Institute of Distance & Open Learning
M.Sc.I.T

UNIVERSITY OF MUMBAI

Certificate

This is to certify that **Rajpurohit Harsh Hargopalsingh** Seat no **600257** has successfully completed all the practical of paper titled **"Image Processing"** for M.Sc. (Information Technology) Part 1 Sem 2 in the year 2022-2023

Signature
Faculty In-Charge

Head of the Department

Examiner

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Practical No : 1

Basics

A. Program to calculate number of samples required for image.

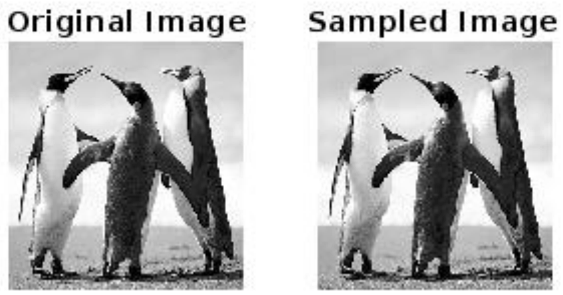
```
clc;
close;
//dimension of the image in inches
m=4;
n=6;
N=400;  //number of dots per inch in each direct
N2=2*N; //number of dots per inch in both horiz
Fs=m*N2*n*N2;
fprintf('Number of samples required to preserve the information in the image=
%d',Fs)
```

Output:

```
Number of samples required to preserve the information in the image= 15360000
```

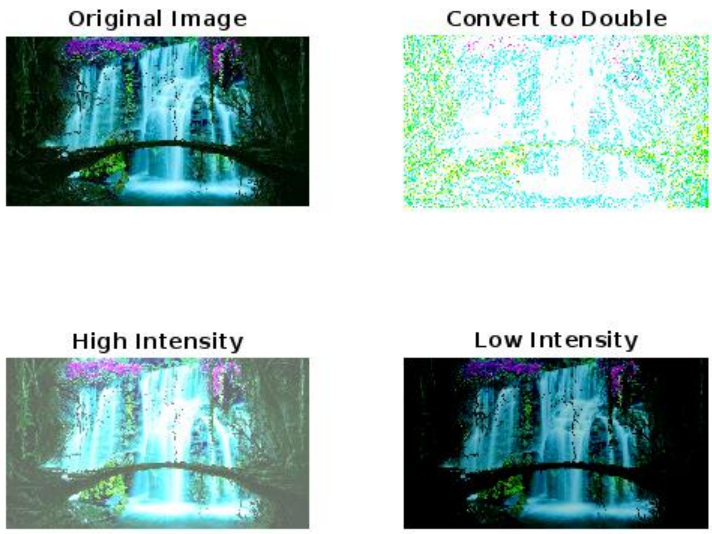
B. Program to study the effects of reducing the spatial resolution of a digital image

```
clc;
clear all;
n=input('Enter the input samples');
img= rgb2gray(imread("IP_img_1.jpg"));
a=size(img);
w=a(2);
h=a(1);
im=zeros(100);
 for i=1:n:h
 for j=1:n:w
 for k=0:n-1
 for l=0:n-1
    im(i+k,j+1)=img(i,j);
 end
 end
 end
 end
 subplot(1,2,1);
 imshow(uint8(img));title('Original Image');
 subplot(1,2,2);
 imshow(uint8(im));title('Sampled Image');
```



C. Program to study the effects of varying the number of intensity levels in a digital image

```
a=imread('Scenary.jpg');
b=double(a);
b1=b+100;
b2=b-50;
subplot(221);
imshow(a);
title('Original Image');
subplot(222);
imshow(b);
title('Convert to Double');
subplot(223);
imshow(uint8(b1));
title('High Intensity');
subplot(224);
imshow(uint8(b2));
title('Low Intensity');
```



D. Program to perform image averaging (image addition) for noise reduction.

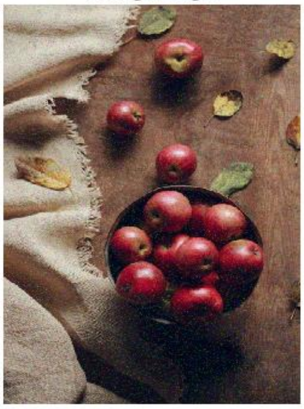
```
close;
clear;
clc;
im=imread('Apple_Image.jpeg');
imshow(im);
title('Orignal image')
figure
imd=im2double(im);
noi=imnoise(imd,'salt & pepper');
imshow(noi);
title('Noisy Image')
figure
s=struct;
for i=1:5
   s(i).noiseimage=imnoise(imd,'salt & pepper');
end
sum=0;
for i=1:5
   sum=sum+s(i).noiseimage;
end
avg=sum/5;
imshow(avg);
title('5 avg image')
figure
s=struct;
for i=1:25
   s(i).noiseimage=imnoise(imd,'salt & pepper');
end
sum=0;
for i=1:25
   sum=sum+s(i).noiseimage;
end
avg=sum/25;
imshow(avg);
title('25 avg image')
figure
s=struct;
for i=1:50
   s(i).noiseimage=imnoise(imd,'salt & pepper');
```

```
end
sum=0;
for i=1:50
   sum=sum+s(i).noiseimage;
end
avg=sum/50;
imshow(avg);
title('50 avg image')
```

Orignal image

Noisy Image

5 avg image



25 avg image

50 avg image

E. Program to compare images using subtraction for enhancing the difference between images.

```
clc;
clear;
close;
warning off;
x=imread('Apple_Image.jpeg');
y=imread('Scenary.jpg');
g=size(x);
y=imresize(y,[g(1),g(2)]);
```

```
figure;
imshow(x);
title('First image');
figure;
imshow(y);
title('Second image');
figure;
imshow(x-y);
title('Difference of two images');
```

Practical No : 2
Image enhancement

A. Basic Intensity Transformation functions

1. Program to perform Image negation

```
clc;
clear all;
a=imread('IP_img_2.jpg');
subplot(1,2,1);
imshow(a);
title('Original img');
[m,n]=size(a);
for i=1:m
for j=1:n
   c(i,j)=255-a(i,j);
end
end
subplot(1,2,2);
imshow(c);
title('Negation img');
```

Output:

Original img

Negation img

2. Program to perform threshold on an image

```
clc;
clear all;
a=imread('IP_img_2.jpg');
b=double(a)
subplot(1,2,1);
imshow(a);
title('Original img');
t=100;
[m,n]=size(b);
for i=1:m
for j=1:n
   if(b(i,j)<t)
   c(i,j)=0;
   else
      c(i,j)=255;
```

```
    end
end
end
subplot(1,2,2);
imshow(c);
title('Threshold img');
```

3. Log transformation

```
clc;
clear all;
a=imread('IP_img_2.jpg');
b=double(a)
subplot(1,2,1);
imshow(a);
title('Original img');
t=10;
[m,n]=size(b);
for i=1:m
for j=1:n
    c(i,j)=t*log(1+b(i,j));
end
end
subplot(1,2,2);
imshow(uint8(c));
title('Threshold img');
```

Output:

4. Power-law transformations

```
clc;
clear all;
a=imread('IP_img_2.jpg');
b=double(a)
```

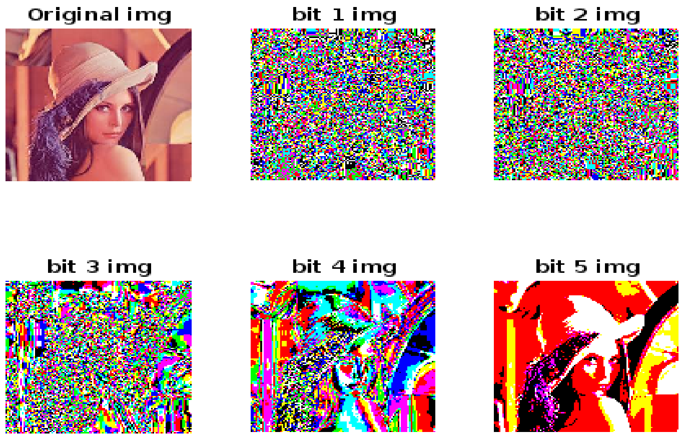
```
subplot(1,2,1);
imshow(a);
title('Original img');
k=1;
gamma=1;
[m,n]=size(b);
for i=1:m
for j=1:n
   c(i,j)=k*(b(i,j)^gamma);
end
end
subplot(1,2,2);
imshow(uint8(c));
title('Power law img');
```

Output:

5. Piecewise linear transformations

```
clc;
clear all;
a=imread('IP_img_2.jpg');
b=double(a)
subplot(2,3,1);
imshow(a);
title('Original img');
f1=bitget(b,1),
subplot(2,3,2);
imshow(f1);
title('bit 1 img');
f2=bitget(b,2),
subplot(2,3,3);
imshow(f2);
title('bit 2 img');
f3=bitget(b,4),
subplot(2,3,4);
imshow(f3);
title('bit 3 img');
f4=bitget(b,6),
```

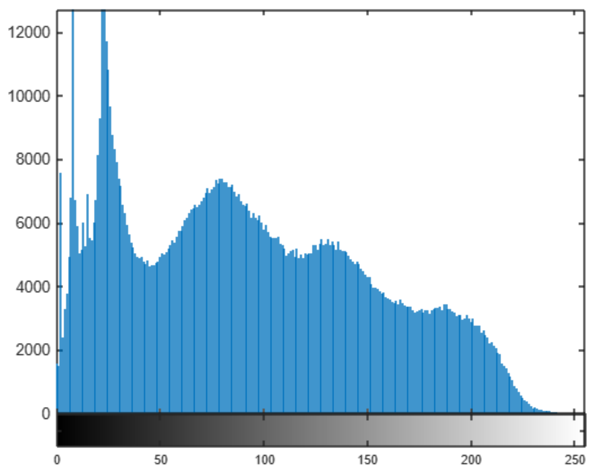
```
subplot(2,3,5);
imshow(f4);
title('bit 4 img');
f5=bitget(b,8),
subplot(2,3,6);
imshow(f5);
title('bit 5 img');
```



B. Intensity transformation and Spatial Filtering

1. Program to plot the histogram of an image and categorise

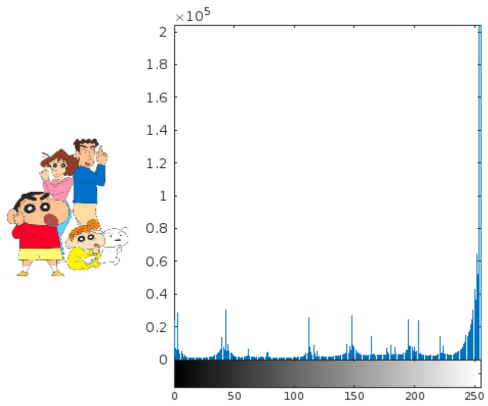
```
clear;
clc;
I=imread('Apple_Image.jpeg');
imshow(I)
figure;
imhist(I);
```

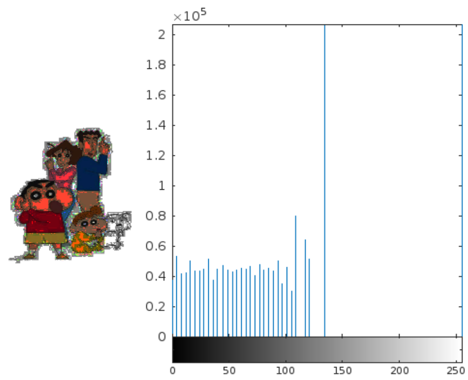


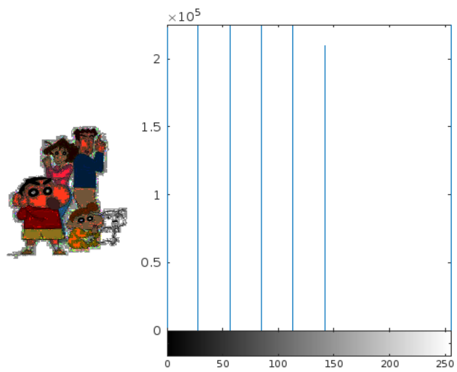
2. Program to apply histogram equalization

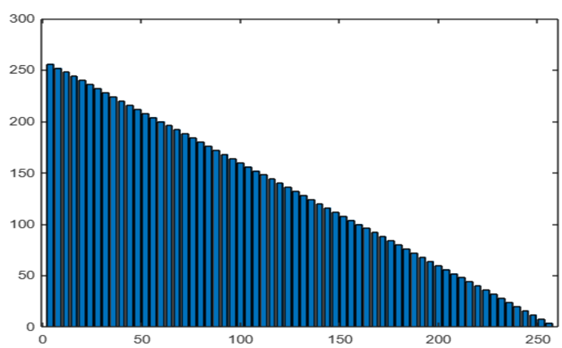
```
I = imread('Cartoon2.jpg');
figure
subplot(1,3,1)
imshow(I)
```

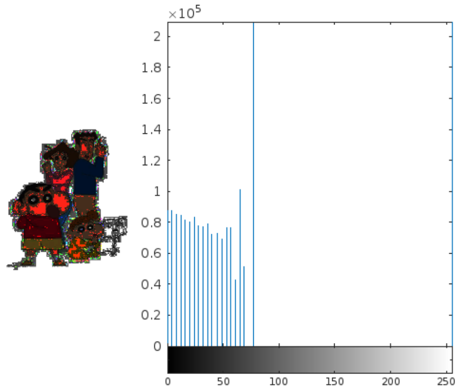
```
subplot(1,3,2:3)
imhist(I)
J = histeq(I);
figure
subplot(1,3,1)
imshow(J)
subplot(1,3,2:3)
imhist(J)
nbins = 10;
K = histeq(I,nbins);
figure
subplot(1,3,1)
imshow(K)
subplot(1,3,2:3)
imhist(K)
target = 256:-4:4;
figure
bar(4:4:256,target)
L = histeq(I,target);
figure
subplot(1,3,1)
imshow(L)
subplot(1,3,2:3)
imhist(L)
```





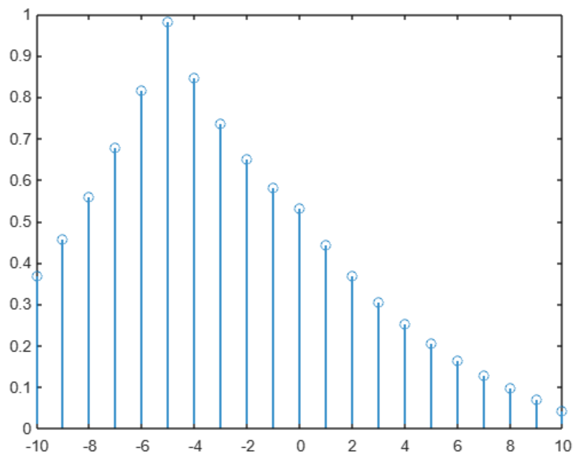






C. Write a program to perform convolution and correlation

```
clear;
clc;
n = 0:15;
x = 0.84.^n;
y = circshift(x,5);
[c,lags] = xcorr(x,y);
stem(lags,c)
n = 0:15;
x = 0.84.^n;
[c,lags] = xcorr(x);
stem(lags,c)
n = 0:15;
x = 0.84.^n;
y = circshift(x,5);
[c,lags] = xcorr(x,y,10,'normalized');
stem(lags,c)
```

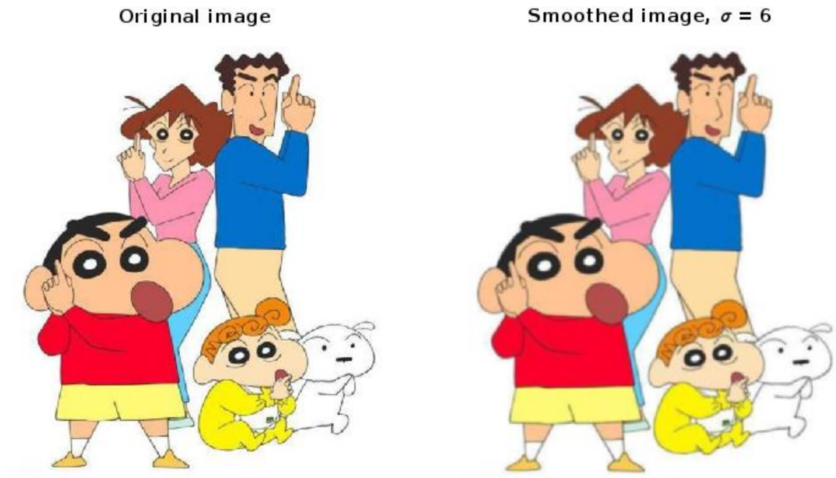


D. Write a program to apply smoothing and sharpening filters on grayscale and color images

a) Low Pass

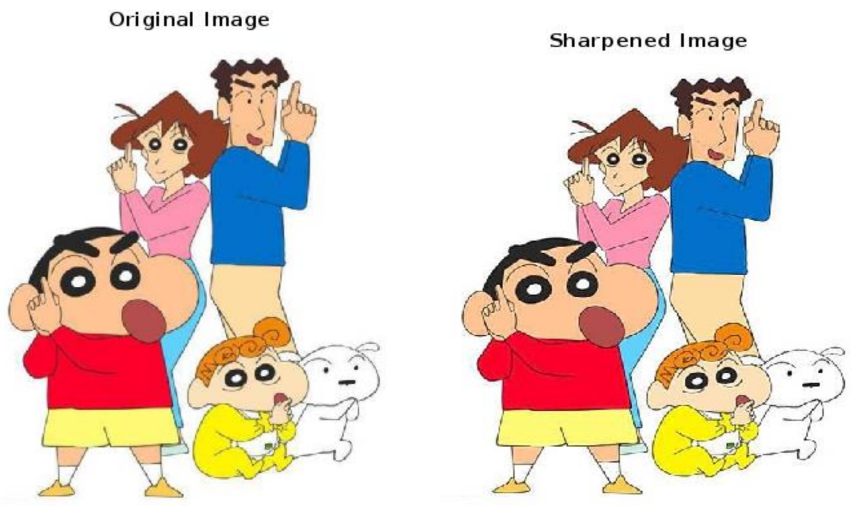
```
clear;
clc;
I = imread('Cartoon2.jpg');
```

```
Iblur1 = imgaussfilt(I,2);
Iblur2 = imgaussfilt(I,4);
Iblur3 = imgaussfilt(I,8);
figure
imshow(I)
title('Original image')
figure
imshow(Iblur1)
title('Smoothed image, \sigma = 6')
```



b) High Pass

```
clear;
clc;
a = imread('Cartoon2.jpg');
imshow(a), title('Original Image');
b = imsharpen(a,'Radius',2,'Amount',1);
figure, imshow(b)
title('Sharpened Image');
```



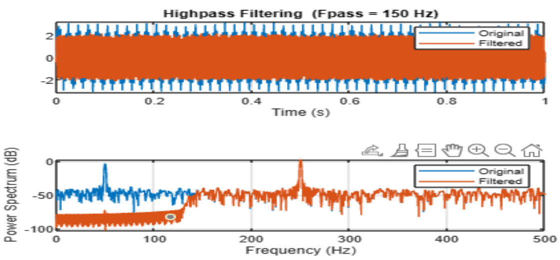
Practical 3
Filtering in Frequency Domain

A. Program to apply Discrete Fourier Transform on an image

```
close;
clear;
clc;
I=imread('Scenary 2.jpeg');
I1=rgb2gray(I);
I2=fft2(I1);
subplot(311);
imshow(I);
subplot(312)
imshow(I1);
subplot(313);
imshow(I2);
I3=ifft2(I2);
I4=uint8(I3);
figure,
subplot(2,1,1);
imshow(I3);
subplot(2,1,2);
imshow(I4);
```

B. Program to apply Low pass and High pass filters in frequency domain

```
clear;
clc;
fs = 1e3;
t = 0:1/fs:1;
x = [1 2]*sin(2*pi*[50 250]'.*t) + randn(size(t))/10;
highpass(x,150,fs)
```



C. Program to apply Laplacian filter in frequency domain

```
k=imread("Scenary .jpeg");
k1=rgb2gray(k);
k1=double(k1);
Laplacian=[0 1 0; 1 -4 1; 0 1 0];
k2=conv2(k1, Laplacian, 'same');
imtool(k1, []);
imtool(abs(k2,[]));
```

D. Program for high frequency emphasis filtering, high boost and homomorphic filtering.

```
alpha = 0.5;
beta = 1.5;
Hemphasis = alpha + beta*H;
plot(1:30,H(1,1:30),'r',1:30,Hemphasis(1,1:30),'b','LineWidth',2);
grid on;
legend('High-pass Filter','High-frequency Emphasis Filter','Location','best');
If = fft2(I, M, N);
Iout = real(ifft2(Hemphasis.*If));
Iout = Iout(1:size(I,1),1:size(I,2));
Ihmf_2 = exp(Iout) - 1;
imshowpair(I, Ihmf_2, 'montage')
imshowpair(Ihmf, Ihmf_2, 'montage')
imshow(histeq(mat2gray(Ihmf)))
imshowpair(histeq(mat2gray(Ihmf)), histeq(mat2gray(Ihmf_2)), 'montage')
```

Practical 4
Image Denoising

A. Program to denoise using spatial mean, median and adaptive mean filtering

```
clc;
clear ;
close all;
a=imread('Apple_Image.jpg');
figure(1),imshow(a),title('origanal image');
b=imnoise(a,'salt & pepper',.02);
figure(2),imshow(b),title('noisy image');
Smax=9;
for i=1:254
  for j=1:254
    n=b(i:i+2,j:j+2);
    Zmin=min(n(:));
    Zmax=max(n(:));
    Zmed=median(n(:));
    sx=3;
    sy=3;
        A1=Zmed-Zmin;
        A2=Zmed-Zmax;
       if (A1>0) && (A2<0)
         B1 = Zxy-Zmin;
         B2 = Zxy-Zmax;
         if (B1>0) && (B2<0)
              b(i:i+2,j:j+2) = n(i,j);
            break;
         else
             b(i:i+2,j:j+2) = Zmed;
            break;
         end
       else
         sx=sx+2;
         sy=sy+2;
         if (sx > Smax) && (sy > Smax)
            b(i:i+2,j:j+2) = n(i,j);
         end
       end
  end
```

```
end
figure(3),imshow(a),title('denoised image');
```

B. Program for Image deblurring using inverse, Weiner filters

```
Ioriginal = imread('Apple_Image.jpg');
imshow(Ioriginal);
title('Original Image');
PSF = fspecial('motion',21,11);
Idouble = im2double(Ioriginal);
blurred = imfilter(Idouble,PSF,'conv','circular');
imshow(blurred);
title('Blurred Image');
wnr1 = deconvwnr(blurred,PSF);
imshow(wnr1);
title('Restored Blurred Image')
noise_mean = 0;
noise_var = 0.0001;
blurred_noisy = imnoise(blurred,'gaussian',noise_mean,noise_var);
imshow(blurred_noisy)
title('Blurred and Noisy Image');
```

Practical 5
Color Image Processing

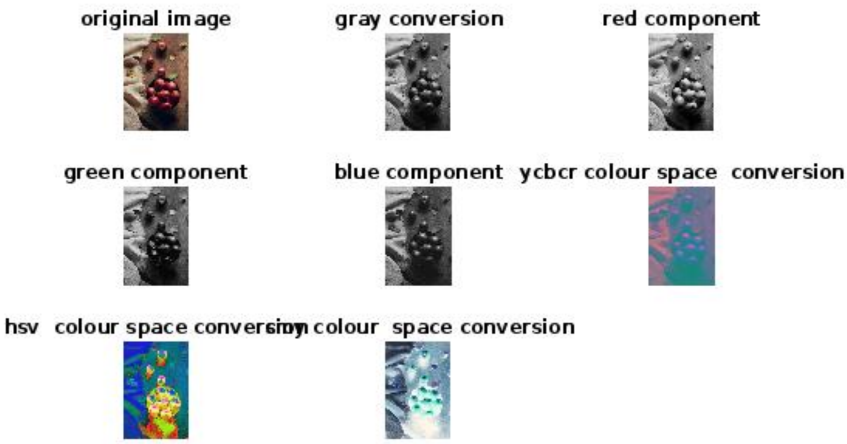
A. Program to read a color image and segment into RGB planes , histogram of color image

```
clc;
clear;
close;
RGB= imread('Apple_Image.jpeg');
imshow(RGB);
figure
ShowColorImage(RGB,'RGB Color Image');
YIQ=rgb2ntsc(RGB);
figure
ShowColorImage(YIQ,'NTSC Image YIQ');
RGB=ntsc2rgb(YIQ);
YCC=rgb2ycbcr(RGB);
figure
ShowColorImage(YCC,'Equivalent HSV image Ycbcr');
RGB=ycbcr2rgb(YCC);
HSV=rgb2hsv(RGB);
figure
ShowColorImage(HSV,'Equivalent HSV image');
RGB=hsv2rgb(HSV);
R=RGB(:,:,1);
G=RGB(:,:,2);
B=RGB(:,:,3);
figure
ShowImage(R,'Red Matrix');
figure
ShowImage(G,'Green Matrix');
figure
ShowImage(B,'Blue Matrix');
```

B. Program for converting from one color model to another model

```
clc;
clear;
close;
warning off;
A=imread('Apple_Image.jpeg');
subplot(4,3,1);
imshow(A);
title('original image');
B=rgb2gray(A);
subplot(4,3,2);
imshow(B);
title('gray conversion');
rgb=im2double(A);
r=rgb(:,:,1);
g=rgb(:,:,2);
b=rgb(:,:,3);
subplot(4,3,3);
imshow(r);
title('red component');
subplot(4,3,4);
imshow(g);
title('green component');
subplot(4,3,5);
imshow(b);
title('blue component');
ycbcr_img=rgb2ycbcr(A);
subplot(4,3,6);
imshow(ycbcr_img);
title('ycbcr colour space  conversion');
hsv_img=rgb2hsv(A);
subplot(4,3,7);
imshow(hsv_img);
title('hsv  colour space conversion');
cmy_img=imcomplement(A);
subplot(4,3,8);
imshow(cmy_img);
title('cmy colour  space conversion');
num=.5*((r-g)+(r-b));
den=sqrt(r-g).^2+(r-g).*(g-b);
```

```
theta=acos(num./den);
H=theta;
Hb greater than g=2*pi-Hb greater than g;
H=H/(2*pi);
num1=min(min(r,g),b);
den1=r+g+b;
den(den==0)=eps;
S=1-3.*num1./den1;
H(S==0)=0;
I=(r+g+b)/3;
hsi=cat(3,H,S,I);
subplot(4,3,9);
imshow(hsi);
title('HSI');
subplot(4,3,10);
imshow(H);
title('hue component');
subplot(4,3,11);
imshow(S);
title('saturation component');
subplot(4,3,12);
imshow(I);
title('brightness component');
```



C. Program to apply false colouring(pseudo) on a gray scale image

Step1:

```
[filename,pathname]=uigetfile('*_*','Select grayscale image');
filewithpath=strcat(pathname,filename);
img=imread(filewithpath);
[r,c]=size(img);
```

```
R=uint8(zeros(r,c));
G=uint8(zeros(r,c));
B=uint8(zeros(r,c));
nos=input('Enter number of Slices:');
color=zeros(nos,3);
interval=zeros(nos,2);
for i=1:nos
   interval(i,:)=input('Enter Intensity Interval');
   color(i,:)=uint8(255*uisetcolor('Select Color for Pseudo coloring'));
end
for s=1:nos
   slice=interval(s,:); LL=slice(1);UL=slice(2);
   rgb=color(s,:); red=rgb(1); green=rgb(2); blue=rgb(3);
   for i=1:r
      for j=1:c
         if img(i,j)>=LL && img(i,j)<=UL
            R(i,j)=red;
            G(i,j)=green;
            B(i,j)=blue;
         end
      end
   end
end
imgc=cat(3,R,G,B);
imshow(imgc);
title('Pseudo color image');
```

Step2:

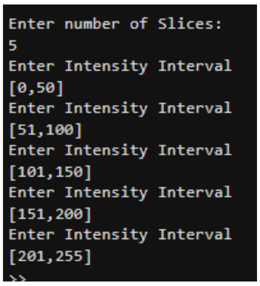
```
[filename,pathname]=uigetfile('*_*','Select grayscale image');
filewithpath=strcat(pathname,filename);
img=imread(filewithpath);
[r,c]=size(img);
R=uint8(zeros(r,c));
G=uint8(zeros(r,c));
B=uint8(zeros(r,c));
coltype=input('Enter choice of color map as string');
colmap=uint8(255*coltype);
if (length(colmap)~=256)
   colmap=imresize(colmap,[256,3]);
end
```

```
for i=1:r
   for j=1:c
      R(i,j)=colmap(img(i,j)+1,1);
      G(i,j)=colmap(img(i,j)+1,2);
      B(i,j)=colmap(img(i,j)+1,3);
   end
end
imgc=cat(3,R,G,B);
imshow(imgc);
title('Pseudo color image');
```

Step3:

```
[filename,pathname]=uigetfile('*_*','Select grayscale image');
filewithpath=strcat(pathname,filename);
img=imread(filewithpath);
[r,c]=size(img);
R=zeros(r,c);
G=zeros(r,c);
B=zeros(r,c);
theta=linspace(0,4*pi,256);
Rv=255*abs(sin(theta)+pi);
Gv=255*abs(sin(theta)-(pi/3));
Bv=255*abs(sin(theta+(pi)/3));
for i=1:r
   for j=1:c
      R(i,j)=Rv(img(i,j)+1);
      G(i,j)=Gv(img(i,j)+1);
      B(i,j)=Bv(img(i,j)+1);
   end
end
imgc=cat(3,uint8 (R), uint8 (G), uint8 (B));
imshow(imgc);
title('Pseudo color image');
```

Step1

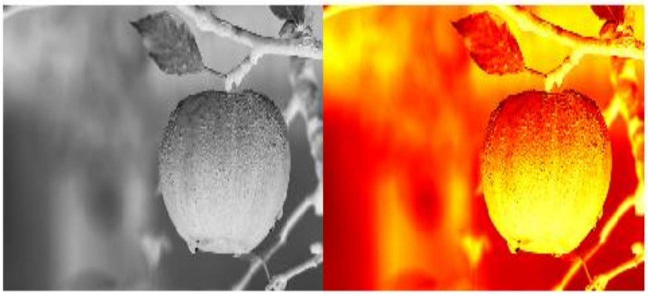


Step2

```
>> Pract5C2
Enter choice of color map as string
hot
>>
```

```
>> montage({img,imgc})
>>
```

Pseudo color image



Step3

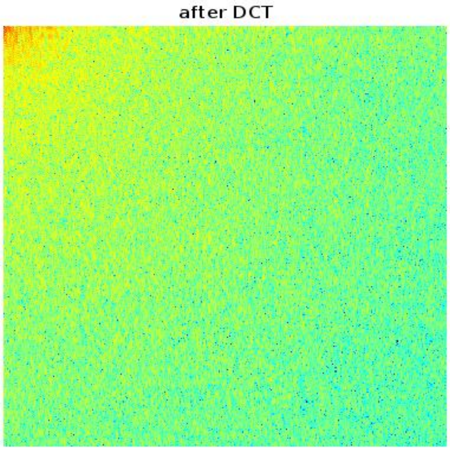
Pseudo color image

Practical 6

Fourier Related Transforms

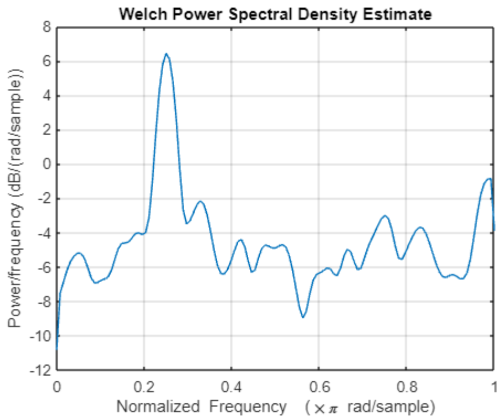
A. Program to compute Discrete Cosine Transforms

```
clc;
I=imread('Scenary 3.jpeg');
I=I(100:460,100:460);
A=double(I);
B=zeros(size(A));
Temp=zeros(size(A));
[M,N]=size(A);
x=1:M;
x=repmat(x',1,N);
y=repmat(1:N,M,1);
for i=1:M
   for j=1:N
      if(i==1)
         AlphaP=sqrt(1/M);
      else
         AlphaP=sqrt(2/M);
      end
      if(j==1)
         AlphaQ=sqrt(1/N);
      else
         AlphaQ=sqrt(2/N);
      end
      cs1=cos((pi*(2*x-1)*(i-1))/(2*M));
      cs2=cos((pi*(2*y-1)*(j-1))/(2*N));
      Temp=A.*cs1.*cs2;
      B(i,j)=AlphaP*AlphaQ*sum(sum(Temp));
   end
end
figure(1);
imshow(I);
title('Original image');
figure(2);
imshow(log(abs(B)),[]);
colormap(jet);
title('after DCT');
```



B. Walsh -Hadamard Transforms

```
rng default
n = 0:319;
x = cos(pi/4*n)+randn(size(n));
pxx = pwelch(x);
pwelch(x)
```



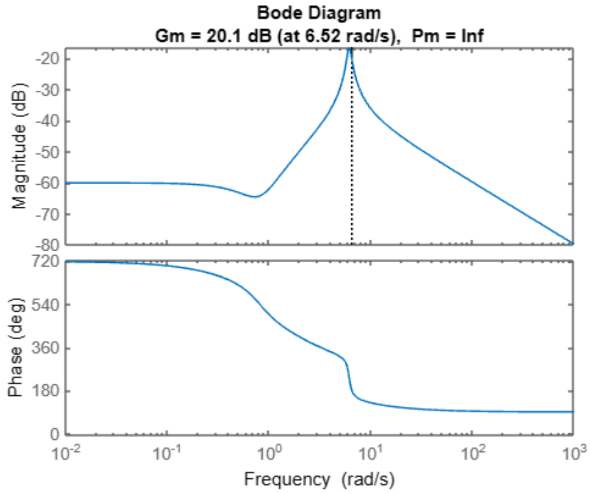
C. Haar Transform Wavelet

Step1

```
image_input=imread('Scenary 5.jpeg');
delta=0.5;
harr_wt(image_input,delta)
if margin>2
   error('harr_wt:TooManyInputs',...
      'requires at most 1 optional inputs');
end
if (margin==1)
   delta=0.01;
end
if (delta>1 || delta<0)
   error('harr_wt: Delta must be a value between 0 & 1');
```

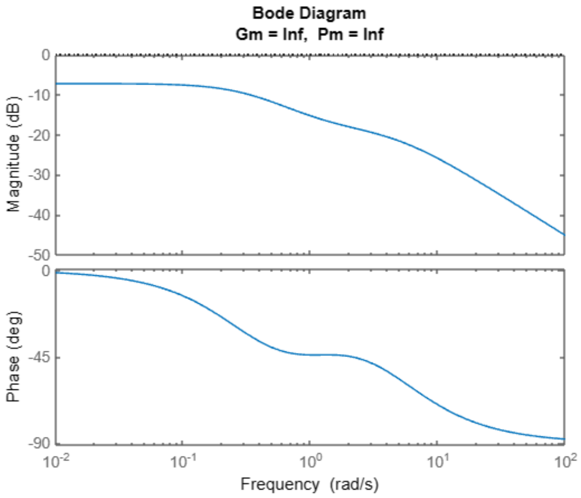
```
end
H1=[0.5 0 0 0 0.5 0 0 0;0.5 0 0 0 -0.5 0 0 0;0 0.5 0 0 0 0.5 0 0;0 0.5 0 0 0 -0.5 0 0; 0 0
0.5 0 0 0 0.5 0; 0 0 0.5 0 0 0 -0.5 0;0 0 0 0.5 0 0 0 0.5;0 0 0 0.5 0 0 0 -0.5];
H2=[0.5 0 0.5 0 0 0 0 0;0.5 0 -0.5 0 0 0 0 0;0 0.5 0 0.5 0 0 0 0;0 0.5 0 -0.5 0 0 0 0; 0 0 0
0 1 0 0 0; 0 0 0 0 0 1 0 0;0 0 0 0 0 0 1 0;0 0 0 0 0 0 0 1];
H3=[0.5 0.5 0 0 0 0 0 0;0.5 -0.5 0 0 0 0 0 0;0 0 1 0 0 0 0 0; 0 0 0 1 0 0 0 0;0 0 0 0 1 0 0
0;0 0 0 0 0 1 0 0;0 0 0 0 0 0 1 0;0 0 0 0 0 0 0 1];
H1=normc(H1);
H2=normc(H2);
H3=normc(H3);
H=H1*H2*H3;
x=double(imread(image_input));
len=length(size(x));
if len~=2
   error('harr_wt: Input image must be a grey image, use "harr_wt_rgb"function to
compress RGB Images');
end
y=zeros(size(x));
[r,c]=size(x);
for i=0:8:r-8
   for j=0:8:c-8
      p=i+1;
      q=j+1;
      y(p:p+7,q:q+7)=(H')*x(p:p+7,q:q+7)*H;
   end
end
figure;
imshow(x/255);
title('Original image');
n1=nnz(y);
z=y;
m=max(max(y));
y=y/m;
y(abs(y)<delta)=0;
y=y*m;
n2=nnz(y);
for i=0:8:r-8
   for j=0:8:c-8
      p=i+1;
      q=j+1;
```

```
        z(p:p+7,q:q+7)=H*y(p:p+7,q:q+7)*H';
    end
end
figure;
imshow(z/255);
imwrite(x/255,'Original.tif');
imwrite(z/255,'Compressed.tif');
title('Compressed image');
```



Step2:

```
if margin>2
    error('harr_wt:TooManyInputs',...
        'requires at most 1 optional inputs');
end
if (margin==1)
    delta=0.01;
end
if (delta>1 || delta<0)
    error('harr_wt: Delta must be a value between 0 & 1');
end
r=rgb(:,:,1);
g=rgb(:,:,2);
b=rgb(:,:,3);
r=hwt(r,delta);
g=hwt(g,delta);
b=hwt(b,delta);
rgb(:,:,1)=r;
rgb(:,:,2)=g;
rgb(:,:,3)=b;
imwrite(rgb/255,'compressed_rgb.jpg');
```

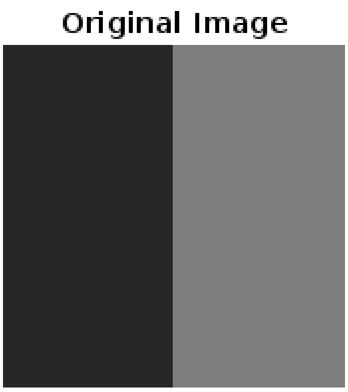


Bode Diagram
Gm = Inf, Pm = Inf
Magnitude (dB)
Phase (deg)
Frequency (rad/s)

Practical 7
Image compression

A. Program to apply compression and decompression algorithm on an image (Arithmetic, Huffman and LZW coding techniques.

```
clear;
clc;
I=[39 39 126 126
   39 39 126 126
   39 39 126 126
   39 39 126 126];
subplot(1,2,1);
imshow(uint8(I));
title('Original Image');
[m,n]=size(I);
Totalcount=m*n;
symbols=unique(I);
counts=histcounts(I(:),symbols);
pro=counts./Totalcount;
dict=huffmandict(symbols,pro);
newvec=reshape(I.',1,[]);
hcode=huffmanenco(newvec,dict);
dhsig1=huffmandeco(hcode,dict);
dhsig=uint8(dhsig1);
back=reshape(dhsig,4,4);
subplot(1,2,2);
imshow(back.');
title('decoded image');
```



Practical 8
Morphological Image Processing

A. Program to apply erosion, dilation, opening, closing

a. Erosion of image

```
clear;
close;
clc;
I=imread('Scenary.jpg');
se1=strel('disk',11);
er=imerode(I,se1);
figure,
imshow(I);
title('Original Image');
figure,
imshow(er);
title('Image after erosion');
```

b. Dilation Of Image

```
A=imread("Apple_Image.jpeg");
se2=strel('ball',5,5);
de=imdilate(A,se2);
figure,
imshow(A);
title('Original Image');
figure,
imshow(de);
title('Image after dilation');
```

Original Image

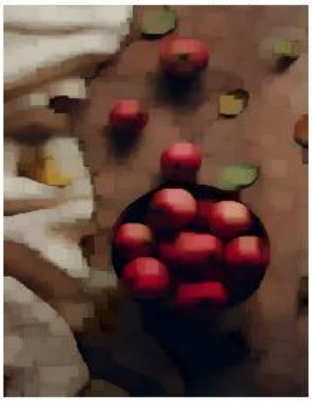
Image after dilation

c. Opening Operation:

```
close;
clear;
clc;
I=imread('Apple_Image.jpeg');
se1=strel('square',20);
io=imopen(I,se1);
figure,
imshow(I);
title('Original Image');
figure,
imshow(io);
title('Image after opening operation');
```

Original Image

Image after opening operation

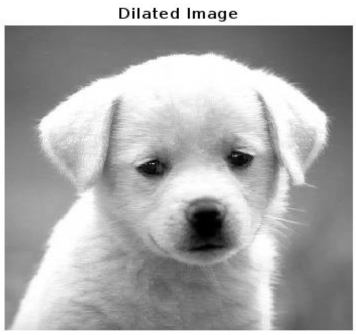


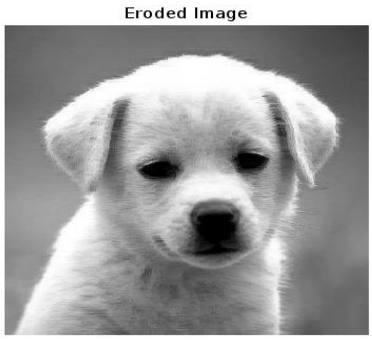
d. Closing Operation:

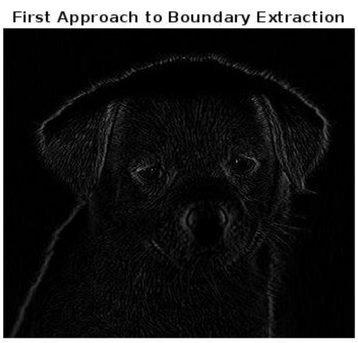
```
A=imread('Scenary.jpg');
se2=strel('disk', 15);
ic=imclose(A,se2);
figure,
imshow(A);
title('Original Image');
figure,
imshow(ic);
title('Image after closing operation');
```

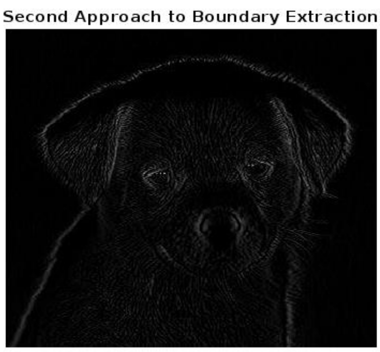
B. Program for detecting boundary of an image

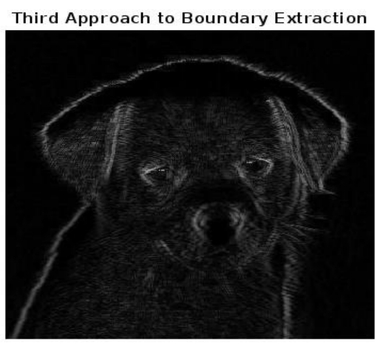
```
clc;
clear;
close;
A=imread('Grayscale.jpg');
B=[0 1 0: 1 1 1: 0 1 0];
A1=imdilate(A,B);
A2=imerode(A,B);
A3=A-A2;
A4=A1-A;
A5=A1-A2;
imshow(A), title('Original Image');
figure, imshow(A1), title('Dilated Image');
figure, imshow(A2), title('Eroded Image');
figure, imshow(A3), title('First Approach to Boundary Extraction');
figure, imshow(A4), title('Second Approach to Boundary Extraction');
figure, imshow(A5), title('Third Approach to Boundary Extraction');
```







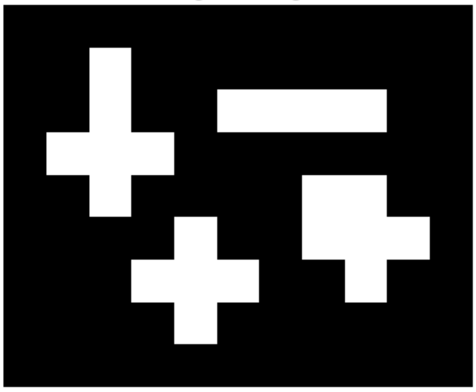




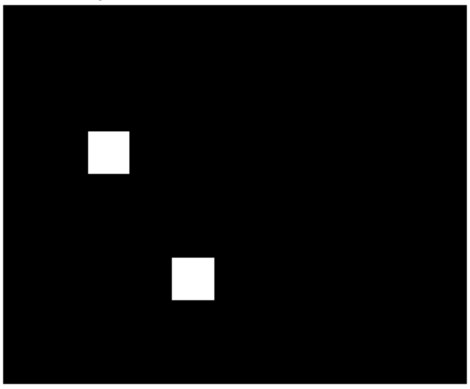
C. Program to apply Hit-or-Miss transform

```
clc;
clear;
close;
warning off
A=[0 0 0 0 0 0 0 0 0 0 0
   0 0 1 0 0 0 0 0 0 0 0
   0 0 1 0 0 1 1 1 1 0 0
   0 1 1 1 0 0 0 0 0 0 0
   0 0 1 0 0 0 0 1 1 0 0
   0 0 0 0 1 0 0 1 1 1 0
   0 0 0 1 1 1 0 0 1 0 0
   0 0 0 0 1 0 0 0 0 0 0
   0 0 0 0 0 0 0 0 0 0 0];
imshow(A);
title('Original Image');
se1=[0 1 0;1 1 1;0 1 0];
se2=~se1;
bw=bwhitmiss(A,se1,se2);
figure;
imshow(bw);
title('Output of Hit and Miss Transform');
```

Original Image



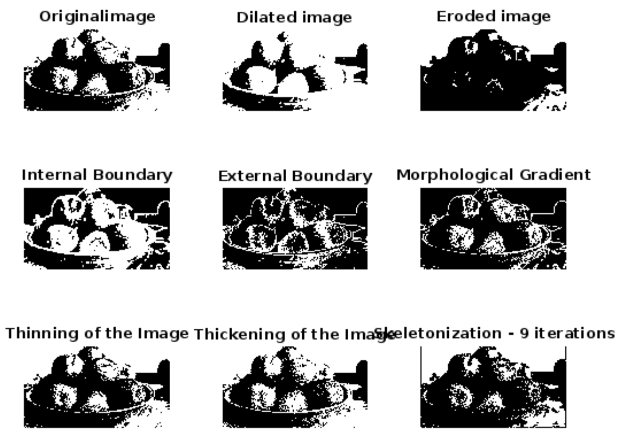
Output of Hit and Miss Transform



D. Program to apply morphological gradient on an image

```
clc;
close;
clear;
myorigimg = imread('Apple_Image.jpg');
myorigimg = imbinarize(rgb2gray(myorigimg));
subplot(3, 3, 1);
imshow(myorigimg);title('Originalimage');
se = strel('disk', 9);
```

```
mydilatedimg = imdilate(myorigimg, se);
subplot(3, 3, 2);
imshow(mydilatedimg);title('Dilated image');
myerodedimg = imerode(myorigimg, se);
subplot(3, 3, 3);
imshow(myerodedimg);title('Eroded image');
internalboundimg = mydilatedimg & ~ myerodedimg;
subplot(3, 3, 4);
imshow(internalboundimg,[]);title('Internal Boundary');
externalboundimg = mydilatedimg & ~myorigimg;
subplot(3, 3, 5);
imshow(externalboundimg,[]);title('External Boundary');
mymorphgradimg = imsubtract(myorigimg,myerodedimg);
subplot(3, 3, 6);
imshow(mymorphgradimg,[]);title('Morphological Gradient');
thinf = bwmorph(myorigimg,'thin');
subplot(3,3,7);
imshow(thinf);title('Thinning of the Image');
thickf = bwmorph(myorigimg,'thicken');
subplot(3,3,8);
imshow(thickf);title('Thickening of the Image');
skelf100 = bwmorph(myorigimg,'skel',9);
subplot(3,3,9);
imshow(skelf100);title('Skeletonization - 9 iterations');
```



E. Program to apply Top-Hat/Bottom-hat Transformations

TopHat

```
original = imread('Scenary 4.jpeg');
figure(1);
imshow(original);
```

```
se = strel('disk',12);
tophat_trans = imtophat(original,se);
figure(2);
imshow(tophat_trans);
```

BottomHat

```
original = imread('Apple_Image.jpeg');
figure(1);
imshow(original);
se = strel('disk',3);
J = imsubtract(imadd(original,imtophat(original,se)),imbothat(original,se));
figure(2);
imshow(J);
```

Practical 9

Image Segmentation

A. Program for Edge detection using

a. Sobel

```
input_image = imread('Apple_Image.jpg');
input_image = uint8(input_image);
figure, imshow(input_image); title('Input Image');
input_image = rgb2gray(input_image);
input_image = double(input_image);
filtered_image = zeros(size(input_image));
Mx = [-1 0 1; -1 0 1; -1 0 1];
My = [-1 -1 -1; 0 0 0; 1 1 1];
for i = 1:size(input_image, 1) - 2
   for j = 1:size(input_image, 2) - 2
      Gx = sum(sum(Mx.*input_image(i:i+2, j:j+2)));
      Gy = sum(sum(My.*input_image(i:i+2, j:j+2)));

      filtered_image(i+1, j+1) = sqrt(Gx.^2 + Gy.^2);
   end
end
filtered_image = uint8(filtered_image);
figure, imshow(filtered_image); title('Filtered Image');
thresholdValue = 100;
output_image = max(filtered_image, thresholdValue);
output_image(output_image == round(thresholdValue)) = 0;
output_image = im2binarize(output_image);
figure, imshow(output_image);
title('Edge Detected Image');
```

Input Image

Filtered Image

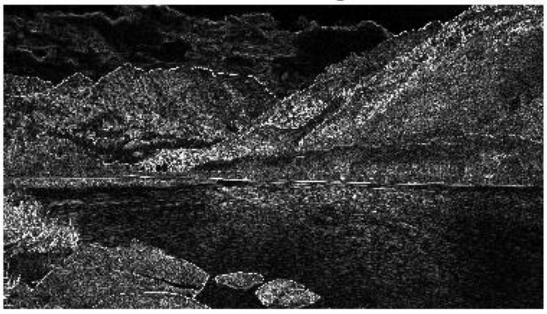
b. Prewitt

```
input_image = imread('Scenary 2.jpeg');
input_image = uint8(input_image);
figure, imshow(input_image); title('Input Image');
```

```
input_image = rgb2gray(input_image);
input_image = double(input_image);
filtered_image = zeros(size(input_image));
Mx = [-1 0 1; -2 0 2; -1 0 1];
My = [-1 -2 -1; 0 0 0; 1 2 1];
for i = 1:size(input_image, 1) - 2
for j = 1:size(input_image, 2) - 2
    Gx = sum(sum(Mx.*input_image(i:i+2, j:j+2)));
Gy = sum(sum(My.*input_image(i:i+2, j:j+2)));
filtered_image(i+1, j+1) = sqrt(Gx.^2 + Gy.^2);
end
end
filtered_image = uint8(filtered_image);
figure, imshow(filtered_image); title('Filtered Image');
thresholdValue = 100;
output_image = max(filtered_image, thresholdValue);
output_image(output_image == round(thresholdValue)) = 0;
output_image = im2binarize(output_image);
figure, imshow(output_image);
title('Edge Detected Image');
```

Input Image

Filtered Image



c. Marr-Hildreth and Canny

```
I = rgb2gray(imread("Scenary 5.jpeg"));
subplot(2, 4, 1),
imshow(I);
title("Gray Scale Image");
L = edge(I, 'Roberts');
subplot(2, 4, 4),
imshow(L);
title("Robert");
M = edge(I, 'log');
subplot(2, 4, 5),
imshow(M);
```

```
title("Log");
M = edge(I, 'zerocross');
subplot(2, 4, 6),
imshow(M);
title("Zerocross");
N = edge(I, 'Canny');
subplot(2, 4, 7),
imshow(N);
title("Canny");
```

Input image for this practical:scenary.jpg