Principles and Applications of Digital Image Processing

【Fall, 2016】

Homework 4

Part 1: (40%)

Design a computer program to perform Fourier transform of an image using FFT. You may use FFT function source code available on the CEIBA course website. The image spectrum obtained after Fourier transform could be further processed using the following method to achieve better display.

F_{MIN} = LOG(1+ABS(F_{min})) F_{min} is the minimum value of the F(u,v) spectrum

F_{MAX} = LOG(1+ABS(F_{max})) F_{max} is the maximum value of the F(u,v) spectrum

Y_{NEW}(u,v) = G*[LOG(1+ABS(F(u,v))) - F_{MIN}]/[F_{MAX} - F_{MIN}]

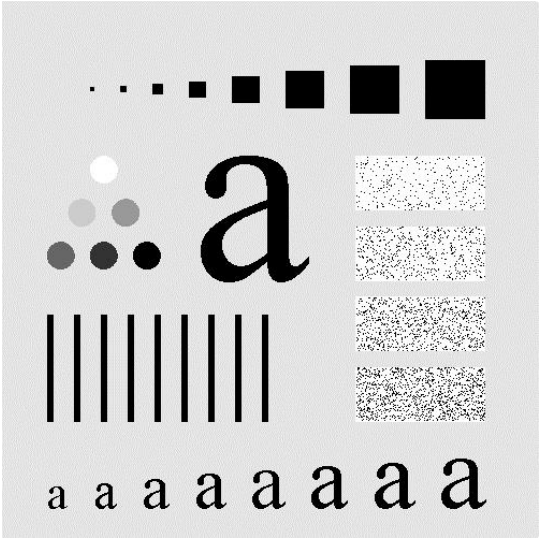
where G is the highest gray level in an image. (G = 255 for most cases)

Is there any difference between the original image and the processed image after forward Fourier transform and inverse Fourier transform using your program? Examine and discuss your result.

Make an analysis of the effect of image size on the processing time of your Fourier transform program.

Part 2: (40%)

Design a program for highpass and lowpass filtering of images using (1) Ideal filter; (2) Butterworth filter; (3) Gaussian filter. Test your program with the following image and discuss the effect of cut-off frequency on the processed image.



Part 3: (20%)

Design an image processing program for homomorphic filtering as described in Section 4.9.6 in our textbook. Your program should have a user-friendly interface allowing flexible adjustment of three parameters γ_H, γ_L, and D_0 defined in equation (4.9.29). Discuss the effect of these parameters on the processed image.

Notes:

1. Please submit your programs and report to the CEIBA course website before **Nov. 18**. Hand in the hardcopies of your report in the class of **Nov. 18 (2:20PM)**.

2. Late submission will have a penalty of 10% discount per day of your grade toward a minimum score of 60. No late submission over a week will be accepted.