Department of Computer Science and Engineering
National Institute of Technology, Hamirpur

Digital Image Processing CS-325

Laboratory Assignment -5

Topic: Digital Image enhancement using median and Laplacian filters

1. Design a program to read a image (.jpg) and apply frequency domain filter with mask dimensionality of 3x3 on each plane (total 3 planes). Display the input image and processed (output) image. Write the conclusion based on the observation of the output image.
   A) Low Pass Filter
   B) High Pass Filter
   C) Lowpass Gaussian Gilter
   D) HighPass Gaussian Filter

Note: *It is a good practice to use input image having salt and pepper noise.*

Study/ Help Material

- A 2-D lowpass filter that passes without attenuation (removing) all frequencies within a circle of radius from the origin, and "cuts off" all frequencies outside this, circle is called an ideal lowpass filter (ILPF); it is specified by the transfer function
- H(u,v) = $\begin{cases} 1 & if\ D(u,v) \le D_0 \\ 0 & if\ D(u,v) > D_0 \end{cases}$
- Here, D_0 is a positive constant and D(u,v) is the distance between a point (u,v) in the frequency domain and centered of the frequency rectangle:
- D(u,v) =$[(u - \frac{P}{2})^2 + (v - \frac{Q}{2})^2]^{1/2}$
- Here, P and Q are padding size.

Gaussian Low Pass Filter

- H(u,v) = $e^{-D^2(u,v)/2\sigma^2}$
- where D_0 is the cutoff frequency. When D(u,v) = D , 0 the GLPF transfer function is down to 0.607 of its maximum value of 1.0.
- Here, σ is the measure of spread about the centre.
- When σ = D_0 , GLPF is down to 0.607, we have
- H(u,v) = $e^{-D^2(u,v)/2{D_0}^2}$

An ideal Highpass filter (IHPF); it is specified by the transfer function

- H(u,v) = $\begin{cases} 0 & if\ D(u,v) \le D_0 \\ 1 & if\ D(u,v) > D_0 \end{cases}$

Gaussian Highpass Filter

H(u,v) = 1-$e^{-D^2(u,v)/2{D_0}^2}$