Assignment 3, DIP, Monsoon 2019
Deadline: Friday 25th Oct, 4:00 PM

Q1a and Q2 are theory.

Note: If you discuss the answers with any of your friends, clearly mention this all the names on written and coding assignments. OR, if your code is inspired from any other source, you must refer the source. In the absence of such references if assignments of more than one student is significantly similar, it may be fall under plagiarism.

You can freely use image restoration code provided to you.

Naming convention for both will be informed.

Q1. a. Solve for W

$$\sum_k \sum_l |F(k,l) - \hat{F}(k,l)|^2 + \lambda |\hat{F}(k,l) L(k,l)|^2$$

$$\hat{F}(k,l) = W(k,l) G(k,l)$$

L is the DFT of Laplacian filter. [3]

b. Write a code using the obtained W to restore a given image. You can synthetically degrade the image using the steps given in image restoration code. Take $\lambda = 0.01$ and show the results. Replace the terms of ratio of power spectrum of noise to image using a constant c. Take c in the range as given in the reference code of image restoration. [2]

Q2. a. Compute discrete Radon transform $g(\rho, \theta)$ for the following 3x3 matrix for three different rotations.

$$f(x,y) = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 100 & 2 \\ 1 & 2 & 2 \end{bmatrix}$$

Take $\theta = \{0, \pi/4, \pi/2\}$ $\rho = \{0, 1, -1\}$. Center element 100 is at origin. Consider $\rho = 0$ along X and Y-axes. ρ is +ve for rightmost column and topmost row, -ve for leftmost column and bottom row. [1]

b. Backproject $g(\rho, \theta)$ for $\theta = \{0, \pi/4, \pi/2\}$ and compute $f_\theta(x, y)$. For $\theta = 0$, you will get a row vector which you can backproject vertically downward, similarly for pi/2, you will get a column vector which can be projected horizontally left. [1]

c. Reconstruct $f(x, y)$ using $f_\theta(x, y)$. [1]

Q3. Write a code for adaptive filtering. [2]