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

Digital Image Processing CS-325

Laboratory Assignment -4

Topic: Digital Image enhancement using median and Laplacian filters

1. Design a program to read a image (.jpg) and apply median 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.
2. Formulate a program to read a image (.jpg) and apply Laplacian filter with mask dimensionality of 3x3 on each plane (total 3 planes). Also, employ sharpening (bringing out of range pixel values within range). Display the input image and processed (output) image. Write the conclusion based on the observation of the output image.

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

Study/ Help Material

- Order-statistic filters are nonlinear spatial filters whose response is based on ordering (ranking) the pixels contained in the region encompassed by the filter.
- Smoothing is achieved by replacing the value of the center pixel with the value determined by the ranking result.
- The best-known filter in this category is the median filter, which, as its name implies, replaces the value of the center pixel by the median of the intensity values in the neighborhood of that pixel.Median filters provide excellent noise reduction capabilities for certain types of random noise, with considerably less blurring.

- The Laplacian is a linear operator.
- The Laplacian: Second Order Derivative
- $\nabla^2 f = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$
- = f(x + 1,y) + f(x – 1,y) + f(x,y+1) + f(x,y-1) –4f(x,y)
- Thus, the basic way in which we use the Laplacian for image sharpening is:
- $G(x,y) = f(x,y) + c[\nabla^2 f(x,y)]$
- Where f(x,y is input while g(x,y) is the output image

The constant c =-1 if the Laplacian filter has negative in the middle while c=1 for the Laplacian filter with positive in the middle.

The various mask are given below.

0	1	0	1	1	1
1	−4	1	1	−8	1
0	1	0	1	1	1

0	−1	0	−1	−1	−1
−1	4	−1	−1	8	−1
0	−1	0	−1	−1	−1