Lab 5 ESRM430
Instructor: Dr. L. Monika Moskal

Lab Objective:

- Image classifications - Part 1

Tools:

- SPRING Software -- version 5.2.7
- Olympia WA digital imagery (true and color near infrared)
  - Date: August 2008
  - Imagery size is 10,000 by 1,500 pixels and 0.1m per pixel.
- Excel File: Lab5.xlsx
- Lots of patience ☺

What you will hand in:

- A Word document containing answers to questions in red, posted to the class dropbox

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Task 1: Set up a directory

- Set up a directory on the C drive to work from. I suggest using …ESRM430/Lab5
- Download Lab 5 materials to your computer from the course website
- Do not work from your flash drive, but do back up the lab folder you have been working with to the flash drive at the end of the lab

Task 2: Open SPRING

The SPRING 5.2.7 software has already been installed on your lab computer. The software is free and can be used on any computer you have permission to install programs on. It can be acquired from the class website.

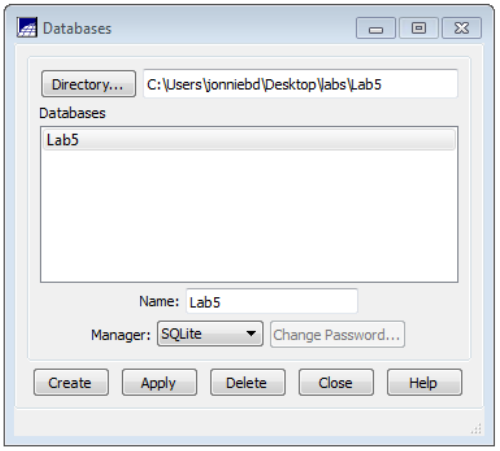
- Open the software by going to All Programs and navigate to the SPRING 5.2.7 folder and click on SPRING 5.2.7

Task 3: Create a Database, Data Model, and Import Imagery

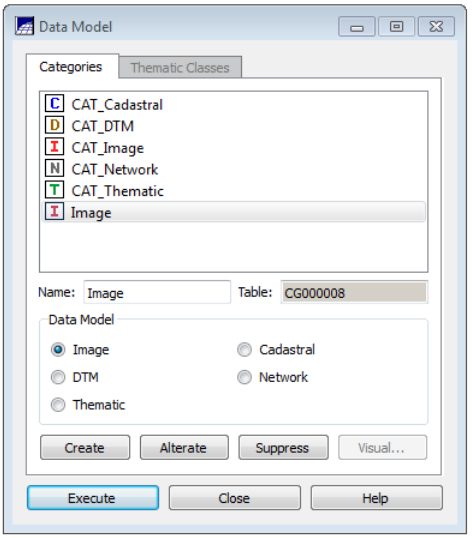
In this task you will create a database, like we did in Lab 4. You will import the true color and color near-infrared imagery on the course website (04406110_TC.TIF, 04406110_NIR2.TIF) of Olympia, WA to work with in the SPRING software. Assume the imagery is not georectified. The steps below are the same as the creating a database, creating a data model, and importing imagery steps in Lab 4.

Step A: Create a database

- After opening SPRING the Database window will open automatically, if it does not in the main menu go to File>Database and create a database with the name "Lab5"; the database type should be SQLite (the Manager drop down box)
- You will be prompted to create a password for your database, choose no unless you want one, it is not required
- Hit the Create and then Apply buttons. If the dialogue box does not close on its own click Close to exit the database dialogue box



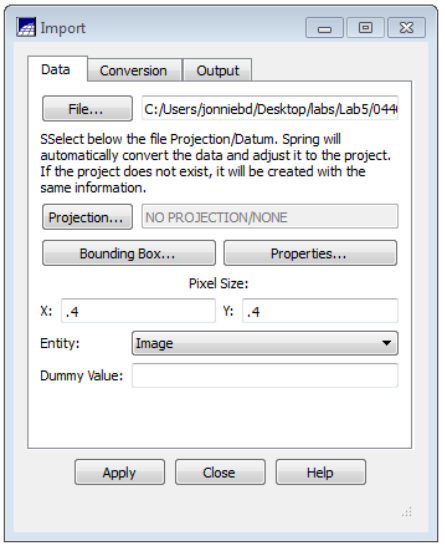
Step B: Choosing a Data Model for the true color imagery



- Go to File>DataModel and choose the CAT_Imade data model
- Enter a name, in this example "Image"
- Hit the Create button and then the Execute button

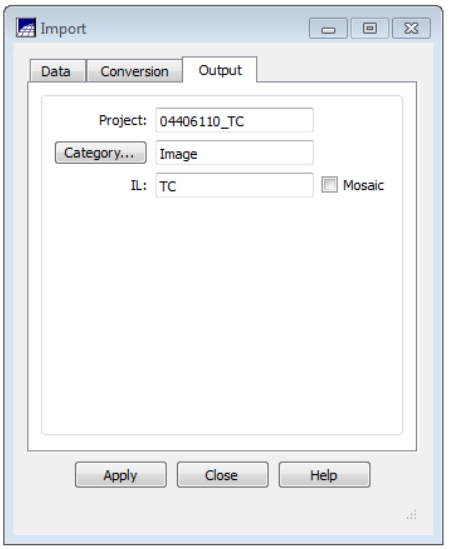
In the past lab you created a data model. This was to show you how to do this if you ever needed to in the future.

Step C: Import the true color imagery (04406110_TC.TIF and 04406110_NIR2.TIF)



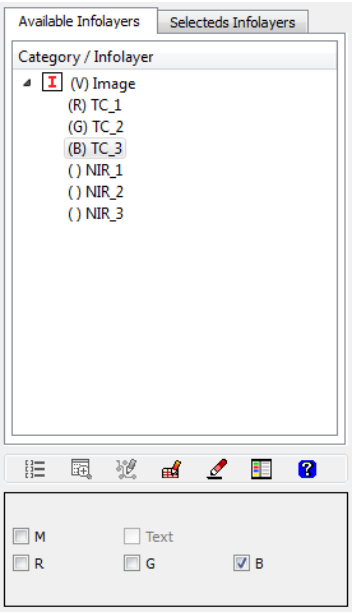
- Import the imagery by going to File>Import>Import Vectorial and Matricial Data
- In the Import window click File and navigate to the folder with the 04406110_TC.TIF and 04406110_NIR2.TIF images (*you may have to change the file type from .spr to TIFF/GEOTIFF(*.tif*.tiff) for your images to appear*)
- Select the image 04406110_TC.TIF
- Entity should be set to Image
- Set Resolution to 0.1 by 0.1 (0.1m pixels)
- Click on the Projection button and set the projection to NO PROJECTION and click Apply

Step D: Name the project and display the imagery



- Click the Output tab and in the Project field name the project "04406110_TC"
- Click the Category button to select the "Image" model type
- Name the IL 'TC' for true color
- Hit the Apply button and then the Close the window
- **Repeat Steps C and D for the near infrared '04406110_NIR2' image (***The only difference will be that you'll type in 'NIR' in the IL field in the Output window*)

- To display your imagery click the control panel icon and click on the TC_1 infolayer to highlight it then click the R radio button to load the red band. Do this for TC_2 for G and TC_3 for blue to load the green and blue bands



I suggest that you display the true color image in the Main tab and the false color near infrared image in the Assistant tab. Subsequent products can be displayed on the additional screen views.

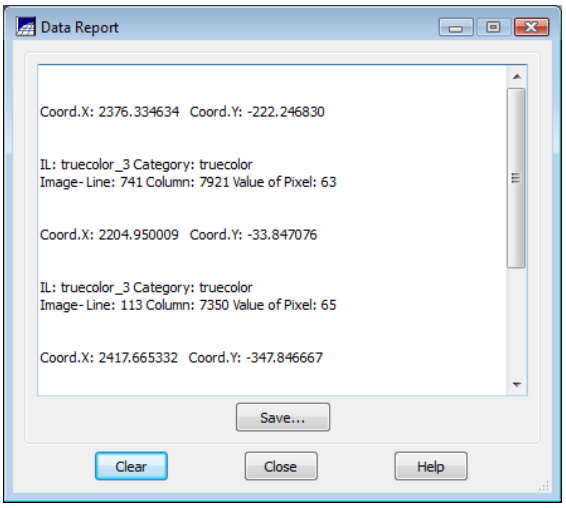
- To load the NIR imagery in a separate tab click the Assistant tab and repeat the steps above for the NIR_1, NIR_2, and NIR_3 bands (NIR_1 = R, NIR_2 = G, NIR_3 = B)

- You can attach the images and subsequent screen views so that as you navigate through the Main view imagery you can always be looking at the same extent in all image screens. To do so use the Attach icon in the main tool bar. From the drop down choose the Assistant tab. The Main and Assistant tabs are now attached

Click back and forth between the Main tab and the Assistant tab to compare differences in the imagery. Note especially how reflective of near-infrared radiation vegetation and buildings are (how red they appear in the NIR image).

Task 4: Extracting Image Information

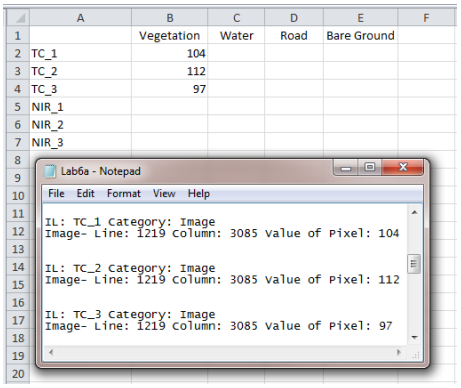
By turning on the Info Cursor you can extract valuable data and create a report of the information from your image.



- Sample the true color and false color imagery at various land cover themes in your image (vegetation, water, road and bare ground) by clicking on these regions. **Note: Be sure to keep track of what image and cover types you are sampling and in what order, you will need to know this for later steps. You can write the cover type into the window text before clicking each new pixel. The Data Report Window will otherwise not keep track of this for you**

- The data values for each band (Red, Green, Blue, or Near Infrared) will be stored in the Data Report window and can be saved in a text file format by clicking Save. Navigate to where you have been saving all previous files, name the file Lab5, and click Save

- Inspect the Lab5.txt file for differences in values. It is helpful to construct a table in Excel to make quick comparisons of pixel values between land cover types and band types.

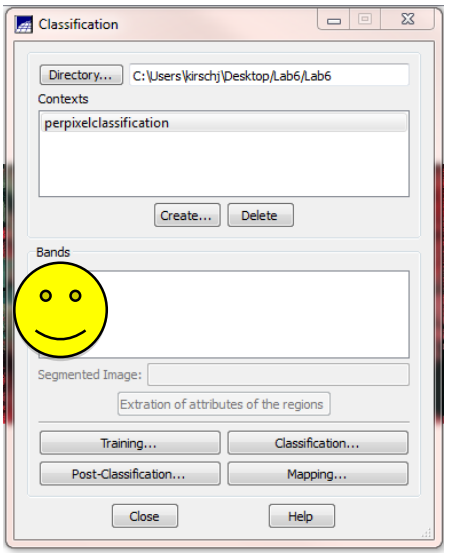


Answer the following question:

1. Based on your tabular or graphic spectral signature data, which imagery (false or true color) is best at distinguishing the 4 land cover categories you tested for? Why?

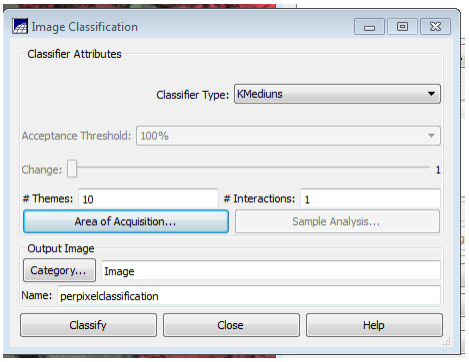
Task 5: Per Pixel Classification

In this task you will focus on classifying the image using the traditional remote sensing approach of **per pixel classification**. You will not be training the computer in class selection; instead you will perform what is called an **unsupervised classification** based solely on the pixel values and not the spatial context of the imagery. You will need to use the imagery that you decided has the best distinguishing capabilities between land cover classes in Task 4 (*either the true color or near infrared imagery*).



- In the Main Menu select Image>Classification…
- Click the Create button and in the Context Creation window name the classification 'perpixelclassification'
- Select the Pixel Analysis Type and highlight the band of the image you think has the best distinguishing capabilities between land cover classes, then click the Apply button

To speed up processing time we're only going to use one band, so select the most appropriate band (*Hint: the one with the greatest amount of separation for your spectral signatures of land cover classes*). In the future you can select multiple bands by holding down the Ctrl key while selecting



- Select the 'perpixelclassification' by clicking on it and in the band Field click on the band you selected in the previous step
- Click the Classification button
- In the Image Classification window select the classifier as KMediuns with # Themes to 10 and # Iterations to 1 (for speed purposes only)
- Name the classification image 'perpixelclassification' and be sure the Category is set to Image and click Classify

Read over the answers to the following questions pertaining to classifications and refer to the Anderson LULC on page 13:

1. What is per pixel classification?

Per pixel classification uses the smallest elements of an image, the pixels, and the spectral values of these pixels. Pixels with similar values are grouped together using an algorithm. Statistical information for the classification is based on the pixel brightness values only. Classification can be used in thematic maps or can be further incorporated into digital analysis. It can be performed on single or multiple image bands to separate areas according to their different scattering or spectral characteristics.

2. What's an unsupervised classification?

Unsupervised classification is the categorization of digital image data by computer processing based solely on the image statistics without availability of training samples. The classification creates natural groupings in the image values, called spectral clusters or classes. In this fashion, values with similar grey levels are assumed to belong to the same cover type. The analyst must then determine the identity of these spectral clusters. Principle clustering algorithms include: K-means clustering, ISODATA clustering, and Narenda-Goldberg clustering.

3. Which band did you choose to use for your classification?

Near infrared band 1

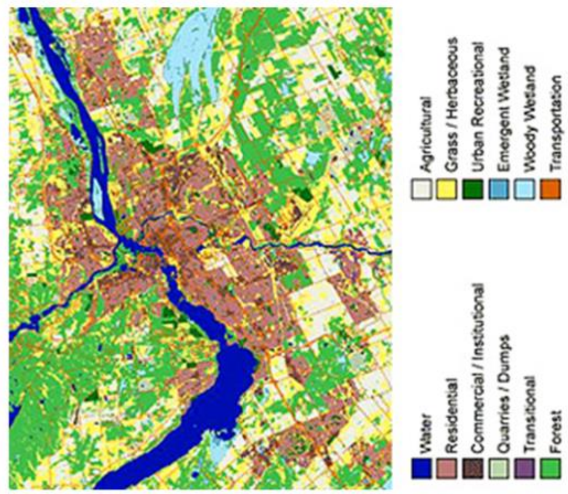
4. **What is the general look of the classification? Think about the manual delineations and automated delineations you have already performed.**

Pixelated, like there is lots of noise in the classification. It would need a lot of filtering to clean it up.

5. **Which Anderson Land Use/ Land Cover (LULC) classes are well identified by your unsupervised classification?**

Water, aquatic vegetation, roads and bare ground.

Level III
111. Single-family Units
112. Multi-family Units
113. Group Quarters
114. Residential Hotels
115. Mobile Home Parks
116. Transient Lodging
117. Other



Level I map using the Anderson LULC Classification (1976-pdf on class website)

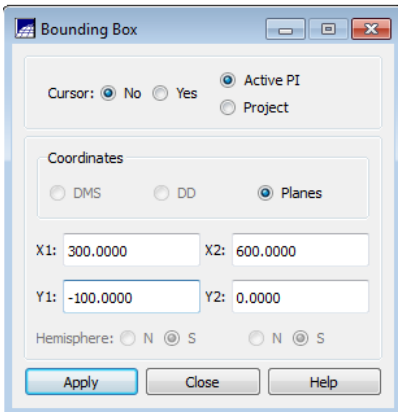
Level I	Level II
1 Urban or Built-up Land	11 Residential
	12 Commercial and Services
	13 Industrial
	14 Transportation, Communications, and Utilities
	15 Industrial and Commercial Complexes
	16 Mixed Urban or Built-up Land
	17 Other Urban or Built-up Land
2 Agricultural Land	21 Cropland and Pasture
	22 Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural
	23 Confined Feeding Operations
	24 Other Agricultural Land
3 Rangeland	31 Herbaceous Rangeland
	32 Shrub and Brush Rangeland
	33 Mixed Rangeland
4 Forest Land	41 Deciduous Forest Land
	42 Evergreen Forest Land
	43 Mixed Forest Land
5 Water	51 Streams and Canals
	52 Lakes
	53 Reservoirs
	54 Bays and Estuaries
6 Wetland	61 Forested Wetland
	62 Nonforested Wetland
7 Barren Land	71 Dry Salt Flats
	72 Beaches
	73 Sandy Areas other than Beaches
	74 Bare Exposed Rock
	75 Strip Mines Quarries, and Gravel Pits
	76 Transitional Areas
	77 Mixed Barren Land
8 Tundra	81 Shrub and Brush Tundra
	82 Herbaceous Tundra
	83 Bare Ground Tundra
	84 Wet Tundra
	85 Mixed Tundra
9 Perennial Snow or Ice	91 Perennial Areas

Task 6: Feature Based Classification Step 1: Segmentation

In this Task you will produce a feature based

classification. To do so you will need to segment your imagery similar to the procedures used in Lab 4.

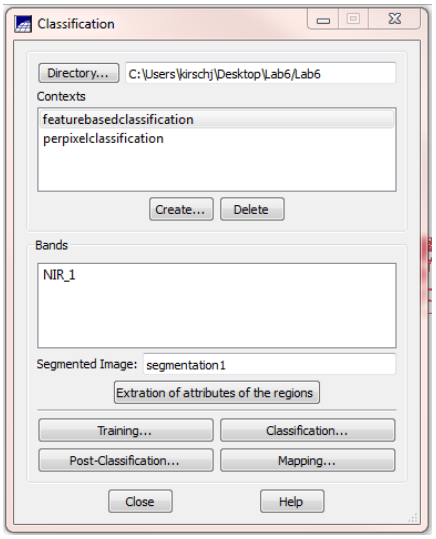
- Go to Image>Segmentation to open the Segmentation window
- In the Segmentation window use a Similarity of 10 and an Area (pixels) of 1000, and use the same image and band that you used in **Task 5**
- In the IL field name the segmentation 'segmentation1'
- We will only segment a subset of the imagery to speed up processing time. Click the Bounding box button and enter the values given below:
    - X1: 300
    - X2: 600
    - Y1: -100
    - Y2: 0



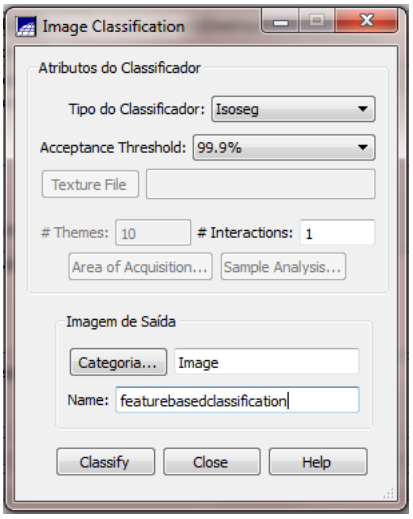
Click Apply and this process will run for a few minutes, use the time to write up your lab.

Task 7: Feature Based Classification Step 2: Feature Based Classification

Use the segmentation you produced in **Task 6** to run a feature based classification of the same image and band you used in **Task 5**.



- Go to Image>Classification
- You will need to create a new classification, click Create to open the Context Creation window. Name the classification 'feaurebasedclassification'
- Click the **Regions** radio button for the Analysis Type
- **Choose an appropriate band to classify**, select the feature based segmentation you created in Task 6 and then click Apply to close the Context Creation window
- With the Classification window still open click the 'featurebasedclassification' Context and then click the Extration of Attributes of the Regions button. After this process finishes click the Classification button to open the Image Classification window
- Use the Isoseg classifier type (*this is an unsupervised clasifier*), with an acceptance treshold of 99.9%. Set the # of Themes to 10 and the # of Interactions to 1. Be sure the Category is set to Image and name the classification 'feaurebasedclassification', then click Classify



Answer the following question:

2. In the feature extraction classification one of the options is to implement image texture, why might you want to do so? Discuss the differences you observed between the two unsupervised classifications you produced using the per pixel and the feature extraction methods. Please list the pros and cons of each method.