Digital Image Processing (IE404)

Assignment 5

1 Instructions

- Implement the following problems in Python or MATLAB.
- **Do not copy code from any source.**
- Prepare a report based on the theory and observations (one report per group).
- Submit the report (PDF format) in the Google Classroom within the deadline.
- The assignments will be evaluated during lab hours.

2 Problems

1. Find out and show the Magnitude and Phase information of the *cameraman* image (Fig.1). Perform log transformation on the magnitude spectrum and show the result. Discuss the reason of difference between the observations (with log and without log transformation). Observe the significance of DFT coefficients of the image by reconstructing the image with higher frequency coefficients and lower frequency coefficients, separately without changing the phase information. *[Tips:Use FFT for finding out the DFT coefficients.]*

Figure 1

2. Demonstrate the significance of magnitude and phase information by reconstructing an image with the magnitude of Fig.2(a) and phase of Fig. 2(b). Repeat the experiment with the magnitude of Fig.2 (b) and phase of Fig.2 (a). *[Tips: First of all resize the images to create same dimensional images]*

3. Implement low pass and high pass filters in frequency domain for Ideal, Butterworth (order 2), and Gaussian kernels and apply those on Fig.1. Discuss about the results.

(a) (b)

Figure 2

4. Consider the image of Fig.1, and implement unsharp masking and highboost filtering in frequency domain. Compare the results with the implementation of spatial domain operation. Tune the parameters (cut-off frequency for frequency domain, kernel size for spatial domain, etc.) to achieve the same results in both domains. Report the results.

5. Add salt and pepper noise and additive white Gaussian noise (AWGN) separately to the image given in Figure 3. Salt and pepper noise should corrupt 20% of the pixels, and consider zero mean and 20 variance for AWGN. Report the results of adding both types of noise. Apply a 5×5 mask of Gaussian low pass filter with a suitable variance on both the noisy images. Furthermore, apply a median filter of 3×3 on both the images. Observe the results and comment on them.

Figure 3

6. Blur the image given in Figure 3 by a second order Butterworth low pass filter with cut-off frequency 15. Then try to restore the image by inverse filtering without limiting the cut-off frequency and with limiting cut-off frequency. Use different cut-off frequencies to get the best result. (Note: You need to add noise to the given image followed by Fourier transformation and filtering.)

7. Consider the blur image created in Problem 6, and restore it using Wiener filtering. Use different values of K for achieving the best results.