ERTH135 LAB 6 – Image Classification Due May 20

Instructions
Please save your code for the following exercises to an m-file and send it to me by email (mwei@ucsd.edu). To help you get started, a demonstration of this lab is in lab6demo.m.

This lab is about image classification. It uses the same 7-band Landsat image of San Diego used in Lab 5, available at ftp://topex.ucsd.edu/pub/class/rs/LAB5_6/. This is a complicated lab, so all steps of the lab have been demonstrated in lab6demo.m on a simple 3-band RGB image, demo.jpg. You should start by downloading these files and running this script to help you understand the steps of the lab. For an overview of classification, read Rees p296-300.

Image classification generally has 3 steps:

1) Create a "training set" of pixels you identify as belonging to a certain group.
2) Classify all the pixels of an image into groups based on your training set.
3) Assess how well each pixel fits into a group, and identify pixels that do not fit well into any group.

1) Start by reading in all 7 bands of the San Diego Landsat image. Display all 7 bands individually, and also display an RGB image (This is exactly the same as problem 2 in Lab 5). You will use this RGB image to identify pixels for your training set.

2) Decide how many "groups" or "classes" you'd like to sort your image into: e.g., "kelp beds", "ocean", "golf courses", etc. Create a 3-column matrix, "tpix", containing the row, column, and group number of each training pixel. To do this, use the Data Cursor feature in your RGB image window. Click on a pixel in the image and a box opens telling you the x-value (column), y-value(row), and R-, G-, and B-values of that pixel. You will need to identify at least 2 training pixels per group. When you have identified the location of each training pixel, create a 7-column matrix, "train", that contains each of the 7 band-values for every pixel identified in tpix.

3a) Before we can use Matlab's classify function, the image data need to be reshaped into a vector with 7 columns (the 7 band values) and nx*ny rows. For this Landsat image, nx=ny=1500, so the matrix of all pixels, "AllPix", will have 7 columns and 2,250,000 rows. Also, in order to use classify, AllPix, train, and group must be data-type double, not uint8, so you will need to convert them.

3b) Classify the image using Matlab's classify function. This step may take the computer a minute. The syntax for this command is:

```
[class, err, misfit] = classify(AllPix, train, group);
```

AllPix is the matrix of 7 band-values for each pixel across the image, train is your training set, and group is which group each training pixel belongs to. Class is a vector telling you which group each pixel belongs to, err is a dummy variable you can ignore, and misfit is a matrix telling you how well each pixel fits into each group (0=doesn't fit, 1= perfect fit).

3c) To look at the classification and the misfit, we'll need to reshape class and misfit back into matrices nx-by-ny. Then we can look at the classification with image or imagesc. (You can use any colormap for this, or if you like you can create a colormap with a color for each group number that makes sense to you, e.g., green for golf courses, blue for ocean. See lab6demo.m for how to do this.) Does the classification make sense? Is all the ocean in one group? All the golf courses in another?

4) OPTIONAL BONUS: Look at the misfit matrix for each group/class. Find the maximum group-misfit value for each pixel: this tells you which pixels fit well into one of the defined groups. Find the pixels with maximum group-misfit value less than 0.9 (pixels that don't fit into any of the groups), and change their class value to a new group number. Now look at the class matrix again with image or imagesc. Where are the pixels that weren't well fit by any of your training set pixels?

5) OPTIONAL BONUS: Redo your classification with a different training set. Add training pixels to existing groups, and add new classes (eg roads, buildings, etc). Can

you create a classified image that properly represents most of the physical features in the Landsat image?