Experiment No.: 04

Experiment Name: Experimental Analysis of Image Filtering.

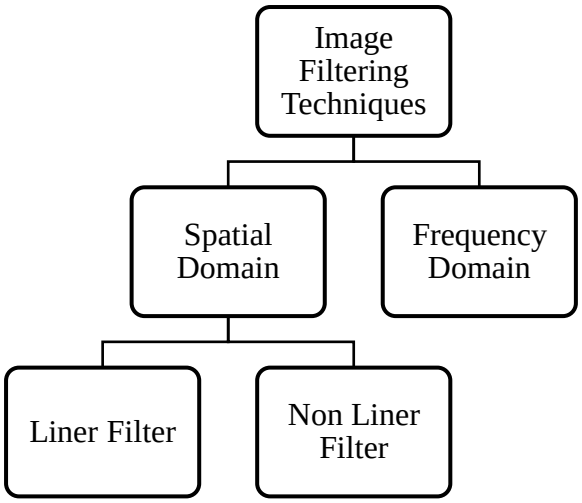
Objectives:

- To know about different types of images.
- To know about different types of image filters.
- To know about different types of image edge detection.

4.1 Theory:

Filtering techniques are use to enhance and modify digital images. Also, images filters are use to blurring and noise reduction, sharpening and edge detection. Image filters are mainly use for suppress high (smoothing techniques) and low frequencies (image enhancement, edge detection).

Classification of image filters is as follows,



Low pass filter: Low pass filter is the type of frequency domain filter that is used for smoothing the image. It attenuates the high frequency components and preserves the low frequency components.

Median filter: The median filter is a non-linear digital filtering technique, often used to remove noise from an image or signal. Such noise reduction is a typical pre-processing step to improve the results of later processing

High pass filter: High pass filter is the type of frequency domain filter that is used for sharpening the image. It attenuates the low frequency components and preserves the high frequency components.

4.2 Equipment:

- Computer
- MATLAB Software
- Images

4.3 Problems:

i. Low pass Filter.

Code:

```
clc;
clear;
img = imread('cameraman.tif');
imgd = im2double(img);

f = ones(6,6)/36;

img1 = filter2(f, imgd);

subplot(121); imshow(img);
subplot(122); imshow(img1);
```

Output:

Original Image

Lowpass Filtered Image

Fig. 4.1: Image Low Pass Filtering

ii. Median Filter.

Code:

```
I = imread('kobi.png');
J = imnoise(I,'salt & pepper',0.5);

r = medfilt2(J(:, :, 1), [3 3]);
g = medfilt2(J(:, :, 2), [3 3]);
b = medfilt2(J(:, :, 3), [3 3]);

K = cat(3, r, g, b);

figure
subplot(121);imshow(J);
subplot(122);imshow(K);
```

Output:

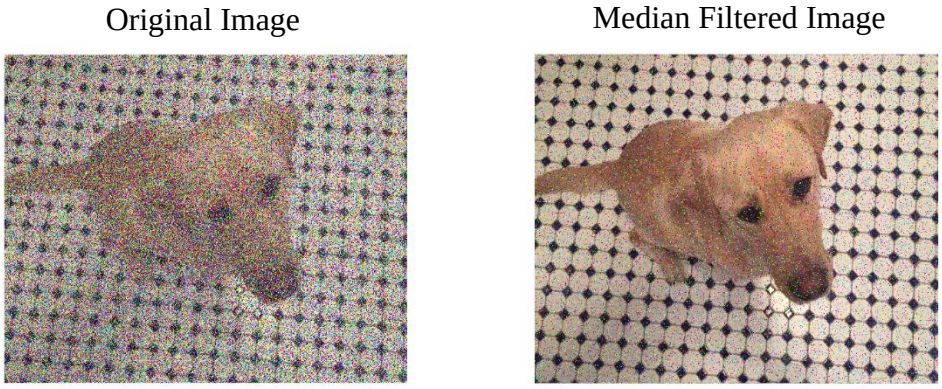


Fig. 4.2: Image Median Filtering

iii. High pass Filter.

Code:

```
clc;
clear;

input_image = imread('cameraman.tif');

[M, N] = size(input_image);
FT_img = fft2(double(input_image));

D0 = 10;

u = 0:(M-1);
idx = find(u>M/2);
u(idx) = u(idx)-M;
v = 0:(N-1);
idy = find(v>N/2);
v(idy) = v(idy)-N;

[V, U] = meshgrid(v, u);
D = sqrt(U.^2+V.^2);
H = double(D > D0);

G = H.*FT_img;

output_image = real(ifft2(double(G)));

subplot(1, 2, 1), imshow(input_image),
subplot(1, 2, 2), imshow(output_image, [ ]);
```

Output:

Original Image

High pass Filtered Image

Fig. 4.3: Image High Pass Filtering

vi. Image Edge Detection.

Code:

```
clc;
clear;
I = imread('cameraman.tif');
BW1 = edge(I,'sobel');
BW2 = edge(I,'canny');
subplot(1,3,1);
imshow(I)
title('Original Image')
subplot(1,3,2);
imshow(BW1)
title('Sobel Filter')
subplot(1,3,3);
imshow(BW2)
title('Canny Filter')
```

Output:

Original Image

Sobel Filter

Canny Filter

Fig. 4.4: Image Edge Detection.

4.4 Conclusion:

In this experiment, we have worked with different Image Filters. Then we experimented image edge detection technique with Sobel filter and Canny filter. Low pass filtering is employed to remove high spatial frequency noise from a digital image. The low-pass filters usually employ moving window operator which affects one pixel of the image at a time, changing its value by some function of a local region (window) of pixels. The operator moves over the image to affect all the pixels in the image. A high-pass filter can be used to make an image appear sharper. These filters emphasize fine details in the image - the opposite of the low-pass filter. High-pass filtering works in the same way as low-pass filtering; it just uses a different convolution kernel. Here for both filtering we used different built-in functions in MATLAB. All the output were as required thus the experiment was done successfully.