SARDAR PATEL COLLEGE OF ENGINEERING	
BAKROL, ANAND	
Academic Year: 2021-22	**Sem: VII**
Name of Teacher: Janki Patel	**Name of Department: IT**
Subject : Computer Vision (3171614)	**Hrs./Week: 2**
Theory/Practical: Practical	

Sr. No	Practical	Signature
1	To study the Image Processing concept.	
2	To obtain histogram equalization image.	
3	To Implement smoothing or averaging filter in spatial domain.	
4	Program for opening and closing of the image.	
5	Program for edge detection algorithm.	
6	Program of sharpen image using gradient mask.	
7	Program for morphological operation: erosion and dilation.	
8	Program for DCT/IDCT computation.	
9	Edge Detection using Sobel, Prewitt and Roberts Operators	
10	Computation of mean, Standard Deviation, Correlation coefficient of the given Image	

EXPERIMENT NO. 1

AIM: To study the Image Processing concept.

THEORY: Digital images play an important role both in daily life applications as well as in the areas of research technology. The digital image processing refers to the manipulation of an image by means of processor. The different elements of an image processing system include image acquisition, image storage, image processing and display

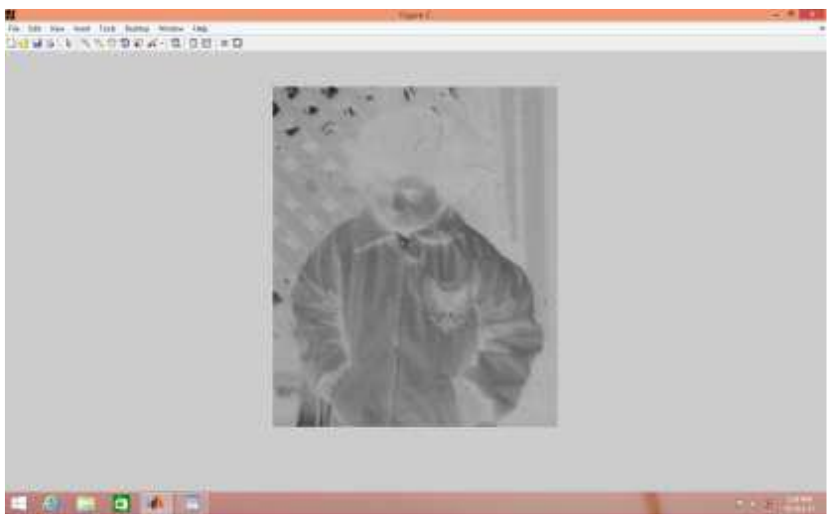
An image is two dimensional function that represent a message of sum characteristics such as brightness or color of viewed scene in the first mat lab program the command used from matlab is imcomplement

PROGRAM:

```
% Program to study the image processing concept
I=imread('pout.tif');
J=imcomplement(I);
figure,imshow(I)
figure,imshow(J)
K=imadjust(I,[0;0.4],[0.5;1])
figure,imshow(K)
```

Result:

Original Image



Complement Image

Conclusion: Thus we have studied the how to obtain complement image from the original image.

EXPERIMENT NO. 2

AIM: To obtain histogram equalization image.

THEORY: Histogram equalization is a method in image processing of contrast adjustment using the image's histogram. Histogram equalization often produces unrealistic effects in photographs; however it is very useful for scientific images like thermal or x-ray images, often the same class of images to which one would apply false color. Also histogram equalization can produce undesirable effects when applied to images with low color depth.

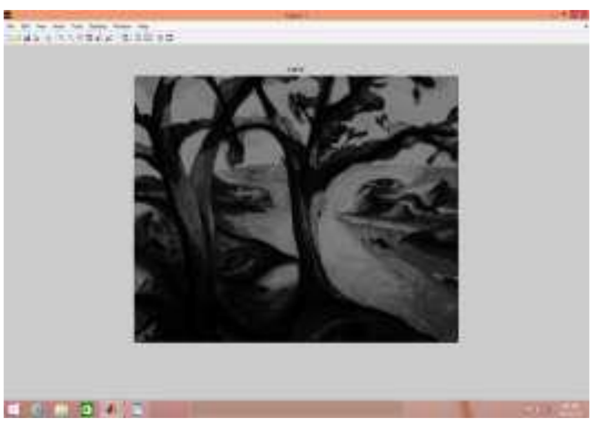
For example, if applied to 8-bit image displayed with 8 bit gray scale it will further reduce color depth (number of unique shades of gray) of the image. Histogram equalization will work the best when applied to images with much higher depth than palette size, like continuous data or 16-bit gray-scale images.

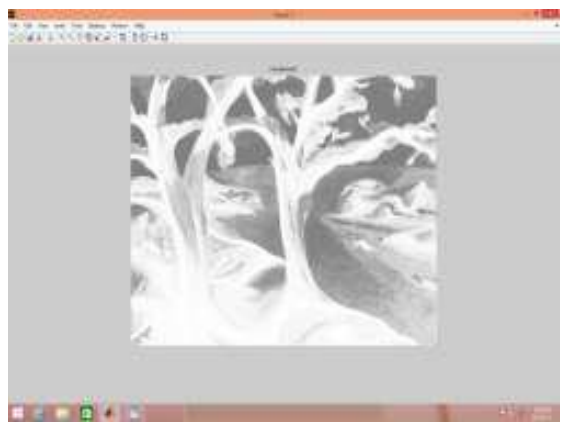
PROGRAM:

```
% Program to obtain histogram equalization concept
I=imread('trees.tif');
J=imcomplement(I);
imhist(J,100);
imshow(I);
title('original');
figure,imshow(J);
title('complement');
I=histeq(I);
figure,imhist(I,64);
title('equilized');
figure,imhist(J,64);
title('histogram');
```

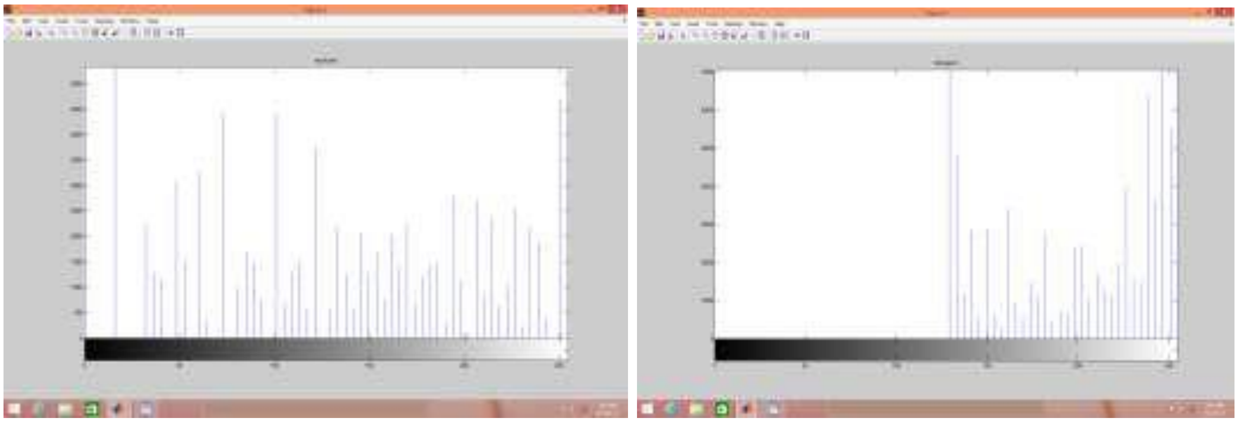
```
n=numel(I);
p=imhist(I)/n;
figure,plot(p);
title('normalized');

K=imadjust(I,[0;1],[0.4;1],0.5);

figure,imshow(K);

title('adjusted image');
T=maketform('affine',[.3 0 0;.5 1 0;0 1 1]);
tformfwd([0,0],T);
I2=imtransform(I,T);
figure,imshow(I2);
title('forward image');
```

Result:





Original Histogram



Equalized Histogram

Conclusion: Thus we have obtained the Equalized Histogram from the original Histogram.

EXPERIMENT NO. 3

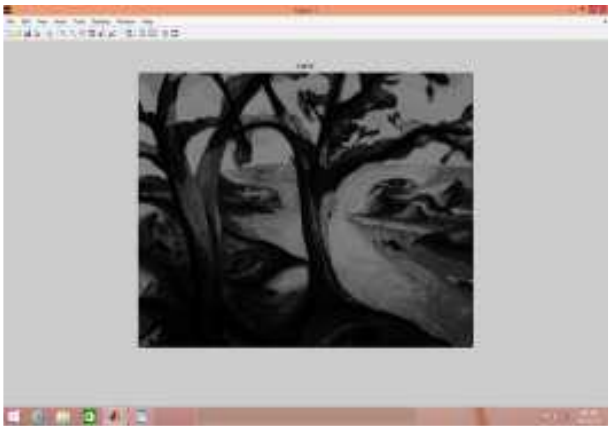
AIM: To Implement smoothing or averaging filter in spatial domain.

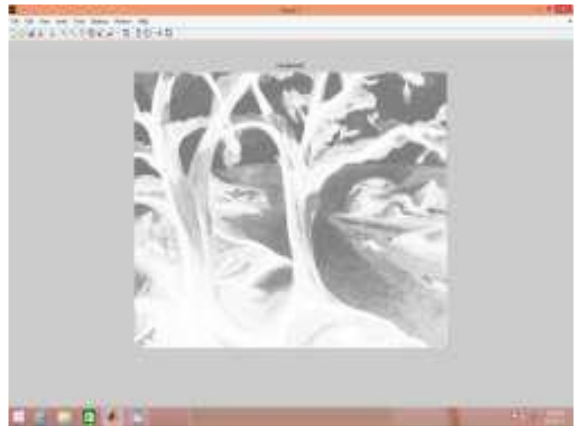
THEORY: Filtering is a technique for modifying or enhancing an image. ... Mask or filters will be defined. The general process of convolution and correlation will be introduced via an example. Also smoothing linear filters such as box and weighted average filters will be introduced.
In statistic and image processing, to smooth a data set is to create an approximating function that attempts to capture important patterns in the data, while leaving out noise or other fine-scale structures/rapid phenomena. In smoothing, the data points of a signal are modified so individual points (presumably because of noise) are reduced, and points that are lower than the adjacent points are increased leading to a smoother signal. Smoothing may be used in two important ways that can aid in data analysis by being able to extract more information from the data as long as the assumption of smoothing is reasonable by being able to provide analyses that are both flexible and robust. different algorithms are used in smoothing.

PROGRAM:

```
% Program for implementation of smoothing or averaging filter in spatial domain

I=imread('trees.tif');
subplot(2,2,1);
imshow(J);
title('original image');
f=ones(3,3)/9;
h=imfilter(I,f,'circular');
subplot(2,2,2);
imshow(h);
title('averaged image');
```

Result:





Conclusion: Thus we have performed the smoothing or averaging filter operation on the Original image and we get filtered image.

EXPERIMENT NO. 4

AIM: Program for opening and closing of the image.

THEORY: In mathematical morphology, opening is the dilation of the erosion of a set by a structuring elements B: Together with closing, the opening serves in computer vision and image processing as a basic workhorse of morphological noise removal. Opening removes small objects from the foreground (usually taken as the bright pixels) of an image, placing them in the background, while closing removes small holes in the foreground, changing small islands of background into foreground. These techniques can also be used to find specific shapes in an image. Opening can be used to find things into which a specific structuring element can fit (edges, corners, ...).

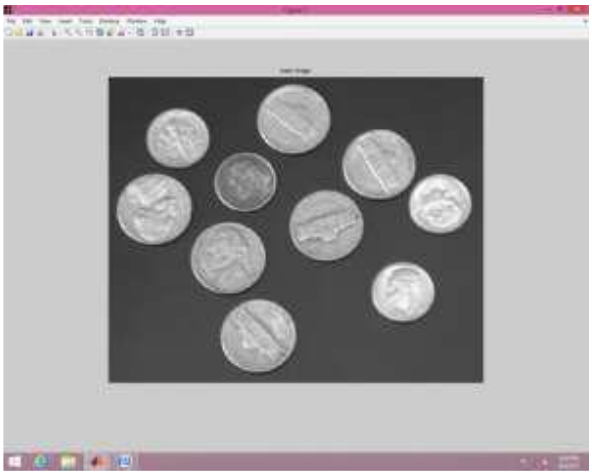
In mathematical morphology, the closing of a set (binary image) *A* by a structuring element *B* is the erosion of the dilation of that set. In image processing, closing is, together with opening, the basic workhorse of morphological image removal. Opening removes small objects, while closing removes small holes.

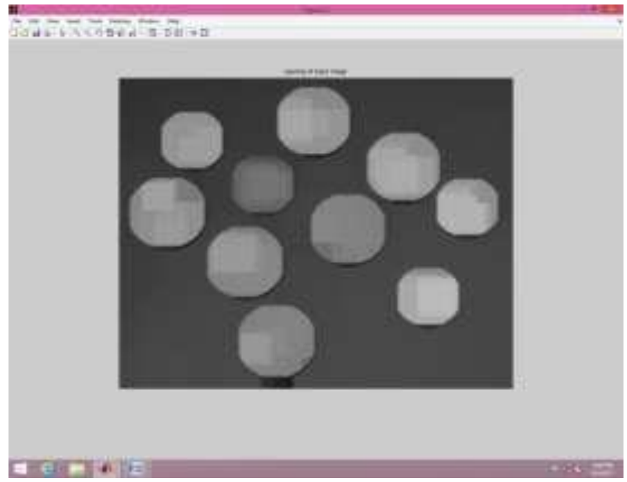
PROGRAM:

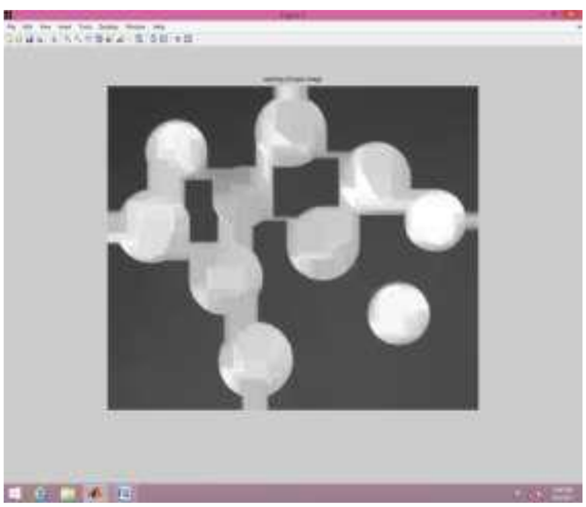
```
f=imread('coins.png');
se=strel('square',20);
fo=imopen(f,se);
figure,imshow(f)
title('input image');
figure,imshow(fo)
title('opening of input image');
fc=imclose(f,se);
figure,imshow(fc)
title('opening of input image');
foc=imclose(fo,se);
```

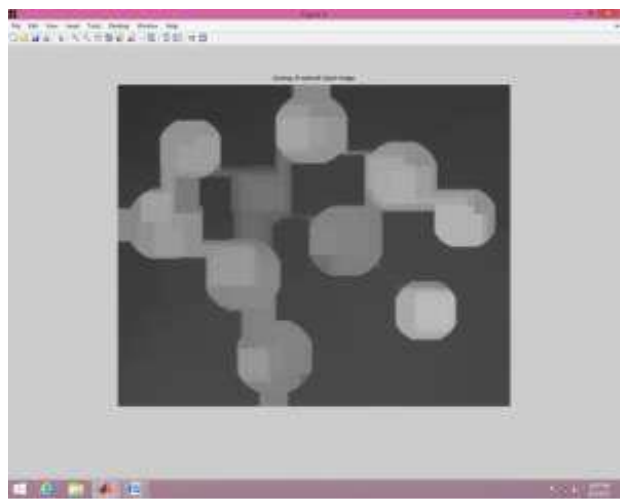
figure,imshow(foc)
title('closing of opened input image');

Result:









Conclusion: Thus we have obtained the opened image and closed image from the original Image.

EXPERIMENT NO. 5

AIM: Program for edge detection algorithm.

THEORY: The Canny edge detector is an edge detection operator that uses a multistage algorithm to detect a wide range of edges in images. It was developed by John F. Canny in 1986. Canny also produced a computational theory of edge detection explaining why the technique works.

The Process of Canny edge detection algorithm can be broken down to 5 different steps:

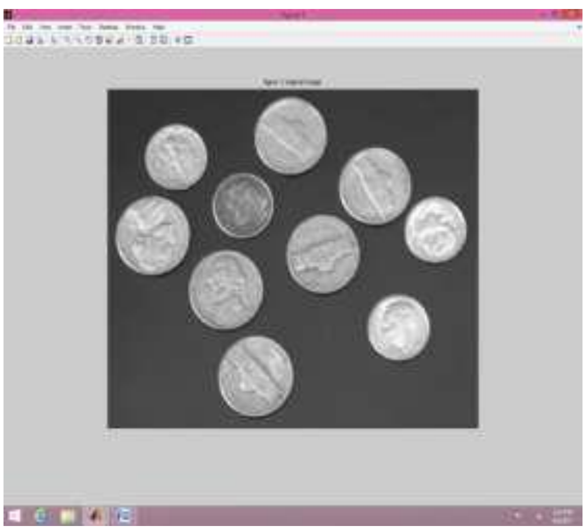
1. Apply Gaussian filter to smooth the image in order to remove the noise
2. Find the intensity gradients of the image
3. Apply non-maximum suppression to get rid of spurious response to edge detection
4. Apply double threshold to determine potential edges
5. Track edges by hypothesis: Finalize the detection of edges by suppressing all the other edges that are weak and not connected to strong edges.

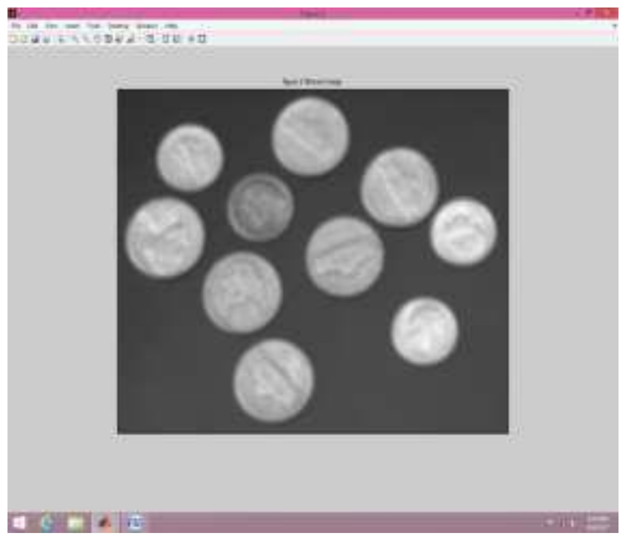
PROGRAM:

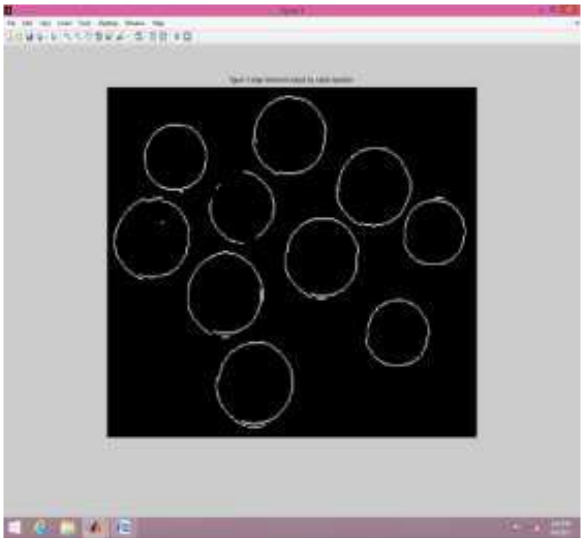
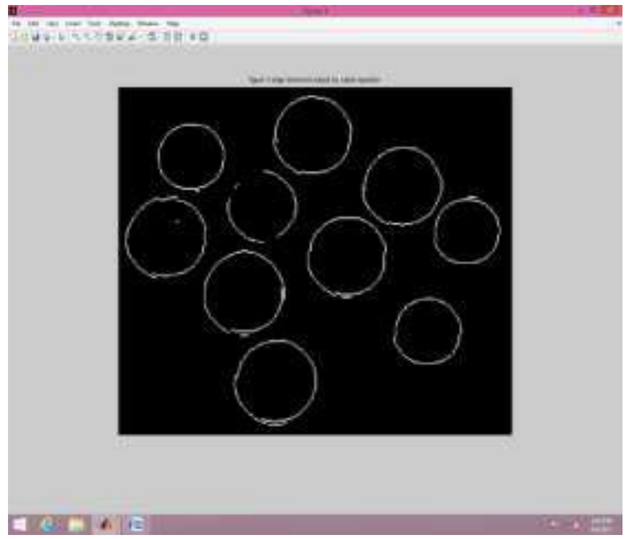
```
%Program for edge detection algorithm
I=imread('coins.png');
figure,imshow(I)
title ('figure 1 original image');
h=ones(5,5)/25;
b=imfilter(I,h);
figure,imshow(b)
title ('figure 2 filtered image');
c=edge(b,'sobel');
figure,imshow(c)
```

```
title ('figure 3 edge detected output by sobel operator');
d=edge(b,'prewitt');
figure,imshow(d)
title ('figure 4 edge detected output by prewitt operator');
e=edge(b,'robert');
figure,imshow(e)
title ('figure 5 edge detected output by robert operator');
f=edge(b,'canny');

figure,imshow(f)
title ('figure 6 edge detected output by canny operator');
```

Result:





Edge detected image

Conclusion: Thus we have detected the edges in the original image.

EXPERIMENT NO. 6

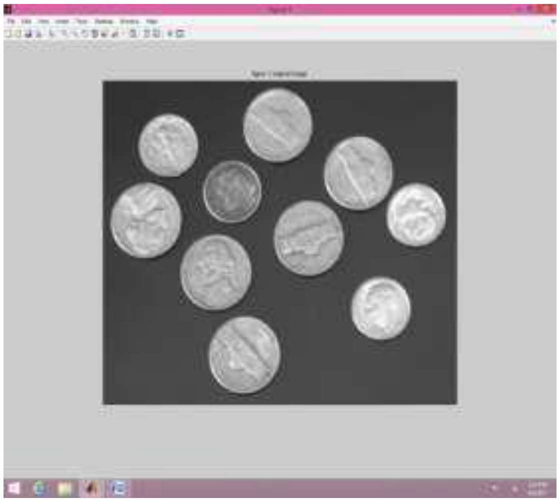
AIM: Program of sharpen image using gradient mask.

THEORY: An image gradient is a directional change in the intensity or color in an image. The gradient of the image is one of the fundamental building blocks in image processing. For example the Canny edge detector uses image gradient for edge detection. Mathematically, the gradient of a two-variable function (here the image intensity function) at each image point is a 2D vector with the components given by the derivatives in the horizontal and vertical directions. At each image point, the gradient vector points in the direction of largest possible intensity increase, and the length of the gradient vector corresponds to the rate of change in that direction.

PROGRAM:

```
% Program of sharpen image using gradient mask
I=imread('coins.png');
subplot(2,2,1);
imshow(I)
title('Original Image');
h=fspecial('sobel');
f=imfilter(I,h,'replicate');
subplot(2,2,2);
imshow(F)
title('filtered image by sobel mask');
s=I+F;
subplot(2,2,4);
imshow(s)
title('Final o/p Image');
```

Result:



Original Image

Conclusion: Thus we have performed the sharpening operation using gradient mask on the Original image.

EXPERIMENT NO. 7

AIM: Program for morphological operation: erosion and dilation.

THEORY: Erosion (usually represented by ⊖) is one of two fundamental operations (the other being dilation) in morphological image processing from which all other morphological operations are based. It was originally defined for binary images, later being extended to grayscale images, and subsequently to complete lattices.

With A and B as two sets in Z2 (2D integer space), the dilation of A and B is defined as A(+)B={Z|(B̂)Z∩A ≠ ϕ}

In the above example, A is the image while B is called a structuring element. In the equation,(B̂)Z simply means taking the reflections of B about its origin and shifting it by Z. Hence dilation of A with B is a set of all displacements, Z, such that (B̂)Z and A overlap by at least one element. Flipping of B about the origin and then moving it past image A is analogous to the convolution process. In practice flipping of B is not done always. Dilation adds pixels to the boundaries of object in an image. The number of pixels added depends on the size and shape of the structuring element. Based on this definition, dilation can be defined as

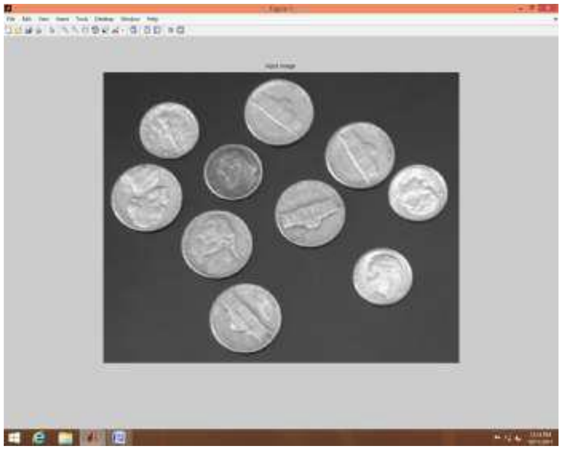
A(+)B={{Z|(B̂)Z∩A} ϵ A}

PROGRAM:

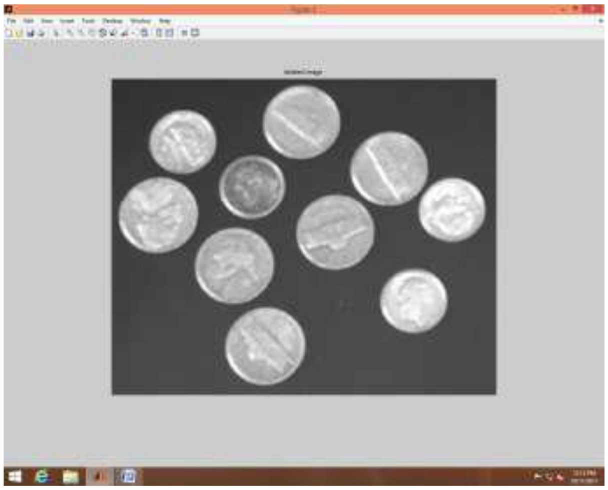
```
% Program for morphological operations: Erosions& Dilation
f=imread('coins.png');
B=[0 1 1;1 1 1;0 1 0];
f1=imdilate(f,B);
se=strel('disk',10);
f2=imerode(f,se);
figure,imshow(f)
title('input image');
```

```
figure,imshow(f1)

title('delated image');
figure,imshow(f2)
title('eroded image');
```

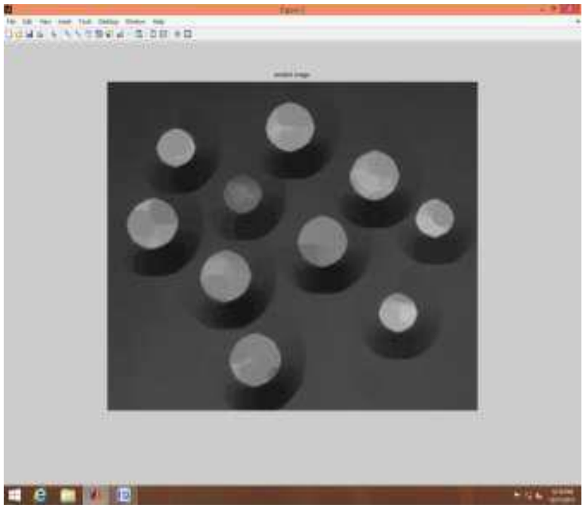
Result:



Original Image



Erosion Image



Dilated Image

Conclusion: Thus we have obtained the erosion and dilated image for the original image.

EXPERIMENT NO. 8

AIM: Program for DCT/IDCT computation.

THEORY: A discrete cosine transform (DCT) expresses a finite sequence of data points in terms of a sum of cosine functions oscillating at different frequencies. DCTs are important to numerous applications in science and engineering, from lossy compression of audio (e.g. MP3) and images (e.g. JPEG) (where small high-frequency components can be discarded), to spectral methods for the numerical solution of partial differential equations. The use of cosine rather than sine functions is critical for compression, since it turns out (as described below) that fewer cosine functions are needed to approximate a typical signal, whereas for differential equations the cosines express a particular choice of boundary conditions.

In particular, a DCT is a Fourier-related transform similar to the discrete Fourier transform (DFT), but using only real numbers. The DCTs are generally related to Fourier Series coefficients of a periodically and symmetrically extended sequence whereas DFTs are related to Fourier Series coefficients of a periodically extended sequence. DCTs are equivalent to DFTs of roughly twice the length, operating on real data with even symmetry (since the Fourier transform of a real and even function is real and even), whereas in some variants the input and/or output data are shifted by half a sample. There are eight standard DCT variants, of which four are common.

Like for the DFT, the normalization factor in front of these transform definitions is merely a convention and differs between treatments. For example, some authors multiply the transforms by so that the inverse does not require any additional multiplicative factor. Combined with appropriate factors of √(2/N), this can be used to make the transform matrix orthogonal.

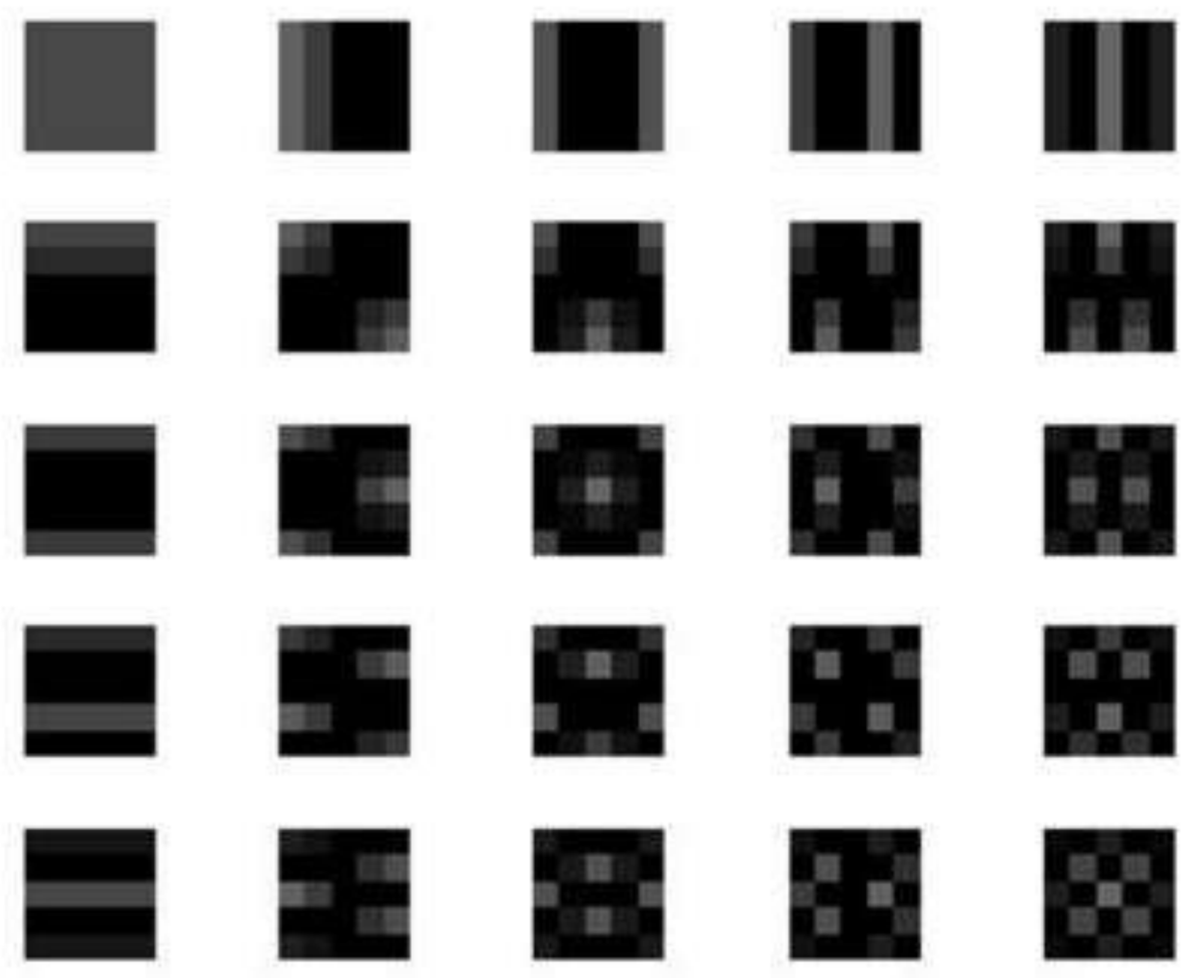
PROGRAM:

```
clc;
clear all;
```

```
close all;

m=input('Enter the basis matrix dimension: ');    % Request user input
n=m;
alpha2=ones(1,n)*sqrt(2/n);
alpha2(1)=sqrt(1/n);
alpha1=ones(1,m)*sqrt(2/m);
alpha(1)=sqrt(1/m);                                 % square root.
for u=0:m-1

        for v=0:n-1

                for x=0:m-1
                        for y=0:n-1
                                a{u+1,v+1}(x+1,y+1)=alpha1(u+1)*alpha2(v+1)*...cos((2*
                                x+1)*u*pi/(2*n))*cos((2*y+1)*v*pi/(2*n));
                        end
                end
        end
end
mag=a;
figure(3)                               % Create figure graphics object
k=1;

% Code to plot the basis
for i=1:m
        for j=1:n
                subplot(m,n,k)                  % Create axes in tiled positions
                imshow(mag{i,j},256)            % Display image
                k=k+1;
        end
end
```

Enter the basis matrix dimension: 5

Result:



Conclusion: Thus we have obtained the DCT/IDCT for the image.

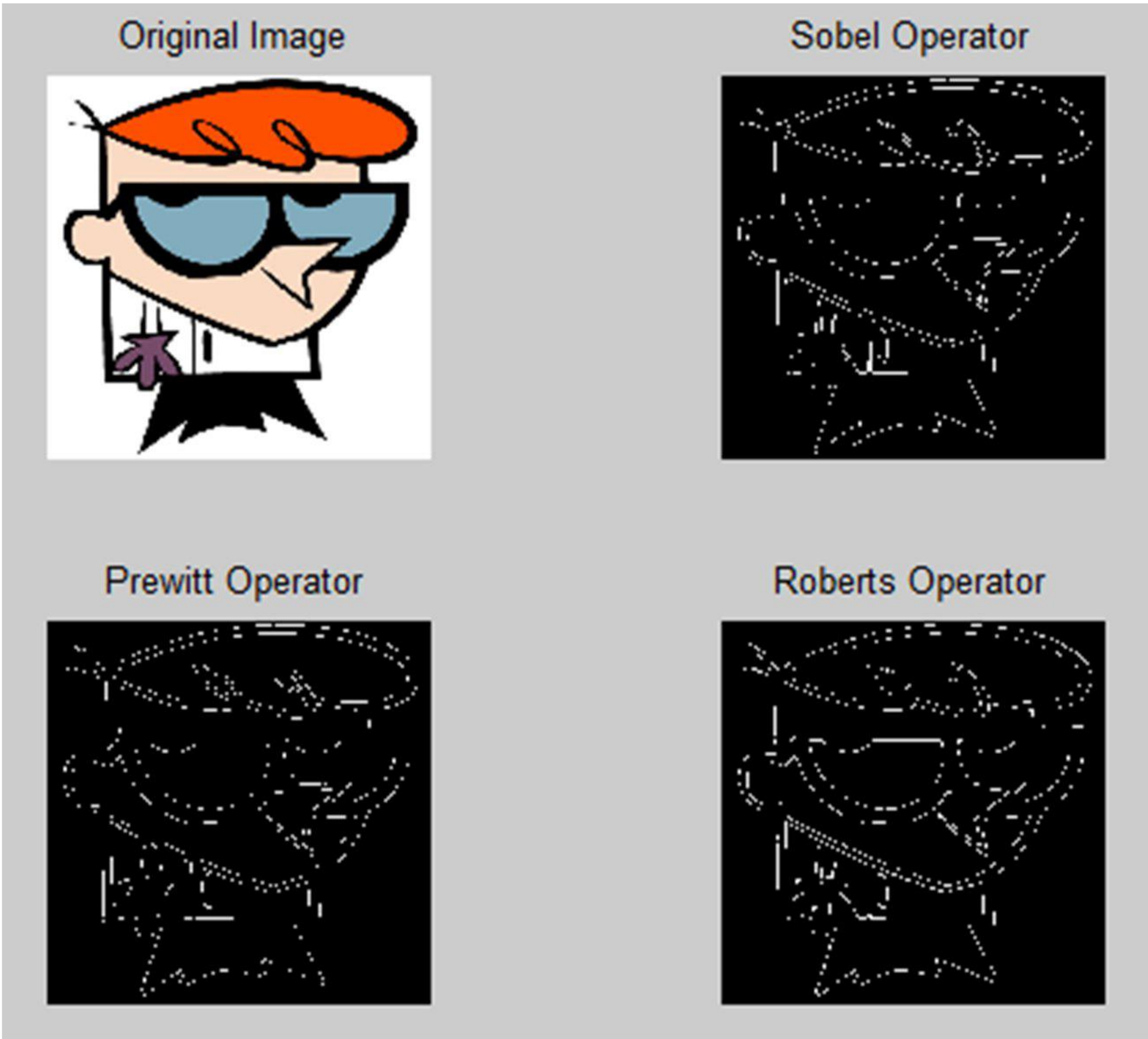
EXPERIMENT NO. 9

AIM: Edge Detection using Sobel, Prewitt and Roberts Operators.

Program:

```
clc;
clear all;
close all;

a = imread('dexter.jpg');
b = rgb2gray(a);
subplot(2,2,1);
imshow(a);
title('Original Image');

c1 = edge(b,'sobel');
subplot(2,2,2);
imshow(c1);
title('Sobel Operator');

c2 = edge(b,'prewitt');
subplot(2,2,3);
imshow(c2);
title('Prewitt Operator');

c3 = edge(b,'roberts');
subplot(2,2,4);
imshow(c3);
title('Roberts Operator');
```

Result:



Conclusion: Thus we have performed the Edge Detection using Sobel, Prewitt and Roberts Operators on the Original image.

EXPERIMENT NO. 10

AIM: Computation of mean, Standard Deviation, Correlation coefficient of the given Image.

Program:

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

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

c=imcrop(g);
subplot(2,2,3); imshow(c);title('Cropped Image');

m=mean2(c);disp('m'); disp(m);
s=std2(c); disp('s'); disp(s);

figure,
k=(checkerboard>0.8);
subplot(2,1,1); imshow(k); title('Image1');

k1=(checkerboard>0.5);
subplot(2,1,2); imshow(k1); title('Image2');

r=corr2(k,k1);
disp('r');disp(r);
```

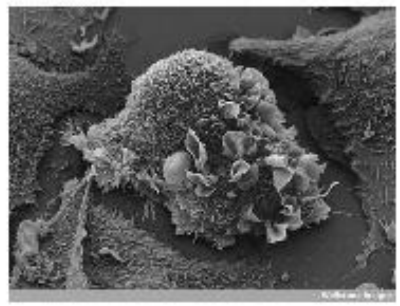
```
m
        74.5173
s
        44.2327
```

r

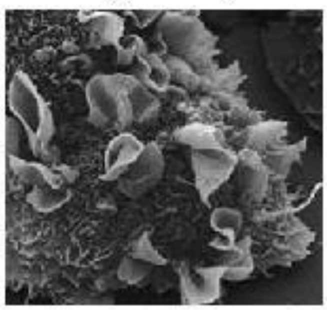
0.5774

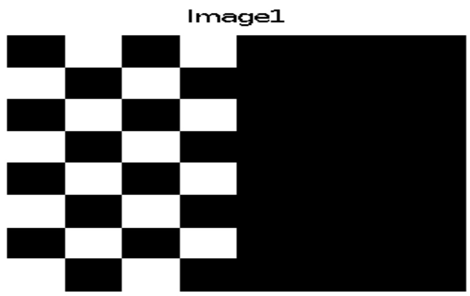
Result:

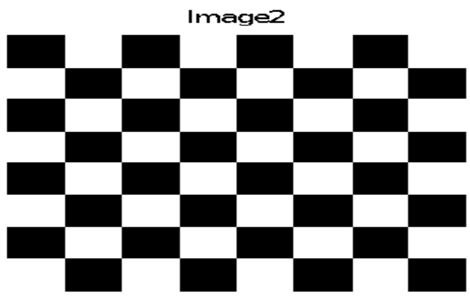
Original Image



Cropped Image







Conclusion: Thus we have performed the Computation of mean, Standard Deviation, Correlation coefficient of the given Image.