ECE 5470 Digital Image Processing
Midterm

Due Date: March 23, 2020 4:00 pm

1. Download the image "Pattern1.jpg" and "Pattern2.jpg". Using 3x3 subimage windows, apply the following filters and show your results for the both images:
   a. Arithmetic mean filter
   b. Geometric mean filter
   c. Harmonic mean filter
   d. Contraharmonic mean filter with Q=1.2 and Q=-1.2
   e. Median filter
   f. Analyze the results for each filter

(25 points)

2. Download the image "Fig2.jpg".
   a. Select the best spatial filter and write MATLAB code to eliminate the noise. Display your result.
   b. Select the best statistical filter and write MATLAB code to eliminate the noise. Display your result.
   c. Compare the result in 2.a and 2.b.

(25 points)

3. Download the image "Fig3.jpg".
   This is a tomography image of a human head, heavily corrupted by sinusoidal noise in at least two directions.
   Clean up the image using band reject filtering. To simplify your project you may ignore padding in this case.

   Hint: Since the noise is sinusoidal, it will show in the spectrum as impulses. Display the spectrum as a guide to where to set up the band of your filter. You may use multiple band reject filter for different D_0 values.

(25 points)

4. Download the image "Fig4.jpg", take Fourier transform
   Implement a blurring filter as following equation

$$H(u,v)=\left[\frac{1}{\pi(0.1u+0.1v)}\right]\sin\left[\pi(0.1u+0.1v)\right]e^{-j\pi(0.1u+0.1v)}$$

Multiply by the blurring filter H(u,v) to generate blur image.

$$G(u,v)=H(u,v)F(u,v).$$

Take the inverse Fourier transform to display blurred image.

Restore the image using the following equation.

$$\hat{F}(u,v)=\left[\frac{1}{H(u,v)}\right]G(u,v)$$

Display the final image to show your best result.

(25 points)

Submit your own MATLAB code and results for each question