EE7150 Computer Project VII
Image Restoration (Chapter 5) & Color Image Processing (Chapter 6)
Due Date: Nov 12, 2021

1. **Salt-and-Pepper Noise Generation and Median Filter based Noise Reduction**

(a) Download Fig. 5.7(a) [both editions] and add salt-and-pepper noise to it, with Pa = Pb = 0.2. Apply median filtering using block (3 x 3) processing approach to the noise corrupted image you created. Explain any major differences between your result and Fig. 5.10(b) [both editions]. Apply two more passes of median filtering and display the resulting images.

2. **Periodic Noise Reduction Using a Notch Filter**

2D discrete sinusoidal noise function and it's Fourier Transform pair is given by,

$$f(x,y) = A\sin(2\pi u_0 x / M + 2\pi v_0 y / N) \Leftrightarrow F(u,v) = jA\frac{MN}{2}[\delta(u+u_0, v+v_0) - \delta(u-u_0, v-v_0)]$$

(a) Download image astronaut-interference.tif and use notch filtering in the frequency domain to remove the sinusoidal interference. **Hint:** Compute the spectrum of the supplied image and magnify the area near the center of the spectrum so you can see the location of the energy bursts caused by the periodic interference. Then use a very narrow Gaussian notch-reject filter transfer function with centers at those burst locations.
(b) Display the original image, the spectrum, the filter transfer function you used, the processed and the interference pattern. The processed image should look like Fig 5.16(d) of 4th Edition (Note for students with 3rd Edition – please refer to the power-point slides for Chapter-5)

3. **Pseudo-Color Image Processing using Intensity Slicing**

(a) Download the image in Fig. 1.10(4) of both editions and process it with two-level intensity slicing so that the river appears yellow and the rest of the pixels are the same shades of gray as in the input image. It is acceptable to have other isolated regions in the image that also appear yellow, but these should be kept as few as possible by proper choice of the two gray-level bands that you input into your program.
(b) Download the image in Figure 7.18(a) [Fig. 6.20(a) of 3rd Edition] and process it with eight-color intensity slicing in an attempt to reproduce the result displayed in Figure 7.18(b) [Figure 6.20 (b) of 3rd Edition]. Your result need not match the exact colors shown in Figure 7.18(b) [Figure 6.20 (b)], but the major regions should be visually separable as in the figure.

4. **Color Image Enhancement by Histogram Processing**

(a) Download the dark-stream color picture in Figure 7.33 [Fig. 6.35 of 3rd Edition]. Histogram-equalize the R, G, and B images separately using the histogram-equalization program from Project-1.
(b) Form an average histogram from the three histograms in (a) and use it as the basis to obtain a single histogram equalization intensity transformation function. Apply this function to the R, G, and B components individually. Compare and explain the differences in the images in (a) and (b).

5. **Color Image Segmentation**

Download Figure 7.26(b) [Fig. 6.28(b) of 3rd Edition] and duplicate Example 7.15 [Example 6.15 of 3rd Edition], but segment instead the darkest regions in the image using appropriate thresholding.