EE610 Autumn 2019
Assignment 2

Instructions:

1. Input image for all questions is the file **image.png**
2. Please use **MATLAB** or **Python** preferably for the coding.
3. Submit a compressed folder containing your code files and a PDF file containing answers, output images, plots and properly commented code. Also specify parameters used.
4. Not commenting the code properly will attract penalty.
5. Please name your submission folder as **Language_YourName_RollNumber_Assignment2**. For example, if person 'xyz' with roll number 12345 has used Python for the assignment and submitted a zip folder, it should be named **Python_xyz_12345_Assignment2.zip**.
6. Do submit the code even if you don't get the output. Partial marks may be given if code is conceptually correct.
7. You will be asked to give a demo of your code if we suspect plagiarism or any other wrongdoing.

Questions:

RRMSE of matrix B w.r.t. matrix A = $\sqrt{\frac{\sum_i \sum_j (A_{ij}-B_{ij})^2}{\sum_i \sum_j (A_{ij})^2}}$

1. Degrade the given M x N image image.png with the following atmospheric turbulence degradation function-
$$\boldsymbol{H(u,v) = \exp(-0.0025[u^2+v^2]^{5/6})}$$
   a) Perform inverse filtering on the degraded image at the different levels of zero mean i.i.d. Gaussian noise, namely standard deviation = 0%, 5%, 10%, 15%, 20%, 25% of maximum intensity in original image. Plot the following 2 curves in a graph- (i) RRMSE of degraded image w.r.t. original image versus standard deviation of noise. (ii) RRMSE of filtered image w.r.t. original image versus standard deviation of noise.
   [Hint: Multiply H(u,v) by an appropriate lowpass filter before implementing inverse filtering]
   b) Perform Wiener filtering on the degraded image at the different levels of zero mean i.i.d. Gaussian noise, namely standard deviation = 0%, 5%, 10%, 15%, 20%, 25% of maximum intensity in original image. Plot the following 2 curves in a graph- (i) RRMSE of degraded image w.r.t. original image versus standard deviation of noise. (ii) RRMSE of filtered image w.r.t. original image versus standard deviation of noise.

2. Degrade the given M x N image image.png with the following motion blurring degradation function-
$$\boldsymbol{H(u,v) = \frac{1}{0.001+\pi(0.1u+0.1v)}[0.001+\sin(\pi(0.1u+0.1v))]\exp(-j\pi(0.1u+0.1v))}$$
   a) Perform inverse filtering on the degraded image at the different levels of zero mean i.i.d. Gaussian noise, namely standard deviation = 0%, 5%, 10%, 15%, 20%, 25% of maximum intensity in original image. Plot the following 2 curves in a graph- (i) RRMSE of degraded image w.r.t. original image versus standard deviation of noise. (ii) RRMSE of filtered image w.r.t. original image versus standard deviation of noise.
   [Hint: Multiply H(u,v) by an appropriate lowpass filter before implementing inverse filtering]
   b) Perform Wiener filtering on the degraded image at the different levels of zero mean i.i.d. Gaussian noise, namely standard deviation = 0%, 5%, 10%, 15%, 20%, 25% of maximum intensity in original image. Plot the following 2 curves in a graph- (i) RRMSE of degraded image w.r.t. original image versus standard deviation of noise. (ii) RRMSE of filtered image w.r.t. original image versus standard deviation of noise.