CMPUT 206:  
Introduction to Digital Image Processing

Lab/Assignment 3 (for the week starting 28 Jan 2008)

Topic: Image Analysis using

Due Date: 1 Feb, 2007 Friday before noon

Submission:  
(Email to TA Saul Rodriguez srodrigu@cs.ualberta.ca)

Note that animation and project work with high quality may be used in demos to other students and audience visiting University of Alberta, or used for research purpose. If you don’t agree, please email Dr. Anup Basu explaining your reason.
1. (a) Given the image above with the integers representing grayscale values, apply the Gradient approach ($\sqrt{g_x^2 + g_y^2}$) to detect the edges.

Put a “X” on the pixel which is detected as an edge pixel, assuming a threshold of 5.

Hint: focus on the blue region and its neighboring pixels.

(b) Put a “X” on the pixel which is detected as an edge pixel, assuming a threshold of 1.
For each of the following, use Photoshop to open the above image and discard the colors. The kernel size is 3x3.

(a) Then define a Prewitt kernel (horizontal) to filter the image. Insert the resulting image next to the color one above.

(b) Repeat the above but use a Sobel kernel (horizontal) to filter the grayscale image. Insert the resulting image next to the one from Prewitt.

(c) Describe the difference between the two (You may want to display both images using Photoshop to compare)?

(d) Define a low filter and apply to the image. Insert the resulting image below.

(e) Define a high filter and apply to the image. Insert the resulting image next to the one above.

(f) Describe the difference between the images obtained in (d) and (e).
(g) Use Photoshop “Maximum” filter with a radius of 5 pixels on the image. Save the image and Insert below.

(h) In (g) above, change the number of radius pixels from a small value to a big value and describe what happens to the image.

(i) Repeat (g) with a “Minimum” filter and image the resulting image next to the resulting image from (g) above.
3.

(a) Let the red square be the horizontal Prewitt kernel. Move it across the image. When it centers at the first “4” (x=4, y=4), what is the new value (g_x)?

(b) At the same pixel (x=4, y=4) and if the red square is the vertical Prewitt kernel, what is the new value (g_y)?

(c) What is $\sqrt{g_x^2 + g_y^2}$?

(d) Repeat at the same pixel (x=4, y=4) using Sobel kernel. What is $\sqrt{g_x^2 + g_y^2}$?

(e) Suggest a threshold value that can detect this pixel as an edge by Sobel but not by Prewitt.
4.

Assuming the white pixels have value 50, and the blue pixels have value 100. What is the new value of the top left corner pixel (○) after applying the median filter:

(a) When the median filter is in the shape of a 3x5 rectangle.

(b) When the median filter is in the shape of a cross.