IMAGE PROCESSING

A PRACTICAL REPORT

ON

IMAGE PROCESSING

SUBMITTED BY
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Seat No:

UNDER THE GUIDANCE OF
PROF. CHIRAG DEORA

Submitted in fulfillment of the requirements for qualifying
MSc. IT Part I Semester - II Examination 2022-2023

University of Mumbai
Department of Information Technology

R.D. & S.H National College of Arts, Commerce & S.W.A. Science
College Bandra (West), Mumbai – 400 050

R. D. & S. H. National & S. W. A. Science College

Bandra (W), Mumbai – 400050.

Department of Information Technology
M.Sc. (IT – SEMESTER II)

Certificate

*This is to certify that **Image Processing Practicals** performed at R.D & S.H National & S.W.A. Science College by Mr. **Mohd Kaif** holding Seat No. _____ studying Master of Science in Information Technology Semester – II has been satisfactorily completed as prescribed by the University of Mumbai, during the year 2022 – 2023.*

Subject In-Charge **Coordinator In-Charge** **External Examiner**

College Stamp

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Practical 1

Aim: Program to calculate the number of samples required for an image.

Practical 1

AIM: Program to calculate the number of samples required for an image.

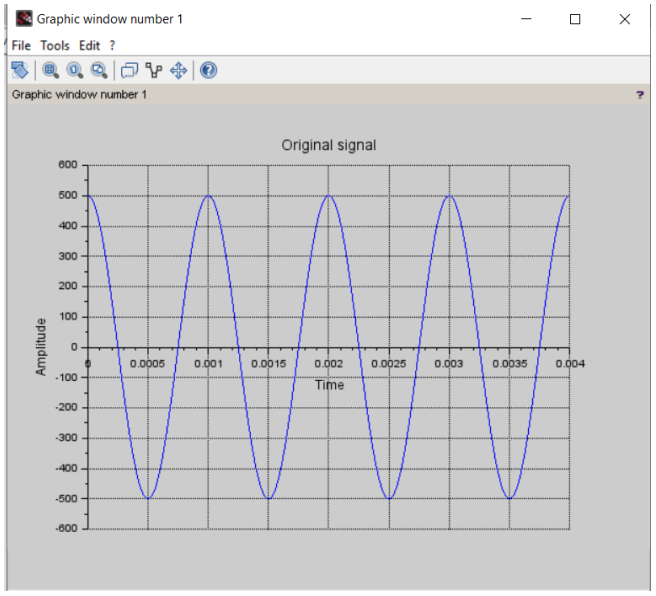
[A]: Program to calculate number of samples required for an image.

Code:

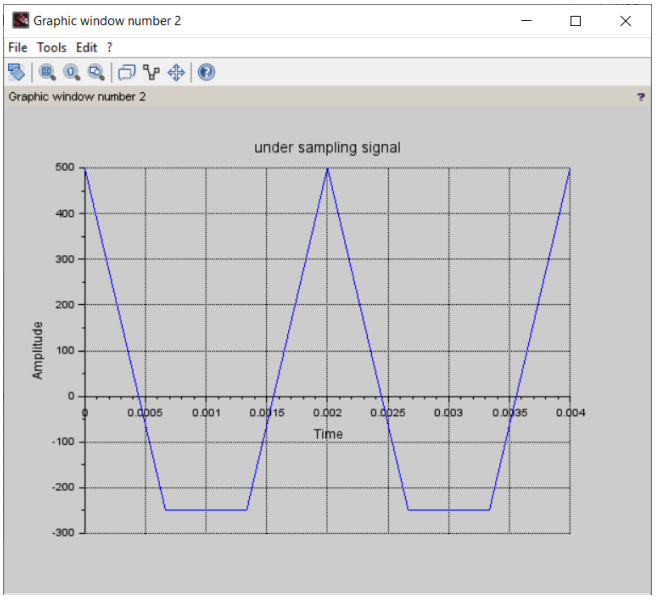
```
clc;
clear;
fm = input('input signal frequency');
k = input('no. of cycles');
A = input('Enter amplitude signal');
tm = 0:1 / (fm*fm) :k/fm;
x = A*cos(2* %pi *fm*tm);
figure(1);

a = gca();
a.x_location = "origin";
a.y_location = "origin";
plot(tm,x);
title('Original signal');
xlabel('Time');
ylabel('Amplitude');
xgrid(1)
fnyq = 2* fm;
fs = (3/4) * fnyq ;
n = 0:1 / fs: k / fm;
x = A * cos(2 * %pi *fm * n);
figure(2);

a = gca();
a.x_location = "origin";
a.y_location = "origin";
plot(n,x);
title('under sampling signal');
xlabel('Time');
ylabel('Amplitude');
xgrid(1)
fnyq = 2* fm;
fo = (3/4) * fnyq ;
o = 0:1 / fo : k / fm;
x = A * cos(2 * %pi *fm * o);
figure(3);

a = gca();
a.x_location = "origin";
a.y_location = "origin";
plot(o,x);
title('nyquist sampling');
xlabel('Time');
ylabel('Amplitude');
```

```
xgrid(1)
fo = 10 * fnyq ;
o = 0:1 / fo : k / fm;
x = A * cos(2 * %pi *fm * o);
figure(4);
a = gca();

a.x_location = "origin";
a.y_location = "origin";
plot2d3('gnn',o,x);
plot(o,x,'r');
title('over sampling signal');
xlabel('Time');
ylabel('Amplitude');
xgrid(1)
```

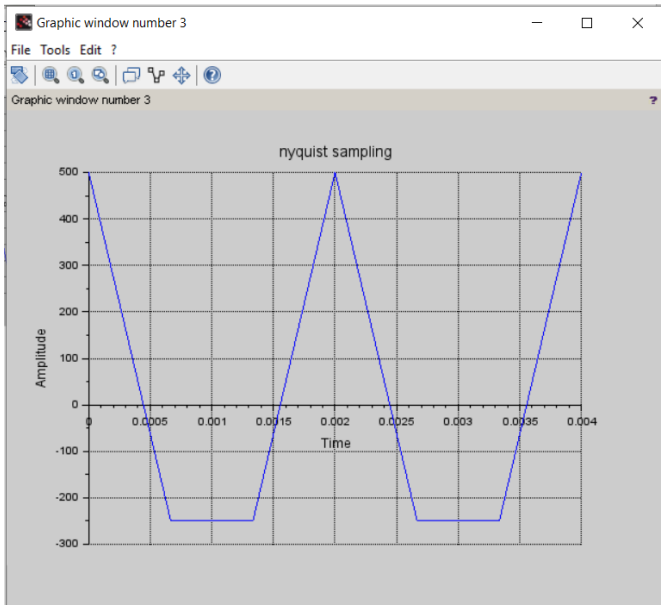
Output:



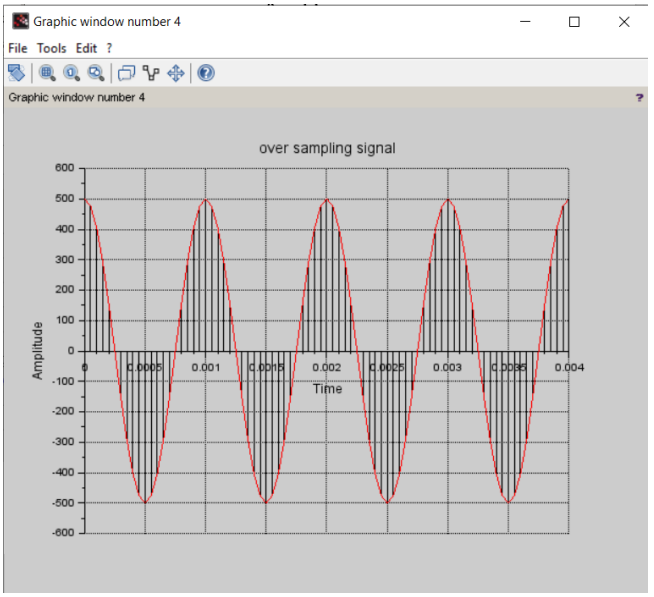
GRAPH 1



GRAPH 2



GRAPH 3



GRAPH 4

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

Code:

```
clc; clear all;
Img=imread('C:\Program Files\scilab-6.1.1\IPCV\images\lena.png');
subplot (2,2,1),imshow(Img),title('Og image 512*512');

Samp=zeros(256);
for i=1:1:512
   for j=1:1:512
      if modulo(i,2)==0 m=i/2;
         if modulo(j,2)==0 n=j/2;
            Samp(i-m,j-n)=Img(i,j);
         else
            n=0;
         end
      else
         m=0;
      end
   end
end

SampImg256=mat2gray(Samp);
subplot(2,2,2),imshow(SampImg256),title('Sampled.Img512*512');
Samp=zeros(128)
for i=1:1:512
   for j=1:1:512
      if modulo(i,4)==0 m=i/4*3;
         if modulo(j,4)==0 n=j/4*3;
            Samp(i-m,j-n)=Img(i,j);
         else
            n=0;
         end
      else
         m=0;
      end
   end
end

SampImg128=mat2gray(Samp);
subplot(2,2,3),imshow(SampImg128),title('Sampled.Img 128*128')
Samp=zeros(64)
for i=1:1:512
   for j=1:1:512
      if modulo(i,8)==0 m=i/8*7;
         if modulo(j,8)==0 n=j/8*7;
            Samp(i-m,j-n)=Img(i,j);
         else
            n=0;
         end
```

```
      else
         m=0;
      end
   end
end

SampImg64=mat2gray(Samp);
subplot(2,2,4), imshow(SampImg128), title('Sampled Image 64 x 64');
Samp = zeros(32);
for i=1:1:512
   for j = 1 : 1 : 512
      if modulo(i,16)==0 m= i/16*4;
         if modulo(j,16)==0 n=j/16*4;
            Samp(i-m,j-n) = Img(i,j);
         else
            n=0;
         end
      else
         m=0;
      end
   end
end
```

Output:

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

Code:

```
clc;
clear all;
figure(1)
subplot(3,3,1);
i=imread('C:\Program Files\scilab-6.1.1\IPCV\images\peppers.png');
imshow(i);
title('original image');
subplot(3,3,2);
j=imresize(i,0.8); imshow(j);
title('resized image 0.8');

subplot(3,3,3);
j=imresize(i,0.7);
imshow(j);
title('resized image 0.7');

subplot(3,3,4);
j=imresize(i,0.6);
imshow(j);
title('resized image 0.6');

subplot(3,3,5); j=imresize(i,0.1);
imshow(j);
title('resized image 0.1');
```

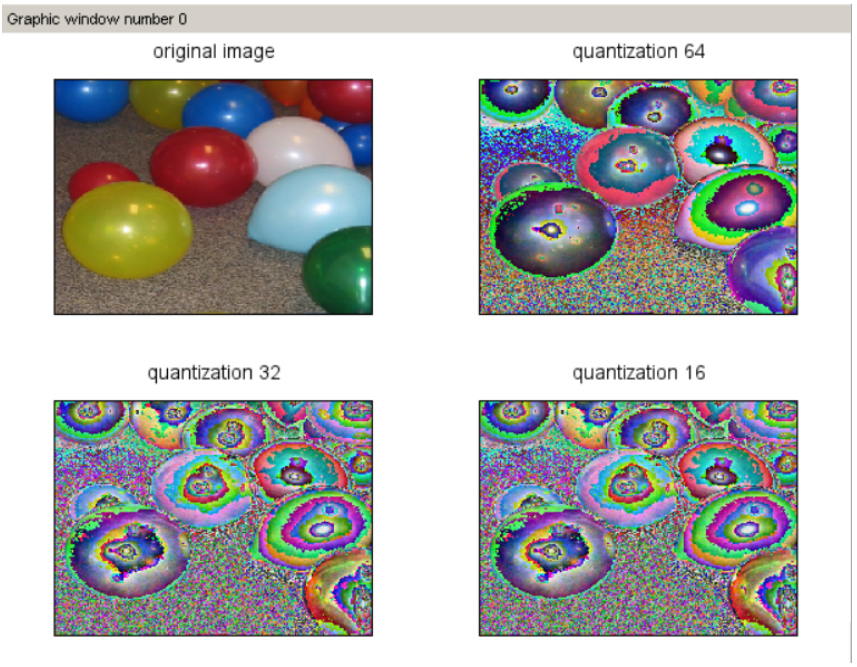
Output:

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

Code:

```
clc;

clear all;


subplot(2,2,1);
i=imread('C:\Program Files\scilab-6.1.1\IPCV\images\balloons.png');
i=double(i);
imshow(uint8(i));

title('original image')
k = floor(i*256)/64;
subplot(2,2,2);
imshow(uint8(k));

title('quantization 64')
k = floor(i*255)/32;
subplot(2,2,3);
imshow(uint8(k));

title('quantization 32')
k = floor(i*255)/32;
subplot(2,2,4);
imshow(uint8(k));

title('quantization 16')
k = floor(i*255)/16;
```

Output:



Practical 2

AIM: Basic Intensity Transformation functions.

Practical 2

AIM: Basic Intensity Transformation functions.

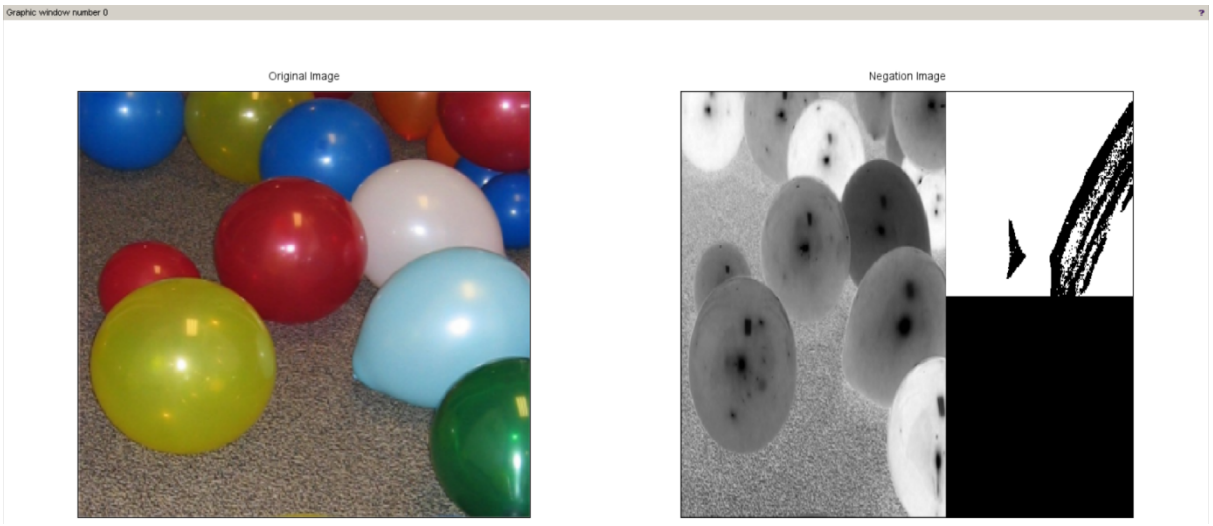
[A]: Basic Intensity Transformation functions

1 : Program to perform Image negation.

Code:

```
clc;

clear all;

a = imread("C:\Program Files\scilab-6.1.1\IPCV\images\balloons.png")

subplot(1,2,1);

imshow(a)

title('Original Image')

[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 Image")
```

Output:

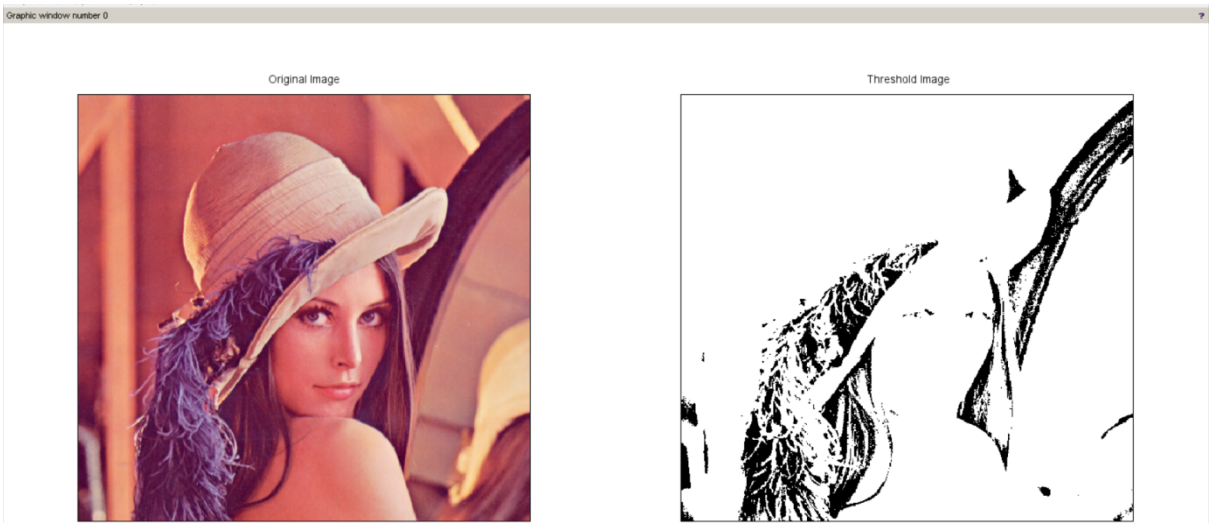


2: Program to perform threshold on an image.

Code:

```
clc;
clear all;

a = imread('C:\Program Files\scilab-6.1.1\IPCV\images\lena.png');
b = double(a)

subplot(1,2,1);
imshow(a);
title('Original Image');
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 Image');
```

Output:

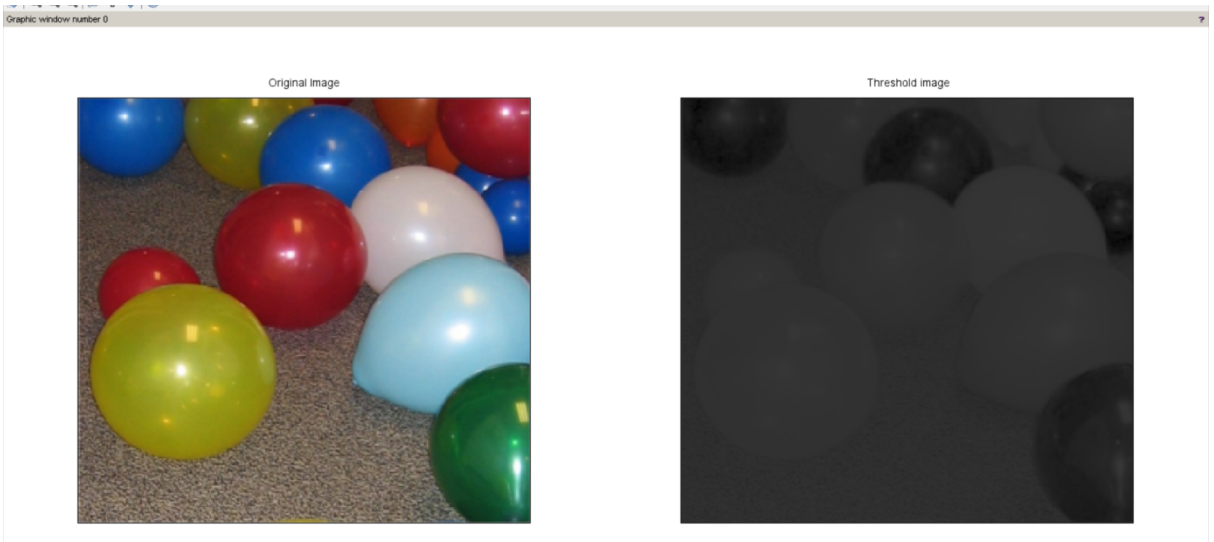


3: Program to perform Log transformation.

Code:

```
clc;
clear all;

a = imread('C:\Program Files\scilab-6.1.1\IPCV\images\balloons.png');
b = double(a)
subplot(1,2,1);
imshow(a);
title('Original Image');

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 image');
```

Output:

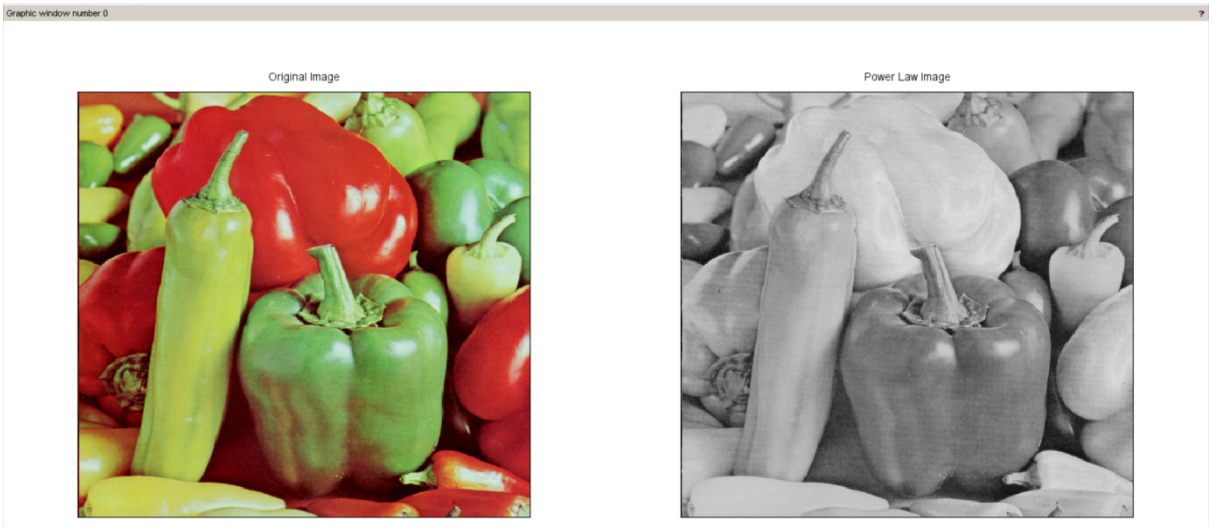


4: Power-law transformations.

Code:

```
clc;
clear all;

a = imread('C:\Program Files\scilab-6.1.1\IPCV\images\peppers.png');
b = double(a)

subplot(1,2,1);
imshow(a);
title('Original Image');

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 Image');
```

Output:



5: Piecewise linear transformations

[i]: Contrast Stretching

Code:

```
clc;
clear;
disp("Contrast Stretching")
a = uigetfile('C:\Program Files\scilab-6.1.1\IPCV\images\balloons.png');
a = imread(a);
a1 = min(min(a));
b = max(max(a));
l = 0.5;
n = 0.5;
m = 3;
v = 1*a1;
w = v + (m * (b-a1));
[r,c] = size(a);

for i = 1:r
for j = 1:c
if (a(i,j) < a1)
   new (i,j) = 1*a(i,j);
elseif (a(i,j) >= a1 & a(i,j) <b)
   new(i,j) = (m*(a(i,j) -a1)) + v;
else
   new(i,j) = (n*(a(i,j) -b)) + w;
end
end
end

subplot(1,2,1);
imshow(a);
title("Original Image");

subplot(1,2,2);
new = double(new);
imshow(uint8(new));
title("After Contrast Stretching");
```

Output:

[ii]: Grey Level Slicing without background

Code:

```
//Grey Level Sliciing without background
clc;
clear all;
printf"Practical 2A: 5[ii] Grey Level Slicing without Background"
p = imread('C:\Program Files\scilab-6.1.1\IPCV\images\circbw.tif');
z = double(p);
[row col] = size(p);
for i = 1:1:row
for j = 1:1:col
if (z(i,j) > 50) && (z(i,j) <150)
   z(i,j) = 255;
else
   z(i,j) = p(i,j);
end
end
end
```

Output:

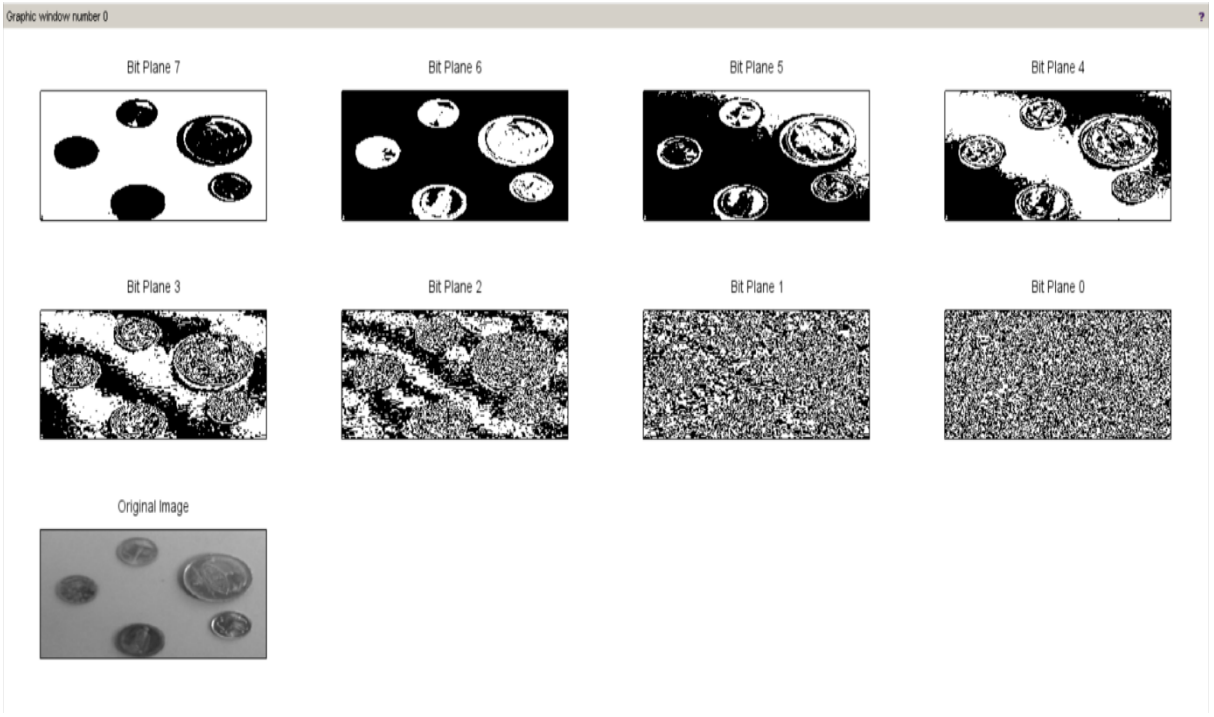
[iii]: Bit Plane Slicing

Code:

```
clc;
clear;
B = imread("C:\Program Files\scilab-6.1.1\IPCV\images\coins.png");
[r,c] = size(double(B));
disp("Practical 2A 5[iii]")
for i =1:r
for j =1:c
MSB(i,j) = bitand(B(i,j), bin2dec('10000000'));
LSB(i,j) = bitand(B(i,j), bin2dec('00000001'));
Second(i,j) = bitand(B(i,j), bin2dec('01000000'));
Third(i,j) = bitand(B(i,j), bin2dec('00100000'));
Fourth(i,j) = bitand(B(i,j), bin2dec('00010000'));
Fifth(i,j) = bitand(B(i,j), bin2dec('00001000'));
Sixth(i,j) = bitand(B(i,j), bin2dec('00000100'));
Seventh(i,j) = bitand(B(i,j), bin2dec('00000010'));
end
end

subplot(4,4,1);
imshow(MSB);
title("Bit Plane 7");

subplot(4,4,2);
imshow(Second);
title("Bit Plane 6");

subplot(4,4,3);
imshow(Third);
title("Bit Plane 5");

subplot(4,4,4);
imshow(Fourth);
title("Bit Plane 4");

subplot(4,4,5);
imshow(Fifth);
title("Bit Plane 3");

subplot(4,4,6);
imshow(Sixth);
title("Bit Plane 2");

subplot(4,4,7);
imshow(Seventh);
title("Bit Plane 1");

subplot(4,4,8);
```

```
imshow(LSB);
title("Bit Plane 0");

subplot(4,4,9);
imshow(B);
title("Original Image");
```

Output:



[B]: Histogram Processing

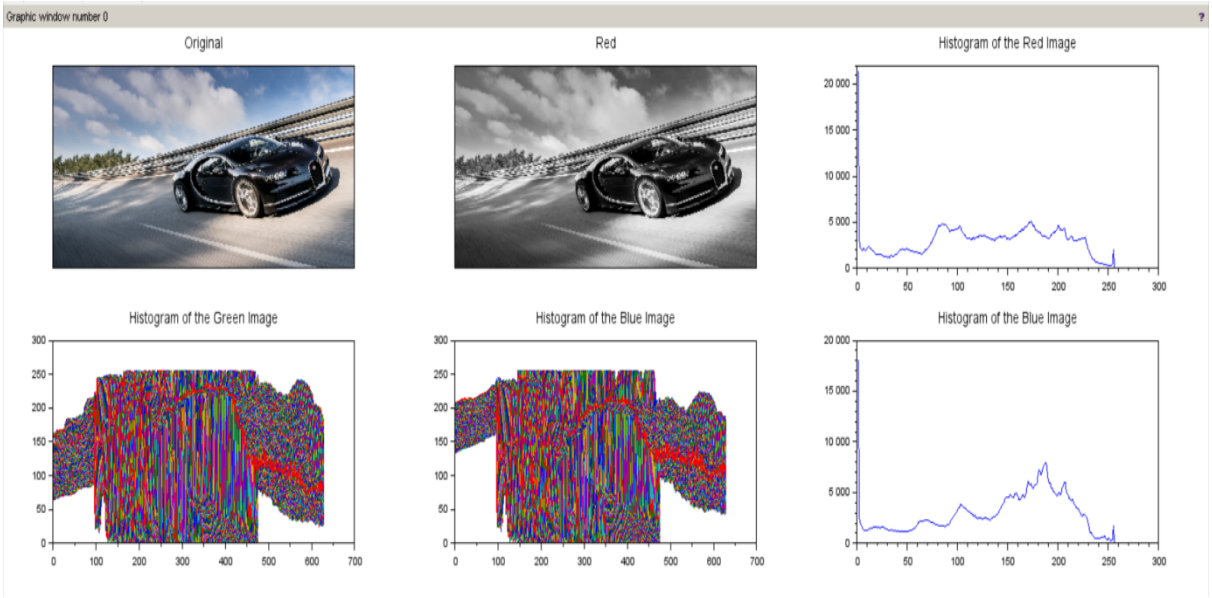
[i]: Program to plot the histogram of an image and categorise

Code:

```
clc;
close;
original = imread('C:\Program Files\scilab-6.1.1\IPCV\images\Bugatti.png');
im_red = original(:,:,1);
im_green = original(:,:,1);
im_blue = original(:,:,3);

subplot(3,3,1);
imshow(original);
title("Original");

subplot(3,3,2);
imshow(im_red);
title("Red");

r = size(im_red,1);
c = size(im_red,2);
h = zeros(1,256);

for i = 1:r
for j = 1:c
if (im_red(i,j) == 0)
   im_red(i,j) = 1;
end
k = im_red(i,j);
h(k) = h(k) + 1;
end
end

subplot(3,3,3);
plot(h);
title("Histogram of the Red Image");

subplot(3,3,4);
plot(im_green);
title("Histogram of the Green Image");

subplot(3,3,5);
plot(im_blue);
title("Histogram of the Blue Image");

a = size(im_blue,1);
b = size(im_blue,2);
x = zeros(1,256);
for i = 1:a
for j = 1:b
if (im_blue(i,j) == 0)
```

```
   im_blue(i,j) = 1;
end
y = im_blue(i,j);
x(y) = x(y) + 1;
end
end

subplot(3,3,6);
plot(x);
title("Histogram of the Blue Image");
```

Output:

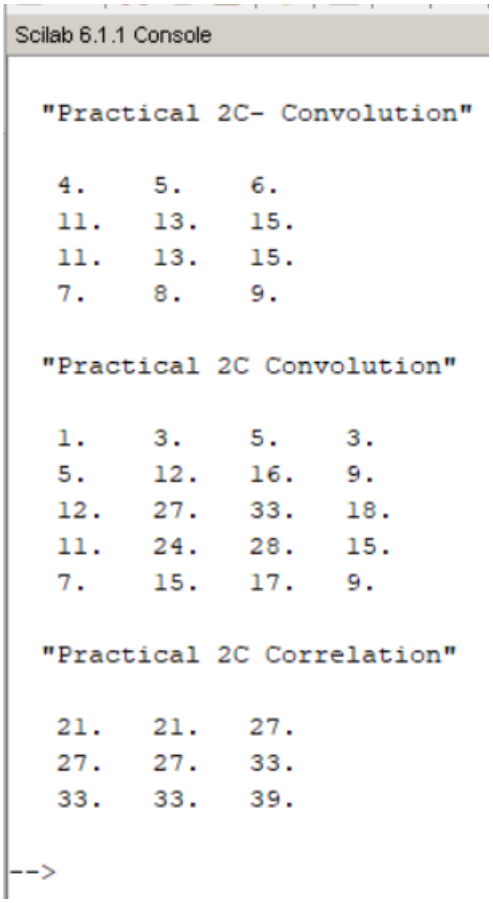


[C]: Convolution and Correlation

Code:

```
clc;
disp("Practical 2C- Convolution")
x = [4,5,6;7,8,9];
h = [1;1;1];
y = conv2(x,h);
disp(y);
disp("Practical 2C Convolution")

a = [1,2,3;4,5,6;7,8,9];
b = [1,1;1,1;1,1];
c = convol2d(a,b);
disp(c);
disp("Practical 2C Correlation")
x =[1,2,3;4,5,6;7,8,9];
h = [1,1;1,1;1,1];
y = corr2(x,h);
disp(y);
```

Output:



[D]: Program to apply smoothing and sharpening filters on grayscale and colour images.

[i]: Low Pass Average Filtering

Code:

```
clc;
clear;
disp("Practical 2D[i] Low Pass Average Filtering")
a = uigetfile("C:\Program Files\scilab-6.1.1\IPCV\images\lena.png");
a = imread(a);
b = double(a);
c = imnoise(a,'salt & pepper',0.2);
d = double(c);
m = (1/9) * (ones(3,3));
[r1,c1] = size(a);

for i = 1:r1
for j = 1:c1
   new(i,j) = a(i,j);
end
end

for i=2:1:r1-1
for j=2:1:c1-1
```

```
   new(i,j) = (m(1)*d(i-1,j-1)) + (m(2)*d(i-1,j)) + (m(3) * d(i-1,j+1)) + (m(4)* d(i,j-1)) + (m(5) * d(i,j)) + (m(6) * d(i,j+1)) + (m(7) * d(i+1,j-1)) + (m(8) * d(i+1,j)) + (m(9) * d(i+1,j+1));
end
end

subplot(1,2,1);
imshow(a);
title("Original Image");

subplot(1,2,2);
imshow(uint8(new));
title("Image after Low Pass Average Filtering");
```

Output:

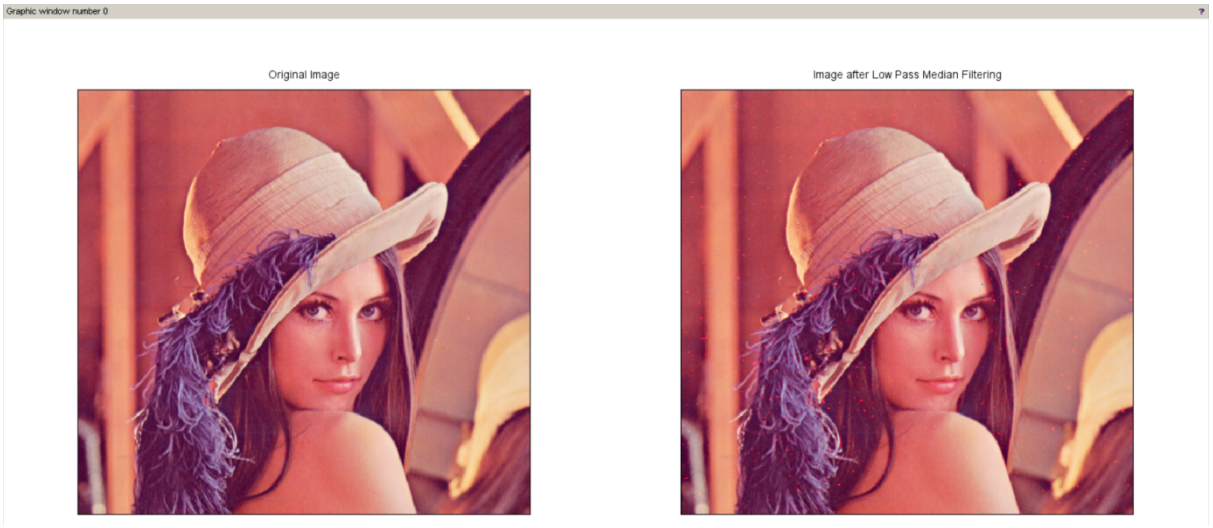
[ii]: Low Pass Median Filtering

Code:

```
cLc;

clear;
disp("Practical 2D[i] Low Pass Median Filtering")
a = uigetfile("C:\Program Files\scilab-6.1.1\IPCV\images\lena.png");
a = imread(a);
b = double(a);
c = imnoise(a,'salt & pepper',0.2);
d = double(c);
m = (1/9) * (ones(3,3));
[r1,c1] = size(a);

for i=2:r1-1
for j=2:c1-1
a1 = [d(i-1,j-1) d(i-1,j) d(i-1,j+1) d(i,j-1) d(i,j) d(i,j+1) d(i+1,j-1) d(i+1,j) d(i+1,j+1)];
a2 = gsort(a1);
med = a2(4);
b(i,j) = med;
end
end

subplot(1,2,1);
imshow(a);
```

```
title("Original Image");

subplot(1,2,2);
imshow(uint8(b));
title("Image after Low Pass Median Filtering");
```

Output:

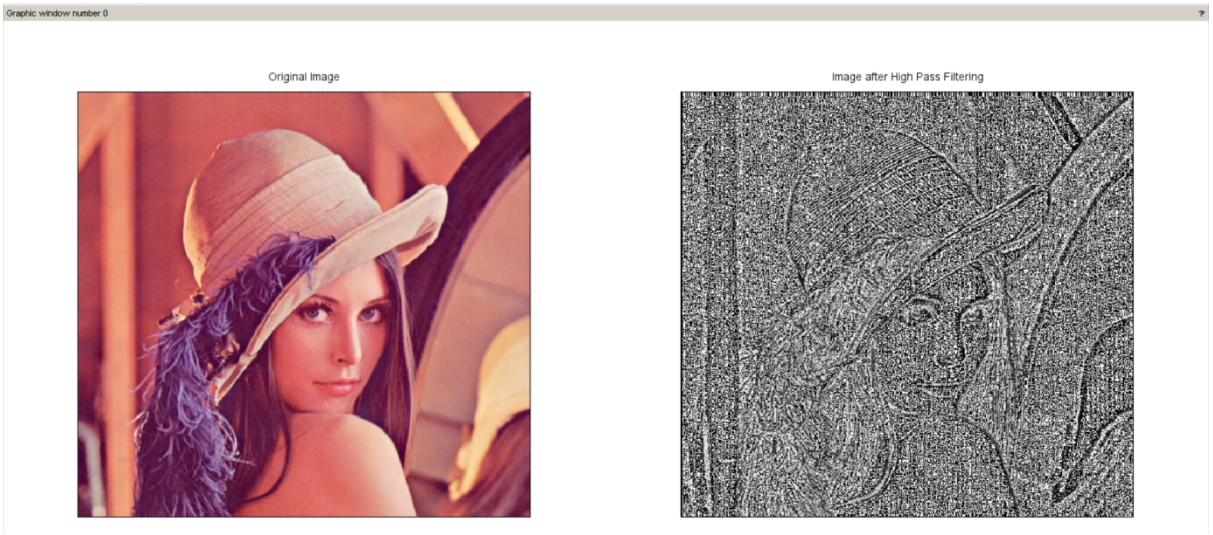


[iii]: High Pass Filtering

Code:

```
clc;
clear;
disp("Practical 2D[iii] High Pass Filtering")
a = uigetfile("C:\Program Files\scilab-6.1.1\IPCV\images\lena.png");
a = imread(a);
d = double(a);
[r1,c1] = size(a);
m = [-1 -1 -1;-1 8 -1;-1 -1 -1];
for i=2:1:r1-1
for j=2:1:c1-1
   new(i,j) = (m(1)*d(i-1,j-1)) + (m(2)*d(i-1,j)) + (m(3) * d(i-1,j+1)) + (m(4)* d(i,j-1)) + (m(5) * d(i,j)) + (m(6) *
d(i,j+1)) + (m(7) * d(i+1,j-1)) + (m(8) * d(i+1,j)) + (m(9) * d(i+1,j+1));
end
end

subplot(1,2,1);
imshow(a);
title("Original Image");

subplot(1,2,2);
imshow(uint8(new));
title("Image after High Pass Filtering");
```

Output:



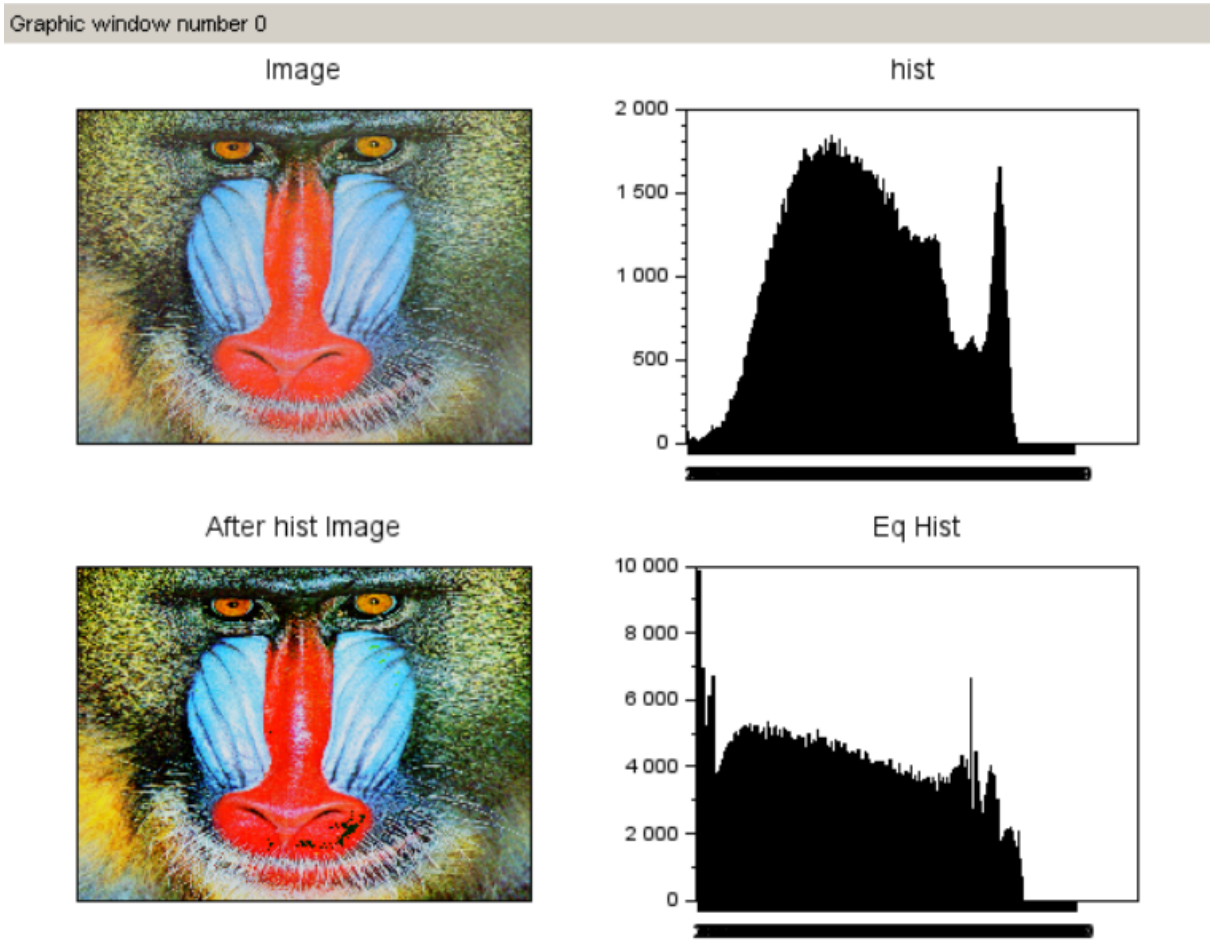
[E]: Histogram Equalization

Code:

```
a = imread('C:\Program Files\scilab-6.1.1\IPCV\images\baboon.png');
a = double(a);
big = 256;
[row col d] = size(a);
c = row*col;
h = zeros(1,300);
z = zeros(1,300);

for e = 1:1:d
   for n = 1:1:row
      for m = 1:1:col
         if a(n,m,e) == 0
            a(n,m,e) = 1;
         end
      end
   end
end
for n = 1:1:row
   for m = 1:1:col
      t = a(n,m);
      h(t) = h(t)+1;
   end
end
pdf = h/c;
cdf(1) = pdf(1);

for x = 2:1:big
   cdf(x) = pdf(x) + cdf(x-1);
end
```

```
new = round (cdf*big);
new = new + 1;
for r = 1:1:d
   for p = 1:1:row
      for q = 1:1:col
         temp = a(p,q,r);
         b(p,q,r) = new(temp);
         t = b(p,q,r);
         z(t) = z(t) + 1;
      end
   end
end
b = b-1;
subplot(2,2,1);imshow(uint8(a)); title('Image');
subplot(2,2,2); bar(h); title('hist'); subplot(2,2,3); imshow(uint8(b));
title('After hist Image'); subplot(2,2,4); bar(z); title('Eq Hist');
```

Output:



Practical 3

AIM: Filtering in Frequency Domain Program to apply Low pass and High pass filters in frequency domain.

Practical 3

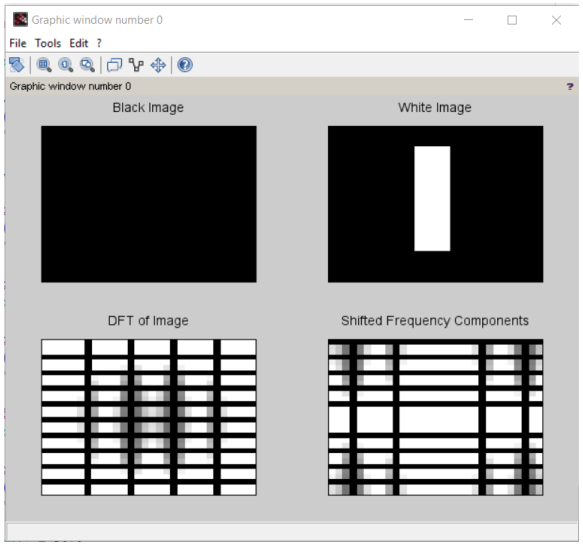
AIM: Filtering in Frequency Domain Program to apply Low pass and High pass filters in frequency domain

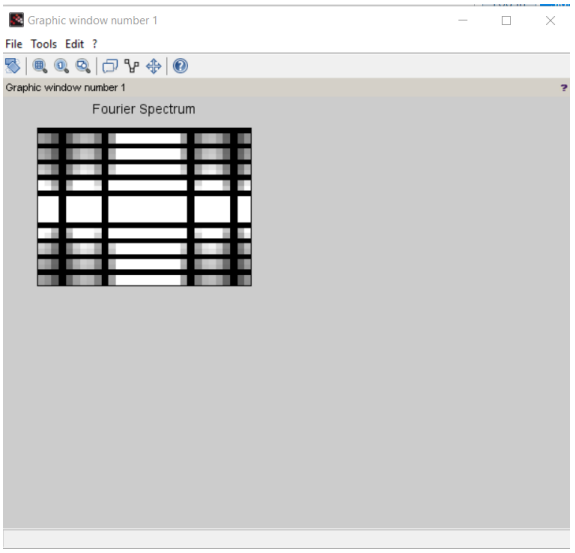
[A]: Program to apply Discrete Fourier Transform on an image.

Code:

```
clc;
clear all;
a = zeros(30,30);

figure,subplot(2,2,1);
imshow(a);
title("Black Image");

a(5:24,13:17) = 1;

subplot(2,2,2);
imshow(a);
title("White Image");

F = fft2(a,256,256);
F2 = abs(F);

subplot(2,2,3);
imshow(F2);
title("DFT of Image");

F3 = fftshift(F);
F3 = abs(F3);

subplot(2,2,4);
imshow(F3);
title("Shifted Frequency Components");

F4 = log(1 + F3);

figure,subplot(2,2,1);
imshow(F4);
title("Fourier Spectrum");
```

Output:





[B]: Ideal Low Pass Filter, Gaussian Low Pass Filter and High Pass Filter.

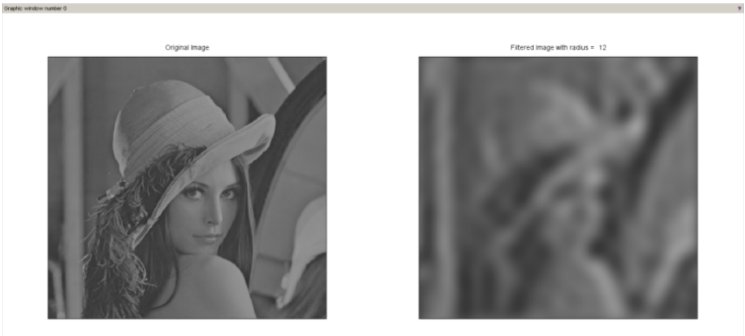
[i] Ideal Low Pass Filter:

Code:

```
clear all;
clc;
img = imread('C:\Program Files\scilab-6.1.1\IPCV\images\Lena_dark.png');
a = double(img);
r = size(a,1);
c = size(a,2);
d0 = input("Enter the cutoff frequency (Radius) = ");
for u = 1:1:r
for v = 1:1:c
d = (((u-(r/2))^2) + ((v-(c/2))^2))^0.5;
if d <= d0
   h(u,v) = 1;
else
   h(u,v) = 0;
end
```

```
end

end

b = fft2(a);

p_original = (abs(b))^2 + (atan(imag(b),real(b)))^2;

p_original = sum(sum(p_original));

c = fftshift(b);

c1 = uint16(c);

new = c.*h;

new2 = uint8(new);

new1 = abs(ifft(new));

subplot(1,2,1);

imshow(img);

title("Original Image");

subplot(1,2,2);

imshow(uint8(new1));

title(['Filtered Image with radius = ' string(d0)]);
```

Output:



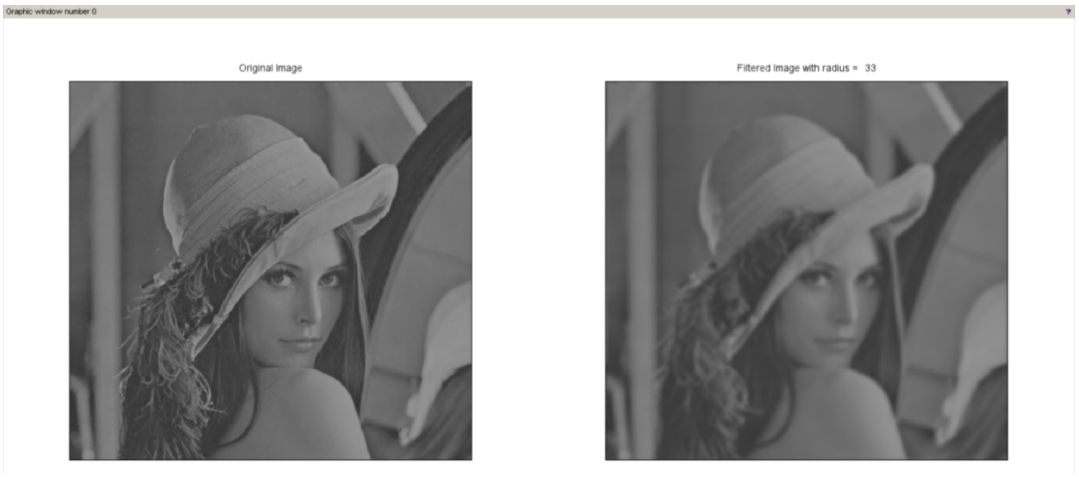
[ii]: Gaussian Low Pass Filter :

Code:

```
clear all;
clc;
img = imread('C:\Program Files\scilab-6.1.1\IPCV\images\Lena_dark.png');
a = double(img);
r = size(a,1);
c = size(a,2);
d0 = input("Enter the cutoff frequency (Radius) = ");
for u = 1:1:r
for v = 1:1:c
d = (((u - (r/2))^2) + ((v - (c/2))^2))^0.5;
dd = d*d;
```

```
h(u,v) = exp(-dd/ (2*d0*d0));
end
end

b = fft2(a);
c = fftshift(b);
c1 = uint16(c);
new = c.*h;
new2 = uint8(new);
new1 = abs(ifft(new));

subplot(1,2,1);
imshow(img);
title("Original Image");

subplot(1,2,2);
imshow(uint8(new1));
title(['Filtered Image with radius = ' string(d0)]);
```

Output:



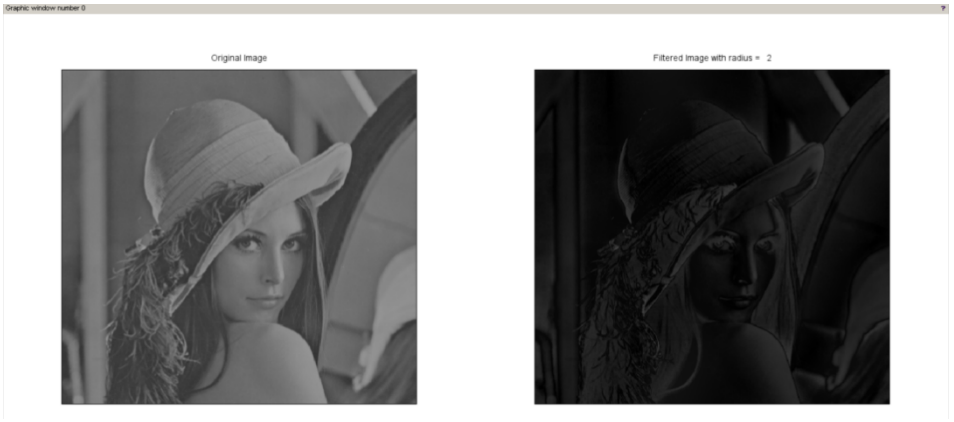
[iii]: High Pass Filter

Code:

```
clear all;
clc;
a = imread('C:\Program Files\scilab-6.1.1\IPCV\images\Lena_dark.png');
r = size(a,1);
c = size(a,2);
d0 = input("Enter the cutoff frequency (Radius) = ");
for u = 1:1:r
for v = 1:1:c
d = (((u-(r/2))^2) + ((v-(c/2))^2))^0.5;
if d <= d0
   h(u,v) = 0;
else
   h(u,v) = 1;
end
```

```
end
end

b = fft2(double(a));
c = fftshift(b);
c1 = uint16(c);
new = c.*h;
new2 = uint8(new);
new1 = abs(ifft(new));

subplot(1,2,1);
imshow(img);
title("Original Image");

subplot(1,2,2);
imshow(uint8(new1));
title(['Filtered Image with radius = ' string(d0)]);
```

Output:

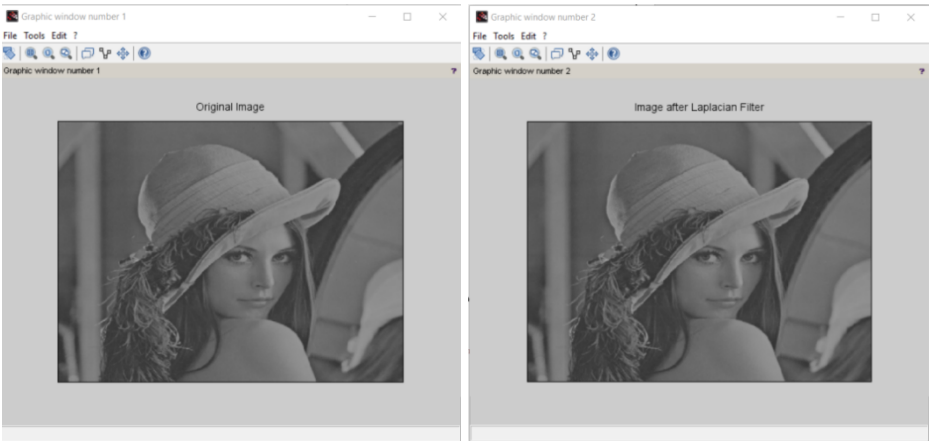


[C]: Program to apply Laplacian filter in frequency domain

Code:

```
I = imread("C:\Program Files\scilab-6.1.1\IPCV\images\Lena_dark.png");

figure(1);
imshow(I);
title("Original Image");
H = fspecial('laplacian',0.2);
lap = imfilter(I,H,"replicate");
figure(2);
imshow(lap);
title("Image after Laplacian Filter");
```

Output:



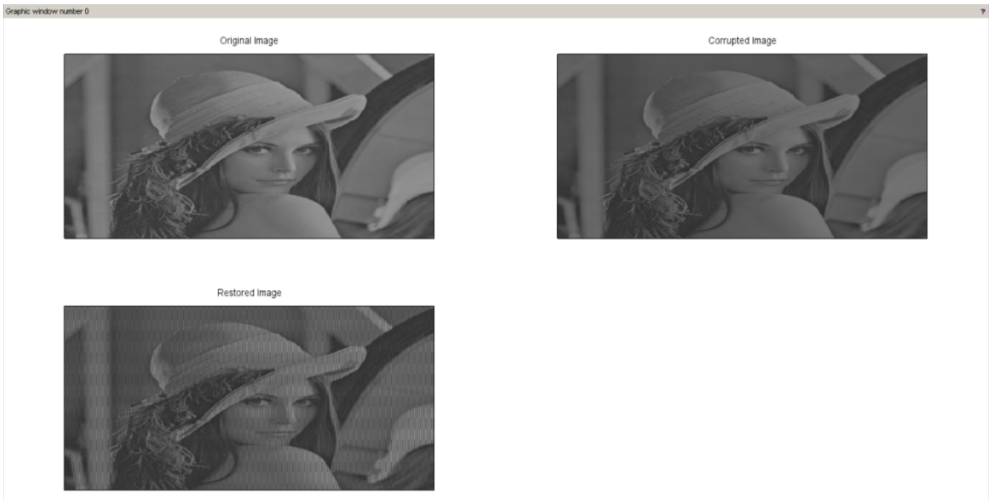
[D]: Program for high frequency emphasis filtering, high boost, and homomorphic filtering.\

[i]: High Frequency Emphasis Filtering

Code:

```
clear all;
clc;
I = imread('C:\Program Files\scilab-6.1.1\IPCV\images\Lena_dark.png');
GM = im2double(I);
t = 512;
p = 1/t:1/t:1;
for k = 1:t
l(k,:) = p(:);
end

product = GM.*1;5
log_GM = log(GM + 1);
log_product = log(product + 1); 5
fft_GM = (fftshift(fft2(log_GM)));
fft_product = (fftshift(fft2(log_product)));
diff_ill = (fft_product - fft_GM);
restored = (fft_product - diff_ill);
restored_im = ifft(restored);
restored_image = exp(restored_im) - 1;
abs_restored_image = abs(restored_image);

subplot(2,2,1);
imshow(uint8(I));
title("Original Image");

subplot(2,2,2);
imshow(log_product);
title("Corrupted Image");

subplot(2,2,3);
imshow(abs_restored_image);
title("Restored Image");
```

Output:



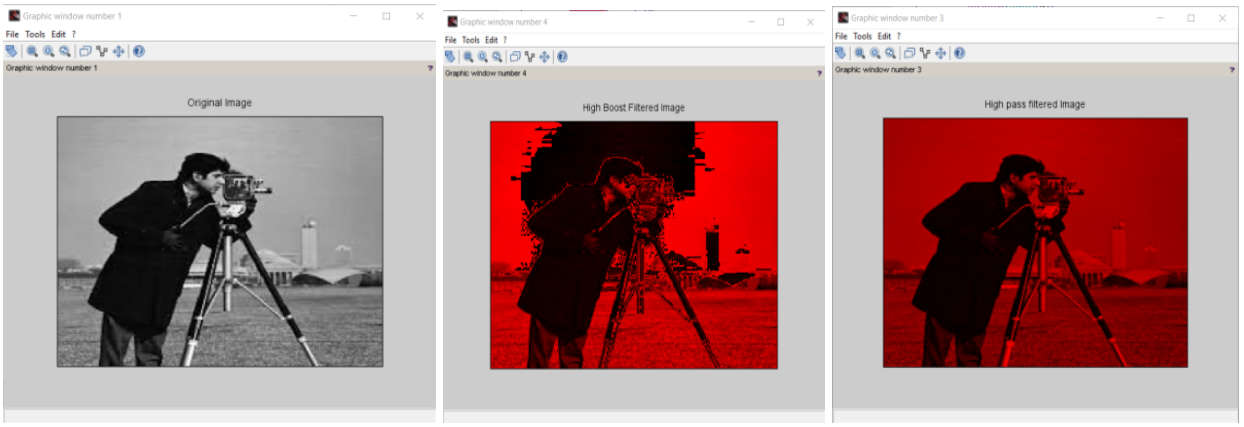
[ii]: High Boost

Code:

```
clc;
close all;
clear all;

a = imread("C:\Program Files\scilab-6.1.1\IPCV\images\Cameraman.jpeg");
a = double(a);

[row,col] = size(a);
D0 = 1 ;
for u = 1:row
for v = 1:col
   D = ((u-(row/2))^2 + (v - (col/2))^2)^0.5;
   if D < D0
      H(u,v) = 0;
      H = H(u,v);
   else
      H(u,v) = 1;
      H = H(u,v);
   end
end
end

A = 1.5;
H1 = (A-1) + H;
ftImg = fft2(a);
shftImg = fftshift(ftImg);
x = shftImg*H;
x1 = shftImg*H1;
X = abs(ifft(x));
X1 = abs(ifft(x1));
figure(1);
imshow(uint8(a));
title('Original Image');

//figure(2);
```

```
//mesh(H);
//title('Frequency Response of high pass filter');

figure(3);
imshow(uint8(X));
title('High pass filtered Image');

figure(4);
imshow(uint8(X1));
title('High Boost Filtered Image');
```

Output:



Original Image High Boost Filtered Image High Pass Filtered Image

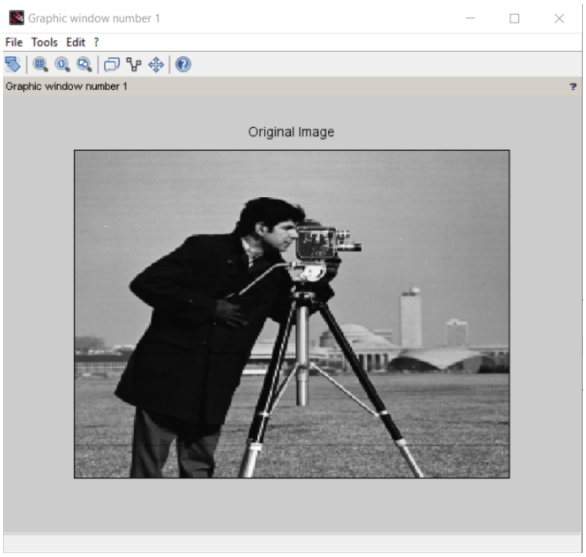
[iii]: Homomorphic Filtering

Code:

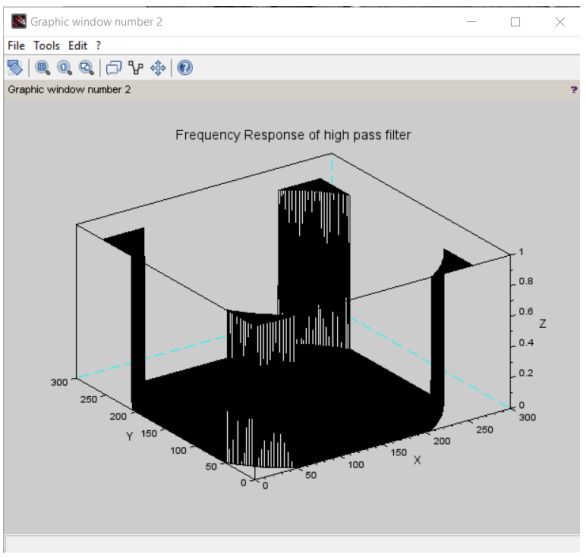
```
clc;

clear all;
a=imread("C:\Program Files\scilab-6.1.1\IPCV\images\cameraman.png");
a = double(a);
[row col] = size(a);

D0 = input('Enter cut-off frequecny : ');
for u = 1:row
   for v = 1:col
      D = ((u-(row/2))^2 + (v-(col/2))^2)^0.5;
      if D<D0 //%High pass filter
         H(u,v) = 0;
      else
         H(u,v) = 1;
      end
   end
end
A=1.5; //%high boost factor
H1 = (A-1)+H; //%high boost filter
ftImg = fft2(a); shftImg = fftshift(ftImg);
```

```
x = shftImg.*H; //%multiply by high pass filter

x1 = shftImg.*H1; //%multiply by high boost filter


X = abs(ifft(x));
X1 = abs(ifft(x1));

figure(1);
imshow(uint8(a));
title('Original Image');

figure(2);
mesh(H);
title('Frequency Response of high pass filter');

figure(3);
imshow(uint8(X));
title('High pass filtered Image');

figure(4);5
imshow(uint8(X1));
title('High Boost Filtered Image');
```

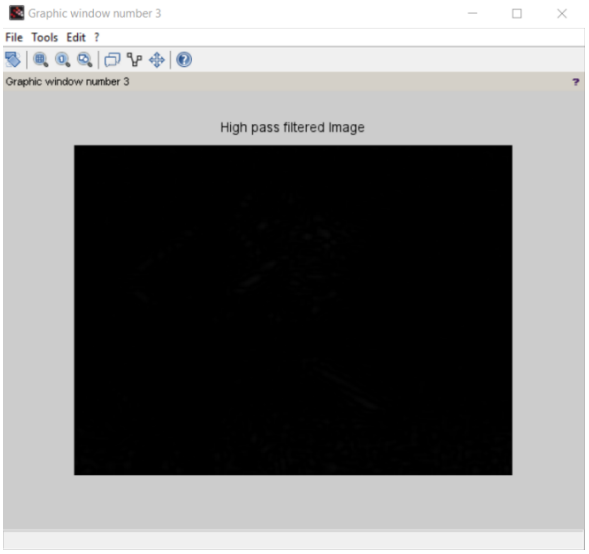
Output:



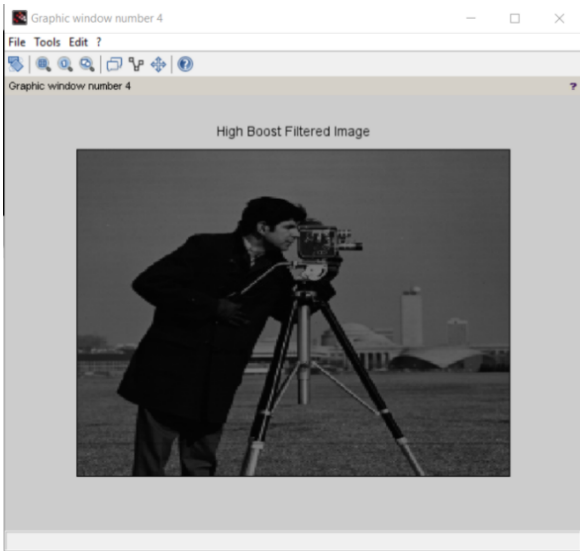
Original Image



Frequency Response of High Pass Filter



Pass Filtered Image



High Boost Filtered Image

Practical 4

AIM: Image Denoising.

Practical 4

AIM: Image Denoising.

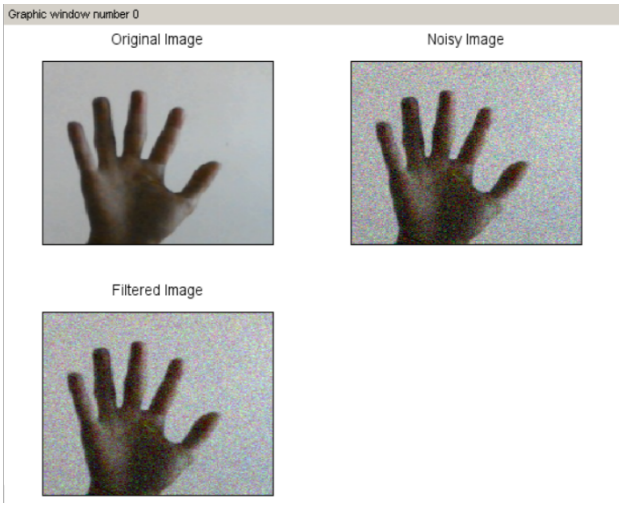
[A]: Program to denoise using spatial mean filtering.

Code:

```
clc;
clear all;
//a = uigetfile("C:\Program Files\scilab-6.1.1\IPCV\images\hand.jpg");
a = imread("C:\Program Files\scilab-6.1.1\IPCV\images\hand.jpg");
b1 = double(a);
c = imnoise(a,'gaussian');
d = double(c);
b = d;
m = (1/9) * (ones(3,3));
[r1,c1] = size(a);
for i = 2:r1-1
for j = 2:c1-1
```

```
   a1 = d(i-1,j-1) + d(i-1,j) + d(i-1,j+1) + d(i,j-1) + d(i,j) + d(i,j+1) + d(i+1,j-1) + d(i+1,j) + d(i+1,j+1);

   b(i,j) = a1 * (1/9);

end

end

subplot(2,2,1);

imshow(uint8(a));

title("Original Image");

subplot(2,2,2);

imshow(uint8(c));

title("Noisy Image");

subplot(2,2,3);

imshow(uint8(b));

title("Filtered Image");
```

Output:



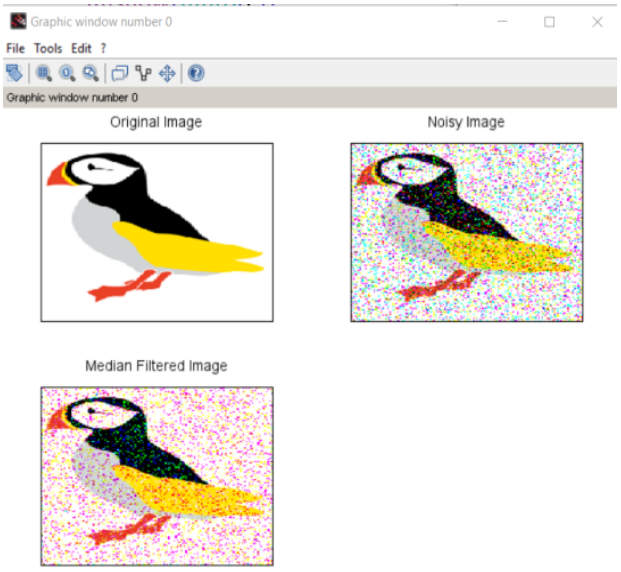
[B]: Program to denoise using Median filtering.

Code:

```
clc;
clear all;
//a = uigetfile("*.*","Select the Image:- ");
a = imread("C:\Program Files\scilab-6.1.1\IPCV\images\puffin.png");
b1 = double(mtlb_double(a));
c = imnoise(a,"salt & pepper",0.2);
d = double(mtlb_double(c));
```

```
b = d;
m = (1/9) * ones(3,3);
[r1,c1] = size(mtlb_double(a));
for i =2:r1-1
for j = 2:c1-1
   a1 = [d(i-1,j-1), d(i-1,j), d(i-1,j+1), d(i,j-1), d(i,j), d(i,j+1), d(i+1,j-1), d(i+1,j), d(i+1,j+1)];
   a2 = gsort(a1,"g","i");
   med = a2(5);
   b(i,j) = med;
end
end

b = uint8(b);

subplot(2,2,1);
imshow(uint8(a));
title("Original Image");

subplot(2,2,2);
imshow(uint8(c));
title("Noisy Image");

subplot(2,2,3);
imshow(uint8(b));
title("Median Filtered Image");
```

Output:



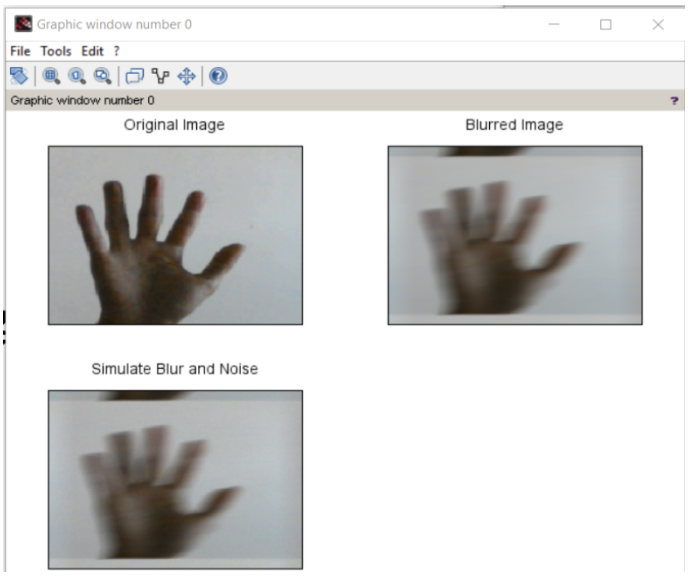
[C]: Program for Image deblurring using inverse, Weiner filters.

Code:

```
clc;
clear all;
Ioriginal = imread("C:\Program Files\scilab-6.1.1\IPCV\images\hand.jpg");
```

```
subplot(2,2,1);
imshow(Ioriginal);
title("Original Image");

PSF = fspecial("motion",21,11);
Idouble = im2double(Ioriginal);
imf = imfilter(Idouble, PSF, "circular", "full");

subplot(2,2,2);
imshow(imf);
title("Blurred Image");

noise_mean = 0;
noise_var = 0.0001;
blurred_noisy = imnoise(imf, "gaussian", noise_mean, noise_var);

subplot(2,2,3);
imshow(blurred_noisy);
title("Simulate Blur and Noise");

estimated_nsr = noise_var;
wnr3 = imdeconvwiener(blurred_noisy, PSF, estimated_nsr);

subplot(2,2,4);
imshow(wnr3);
title("Restoration of Blurred, Noisy Image Using Estimated NSR");
```

Output:



Practical 5

AIM: Colour Image Processing.

Practical 5

AIM: Color Image Processing.

[A]: Program to read a colour image and segment into RGB planes, histogram of colour image.

Code:

```
clc;
close;
original = imread("C:\Program Files\scilab-6.1.1\IPCV\images\peppers.png");
im_red = original (:,:,1);
im_green = original (:,:,1);
im_blue = original (:,:,3);
subplot(3,3,1);
imshow(original);
title("Original Image");
```

```
subplot(3,3,2);
imshow(im_red);
title("Red");
r = size(im_red,1);
c = size(im_red,2);
h = zeros(1,256);
for i = 1:r
for j = 1:c
if (im_red(i,j) == 0)
   im_red(i,j) = 1;
end
k = im_red(i,j);
h(k) = h(k) + 1;
end
end
subplot(3,3,3);
plot(h);
title("Histogram of the Red Image");
subplot(3,3,4);
imshow(im_green);
title("Green");
subplot(3,3,5);
imshow(im_blue);
title("Blue");
a = size(im_blue,1);
b = size(im_blue,2);
x = zeros(1,256);
for i = 1:a
for j = 1:b
if (im_blue(i,j) == 0)
   im_blue(i,j) = 1;
end
```

```
y = im_blue(i,j);

x(y) = x(y) + 1;

end

end

subplot(3,3,6);

plot(x);

title("Histogram of the Blue Image");
```

Output:

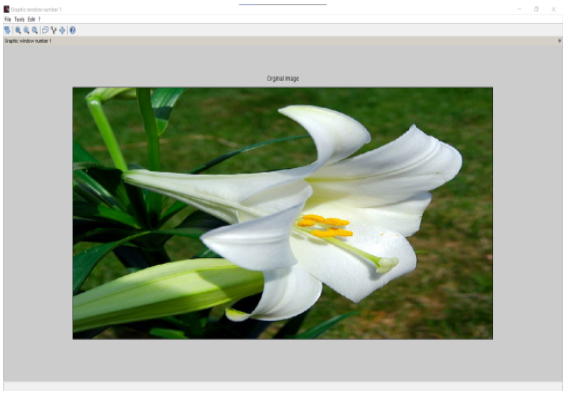
[B]: Program for converting from one colour model to another model.

Code:

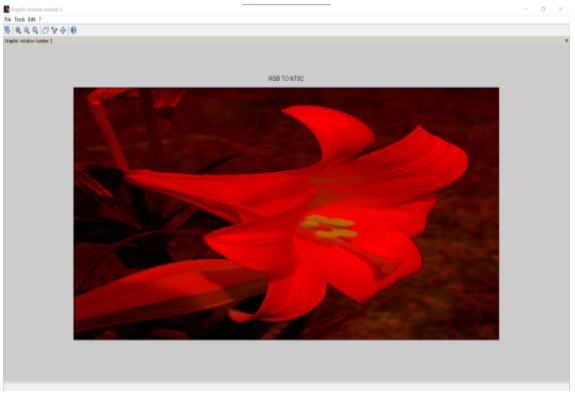
```
a = imread("C:\Program Files\scilab-6.1.1\IPCV\images\Lily.JPG");

figure(1);
imshow(a);
title("Orginal Image");

k = rgb2ntsc(a);
figure(2);
imshow(k);
title("RGB TO NTSC");

I = rgb2ycbcr(a);
figure(3);
imshow(I);
title("RGB TO YCbCr");

m = imcomplement(a);
figure(4);
imshow(m);
```

```
title("RGB to CMY");

imr = a(:,:,1);
img = a(:,:,2);
imb = a(:,:,3);
figure(5);
imshow(imr);

figure(6);
imshow(img);

figure(7);
imshow(imb);
I = (imr + img + imb)/3;
[m,n] = size(imr);
for c = 1:m
   for d = 1:n
      min1 = min(imr(c,d),img(c,d));
      min2 = min(min1,imb(c,d));
      S(c,d) = 1 - (3/(imr(c,d) + img(c,d) + imb(c,d))) * min2;
    end
end

for c = 1:m
   for d = 1:n
      temp = (0.5*(imr(c,d)-img(c,d))+(imr(c,d)- imb(c,d)))/sqrt(double(imr(c,d)*imr(c,d)+(imr(c,d)+
imb(c,d))*(img(c,d)-imb(c,d))));
      H(c,d) = acos(double(temp));
end
end

for c = 1:m
   for d = 1:n
      finali(c,d,1) = I(c,d);
      finali(c,d,2) = S(c,d);
      finali(c,d,3) = H(c,d);
end
end

figure(8);
imshow(finali);
title("Final Image");
```

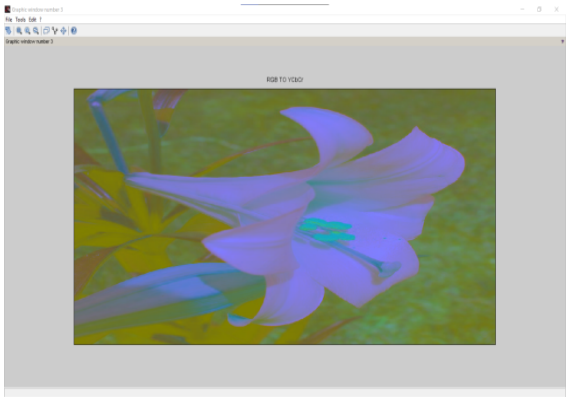
Output:



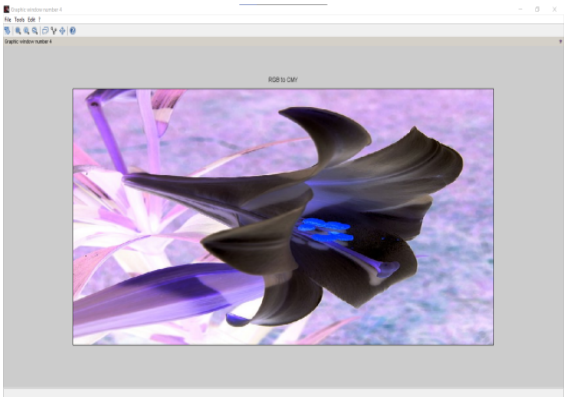
Original Image



RGB TO NTSC



RGB TO YCbCr



RGB TO CMY

Image 5

Image 6

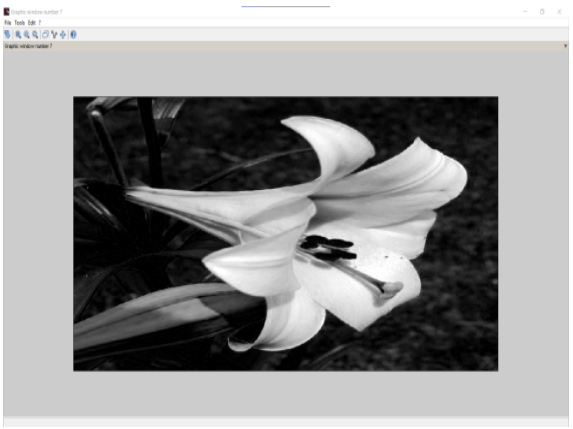


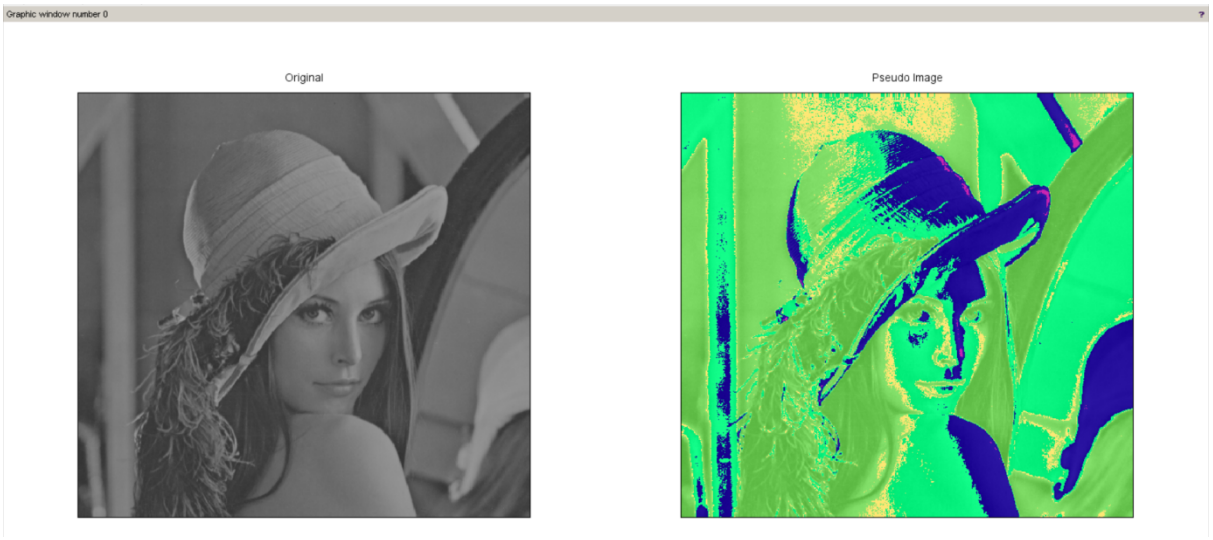
Image 8

[C]: Program to apply false colouring (pseudo) on a Gray Scale image.

Code:

```
a = imread("C:\Program Files\scilab-6.1.1\IPCV\images\Lena_dark.png");
[l,m,n] = size(a);

for i = 1:l
   for j = 1:m
      for k = 1:n
         if a(i,j)>=0 & a(i,j) < 50
            b(i,j,1) = a(i,j,1)+50;
            b(i,j,2) = a(i,j,1)+100;
            b(i,j,3)= a(i,j,1)+10;
         end
         if a(i,j)>=50 & a(i,j) < 100
            b(i,j,1)=a(i,j,1)+35;
            b(i,j,2)=a(i,j,1)+128;
            b(i,j,3)=a(i,j,1)+10;
         end
         if a(i,j)>=100 & a(i,j) < 150
            b(i,j,1)=a(i,j,1)+152;
            b(i,j,2)=a(i,j,1)+130;
            b(i,j,3)=a(i,j,1)+15;;
         end
         if a(i,j)>=150 & a(i,j) < 200
            b(i,j,1)=a(i,j,1)+50;
            b(i,j,2)=a(i,j,1)+140;
            b(i,j,3)=a(i,j,1)+25;
         end
         if a(i,j)>=200 & a(i,j) < 256
            b(i,j,1)=a(i,j,1)+120;
            b(i,j,2)=a(i,j,1)+160;
            b(i,j,3)=a(i,j,1)+45;
         end
      end
   end
end

subplot(1,2,1);
imshow(a);
title('Original');

subplot(1,2,2);
imshow(b);
title('Pseudo Image');
```

Output:



Practical 6

AIM: Fourier Related Transformations

Practical 6

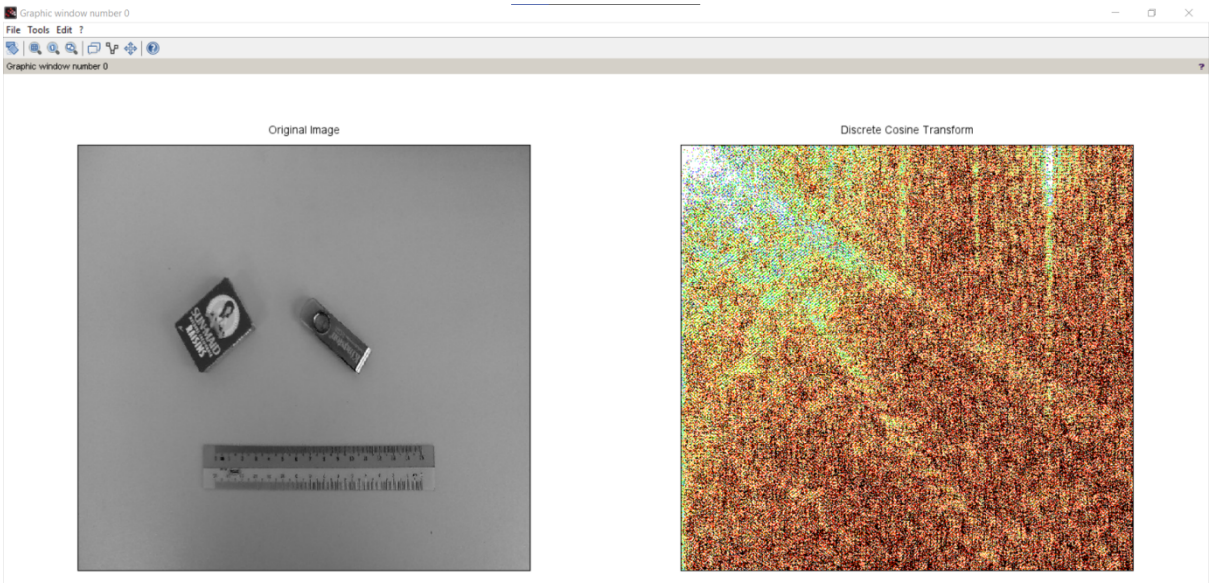
AIM: Fourier Related Transformations.

[A]: Program to compute Discrete Cosine Transforms.

Code:

```
clc;

clear all;

img=imread("C:\Program Files\scilab-6.1.1\IPCV\images\measure_gray.jpg");

dct_img = imdct(img);

subplot(1,2,1);

imshow(img);

title('Original Image');

subplot(1,2,2);

imshow(dct_img,rainbowcolormap(32));

title('Discrete Cosine Transform');
```

Output:



Practical 7

AIM: Morphological Image Processing.

Practical 7

AIM: Morphological Image Processing.

[A]: Program to apply erosion, dilation, opening, closing Opening.

[i] Opening Code:

```
img = imread("C:\Program Files\scilab-6.1.1\IPCV\images\Cameraman.jpeg");

se1 = imcreatese('rect',3,3);

im2 = imerode(img,se1);

im3 = imdilate(im2,se1);

subplot(1,2,1);

imshow(img);

title("Original Image");

subplot(1,2,2);

imshow(im3);

title("Opening Image");
```

Output:

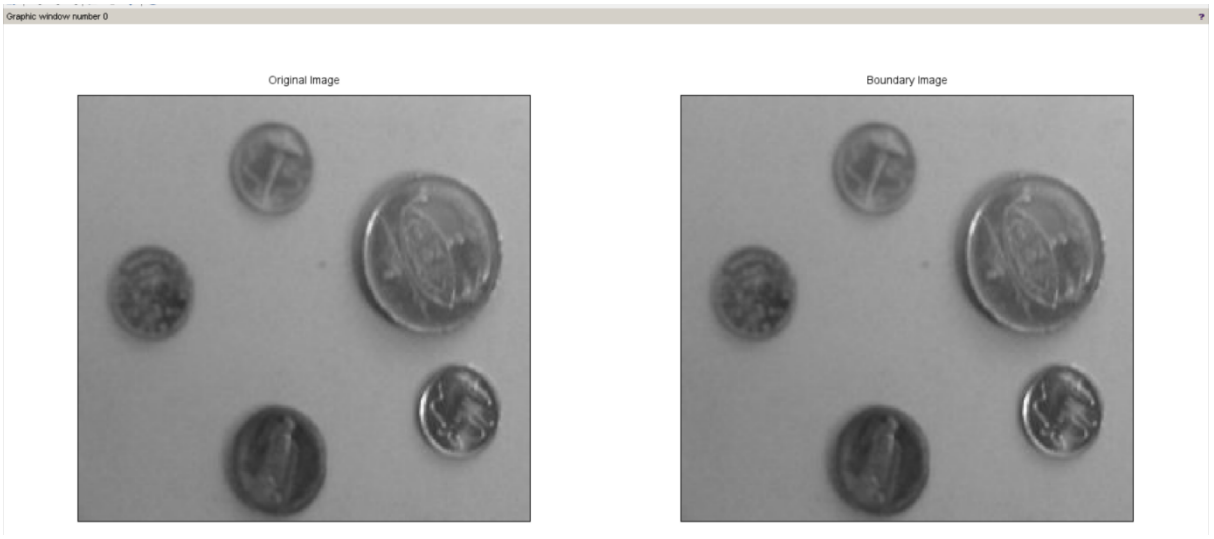
[B]: Program for detecting boundary of an image.

Code:

```
clc;
clear;
a = imread('C:\Program Files\scilab-6.1.1\IPCV\images\coins.png');
img = imread('C:\Program Files\scilab-6.1.1\IPCV\images\coins.png');
subplot(1,2,1),imshow(a),title("Original Image");
subplot(1,2,2),imshow(img),title("Boundary Image");
BW = im2bw(img);
imshow(BW);
dim = size(BW)
col = round(dim(2)/2)-90;
row = min(find(BW(:,col)))
boundary = bwtraceboundary(BW,[row, col],'N');
imshow(img);
```

```
plot(boundary(:,2),boundary(:,1),'g','LineWidth',3);
BW_filled = imfill(BW,'holes');
boundaries = bwboundaries(BW_filled);

for k=1:10
   b = boundaries{k};
   plot(b(:,2),b(:,1),'g','LineWidth',3);

end
```

Output:

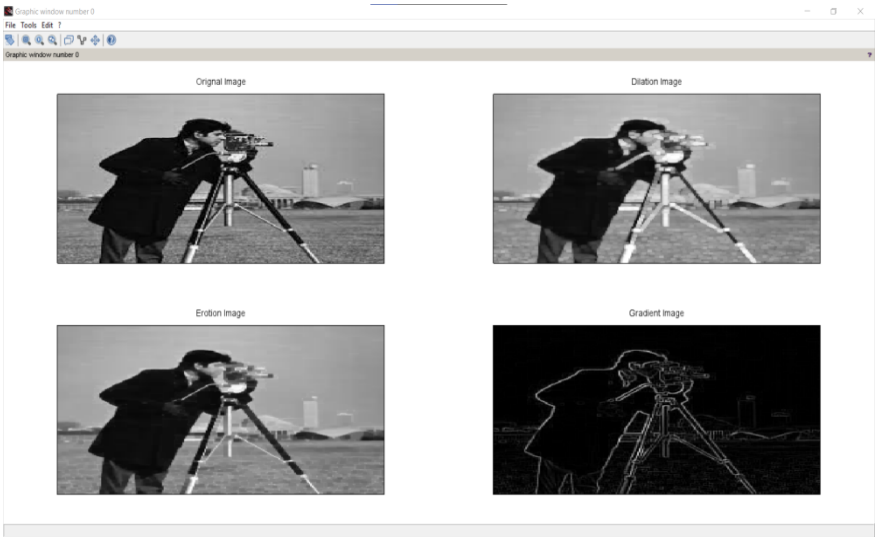


[C]: Program to apply morphological gradient on an image.

Code:

```
clc;
clear;
img=imread('C:\Program Files\scilab-6.1.1\IPCV\images\Cameraman.jpeg');
se = imcreatese('rect',3,3);
img_dilate = imdilate(img,se);
img_erode = imerode(img_dilate,se);
g=img_dilate-img_erode;

subplot(2,2,1),imshow(img),title('Orignal Image');
subplot(2,2,2),imshow(img_dilate),title('Dilation Image');
subplot(2,2,3),imshow(img_erode),title('Erotion Image');
subplot(2,2,4),imshow(g),title('Gradient Image');
```

Output:

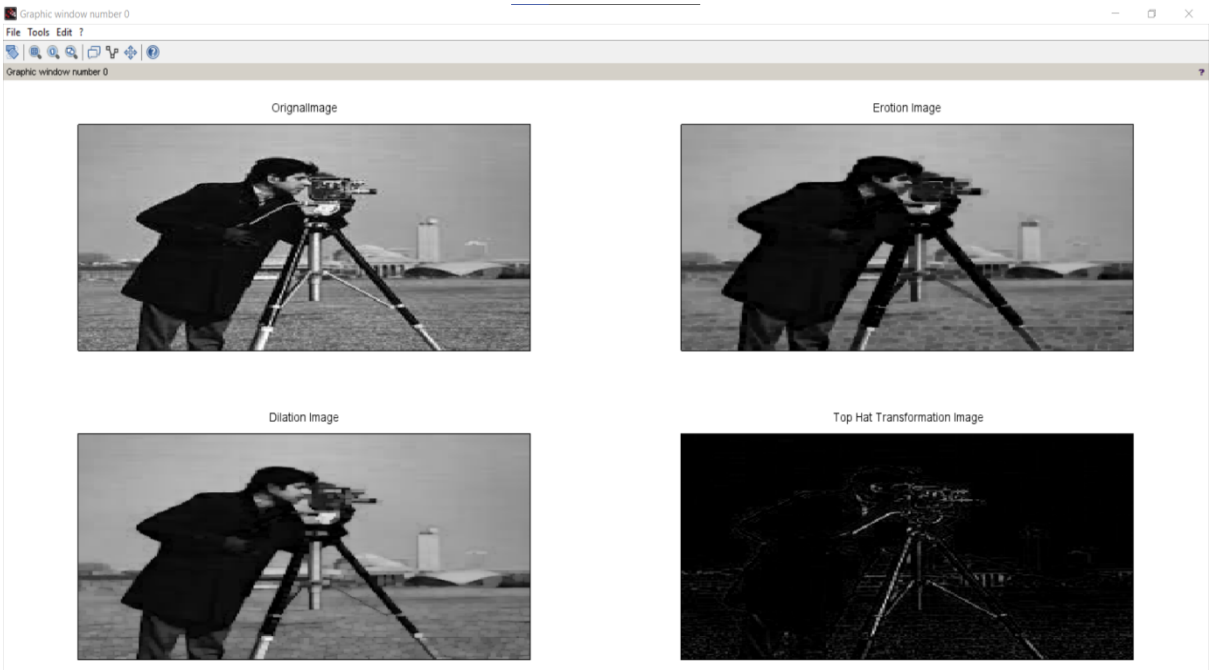


[D]: Program to apply Top-Hat/Bottom-hat Transformations.

Code:

```
clc;
clear;
img=imread('C:\Program Files\scilab-6.1.1\IPCV\images\Cameraman.jpeg');
se1=imcreatese('rect',3,3);
im1=imerode(img,se1);
im2=imdilate(im1,se1);
h=img-im2;

subplot(2,2,1),imshow(img),title('OrignalImage');
subplot(2,2,2),imshow(im1),title('Erotion Image');
subplot(2,2,3),imshow(im2),title('Dilation Image');
subplot(2,2,4),imshow(h),title('Top Hat Transformation Image');
```

Output:



Practical 8

AIM: Image Segmentation.

Practical 8

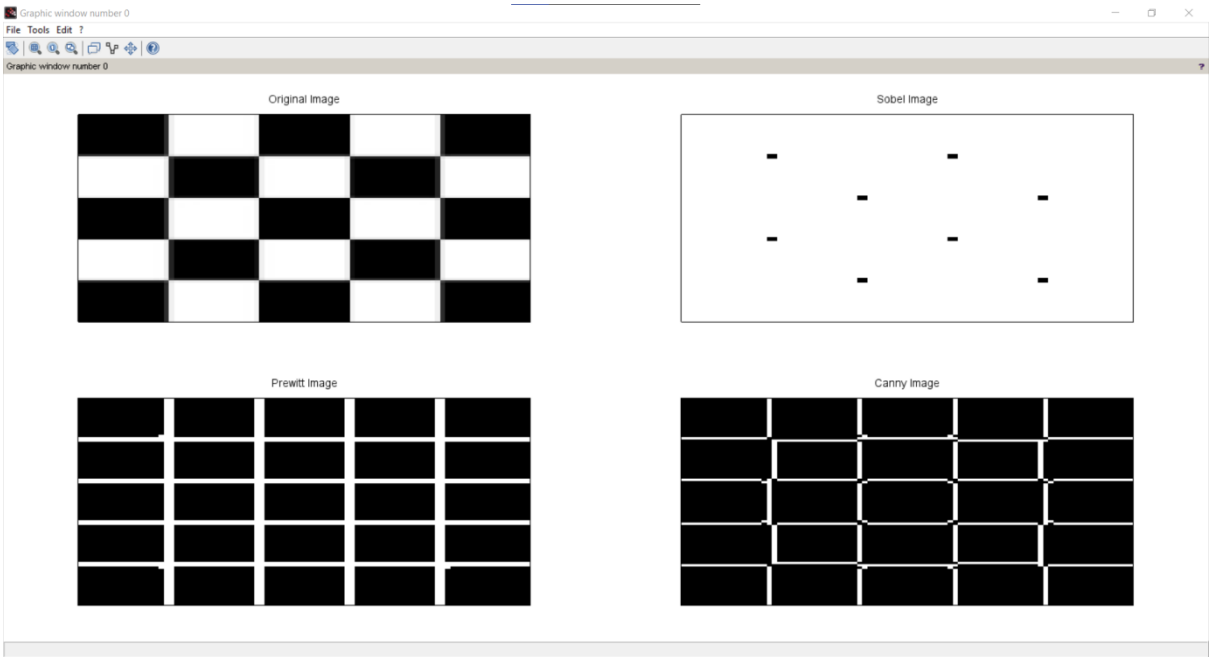
AIM: Image Segmentation.

[A]: Program for Edge detection using Sobel, Prewitt, Marr-Hildreth and Canny.

Code:

```
clc;
clear all;
img = imread("C:\Program Files\scilab-6.1.1\IPCV\images\checkerbox.png");
img = rgb2gray(img);
ed_Sobel = edge(img,'sobel');
ed_Prewitt = edge(img,'prewitt');
ed_Canny = edge(img,'canny');

subplot(2,2,1);
imshow(img);
title('Original Image');

subplot(2,2,2);
imshow(ed_Sobel);
title('Sobel Image');

subplot(2,2,3);
imshow(ed_Prewitt);
title('Prewitt Image');

subplot(2,2,4);
imshow(ed_Canny);
title('Canny Image');
```

Output:



PRESENTATION

Image Degradation and Restoration Process

-Mohd Kaif
M.Sc. I.T. Part 1
22001

Definition:- Image restoration

Image restoration is the operation of taking a corrupt/noisy image and estimating the clean, original image. Corruption may come in many forms such as motion blur, noise and camera mis-focus. Image restoration is performed by reversing the process that blurred the image and such is performed by imaging a point source and use the point source image, which is called the Point Spread Function (PSF) to restore the image information lost to the blurring process.

Image restoration is different from image enhancement in that the latter is designed to emphasize features of the image that make the image more pleasing to the observer, but not necessarily to produce realistic data from a scientific point of view. Image enhancement techniques (like contrast stretching or de-blurring by a nearest neighbor procedure) provided by imaging packages use no *a priori* model of the process that created the image.

With image enhancement noise can effectively be removed by sacrificing some resolution, but this is not acceptable in many applications. In a fluorescence microscope, resolution in the z-direction is bad as it is. More advanced image processing techniques must be applied to recover the object.

Main use cases

The objective of image restoration techniques is to reduce noise and recover resolution loss. Image processing techniques are performed either in the image domain or the frequency domain. The most straightforward and a conventional technique for image restoration is deconvolution, which is performed in the frequency domain and after computing the Fourier transform of both the image and the PSF and undo the resolution loss caused by the blurring factors. Nowadays, photo restoration is done using digital tools and software to fix any type of damage images may have and improve the general quality and definition of the details.

3. Noise reduction is the process of removing noise from a signal. Noise reduction techniques exist for audio and images. Noise reduction algorit +hms may distort the signal to some degree. **Noise rejection** is the ability of a circuit to isolate an undesired signal component from the desired signal component, as with common-mode rejection ratio.

All signal processing devices, both analog and digital, have traits that make them susceptible to noise. Noise can be random with an even frequency distribution (white noise), or frequency-dependent noise introduced by a device's mechanism or signal processing algorithms.

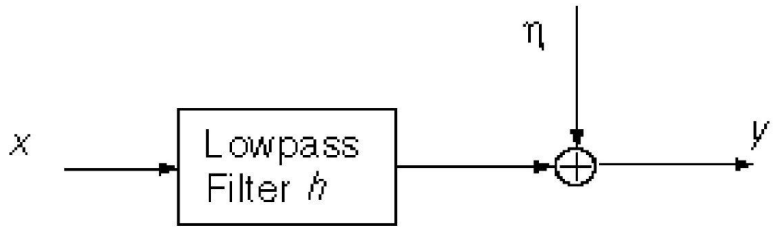
In electronic systems, a major type of noise is *hiss* created by random electron motion due to thermal agitation. These agitated electrons rapidly add and subtract from the output signal and thus create detectable noise.

Definition:- Image Degradation

The purpose of image restoration is to "compensate for" or "undo" defects which degrade an image. Degradation comes in many forms such as motion blur, noise, and camera misfocus. In cases like motion blur, it is possible to come up with an very good estimate of the actual blurring function and "undo" the blur to restore the original image. In cases where the image is corrupted by noise, the best we may hope to do is to compensate for the degradation it caused. In this project, we will introduce and implement several of the methods used in the image processing world to restore images.

Degradation Model

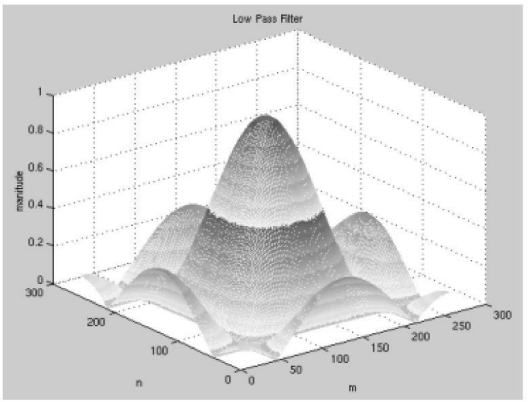
The block diagram for our general degradation model is



Inverse Filtering

If we know of or can create a good model of the blurring function that corrupted an image, the quickest and easiest way to restore that is by inverse filtering. Unfortunately, since the inverse filter is a form of high pass filer, inverse filtering responds very badly to any noise that is present in the image because noise tends to be high frequency. In this section, we explore two methods of inverse filtering - a thresholding method and an iterative method.

Method 1: Thresholding

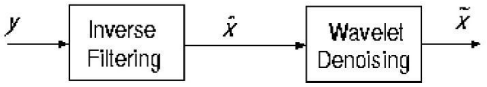


Wiener Filtering

The inverse filtering is a restoration technique for deconvolution, i.e., when the image is blurred by a known lowpass filter, it is possible to recover the image by inverse filtering or generalized inverse filtering. However, inverse filtering is very sensitive to additive noise. The approach of reducing one degradation at a time allows us to develop a restoration algorithm for each type of degradation and simply combine them. The Wiener filtering executes an optimal tradeoff between inverse filtering and noise smoothing. It removes the additive noise and inverts the blurring simultaneously.

Wavelet-based Image Restoration

Although the Wiener filtering is the optimal tradeoff of inverse filtering and noise smoothing, in the case when the blurring filter is singular, the Wiener filtering actually amplify the noise. This suggests that a denoising step is needed to remove the amplified noise. Wavelet-based denoising scheme, a successful approach introduced recently by Donoho, provides a natural technique for this purpose. Therefore, the image restoration contains two separate steps: Fourier-domain inverse filtering and wavelet-domain image denoising. The digram is shown as follows.



Conclusions

So what can we say about image restoration? We can see that inverse filtering is a very easy and accurate way to restore an image provided that we know what the blurring filter is and that we have no noise. Because an inverse filter is a high pass filter, it will tend to amplify noise as was presented in our results. The second way of inverse filtering was through an iterative procedure. Since that is more or less an averaging method, it deals a little better with noise by averaging it out. But both methods do not deal well with noise. We must use some method of restoration which would trade off inverse filtering with de-noising.

THANK YOU