1. Homomorphic filtering

```
clc;
close all;
clear all;
r=imread('CT Brain.jpg');
b=im2double(r);
I=log(1+b);
[m,n]=size(I);
for i=1:m
   for j=1:n
      p(i,j)=((-1)^(i+j))*I(i,j);
   end
end
bf=fft2(p);
for u=1:m
   for v=1:n
      d=((u-m/2)^2+(v-n/2)^2)^(1/2);
H(u,v)=1-exp(-d^2/100);
   end
end
G=bf.*H;
g=real(ifft2(G));
for i=1:m
   for j=1:n
      g1(i,j)=((-1)^(i+j))*g(i,j);
   end
end
g2=(exp(g1)-1);
subplot(211);
imshow(b);
subplot(212);
imshow(g2,[]);
```

2. Image smoothening using Mean filter

```
clc; clear all; close all;
pkg load image
b=imread('C:\Users\admin\Desktop\Medical Image\MRI T2 Brain.jpg');
a1=imnoise(b,'gaussian');
a2=imnoise(b,'salt & pepper');
a3=imnoise(b,'gaussian',0.2,0.8);
m1=fspecial('average',[3,3]);
m2=fspecial('average',[5,5]);
o1=imfilter(a1,m1);
o2=imfilter(a2,m1);
o3=imfilter(a3,m1);
o4=imfilter(a1,m2);
o5=imfilter(a2,m2);
o6=imfilter(a3,m2);
figure(1)
subplot(3,3,1), imshow(a1); title("Gaussian noise");
subplot(3,3,2), imshow(a2); title("Salt and pepper noise");
subplot(3,3,3), imshow(a3); title("Gaussian noise with mean and variance");
subplot(3,3,4), imshow(o1); title("Gaussian with 3x3 average");
subplot(3,3,5), imshow(o2); title("salt and pepper with 3x3average");
subplot(3,3,6), imshow(o3); title("Gaussian with Mean & Variance with 3x3average");
subplot(3,3,7), imshow(o4); title("Gaussian with 5x5average");
subplot(3,3,8), imshow(o5); title("S&P with 5x5 average");
subplot(3,3,9), imshow(o6); title("Gaussian Mean & Var with 5x5average");
```

3. Image smoothening using Median filter

```
clc; clear all; close all;
pkg load image
b=imread('C:\Users\admin\Desktop\Medical Image\MRI T2 Brain.jpeg');
a1=imnoise(b,'gaussian');
a2=imnoise(b,'salt & pepper');
a3=imnoise(b,'gaussian',0.2,0.8);
m1=fspecial('average',[3,3]);
m2=fspecial('average',[5,5]);
o1=medfilt2(a1,[3,3]);
o2=medfilt2(a2,[3,3]);
o3=medfilt2(a3,[3,3]);
o4=medfilt2(a1,[5,5]);
o5=medfilt2(a2,[5,5]);
o6=medfilt2(a3,[5,5]);

figure(1)
subplot(2,3,1), imshow(o1); title("Gaussian with 3x3 median");
subplot(2,3,2), imshow(o2); title("Salt and pepper with 3x3 median");
subplot(2,3,3), imshow(o3); title("Gaussian with mean and variance  with 3x3 median");
subplot(2,3,4), imshow(o4); title("Gaussian with 5x5 median");
subplot(2,3,5), imshow(o5); title("salt and pepper with 5x5 median ");
subplot(2,3,6), imshow(o6); title("Gaussian with Mean & Variance with 5x5 median");
```

4. Peak to signal noise ratio

```
clc;
clear all;
close all;
pkg load image
b=imread('C:\Users\admin\Desktop\image BIPL\CT
Brain.jpg');
a1=imnoise(b,'gaussian');
a2=imnoise(b,'salt & pepper');
a3=imnoise(b,'gaussian',0.2,0.8);
m1=fspecial('average',[3,3]);
m2=fspecial('average',[5,5]);
o1=imfilter(a1,m1);
o2=imfilter(a2,m1);
o3=imfilter(a3,m1);
o4=imfilter(a1,m2);
o5=imfilter(a2,m2);
o6=imfilter(a3,m2);
[p1,s1]=psnr(o1,a1);
[p2,s2]=psnr(o2,a1);
[p3,s3]=psnr(o3,a2);
[p4,s4]=psnr(o4,a2);
```

5. Fusion technique

```
clc;
clear all;
close all;
pkg load image;
I1=double(imread('C:\Users\admin\Desktop\resized img\CT1.jpg'));
if size(I1,3)==3
  I1=rgb2gray(I1);
end
I2=double(imread('C:\Users\admin\Desktop\resized img\mri1.png'));
if size(I2,3)==3
  I2=rgb2gray(I2);
end
for i=1:size(I1,1);
    for j=1:size(I1,2);
        I(i,j)=max(I1(i,j),I2(i,j));
     end
end
figure(1)
subplot(1,3,1);
imshow(I1,[]);
title('Image 1');
subplot(1,3,2);
imshow(I2,[]);
title('Image 2');
subplot(1,3,3);
imshow(I,[]);
title('Fused Image maximum fusion rule');
if size(I2,3)==3
  I2=rgb2gray(I2);
end
for i=1:size(I1,1);
    for j=1:size(I1,2);
        I(i,j)=min(I1(i,j),I2(i,j));
     end
end
figure(2)
subplot(1,3,1);
imshow(I1,[]);
title('Image 1');
subplot(1,3,2);
imshow(I2,[]);
title('Image 2');
subplot(1,3,3);
imshow(I,[]);
title('Fused Image minimum fusion rule');
```

6. Region growing

```
clc; clear all; close all;
pkg load image
%function(g,NR,SI,TI)=regiongrow(f,S,T)
%NR-no of regions
%SI-final seed
%TI-threshold image

f=imread('C:\Users\admin\Desktop\Medical Image\CT Brain.jpg');
f=double(f);
S=input('input value of S: ');
T=input('input value of T: ');

%if S is scalar, obtain seed image
if numel(S)==1
SI=f==S;
S1=S;
else
SI=bwmorph(S,'shrink',Inf);
J=find(SI);
S1=f(J); %array of seed value
end

TI=false(size(f));
for K=1:length(S1)
seedvalue=S1(K);
S=abs(f-seedvalue)<=T;
TI=TI|S;
end

figure;
subplot(2,2,1);
imshow(SI);
subplot(2,2,2);
imshow(TI);

[g,NR]=bwlabel(imreconstruct(SI,TI));
subplot(2,2,3);
imshow(g)
```

7. Gradient filters

(i) Prewitt filter

```
clc;
clear all;
close all;
pkg load image
a=imread('C:\Users\admin\Desktop\Medical Image\ultrasound_liver.jpg');
b1=[-1 -1 -1 :0  0 0:1 1 1];
b2=[-1 -1 0:1 0 1: 0 1 1];
b3=[-1 0 1:-1 0 1:-1 0 1];
b4=[0 1 1:-1 0 1: -1 0 1];
b5=[1 1 1:0 0 0:-1 -1 -1];
b6=[1 1 0: 1 0 -1:0 -1 -1];
b7=[1 0 -1:1 0 -1:1 0 -1];
b8=[0 -1 -1:1 0 -1: 1 1 0];
a1=imfilter(a,b1);
a2=imfilter(a,b2);
a3=imfilter(a,b3);
a4=imfilter(a,b4);
a5=imfilter(a,b5);
a6=imfilter(a,b6);
a7=imfilter(a,b7);
a8=imfilter(a,b8);
figure(1)
imshow(a);
title("original image");
figure(2);
subplot(2,2,1); imshow(a1); title("prewitt operator(H-line) o/p");
```

```
subplot(2,2,2); imshow(a2); title("prewitt operator(45 degree) o/p");
subplot(2,2,3); imshow(a3); title("prewitt operator(v-line) o/p");
subplot(2,2,4); imshow(a4); title("prewitt operator(-45 degree) o/p");
figure(3)
subplot(2,2,1); imshow(a5); title("prewitt operator(H-line) o/p");
subplot(2,2,2); imshow(a6); title("prewitt operator(45 degree) o/p");
subplot(2,2,3); imshow(a7); title("prewitt operator(v-line) o/p");
subplot(2,2,4); imshow(a8); title("prewitt operator(-45 degree) o/p");
```

(ii) Sobel filter

```
clc;
clear all;
close all;
pkg load image
a=imread('C:\Users\admin\Desktop\Medical Image\ultrasound_liver.jpg');
b1=[-1 -2 -1: 0 0 0: 1 2 1];
b2=[-2 -1 0: 1 0 1: 0 1 2];
b3=[-1 0 1: -2 0 2: -1 0 1];
b4=[0 1 2 : -1 0 1: -2 -1 1];
b5=[1 2 1: 0 0 0: -1 -2 -1];
b6=[2 1 0: 1 0 -1 : 0 -1 -2];
b7=[1 0 -1 : 2 0 -2: 1 0 -1];
b8=[0 -1 -2:1 0 -1:2 1 0];
a1=imfilter(a,b1);
a2=imfilter(a,b2);
a3=imfilter(a,b3);
a4=imfilter(a,b4);
a5=imfilter(a,b5);
a6=imfilter(a,b6);
a7=imfilter(a,b7);
```

```
a8=imfilter(a,b8);
figure(1)
imshow(a);
title("original image");
figure(2);
subplot(2,2,1); imshow(a1); title("sobel operator(H-line) o/p");
subplot(2,2,2); imshow(a2); title("sobel operator(45 degree) o/p");
subplot(2,2,3); imshow(a3); title("sobel operator(v-line) o/p");
subplot(2,2,4); imshow(a4); title("sobel operator(-45 degree) o/p");
figure(3)
subplot(2,2,1); imshow(a5); title("sobel operator(H-line) o/p");
subplot(2,2,2); imshow(a6); title("sobel operator(45 degree) o/p");
subplot(2,2,3); imshow(a7); title("sobel operator(v-line) o/p");
subplot(2,2,4); imshow(a8); title("sobel operator(-45 degree) o/p");
```

(iii) Robert filter

```
Clc; close all; clear all;
a=imread(“cameraman.tiff”);
b1=[1 0: 0 -1];
b2=[0 1: -1 0];
a1=imfilter(a,b1);
a2=imfilter(a,b2);
subplot(2,2,1);
imshow(a);
title(‘original image’);
figure(2)
subplot(2,2,2);
imshow(a1);
title(‘Gx’);
subplot(2,2,3);
imshow(a2);
title(‘Gy’);
```

8. Segmentation using Thresholding

```
clc;
clear all;
close all;
pkg load image;
I1=double(imread('C:\Users\admin\Desktop\Medical
Image\MRI Brain T1(image2).png'));
if size(I1,3)==3
  I1=rgb2gray(I1);
end
figure(1)
imshow(I1,[]);
figure(2)
hist(I1);
[m n]=size(I1);
for i=1:m
  for j=1:n
   if I1(i,j)>150
    I2(i,j)=I1(i,j);
   else
    I2(m,n)=0;
  end
end
end
figure(3);
imshow(I2,[]);
```

9. Histogram Equalisation

```
Clc;close all;clear all;
a=imread('CT Brain.jpg');
b=histeq(a);
subplot(2,2,1);
imshow(a);
title('original image');
subplot(2,2,2);
imshow(b);
title('after histogram equalisation');
subplot(2,2,3);
imshow(a);
title('original histogram');
subplot(2,2,4);
imshow(b);
title('after histogram equalisation');
```

10. 2D convolution

```
clc;
clear all;
close all;
f=imread('ultrasound_liver.jpg');
g1=imcomlement(f);
g2=imcomlement(f);
g3=ones(size(f));
o1=conv2(f,g1,'same');
o2=conv2(f,g2,'same');
o1=conv2(f,g3,'same');
subplot(4,3,1);
imshow(f);
title('input image');
subplot(4,3,2);
imshow(g1);
title('mask 1');
subplot(4,3,3);
imshow(g2);
title('mask 2');
subplot(4,3,4);
imshow(g3);
title('mask 3');
subplot(4,3,5);
imshow(o1);
title('o1=f*g1');
subplot(4,3,6);
imshow(o2);
title('o2=f*g2');
subplot(4,3,7);
imshow(o3);
title('o3=f*g3');
subplot(4,3,8);
imhist(f);
title('histogram of f');
```

```
subplot(4,3,9);
imhist(o1);
title('histogram of o1');
subplot(4,3,10);
imhist(o2);
title('histogram of o2');
subplot(4,3,11);
imhist(o3);
title('histogram of o3');
mean of input=mean2(f);
mean of o1=mean2(o1);
mean of o2=mean2(o2);
mean of o3=mean2(o3);
```

11. Moving Average Filter

```
clc;
close all;
clear all;
pkg load image;
a2=imread('C:\Users\admin\OneDrive\Desktop\Medical Image\CT Brain.jpg');
a=imnoise(a2,'salt and pepper',0.03);
b=im2double(a)
[m,n]=size(b);
for i=2:m-1
  for j=2:n-1
    c=[b(i-1,j-1),b(i-1,j),b(i-1,j+1);
    b(i,j-1),b(i,j),b(i,j+1);
    b(i+1,j-1),b(i+1,j),b(i+1,j+1)];
    o1=sum(sum(c));
    o=1/9*o1;
    output(i,j)=o;
  end
```

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

12. Hit or Miss Transformation

```
clc;
clear;
close all;
pkg load image;
a1=[0 0 0 0 0 0 0 0 0 0;
 0 1 1 1 0 1 1 1 0 0;
 0 1 1 1 0 1 1 0 0 0;
 0 1 1 1 0 1 1 1 0 0;
 0 0 0 0 0 0 0 0 0 0];
 a2=imcomplement(a1);
 b1=[0 1 0;1 1 1;0 1 0];
 o2=imcomplement(b1);
 o1=imerode(a1,b1);
 subplot(2,2,1);
 imshow(a1);
 subplot(2,2,2);
 imshow(o1);
 o2=bwhitmiss(a1,b1,o2);
 subplot(2,2,3);
 imshow(o2);
```

13. Fourier Boundary Descriptor

```
Clc; clear all; close all;
a=[1+i, 2+i, 3+i, 4+i, 5+i, 5+2i, 5+3i, 4+3i, 3+3i, 2+3i,1+3i,1+2i,1+i];
subplot(2,2,1);
plot(a);
b=fft(a,12);
k1=2;
c1=b(1:k1);
o1=ifft(c1,12);
subplot(2,2,2);
plot(o1);
k2=6;
c2=b(1:k2);
o2=ifft(c2,12);
subplot(2,2,3);
plot(o2);
k2=10;
c3=b(1:k3);
o3=ifft(c3,12);
subplot(2,2,4);
plot(o3);
```

14. Mean and Median Filter

```
Clc ; clear all; close all;
i=imread('ultrasound fetus.jpg');
subplot(2,2,1);
imshow(i);
title('original image');
n=imnoise(i,'salt & pepper');
subplot(2,2,2);
imshow(n);
title('noisy image');
f1=fspecial('average');
Ip=imfilter(n,f1);
```

```
subplot(2,2,3);
imshow(Ip);
title('Mean filtered image');
m=medfilt2(n);
subplot(2,2,4);
imshow(m);
title('Median filtered image');
```

15. Intensity Level Slicing

```
Clc ;clear all; close all;
a=input('enter the value of A: ');
b=input('enter the value of B: ');
figure('Name', 'Intensity Level Slicing');
i1=imread('ultrasound fetus.jpg');
subplot(1,3,1);
imshow(i);
title('input image');
[m,n]=size(i1);
for i=1:m
    for j=1:n
        if i1(i,j)>a && i1(i,j)<=b
           i1(i,j)=255;
        end
    end
end
subplot(1,3,2);
imshow(i1);
title('without background');
for i=1:m
    for j=1:n
        if i1(i,j)>a && i1(i,j)<=b
           i1(i,j)=255;
        else
           i2(i,j)=i1(i,j);
        end
```

```
    end
end
subplot(1,3,3);
imshow(i11);
title('with background');
```

16. High and Low Pass Filters

```
Clc ; clear all; close all;
i=imread('ultrasound fetus.jpg');
subplot(1,3,1);
imshow(i);
title('original image');
f1=fspecial('average');
Ip=imfilter(i,f1);
subplot(1,3,2);
imshow(Ip);
title('Low pass filtered image');
f2=fspecial('unsharp');
Hp=imfilter(i,f2);
subplot(1,3,3);
imshow(Hp);
title('High pass filtered image');
```

17. Order Filter

```
Clc ; clear all ; close all;
a=imread('CT Brain.jpg');
o1=ordfilt2(a,1,ones(3,3));
o2=ordfilt2(a,9,ones(3,3));
o3=ordfilt2(a,5,ones(3,3));
subplot(1,4,1);
imshow(a);
title('original image');
subplot(1,4,2);
imshow(o1);
title('Min filter image');
subplot(1,4,3);
imshow(o2);
title('Max filter image');
subplot(1,4,4);
imshow(o3);
title('Median filter image');
```