EE 4830 Digital Image Processing **Homework #5**

Due Date: March 29th 2006

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: Matlab Experiment of Wiener Filtering (50%)

> *Note for this problem, feel free to use the existing Matlab functions such as the Wiener deconvolution function (`deconvwnr`). Matlab examples have been included in the file "`weiner-filter.htm`". 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.*

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 20 pixels at an angle of 30 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.

Estimate the quality of the restored image by computing the SNR (in dB) between the restored image and the original image before blurring and adding noise.

(d) If we don't use the full knowledge about the autocorrelation functions, instead just use the noise-to-signal power ratio (NSR) between the noise and the image, what will be the quality of the restored image? Note you don't have to convert NSR to the dB unit.

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

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