

Name: _____

Remote Sensing of the Environment
GEOG/GEOL 4093/5093
Spring Semester 2008

Lab Exercise #9: 11/06/2008
Due: 11/13/2008

Cryospheric Applications of Remote Sensing

Launch Internet Explorer and type [\\nyx\rs4093](http://nyx.rs4093) into address bar and hit enter, that takes you to the remote sensing class folder “rs4093” in CIRES server. Copy the folder “Lab_9” to “C:” drive.

One important application of remote sensing is the classification of land cover types. In this lab you will get a small sample of image classification techniques and their application to snow and ice.

Begin by displaying a 5,4,3 RGB composite of the image **C:\Lab_9\quel_1992_tm_dark_obj**. This is a subset of a Landsat TM image covering the Quelccaya (pronounced “kwel-KĪ-ah”) ice cap in southern Peru. In this band combination, the bedrock will appear reddish and the ice cap will appear cyan to blue. For more background information, see: <http://pubs.usgs.gov/prof/p1386i/peru/orient.html#VILC>

1. What color does vegetation appear in this band combination? What about water (1)?

There are a number of techniques for classifying an image. These techniques are generally broken down into two major categories, **supervised** classification techniques and **unsupervised** classification techniques. In supervised techniques, the user will provide the system with some information regarding either the land cover of the image or the spectral signature of different land covers. The system will then apply the known spectral information to the rest of the image and determine a class for some or all pixels. Unsupervised techniques, on the other hand, do not require any *a priori* knowledge of the area. Instead, the system analyzes the spectra of every pixel and groups them into clusters. These clusters serve as classes and the user is left to determine what land cover classes correspond to each cluster.

Part I: Supervised Techniques

Here you will use the familiar ROI tool to define some land cover classes. You will then use several supervised techniques to classify ice and snow in the image.

From the main ENVI menu, under Basic Tools, choose the ROI tool and begin drawing a new polygon that encloses an area that you are confident is purely ice or snow (not a mix with other land covers). Close the polygon by right clicking inside of it twice. Create new ROIs for water, vegetation and bedrock. Try to choose homogeneous areas. Refer to the figure attached for sample locations of each of these cover types.

Once you have created four ROIs, choose “Select All” and then click “Stats”. This should calculate and plot mean spectra for each of the regions.

4. What areas are classified as ice and snow? What areas are missed? Why do you think you got this pattern? Find a way to calculate the area of the ice and snow and give it in km^2 (4).

Return to the Endmember Collection window. Click *Apply* again. Use the same parameters, but change the angle to 0.35 radians. Display the resulting image.

5. What are you actually doing when you change the angle to 0.35 radians? Draw a sketch of this. What effects did changing the angle have on the classification? Is this a better classification of ice? What areas are still missed (3)?

In the Endmember Collection window, change the algorithm to *Minimum Distance*. This classification scheme calculates the Euclidean distance from each image pixel to the mean vectors of each class that you provided. The endmembers should already be loaded. Click *Apply*. Again, choose Memory as the output and do not output a rule image. Enter 100 as the max distance. (You can experiment with other $\frac{1}{2}$ -widths). Display the resulting image in a new window. Link all open windows and compare the classifications.

6. How does the minimum distance algorithm perform compared to the SAM algorithm? Where does it do better? Where does it do worse (2)?

7. Does the Minimum Distance or the SAM algorithm classify more pixels as vegetation (2)?

Change the algorithm to *Parallelepiped*. This is a very simple classification technique. You can read about it in the ENVI online help. Choose 100 as the half-width.

8. How does the simple Parallelepiped algorithm compare to the other two classification schemes (2)?

9. Which of these supervised techniques seems to do the best job in classifying ice and snow in this image (2)?

10. Do any of the algorithms correctly classify all of the ice and snow in the image? Why do you think this is so (2)?

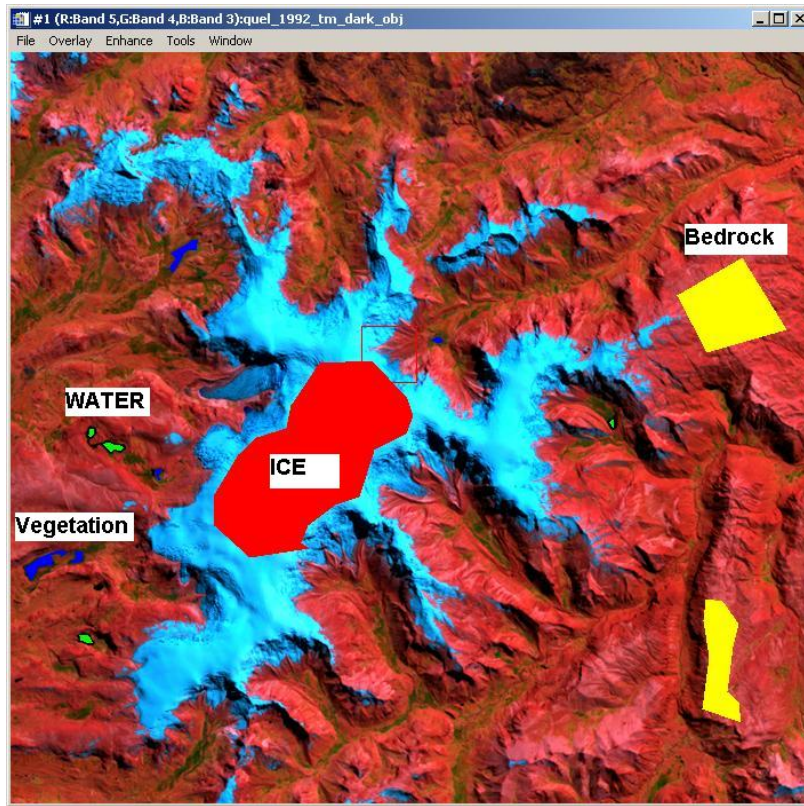


Figure 1: Location of possible spectral sample training sites.