Fourth Year Mechatronics Department
CSE496: Digital Image Processing
Sheet #05: Image Enhancement in the Frequency Domain
Spring 2015

Ain Shams University
Faculty of Engineering

1- Find and plot the Fourier spectrum of the discrete function $f(x) = 1, 0 \leq x \leq M$ where M is a positive integer. You must show the effect of increasing M. For example, plot the spectrum when $M=M_0$, $2M_0$, and $4M_0$ respectively (M_0 is an initial positive integer). Comment on the results.

2- Find the DFT of a spatial filter h(x,y) defined as a box centered at the origin. Assume that the length, width, and height of the box are M, N, and A respectively.

3- Repeat Q1 for the function, $g(x)=(-1)^x f(x)$.

4- Find the inverse DFT of the transfer function: $H(u,v) = Ae^{-(u^2+v^2)/(2\sigma^2)}$. Hint: Treat variables as continuous.

5- Find the DFT of the image function: $h(x,y) = 2\pi A e^{-2\pi^2\sigma^2(x^2+y^2)}$. Hint: Treat variables as continuous.

6- Suppose that you form a low pass spatial filter by averaging the N4 neighbors' intensities of the point (x, y). Find the DFT of the filter and show that it's a LPF.

7- Repeat Question 6 but for the N8 neighbors.

8- Find the DFT of the Laplacian filter. Is it a HPF?

9- What are the consequences of using ideal low pass filters?

10- Given an input image function f(x,y):-

a) Obtain the function $f_1(x, y) = (-1)^{(x+y)} f(x)$.
b) Obtain the DFT of $f_1(x,y)$ and name it by $F_1(u, v)$.
c) Obtain $F_2(u,v)$ as the complex conjugate of $F_1(u,v)$.
d) Obtain the inverse DFT of $F_2(u,v)$ and name it as $f_2(x,y)$.
e) Obtain the real part of $f_2(x,y)$ and name it as $f_3(x,y)$.
f) Obtain $f_4(x,y)=(-1)^{(x+y)} f_3(x)$. What is the relation between $f_4(x,y)$ and f(x,y).
g) Write a computer program to show the above process output with different images.