EXPT. NO:3
DATE:13.02.24

IMAGE AND ENHANCEMENT OPERATION USING LOW PASS & HIGH PASS FILTERS AND EDGE DETECTION OPERATIONS

1. IMAGE FILTERING USING LPF&HPF

AIM:

To implement following the image enhancement operation using Matlab

- Median Filters
- Median Filters and average filter
- Implementation of filter using Convolution

SOFTWARE USED:

MATLAB version 2014a.

THEORY:

Image enhancement operations using LPF (Low Pass Filter) and HPF (High Pass Filter) are techniques used to improve the quality or highlight specific features in an image.

• Low Pass Filter (LPF):

LPF is used to remove high-frequency noise from an image while preserving the low-frequency components. It helps in smoothing or blurring the image, which can reduce noise and make the image more visually appealing.

• High Pass Filter (HPF):

HPF is used to enhance the edges and fine details in an image by highlighting high-frequency components. It amplifies the differences between adjacent pixel values, making edges appear sharper and more pronounced.

HPF is commonly used in edge detection and sharpening operations to improve image clarity and emphasize important features.

1. Median filter: A median filter is a non-linear digital filtering technique used primarily for removing noise from images. Unlike linear filters, such as mean or Gaussian filters, which compute a weighted average of pixel values in a neighborhood, a median filter replaces each pixel value with the median value of the intensities in its local neighborhood.

The median filter is effective at reducing noise, especially impulse noise or salt-and-pepper noise, which randomly corrupts individual pixels with either very high or very low intensity values.

2. Average filter: The average filter, also known as the mean filter, is a type of linear filter used in image processing for smoothing or blurring images. It replaces each pixel's value with the average

(mean) value of its neighborhood.

The size of the neighborhood (kernel size) determines the extent of smoothing applied to the image. Larger neighborhoods result in more significant smoothing but may also cause more blurring of details.

3. Implementation of filter using Convolution:

Convolution is a mathematical operation used in image processing to apply a filter or kernel to an image. It involves combining each pixel in the image with its neighboring pixels, weighted by the values in the filter kernel.

EDGE DETECTION:

Edge detection is a fundamental technique in image processing and computer vision used to identify boundaries within an image. It involves detecting abrupt changes in intensity or color in adjacent pixels, which often correspond to edges or boundaries between different objects or regions in the image. The goal of edge detection is to highlight these areas of significant intensity variation, making them easier to identify and analyze for further processing tasks such as object detection, segmentation, and feature extraction. Edge detection algorithms typically involve applying convolution operations, gradient calculations, and thresholding techniques to identify and localize these edges in an image

PROGRAM 1:

Image filtering using LPF and HPF

1A. Median Filters

```
I=imread('lake.jpg');
K = rgb2gray(I);
J= imnoise(K ,'salt & pepper',0.05);
f= medfilt2(J,[3,3]);
f1=medfilt2(J,[10,10]);
subplot(3,2,1);
imshow(I);
title('Original Image');
subplot(3,2,2);
imshow(K);
title('Gray Image');
subplot(3,2,3);
imshow(J);
title('Noise added Image');
subplot(3,2,4);
imshow(f);
title('3x3 Image');
subplot(3,2,5);
imshow(f1);
title('10x10 Image');
```

OUTPUT:

1B.Mean Filter and Average Filter

```
i=imread('lake.jpg');
g=rgb2gray(i);
g1=fspecial('average',[3 3]);
b1 = imfilter(g,g1);
subplot(2,2,1);
imshow(i); title('Original Image');
subplot(2,2,2);
imshow(g);
title('Gray Image');
subplot(2,2,3);
imshow(b1);
title('3x3 Image');
g2= fspecial('average',[10 10]);
b2=imfilter(g,g2);
subplot(2,2,4);
imshow(b2);
title('10x10 Image');
```

OUTPUT:

1C. Implementation of filter using Convolution

```
I= imread('lake.jpg');
I=I(:,:,1);
subplot(2,2,1);
imshow(I);
title('Original Image');

a=[0.001 0.001 0.001; 0.001 0.001 0.001; 0.001 0.001 0.001];
R=conv2(a,I);
subplot(2,2,2); imshow(R);
title('Filtered Image');

b=[0.005 0.005 0.005; 0.005 0.005 0.005; 0.005 0.005 0.005];
R1=conv2(b,I);
subplot(2,2,3);
imshow(R1);
title('Filtered Image 2');
```

OUTPUT:

2. Implementation of image sharpening filters and Edge Detection using Gradient Filters

```
i=imread('lake.jpg');
subplot(4,2,1);
imshow(i);
title('Original Image');

g=rgb2gray(i);
subplot(4,2,2);
imshow(g);
title('Gray Image');

f=fspecial('laplacian',0.05);
im=imfilter(g,f);
subplot(4,2,3);
imshow(im);
title('Laplacian ');

s=edge(g, 'sobel');
subplot(4,2,4);
imshow(s);
title('Sobel');
```

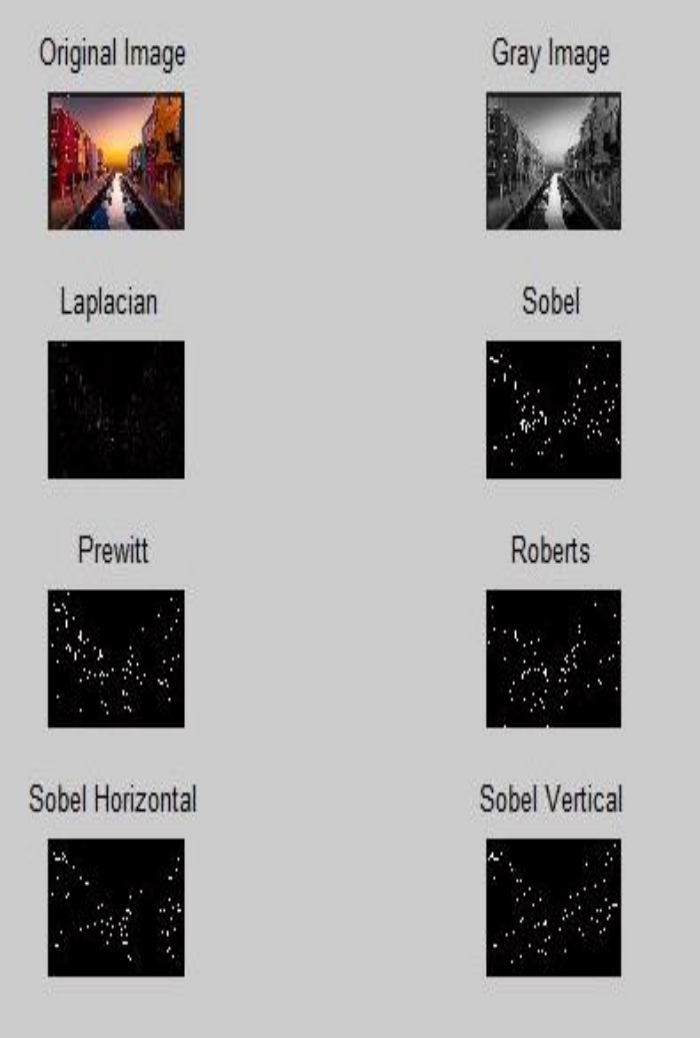
```
p=edge(g, 'prewitt');
subplot(4,2,5);
imshow(p);
title('Prewitt');

r=edge(g, 'roberts');
subplot(4,2,6);
imshow(r);
title('Roberts');

[BW,thresh,gv,gh]=edge(g,'sobel',[],'horizontal');
[BW1,thresh1,gv1,gh1]=edge(g,'sobel',[],'vertical');

subplot(4,2,7);
imshow(BW);
title('Sobel Horizontal');
subplot(4,2,8);
imshow(BW);
title('Sobel Vertical');
```

OUTPUT:



RESULT:

Image And Enhancement Operation Using Low Pass & High Pass Filters And Edge Detection Operations using MATLAB has been studied and verified successfully.