Computer Vision

Lab-01

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Ques 1.

Compare imadjust() and imcomplement() for obtaining negative of an Image.

Source code:-

```
clc;

pkg load image;
img=imread('cameraman.tif');
img_double=im2double(img);
subplot(2,3,1);
imshow(img_double);
title("original image");

im_comp=imcomplement(img_double);
subplot(2,3,2);
imshow(im_comp);
title("complement image");

im_adj=imadjust(img_double);
subplot(2,3,3);
imshow(im_adj);
title("imadjust [LOWIN; HIGHIN],[LOWOUT; HIGHOUT]");

im_adj_1=imadjust(img_double,[0.5:0],[0;1]);
subplot(2,3,4);
imshow(im_adj_1);
title("value [0.5:0],[0;1]");

im_adj_2=imadjust(img_double,[0;0.5],[0;1]);
subplot(2,3,5);
imshow(im_adj_2);
title("value [0;0.5],[0;1]");

im_adj_3=imadjust(img_double,[0.5:0],[1;0]);
subplot(2,3,6);
imshow(im_adj_3);
title("value [0;0.5],[1;0]");
```

Output image:

Observation:

First image is the original image and second image is complement of the original image. When we start vary for different values of in and out value of imadjust, at one point where lowin=0, highin=0.5, lowout=1 and highout=0 the image we get will exactly will be same as the imcomplement image.

Ques 2.

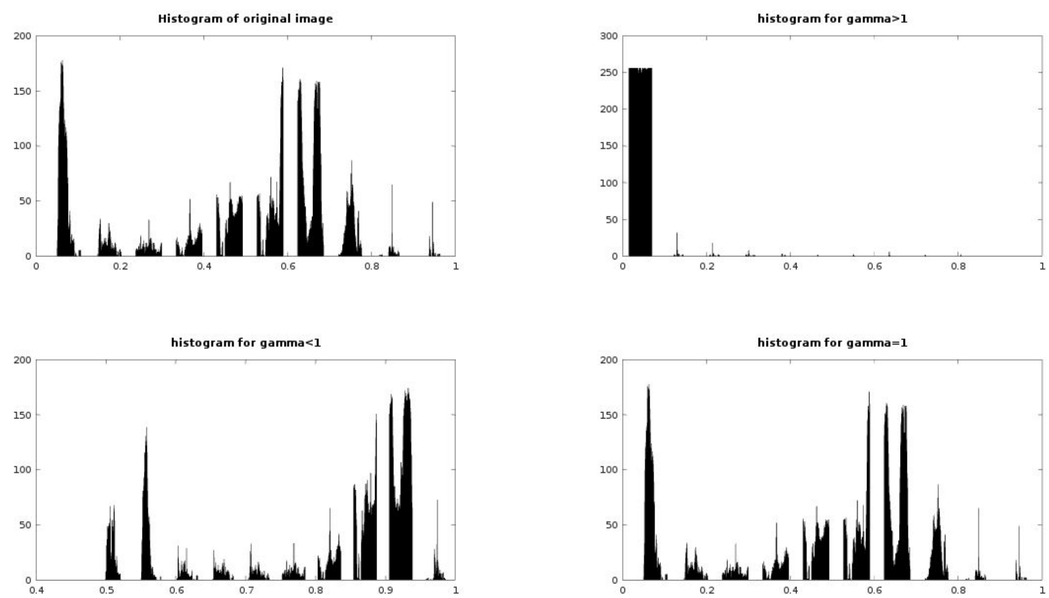
Observe the effects of changing Gamma on an image. Show their effects on band of interest using histogram of the input image and corresponding processed image.

Source code:

```
clc;
pkg load image;
img=imread('cameraman.tif');
img_double=im2double(img);
subplot(2,2,1);
hist(img_double);
title("Histogram of original image");
```

```
im_gamma=imadjust(img_double,[],[],20);
subplot(2,2,2);
imshow(im_gamma);
hist(im_gamma);
title("histogram for gamma>1");

im_gamma=imadjust(img_double,[],[],0.20);
subplot(2,2,3);
imshow(im_gamma);
hist(im_gamma);
title("histogram for gamma<1");

im_gamma=imadjust(img_double,[],[],1);
subplot(2,2,4);
imshow(im_gamma);
hist(im_gamma);
title("histogram for gamma=1");
```

Output image:



Observation:-

The frequency of occurrence of any pixel is dependent on the value of gamma. When we take the value of gamma>1 the pixel is more oriented towards blackish. When the value of gamma<1, the frequency of pixel to be occurred is more likely to be white. And remains same when we take the value of gamma is equal to 1.

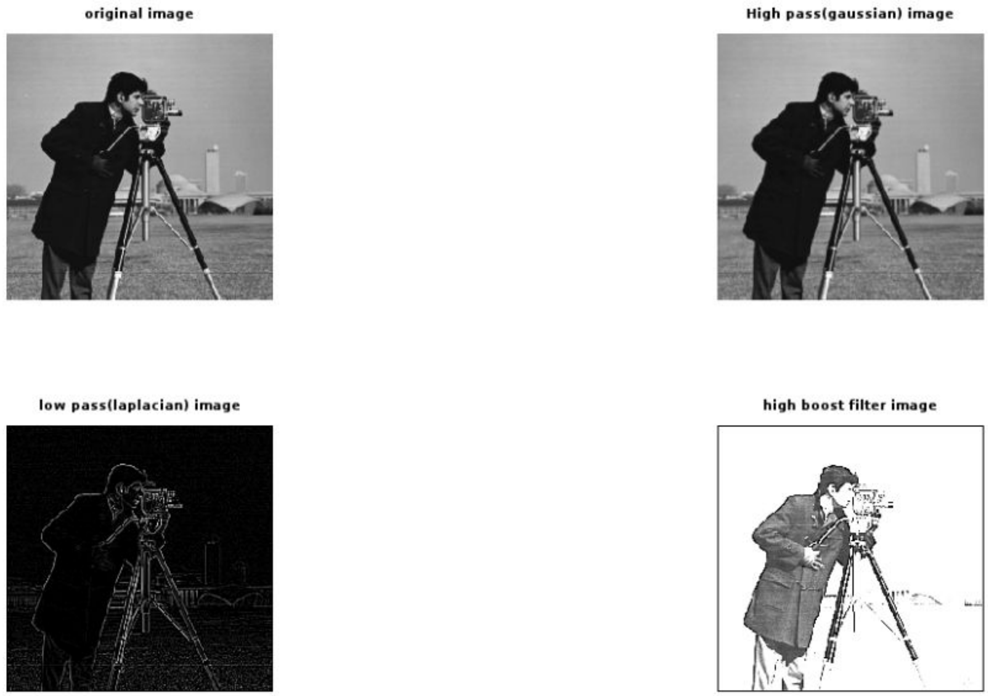
Ques 3.

Demonstrate following linear filtering operations using imfilter():
(i) low-pass filter, (ii) high-pass filter, and (iii) high-boost filter

Source code:

```
clc;
pkg load image;
img=imread('cameraman.tif');
img_double=im2double(img);
subplot(2,2,1);
imshow(img_double);
title("original image");


f=fspecial("gaussian",3);
subplot(2,2,2);
j=imfilter(img_double,f);
imshow(j);
title("High pass(gaussian) image");

f=fspecial("laplacian",0.3);
subplot(2,2,3);
j=imfilter(img_double,f);
imshow(j);
title("low pass(laplacian) image");


subplot(2,2,4);
A=[-1 -1 -1; -1 17 -1; -1 -1 -1];
j=conv2(img_double,A);
imshow(j);
title("high boost filter image");
```

Output image:



Observation:

In the 2nd image the image is passed from high pass filter hence the image is more sharper because in high pass if one pixel is brighter, it's gets boosted. In the 3rd image, the image is passed from low pass filter, therefore is smooths out the image. In the 4th image, the image is passed from high boost filter which emphasize high frequency components representing the image details (by means such as sharpening) without eliminating low frequency components.

Ques 4.

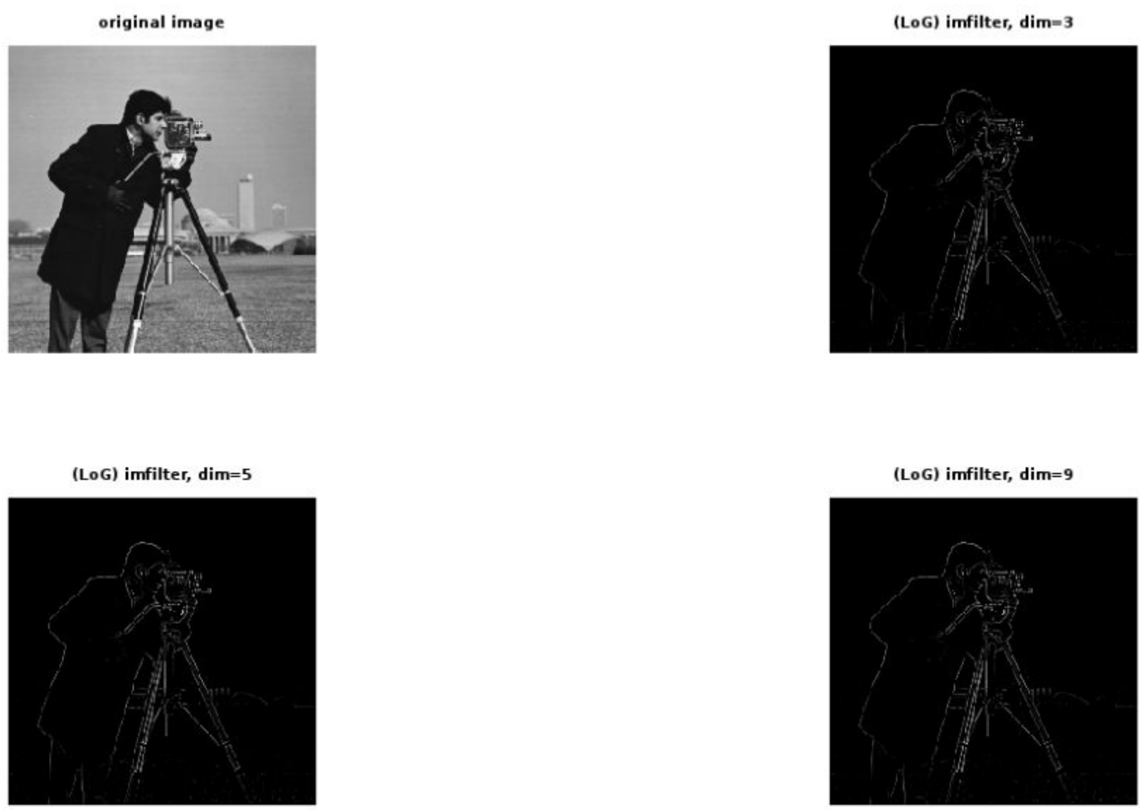
Consider an image. Apply Laplacian of Gaussian (LoG) filtering operation to detect the edges of the image. Experiment with different sizes of
masks and windows. Compare their outputs along with corresponding
histograms. Use fspecial() and imfilter() commands.

Source code:

```
clc;
pkg load image;
img=imread('cameraman.tif');
img_double=im2double(img);
subplot(2,2,1);
imshow(img_double);
title("original image");

f=fspecial("log",3);
```

```
subplot(2,2,2);
j=imfilter(img_double,f);
imshow(j);
title("(LoG) imfilter, dim=3");

f=fspecial("log",5);
subplot(2,2,3);
j=imfilter(img_double,f);
imshow(j);
title("(LoG) imfilter, dim=5");

f=fspecial("log",9);
subplot(2,2,4);
j=imfilter(img_double,f);
imshow(j);
title("(LoG) imfilter, dim=9");
```

Output image:



Observation:

When we are applying laplacian of log(LoG) filter for different mask the edges of the images become more clear as we are increasing the dimension of the mask.

Ques 5.

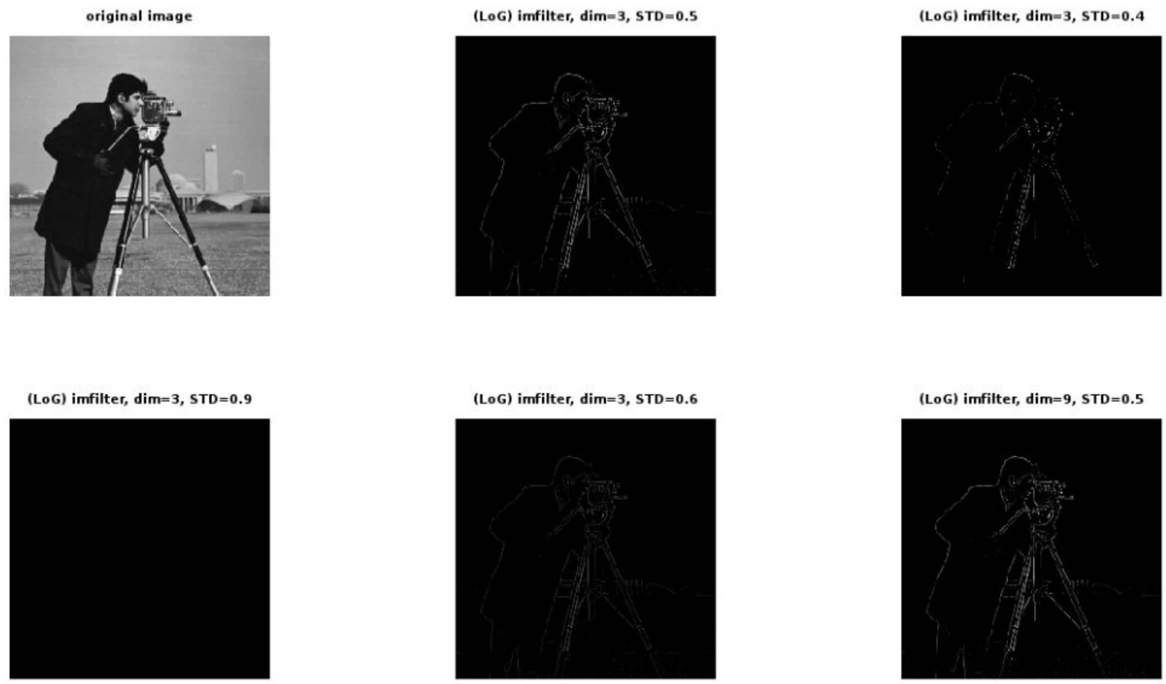
Compare and contrast the functioning of LoG and the high-pass filtering operations for detecting edges from an image

Source code:

```
clc;
pkg load image;
img=imread('cameraman.tif');
img_double=im2double(img);
subplot(2,3,1);
imshow(img_double);
title("original image");


f=fspecial("log",3,0.5);
subplot(2,3,2);
j=imfilter(img_double,f);
imshow(j);
title("(LoG) imfilter, dim=3, STD=0.5");

f=fspecial("log",3,0.4);
subplot(2,3,3);
j=imfilter(img_double,f);
imshow(j);
title("(LoG) imfilter, dim=3, STD=0.4");

f=fspecial("log",3,0.9);
subplot(2,3,4);
j=imfilter(img_double,f);
imshow(j);
title("(LoG) imfilter, dim=3, STD=0.9");

f=fspecial("log",3,0.6);
subplot(2,3,5);
j=imfilter(img_double,f);
imshow(j);
title("(LoG) imfilter, dim=3, STD=0.6");

f=fspecial("log",9,0.5);
subplot(2,3,6);
```

```
j=imfilter(img_double,f);
imshow(j);
title("(LoG) imfilter, dim=9, STD=0.5");
```

Output image:



Observation:

We can see that as the value of the spread of the filter is varies from 0.5 in either of the side the the image is becoming more blackish. At the value of spread of filter is 0.5 and we increase the value of mask the edges is becoming more clear.

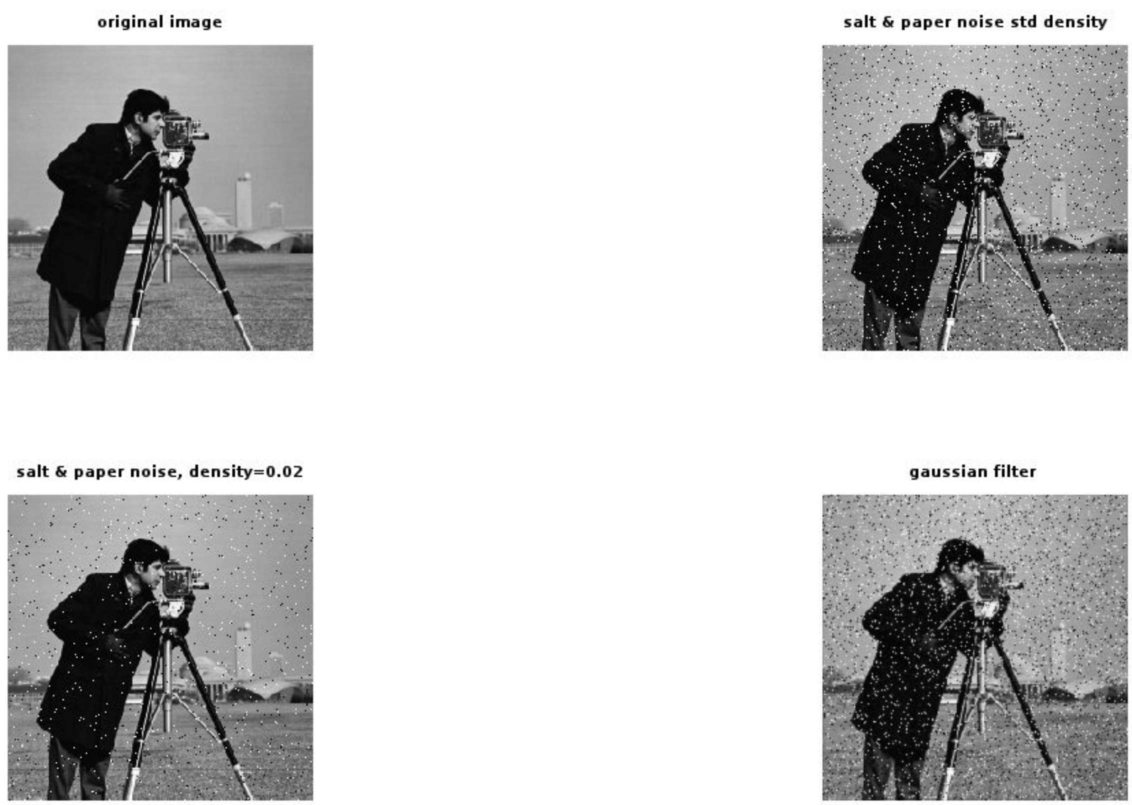
Ques 6.

Consider an image. Add different amounts of salt & pepper noise in it. Now try removing the noise using appropriate filtering in the spatial domain of the image. Display all the outputs.

Source code:

```
clc;
pkg load image;
img=imread('cameraman.tif');
img_double=im2double(img);
```

```
subplot(2,2,1);
imshow(img_double);
title("original image");

subplot(2,2,2);
j=imnoise (img_double, "salt & pepper");
imshow(j);
title("salt & paper noise std density");

subplot(2,2,3);
j=imnoise (img_double, "salt & pepper",0.02);
imshow(j);
title("salt & paper noise, density=0.02");

f=fspecial("gaussian",3);
j=imnoise (img_double, "salt & pepper",0.09);
j=imfilter(j,f);
subplot(2,2,4);
imshow(j);
title("gaussian filter ");
```



Observation:

We can see that applying gaussian filter to salt and pepper noised image doesn't helped much to remove noise although it blurred noise upto some extent but applying median filter completely removed noise from the image.

Ques 7.

Repeat the Q.6 for Gaussian noise

Source code:

```
clc;
pkg load image;
img=imread('cameraman.tif');
img_double=im2double(img);

subplot(2,2,1);
imshow(img_double);
title("original image");

subplot(2,2,2);
j=imnoise (img_double, "Gaussian");
imshow(j);
title("Gaussian std density");

subplot(2,2,3);
j=imnoise (img_double, "Gaussian",0.02);
imshow(j);
title("Gaussian, density=0.02");

subplot(2,2,4);
j=imnoise (img_double, "Gaussian",0.09);
imshow(j);
title("Gaussian, density=0.09");
```

Output image:

original image

Gaussian std density

Gaussian, density=0.02

Gaussian, density=0.09

Observation:

When we are applying the gaussian noise, it is taking density by default as 0.5 and in this case the intensity of each pixel is large number, but we varies from std=0.5 the intensity decreases, due to such case the image is more blurr.

Ques 8.

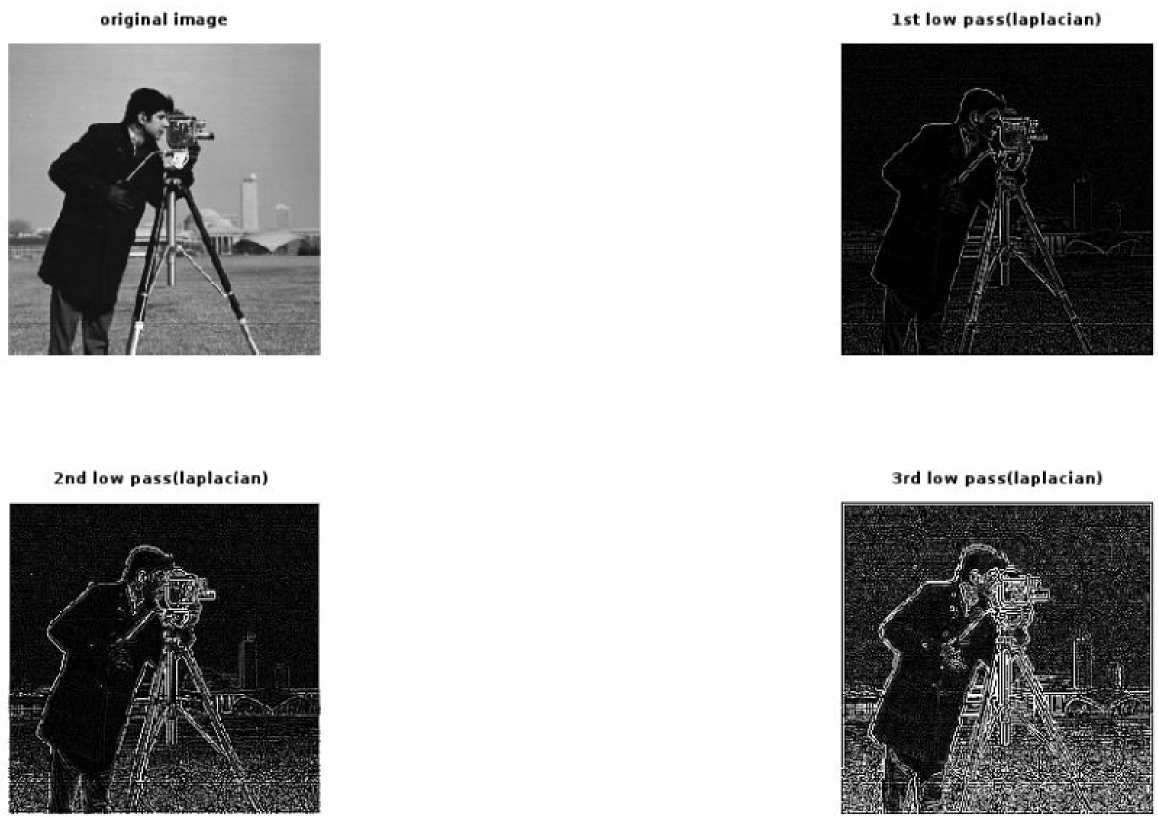
Demonstrate the effects of repeatedly applying low-pass filter operation on an image.

Source code:

```
clc;
pkg load image;
img=imread('cameraman.tif');
img_double=im2double(img);
subplot(2,2,1);
imshow(img_double);
title("original image");


f=fspecial("laplacian",0.3);
```

```
subplot(2,2,2);
j=imfilter(img_double,f);
imshow(j);
title("1st low pass(laplacian)");

subplot(2,2,3);
j=imfilter(j,f);
imshow(j);
title("2nd low pass(laplacian) ");

subplot(2,2,4);
j=imfilter(j,f);
imshow(j);
title("3rd low pass(laplacian)");
```

Output image:



Observation:

It can be observed that after applying gaussian filter repeatedly the image get more blurred each
time because of lack of high frequency components filtered out.