ELE 473 573 HW 2

Due June 10

May 27, 2019

1. Calculate the filter output for the following image and filters in the spatial domain, use upper left pixel as the origin (0,0):

$$I = \begin{bmatrix} 1 & 3 & 2 & 5 \\ 1 & 3 & 2 & 1 \\ 1 & 3 & 2 & 0 \end{bmatrix} \quad F = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} \tag{1}$$

2. Are the following valid distance functions between pixel $p = [p_x, q_x]$ and pixel $q = [q_x, q_y]$. Prove your answers.
$D(p, q) = p_x + q_x + p_y + q_y$
$D(p, q) = p_x.q_x + p_y.q_y$
$D(p, q) = p_x.p_y + q_x.q_y$

3. Consider the following systems where $g[m, n]$ is the output and $f[m, n]$ is the input image to the system. Images are discrete. Are these systems linear? Are they shift invariant? Prove your answers.
$g[m, n] = f[m^2, n^2]$
$g[m, n] = f[m + 2, n + 2]$

4. Is histogram equalization for digital images a linear shift invariant process? How about for the continuous case? Prove your answers.

5. Find two applications where image log and image exponentials create enhanced (visually) images, and explain them. These applications should be applications that you can use your phone's camera to acquire images. Acquire such images and show that log and exponential created visually improved images by printing the original and enhanced images for both cases/applications.