EE 4830 Digital Image Processing **Homework #4**

Due Date: April 14^{th} 2005

Readings: Chapter 5 of G&W, Matlab example for Weiner Filtering

Problem #1: Derivation of Motion Blur Filter (50%)

See Problem 5.19 of the textbook (Gonzalez and Woods)

Problem #2: Choose one from the following 2 options.

(Note for both experiments listed below, there are existing Matlab functions you can use. For example, the Weiner deconvolution function and the contour tracing function. Feel free to use those. But if you have interest and are able to implement your own functions by applying what we taught in the class, it will be great and we will assign bonus points for such efforts.)

Option A:

Matlab Experiment of Weiner Filtering (50%)

(see the Matlab example in wiener-filter.htm on the course web site)

This problem allows you to gain familiarity with the design of Weiner Filter and its effect on image restoration.

Download the color image lena.jpg from the course web site. Its resolution is 256 by 256.

(a) Simulate a case of a linear motion across 15 pixels at an angle of 25 degree. Use the "fspecial" function in Matlab to generate the point spread function (i.e., h) of the motion blur filter. Apply the filter to the image and plot the blurred image.

(b) Simulate the effect of the additive noise. Use "randn" function in Matlab to generate a noise with the normal distribution with zero mean and variance of 0.25. Add the simulated noise to the blurred image from (a). Plot the image with the additive noise.

(c) Follow the Matlab example to compute the autocorrelation functions of the image and the noise. Apply the Weiner Filter to the blurred image from (b) to get a restored image. Plot the restored image.

Compute the SNR between the restored image and the original image before blurring and noise.

(d) If we don't use the full knowledge about the autocorrelation functions, instead just use the SNR between the noise and the image, what will be the quality of the restored image?

Follow the Matlab example to compute the NSR between the noise and the image. Apply the Weiner filter with the SNR value and the blur filter only, but not the autocorrelation functions.

Plot the restored image and compute the SNR between the restored image and the original image before blurring and noise. Compare them to the results from part (c).

Option B:

Matlab Experiment of boundary tracing (50%)

(see the matlab example *ipexradius.htm* provided on the course web site)

We will experiment with Matlab tools for detecting the object boundary and measuring its size in this problem.

First, read the image "HW4-sp05-image.png" into Matlab. It is an image showing a few objects like rubber bands, the pen cap, and two pills.

(1) Convert the image to black and white and detect a point on the boundary of the rubber band (the one shown in the upper right area).

(2) Use the "bwtraceboundary" function in Matlab to trace a segment of boundary of the rubber band. Plot the traced boundary over the original image.

(3) Use matlab codes similar to those in the example program *ipexradius.htm* to find a circle that best-fits the traced boundary segment. Plot the estimated circle over the original image.