EE 5356 - DIGITAL IMAGE PROCESSING - PROJECT 14

Low-pass and High-pass filter

Steps:

1. Use fft2 and fftshift function

2. Ideal LPF enhances all frequency components within a specified radius from the center of the

FT, while attenuating all others. Mathematical formulation for ideal LPF ,

*HI(u,v) = 1 if D(u,v) Do*

*0 if D(u,v) > Do*

where D(u,v) =

Figure: 2D view of ideal LPF

3. Gaussian LPF attenuates high frequencies using a transfer function whose shape is based on

a Gaussian curve. The width of the bell-shaped curve can be controlled by specifying the

parameter σ. Mathematical formulation for Gaussian LPF

*HG(u,v) = e-(D(u,v)^2)/2σ^2*

4. Butterworth LPF attenuates high frequencies and its behavior is a function of cutoff

frequency Do and the order of the filter, n. Mathematical formulation for Butterworth LPF

*HB(u,v) = 1/(1+(D(u,v)/Do)^2n)*

5. Ideal HPF attenuates all frequency components within a specified radius from the center of

the FT, while enhancing all others. Mathematical formulation for ideal HPF,

*Hl(u,v) = 0 if D(u,v) Do*

*1 if D(u,v) > Do*

6. Gaussian HPF attenuates low frequencies using a transfer function whose shape is based on

a Gaussian curve. The width of the bell-shaped curve can be controlled by specifying the

parameter σ. Mathematical formulation for Gaussian HPF

*HG(u,v) = 1-e-(D(u,v)^2)/2σ^2*

7. Butterworth HPF attenuates low frequencies and its behavior is a function of cutoff

frequency Do and the order of the filter, n. Mathematical formulation for Butterworth HPF

*HB(u,v) = 1/(1+(Do/D(u,v))^2n)*

Submit the following:

1. Use the function log\_rep = log(1+ abs(ft\_shift));

2. Use mesh function.

4. Use ifft2 function

References:

1. Marques, Oge “Practical image and video processing using MATLAB,” pp. 243-251, Wiley, 2011.
2. A. K. Jain "Fundamentals of Digital Image Processing," Prentice Hall.
3. EE 5356, Access files, click on DFT – part1, properties of the 2-D DFT (pp. 49-58). See also Fig. 4.15 from the text on page 55.