

Inel 5327

Final Project

Name: _____

Spring 2009

StudentID: _____

Due Date: 14 May 2009

100 points

1. 2-D Fast Fourier Transform

- (a) Write a computer program the 2D FFT of an image.
- (b) Your program should be able to center the transform for filtering, compute inverse Fourier transform and compute the spectrum.
Your report should include Fig. 4.41(a) from the book web site and compute its (centered) Fourier spectrum and Display the spectrum.

2. Low pass filtering

- (a) Implement the Gaussian lowpass filter in Eq. (4.8-7). You must be able to specify the size, $M \times N$, of the resulting 2D function. In addition, you must be able to specify the location of the center of the Gaussian function.
- (b) Download Fig. 4.41(a) from the book web site and lowpass filter it to duplicate the results in Fig. 4.48.

3.High pass filtering

- (a) Implement the Gaussian highpass filter of Eq. (4.9-4). (Note that you can use the low pass filtering program to generate highpass filters.)
- (b) Download Fig. 4.41(a) from the book web site and highpass filter it to duplicate the results in Fig. 4.56.

4. Noise generator

- (a) Find (or develop) a program to add Gaussian noise to an image. You must be able to specify the noise mean and variance.
- (b) Find (or develop) a program to add salt-and-pepper (impulse) noise to an image. You must be able to specify the probabilities of each of the two noise components.
- (c) Implement other noise generators to add noise to image using matlab functions for uniform, Rayleigh noise, etc.

5. Median filtering

- (a) Use the spatial filtering function you did in your project to implement a 3x3 median filter.
- (b) Download Fig. 5.7(a) from the book web site and add salt-and-pepper noise to it, with $P_a = P_b = 0.2$.
- (c) Apply median filtering to the image in (b). Explain any major differences between your result and Fig. 5.10(b).

6. Periodic noise reduction using notch filter

- (a) Write a program that implements sinusoidal noise of the form given in Problem 5.14. The inputs to the program must be the amplitude, A , and the two frequency components u_0 and v_0 shown in the problem equation.

- (b) Download image 5.26(a) from the book web site and add sinusoidal noise to it, with $u_0 = M/2$ (the image is square) and $v_0 = 0$. The value of A must be high enough for the noise to be clearly visible in the image.
- (c) Compute and display the spectrum of the image. If the FFT program you developed can only handle images of size equal to an integer power of 2, reduce the size of the image to 512×512 or 256×256 . Resize the image before adding noise to it.
- (d) Notch-filter the image using a notch filter of the form shown in Fig. 5.19(c).