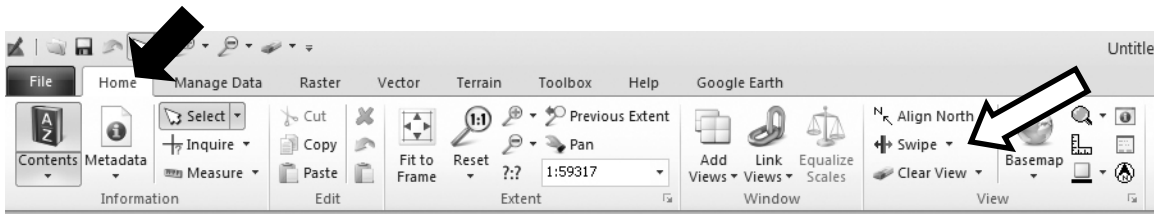
In the Table of Contents on the left side of the ERDAS desktop, **right-click** on the **lansing_sub_iso_24-30-95.img** file and select “Display Attribute Table” from the pop-up menu. The **Attribute Table** opens below the yellow banner across the bottom of the screen. You can either leave the Attribute Table “parked” at the bottom of the screen (left-click-drag the upper boundary of the yellow banner to expand the table), or you can left-click-drag the yellow banner up into the “**2D View #1**” where it will become a “loose” window on top of the “**2D View #1**”.

Left-click on the column name “**Opacity**” to select all 29 cells in the column, then **right-click** on the column name “**Opacity**” to open the *Column Options* pop-up menu. Select “**Formula**” from the *Column Options* menu which opens the Formula window.

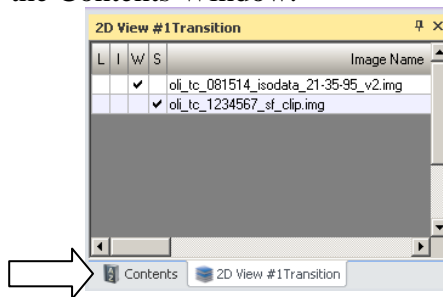
In the **Formula** window, click **0** from the number pad at the right. Note that a “**0**” was placed in the **Formula** field. **Click Apply** to change all of the values in the **Opacity** column to **0**. Note that the Isodata classified image “disappears” from the viewer frame. **Click the Close** button to dismiss the **Formula** window.



7. In the **Attribute Table**, click on **Class 1** to make it active. **Click and hold on the color patch** in the **Color** column for **Class 1** and change the color to something very obvious (*e.g.*, **Yellow**). This provides better visibility in the Viewer. **Change the Opacity for Class 1** by **clicking on this cell** in the table and replacing 0 with **1**.
8. From the main ERDAS toolbar, **click** on the **Swipe** tool icon located within the View group under the **Home** tab. The *Transition Window* opens docked within the contents frame.



The **Transition Window** opens with default settings of a vertical “swipe edge” located 50% across the width of the scene. Since there are only two layers in the Contents frame, the top layer (**lansing_sub_iso_24-30-95.img**, the ISODATA classified output file) has been pre-set to be the **Working** layer and the **lansing_sub.img** layer is pre-set to **Static** (see figure below). Note also, that by clicking on the tabs at the bottom of the contents frame you can display either the Transition Window or the Contents Window.



Because of the default settings, the selected ISODATA cluster (class 1), displayed in Yellow, if present will appear only on the left half of the scene. By manipulating the **Slider Bar** in the “**Transition Extent window**” you can “cover” and “uncover” the color composite image with the classification image (showing only this one class, at the moment).



As a result of your **visual inspection** of the overlay of cluster 1, **decide which cover type(s)** is (are) captured in this cluster and **label it** appropriately in the **Class_Names** column of the Attribute Table; **change its color** to something meaningful (but not yellow, *e.g.*, blue for water) in the **Color** column. For clusters that contain too many cover types to be useful, label them according to the multiple classes (*e.g.*, developed, grass, and bare soil) and assign such a mixed cluster the color Black.

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Save the edited Attribute Table **after each edit** by **right-clicking** the **lansing_sub_iso_24-30-95.img** in the **Contents** pane and **selecting** the “**Save Layer**” option from the pop-up menu.

*** **

To facilitate your comparison with your supervised classification outcome, try to use the same land cover classification scheme:

- **Urban, high intensity** (commercial, industrial and transportation combined)
 - **Urban, low intensity** (residential)
 - **Broadleaf forests** (upland and lowland, combined)
 - **Green herbaceous** (crops/hay/turf grass, combined)
 - **Bare mineral soils, moist and/or high organic matter content**
 - **Bare mineral soils, dry and/or low organic matter content**
 - **Bare organic soils**
 - **Water** (rivers, lakes and ponds, combined)
9. In the **Attribute Table**, click on **Class 1** to make it active and **change the Opacity for Class 1** from 1 back to **0**. Click on **Class 2** to make it active and **change its Opacity** from 0 to **1**. Click and hold on the **color patch** in the **Color** column for **Class 2** and change the color to **Yellow**.

Repeat the above inspection and labeling actions for all the clusters, saving the Attribute Table *after each edit* by saving the **lansing_sub_iso_24-30-95.img** layer.

If you are having difficulties classifying certain land cover types from the Landsat image, refer to the high-resolution imagery on Google Maps (<https://www.google.com/maps/>). Keep in mind, however, that the Landsat TM scene you are interpreting was acquired on June 17, 2001, while the imagery on Google Maps is from 2015 – 14 years later!

The spectral clusters developed by ISODATA may encompass a variety of LULCs at different levels of classification precision (*e.g.*, a cluster may capture the level-2 category “Wooded Wetland” reasonably well, but be a mixture of several level-3 categories [Lowland Hardwoods, Lowland Conifers and Shrub Swamps]). Also, some of the clusters may capture LULC categories that we did not use in our supervised classification.

10. After you are finished labeling all 29 clusters, **close** the Transition tool.



Right-click on the **first row** in the **Attribute Table** and click **“Select All”** from the pop-up menu. **Left-click** on the column name **Opacity** to select this column for activity, then **right-click** on the column name **Opacity** to open the Column Options pop-up menu. Select **“Formula”** from the **Column Options** menu.

In the **Formula** window, **click 1** from the number pad at the right, which places a 1 in the **Formula** field. **Click “Apply”** to change all of the values in the **Opacity** column to **1**. Note that the entire ISODATA classified image “reappears” in the viewer frame. **Click the Close** button to dismiss the **Formula** window.

Review the **Attribute Table** to verify that all 29 clusters are **labeled** and **colored** appropriately to match the categories from the two supervised classifications you performed (*i.e.*, all the water clusters are colored blue; all the broadleaf forest clusters are colored medium green; all the “confused” clusters are black, etc.). **SAVE** the **lansing_sub_iso_24-30-95.img** layer *one final time*.

11. For your own future use, **COMMENT ON THE ADEQUACY OF THESE 29 CLUSTERS**. Are some of them “confused” by containing two or more important land cover/use classes? Which, if any, cover types were adequately classified by one or more clusters? Open your maximum likelihood and SAM output files **in a second and third viewer** and **geolink** them to the “**2D View #1**” viewer. Use the zoom and pan tools to compare these three approaches to image classification.

COMMENTS: