EE/GP140 – The Earth From Space – Winter 2008 **Handout 7**
Lab exercise #1

Today's exercise involves examining and interpreting several remote sensing images of the Earth's surface. Specifically, we are going to look at images of our own local neighborhood. Most of these data were acquired by the Landsat Thematic Mapper satellite. Follow each of the steps below in order to analyze the images. Where noted, record items for your writeup. The writeups may be fairly informal, but be sure to include all necessary information.

1. Turn on the computer monitor and log in using your Leland ID and password.

2. You will be using a program called "Scion Image" and viewing some data files that you will store on the computer's desktop. Note that your personal desktop and the visible Desktop on the computer may not be the same, depending on the computer configuration. If your downloaded files do not appear on your visible desktop, navigate through your user name and the "Documents and Settings" folder to find your personal desktop folder. Open a web browser, and go to the class web page at http://www.stanford.edu/class/ee140.

3. First, you will need to load the Image program. It will probably be installed on your computer already if you are seated at one of the cluster machines. If not, install it yourself from the web page. Under the Software tab on the class page, download the file InstallImage.exe to the desktop. Execute this file by double clicking and install it on the desktop.

4. Next, select the Homework tab on the class web page. Download the file under "Zip file for Lab Exercise 1'. Unzip this file by double clicking. If your computer does not have WinZip already installed to unzip the exercise folder, you can download it from the Software tab and use this version of the program to unzip the exercise.

5. Start the Scion Image program.

6. When the program starts up, open the "file" menu, and select "import."

7. Navigate the menu to find the desktop, and double click to select it.

8. Locate the Ex. 1 directory on the desktop, and double click to open it.

9. To begin, open the Ex. 1 folder. Inside you should see several files, stanford.hires.tiff, stanford.rgb.tiff, stanford.cir.tiff, and sf6by6.cir.tiff. On some machines, Windows does not show the last suffix of a filename and the files are called stanford.rgb, etc. We will begin with the stanford.hires.tiff file, which as you might expect, is an image of the campus.

10. Find the Ex. 1 directory in the pulldown menu in Image and double click on stanford.hires.tiff.

11. Click OK in the dialogue box that appears.

12. Use the hand tool to move the picture around.

13. Find in the image where you are now sitting, your dorm (if visible), and the fountain in front of Hoover Tower.

14. In Image, select the tool that looks like a dotted outline box from the tool window. You can still locate the precise pixel position using the hand tool, but the smaller cursor for the box tool makes this easier.

15. Click on the "info" window to bring it to the foreground. If necessary, move the window so that you can see it and the image simultaneously. Place the cursor on each of the three items listed above and note the position on each in pixels. We'll define these on the board during class.

We will now study stanford.rgb.tiff, stanford.cir.tiff, and sf6by6.cir.tiff. Each of the Stanford images is 1024 by 1024 pixels in size. Each pixel represents 28.5 x 28.5 meters on the ground. The SF image will be of the bay area, also 1024x1024 but the pixels are now larger.

16. Open the Ex. 1 folder again in Image to see the files.

17. Find the Ex. 1 directory in the pulldown menu in Image and double click on stanford.rgb.tiff (or stanford.rgb).

18. Find each of the following in the image. You may find this easier using the Zoom tool- it looks like a magnifying glass. Use the hand tool to reposition the image, if necessary.

The Dumbarton Bridge
Moffett Field runways
SLAC
Highway 280
Stanford
Stanford Stadium
Your house/dorm

Next, we will make some distance measurements. We can use the Pythagorean theorem to get the length of diagonal lines:

$$\text{distance} = \sqrt{x^2 + y^2}$$

where distance is the diagonal distance, and x and y are the horizontal and vertical lengths of a line.

19. In Image, select the tool that looks like a dotted outline box from the tool window.

20. Click on the "info" window to bring it to the foreground. If necessary, move the window so that you can see it and the image simultaneously.

21. Now, as you move the cursor around in the image window the info window gives you the location in pixels and inches.

22. What is the location of the field in Stanford Stadium in pixels ?

23. Find the Dish, one of three dots on the hill bewteen Stanford and Highway 280. What is its location in pixels ?

24. Calculate the distance between the two locations in pixels in x and y, that is horizontally and vertically. With these two number, estimate the distance from one location to the other in pixels ?

25. Since the pixel spacing in this image is 28.5 meters, multiply the value in pixels by 28.5 to get the distance in meters.

Now that we know how to calculate distances, we'll let the computer do the work. We have to set the measurement scale so the computer knows the pixel spacing.

26. Select the item "Set Scale" from the "Analyze" menu.

27. On the "Units" submenu, select meters.

28. Enter 1.0 for measured distance, and 28.5 for known distance. The scale should read "Scale 0.035 pixels per meter".

29. Click OK.

Now distances show in the info window in meters.

30. Next, move the image window to the right by placing the mouse in the top portion of the window and dragging. Move it just enough that you can read the values in the info window easily.

31. Select the line tool (looks like a slanted line) from the tool window.

32. Place the cursor anywhere in the image. Holding the mouse button down, move the cursor, drawing a line from where you started to where you end up. Keeping the mouse button depressed at the end of the line allows you to read the line length directly from the

info window. Use this method to again measure the distance from the stadium to the dish. If you want to erase the line you have just drawn, use the Edit -> Undo command.

33. How long is SLAC's accelerator ?

34. How long is the longest runway at Moffett Field ?

35. What is the length of the Dumbarton bridge from the edges of the Bay proper ?

36. Finally, open the second image of the area called "stanford.cir.tiff" through the import menu as before. Examine the colors in this image. Using your knowledge of the local geography, which color corresponds most closely to areas covered by vegetation ? Identify areas of dense vegetation growth. This coloring follows from displaying the reflectance of the ground at infrared wavelengths as red.

Let's now look at a larger scale image. Close the Stanford image by clicking in the small box at the upper right (on some machines, upper left) of the image window.

Open the sf6by6cir.tiff image through the import menu as before.

37. Reset the scale by again opening "set scale" under "Analyze." Set units to meters, measured distance to 1 pixel, and known distance to 171 meters. The scale should read 0.005848 pixels per meter. Click OK.

38. Find the approximate location of Stanford on this image.

39. Find the approximate location of the San Andreas fault by imagining a line that goes through the Crystal Springs reservoir along highway 280. Note how close this line runs by Stanford.

40. Examine the image to find the areas of densest vegetation (red color). What geographical areas are most heavily vegetated ?

41. About how far is it from Santa Cruz to San Francisco, as the crow flies ?

42. Would you expect there to be a road that runs along a straight line from Santa Cruz to San Francisco ? Could one be built easily ?

*Analysis of your home town

This section is to be completed and turned in as part of your Week 1 homework assignment.

In this exercise, you will download a satellite image from the web and analyze its characteristics. I suggest that you choose your home town for the area you wish to analyze, but you may select any region you are familiar with. If, for example, the images

available for your home town are not very high quality, you may pick Palo Alto, or any other region you have visited often.

43. Open a web browser and point it to Google. Above the Google banner, click on "Maps."

44. Enter your town in the search window, and press return. A map of your area should be visible in the window.

45. Click the "Satellite" button to get the satellite image. If none exists or if it is of poor quality, select another region by name.

46. Expand the Google window to full screen.

47. Zoom as you like and pan around until the displayed image contains several landmarks with which you are familiar.

48. Save this image to the clipboard by typing either Alt – Print Screen or Function – Print Screen, depending on your keyboard layout.

49. The program MWSnap may be already installed on your machine. If not, install it as in items 50- 51 below.

50. Once this image is saved, go to the class website, and download the program MWSnap from the software tab on the web site.

51. Run the installer and install the software onto your desktop.

52. Start MWSnap. Under the Edit menu, select "Paste." This should place your image in the window.

53. Under the file menu, select "Save as…".

54. Under "Save in," select Desktop.

55. Choose a name for your file, such as Myhometown.

56. Under "Save as type,", select "TIFF files (*.tif)." Save the file and exit MWSnap.

57. Start or Open Scion Image. Under the file menu, select Open, find your file, and open it.

58. Now, when you place your cursor over your image you should be able to see the cursor location in the Info window.

59. Find two landmarks that you recognize, and record their positions in units of pixels. Calculate the distance between them in pixels. Estimate the actual distance between the landmarks and find the pixel spacing for your image.

60. Now, find at least 2 more recognizable landmarks in the image and calculate the distance between these two. For example, you may want to calculate the distance from your home to your high school, or from your town to a neighboring town. Record all of these distances and turn them in as part of the Week 1 homework writeup.

Shut down your computer and finish.