UNIVERSITI TEKNOLOGI MALAYSIA

FINAL EXAM SEMESTER II, 2019/2020

SCSV3213 - 02

FUNDAMENTAL OF IMAGE PROCESSING

LAB AND TUTORIAL

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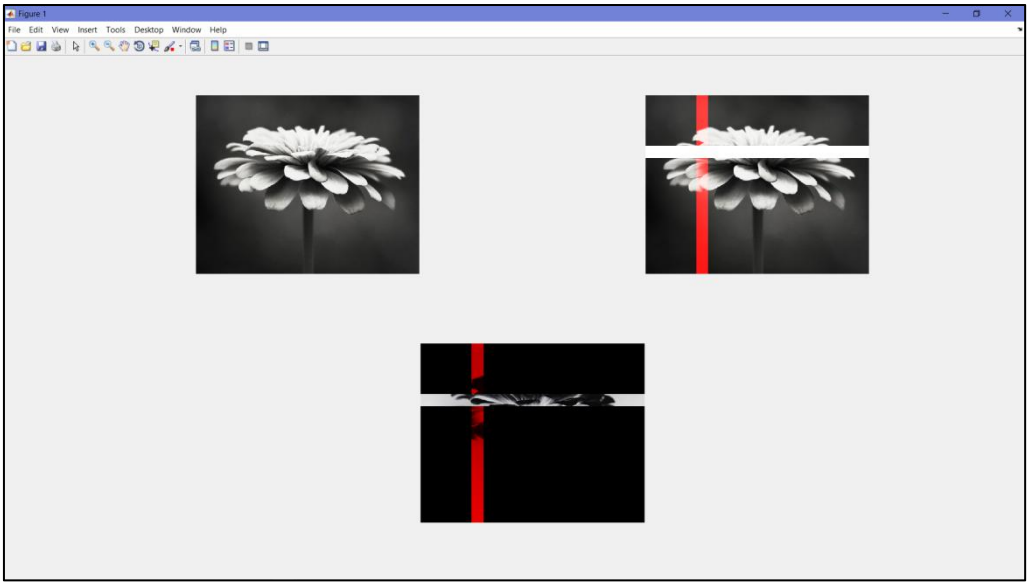
TABLE OF CONTENT

FIP LAB 1

TUTORIAL 1

```
A = imread('flower.jpg');
B = A;
B(130:160,:) = 255; B(:,130:160)=255;
C = imsubtract(B,A);
subplot(2,2,1);imshow(A);
subplot(2,2,2);imshow(B);
subplot(2,2,3:4);imshow(C);
```



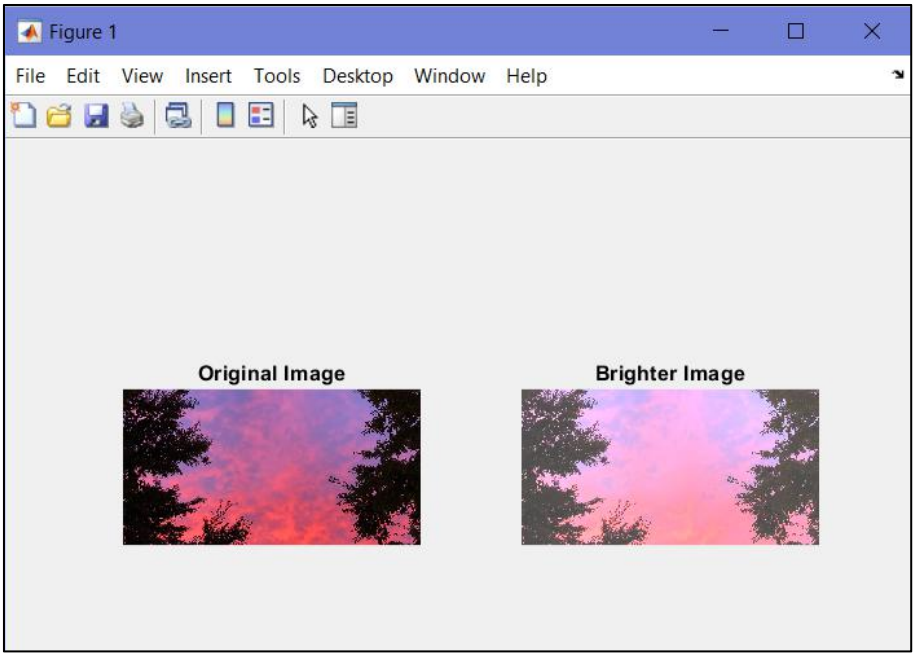
TUTORIAL 2

```
I = imread ('lindsay.tif');
x = I (100:220,100:230);
x = I (100:220,100:230,:);
x = imrotate (x,180);
I (100:220,100:230,:)= x
```

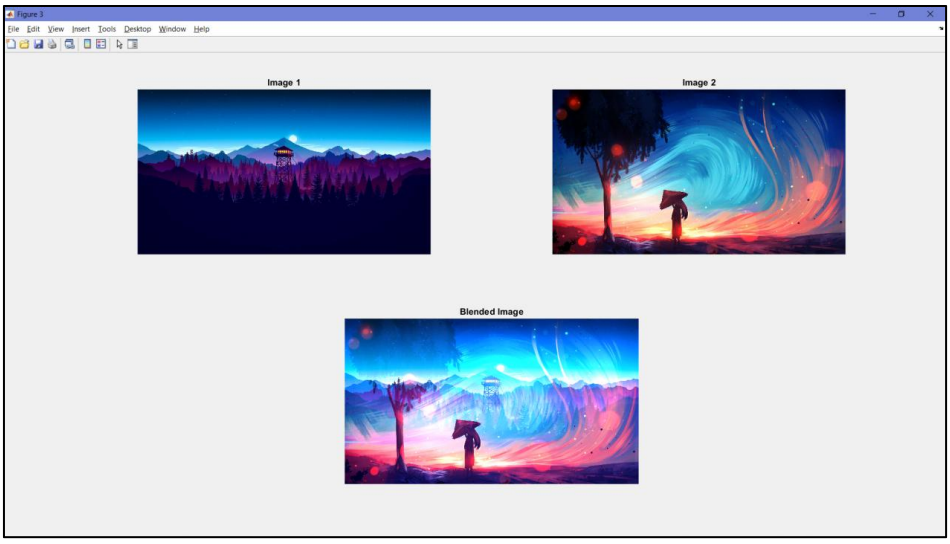
FIP LAB 2 AND 3

TUTORIAL 1 :

```
I = imread('sunset.jpg');
I2 = imadd(I,75);
figure
subplot(1,2,1), imshow(I), title('Original Image');
subplot(1,2,2), imshow(I2), title('Brighter Image');
```

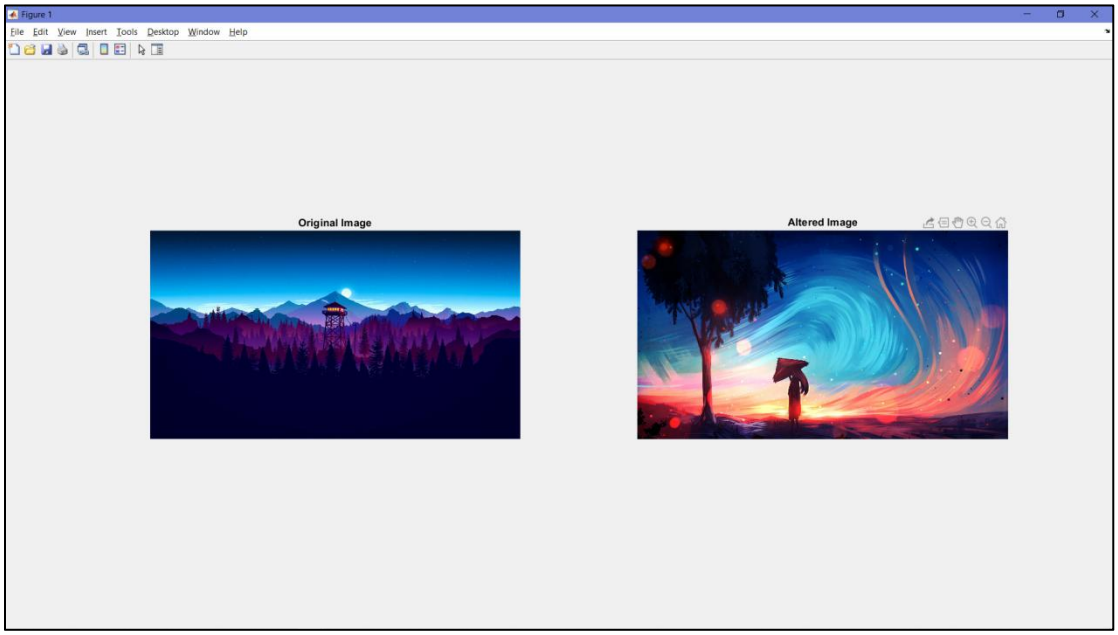


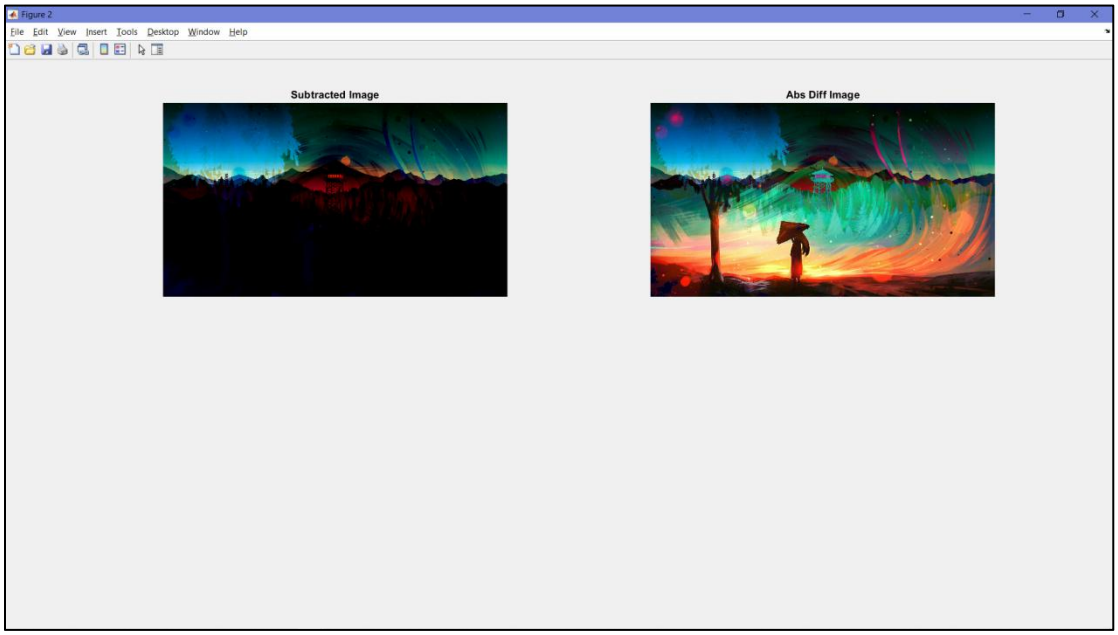

```
Ia = imread('pretty1.jpg');
Ib = imread('pretty2.jpg');
Ic = imadd(Ia, Ib);
figure; subplot(2,2,1); imshow(Ia), title('Image 1');
subplot(2,2,2),imshow(Ib), title('Image 2');
subplot(2,2,3:4),imshow(Ic), title('Blended Image');
```



TUTORIAL 2 :

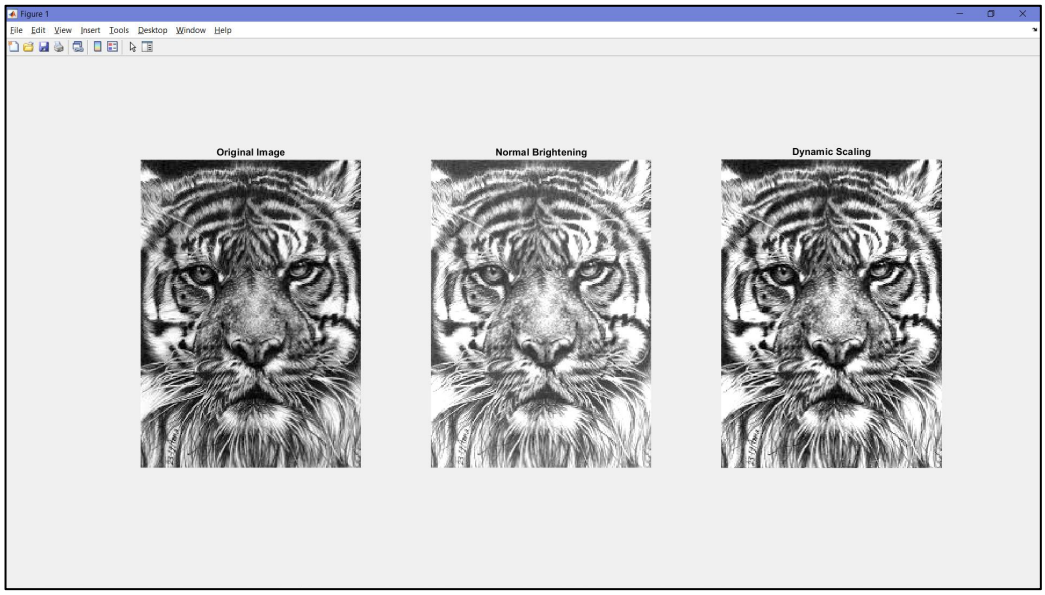
```
I = imread('pretty1.jpg');
J = imread('pretty2.jpg');
figure(1); subplot(1,2,1), imshow(I), title('Original Image');
subplot(1,2,2), imshow(J), title('Altered Image');
diffim = imsubtract(I,J);
figure(2)
subplot(2,2,1), imshow(diffim), title('Subtracted Image');
diffim2 = imabsdiff(I,J);
subplot(2,2,2), imshow(diffim2), title('Abs Diff Image');
```



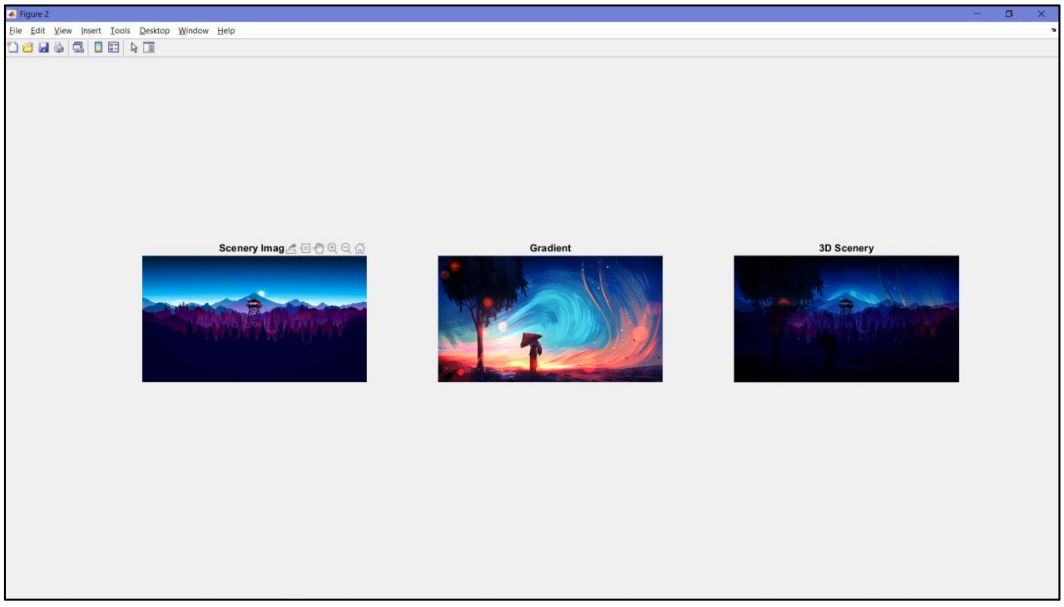


TUTORIAL 3 :

```
I = imread('tiger.jpg');
I2 = imadd(I, 50);
I3 = immultiply(I, 1.2);
figure
subplot(1,3,1), imshow(I), title('Original Image');
subplot(1,3,2), imshow(I2), title('Normal Brightening');
subplot(1,3,3), imshow(I3), title('Dynamic Scaling');
```

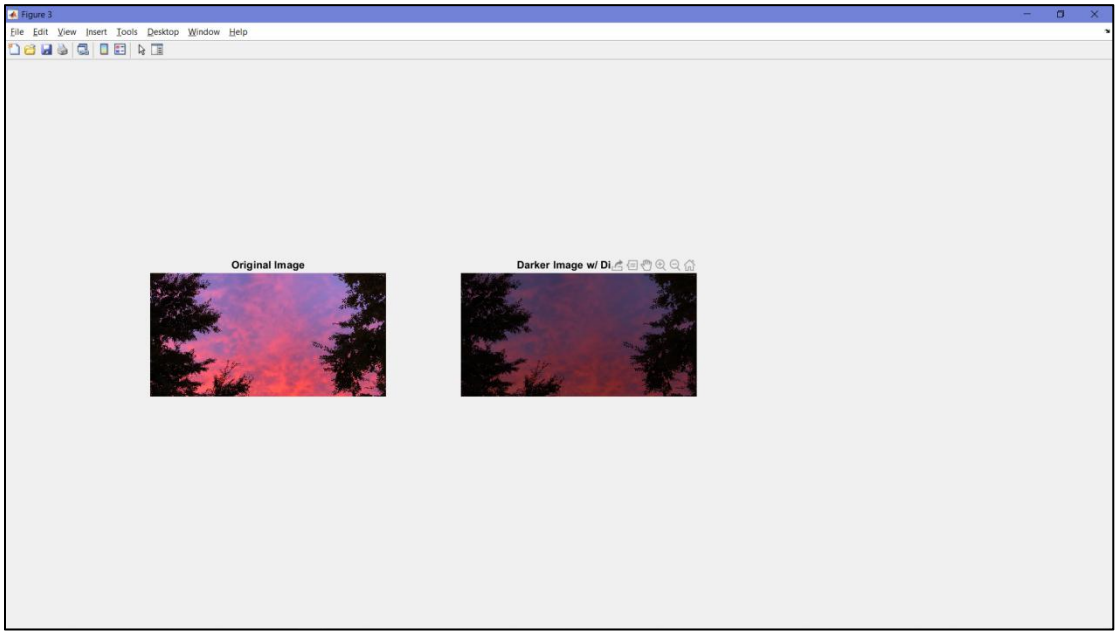



```
I = im2double(imread('pretty1.jpg'));
J = im2double(imread('pretty2.jpg'));
K = immultiply(I,J);
figure
subplot(1,3,1), imshow(I), title('Scenery Image');
subplot(1,3,2), imshow(J), title('Gradient');
subplot(1,3,3), imshow(K,[]), title('3D Scenery');
```

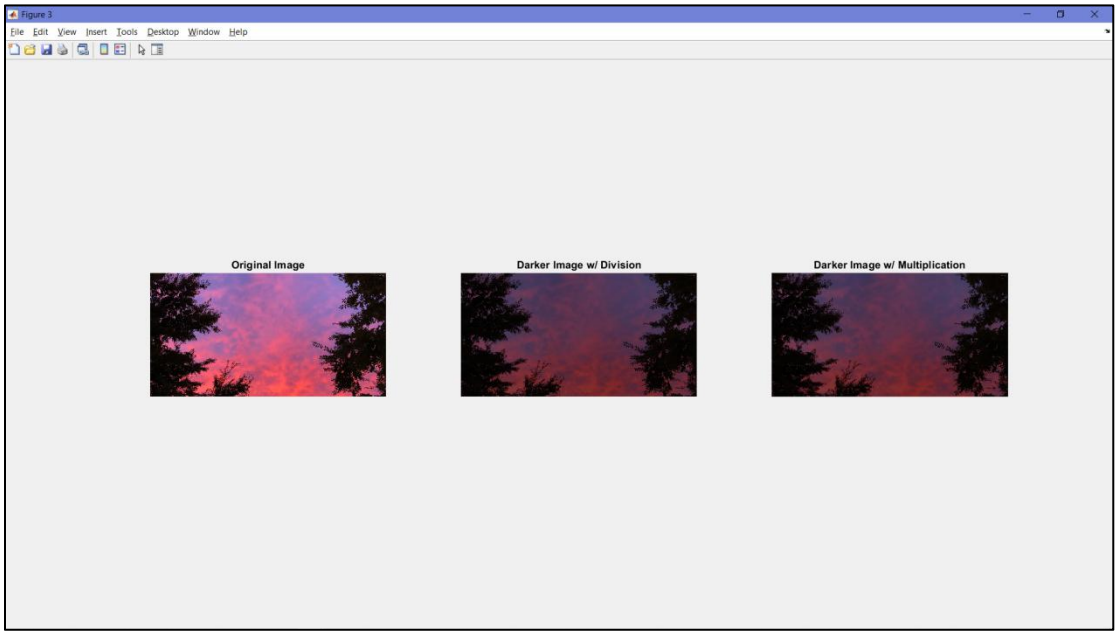


TUTORIAL 4 :

```
I = imread('sunset.jpg');
I2 = imdivide(I,2);
figure
subplot(1,3,1), imshow(I), title('Original Image');
subplot(1,3,2), imshow(I2), title('Darker Image w/ Division');
```

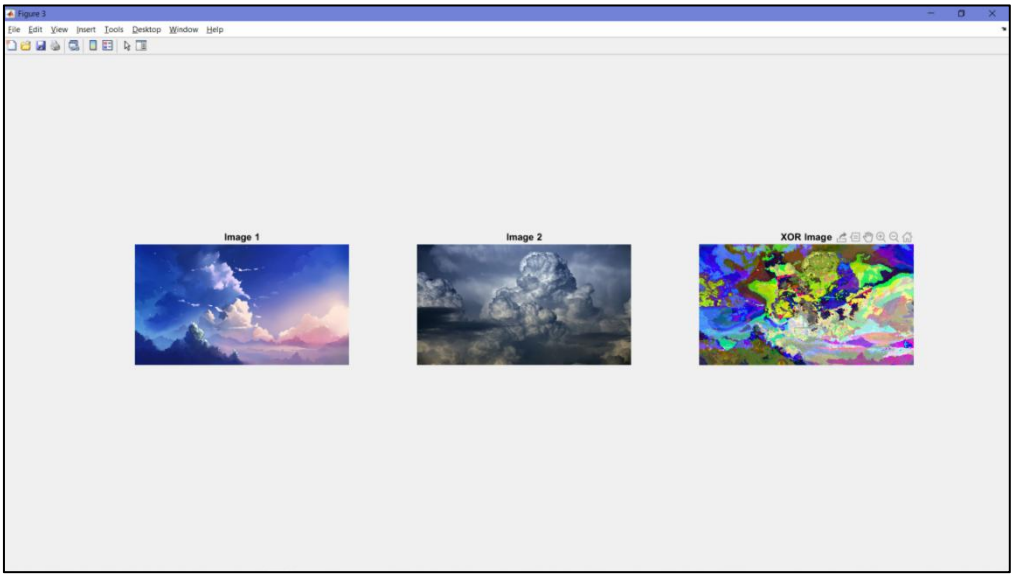



```
I = imread('sunset.jpg');
I2 = imdivide(I,2);
figure
subplot(1,3,1), imshow(I), title('Original Image');
subplot(1,3,2), imshow(I2), title('Darker Image w/ Division');
I3 = immultiply(I,0.5);
subplot(1,3,3), imshow(I3), title('Darker Image w/ Multiplication');
```



TUTORIAL 5 :

```
I = imread('C1.jpg');
I2 = imread('C2.jpg');
I_xor = bitxor(I,I2);
figure; subplot(1,3,1), imshow(I), title('Image 1');
subplot(1,3,2), imshow(I2), title('Image 2');
subplot(1,3,3), imshow(I_xor,[]), title('XOR Image');
```




```
I = imread('cam.jfif');
I_adj = imdivide(I,1.5);
subplot(1,2,1); imshow(I);
subplot(1,2,2); imshow(I_adj);
bw = im2uint8(roipoly(I));
bw_cmp = bitcmp(bw);
roi = bitor(I_adj,bw_cmp);
not_roi = bitor(I,bw);
new_img = bitand(roi,not_roi);
imshow(new_img)
```

TEST YOUR UNDERSTANDING :

```
I = imread('cam.jfif');
I2=I;
I2(166:167,176:177)=0;
I2(166:167,145:146)=0;
I2(56:57,176:177)=0;
I2(123:124,115:116)=0;
figure; subplot(1,2,1);imshow(I);
subplot(1,2,2);imshow(I2);
```

TUTORIAL 6 :

```
I = imread('sunset.jpg');
figure, subplot(2,2,1), imshow(I), title('Image')
subplot(2,2,2), imhist(I,256), axis tight, title('Histogram')
subplot(2,2,3), imhist(I,64), axis tight, ...
title('Histogram with 64 bins')
subplot(2,2,4), imhist(I,32), axis tight, ...
title('Histogram with 32 bins')
title('Histogram with 32 bins')
c = imhist(I,32);
c_norm = c / numel(I);
figure, subplot(1,2,1), bar_1 = bar(c);
set(gca, 'XLim', [0 32], 'YLim', [0 max(c)]);
set(gca, 'XTick', [0:8:32], 'YTick', ...
set(gca, 'XTick', [0:8:32], 'YTick', ...
[linspace(0,7000,8) max(c)];
set(bar_1, 'FaceColor', 'r'), title('Bar Chart')
subplot(1,2,2), bar_2 = bar(c_norm)
set(gca, 'XTick', [0:8:32], 'YTick',...
[linspace(0,0.09,10) max(c_norm)]

ans =

  Columns 1 through 5

         0    0.0100    0.0200    0.0300    0.0400

  Columns 6 through 10

    0.0500    0.0600    0.0700    0.0800    0.0900

  Column 11

    0.1474

xlim([0 32]), ylim([0 max(c_norm)])
title('Normalized Bar Chart')
set(bar_2, 'FaceColor', 'g')
```

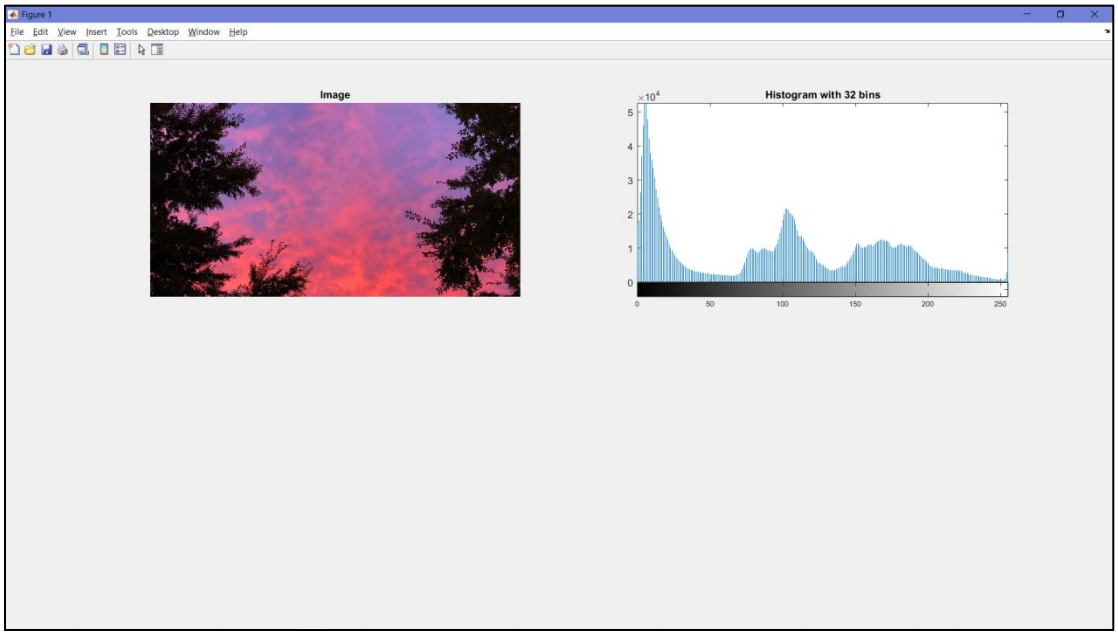


Figure 1
File Edit View Insert Tools Desktop Window Help
Image
Histogram with 32 bins
×10^4
5
4
3
2
1
0
0
50
100
150
200
250

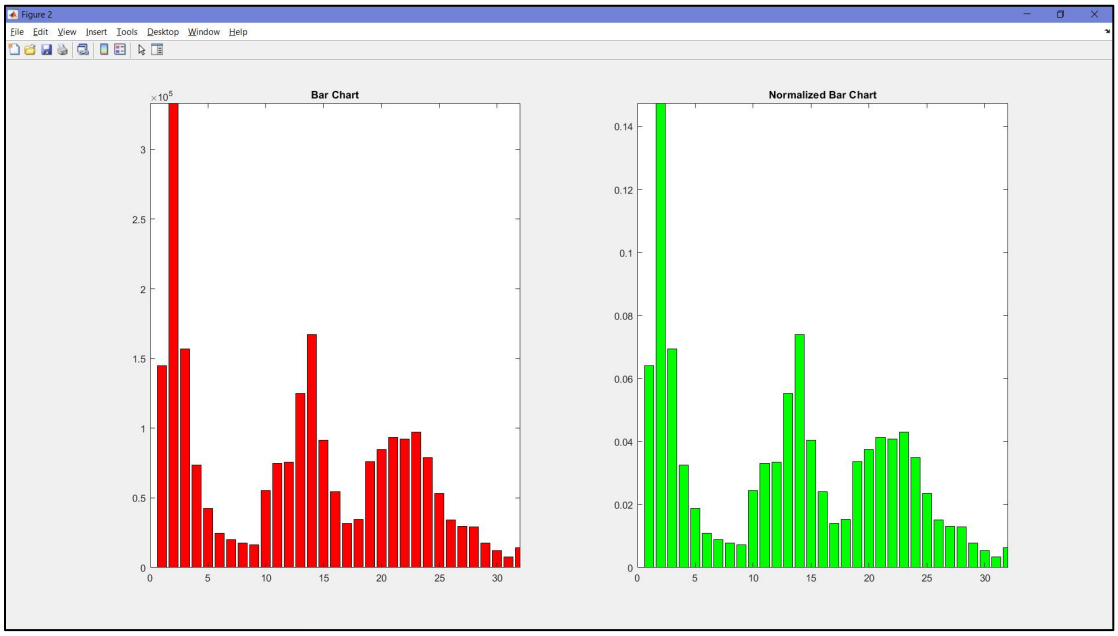
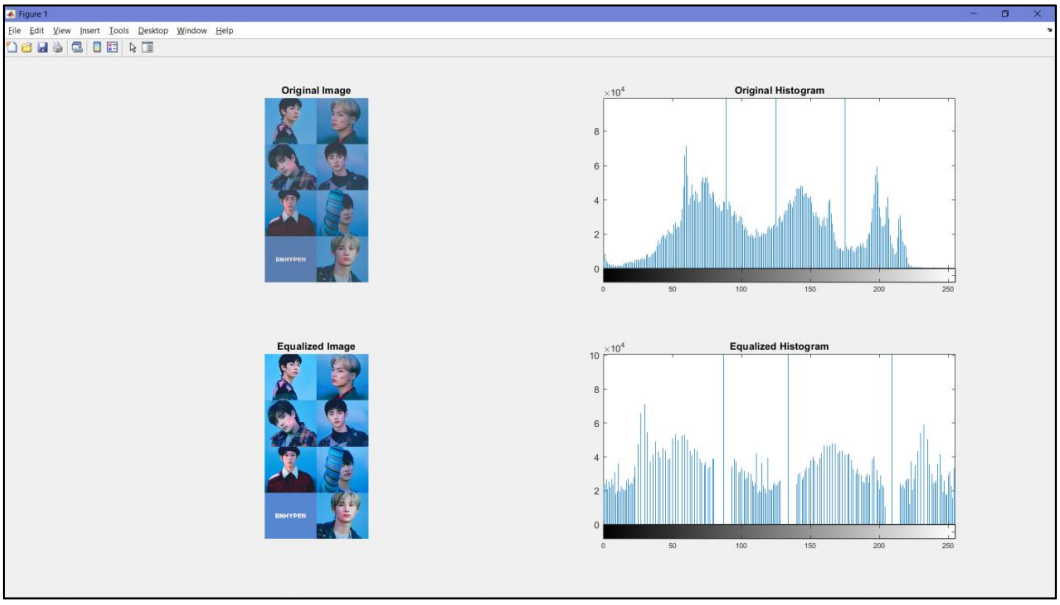


Figure 2
File Edit View Insert Tools Desktop Window Help
Bar Chart
×10^5
3
2.5
2
1.5
1
0.5
0
0
5
10
15
20
25
30
Normalized Bar Chart
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
30

TUTORIAL 7 :

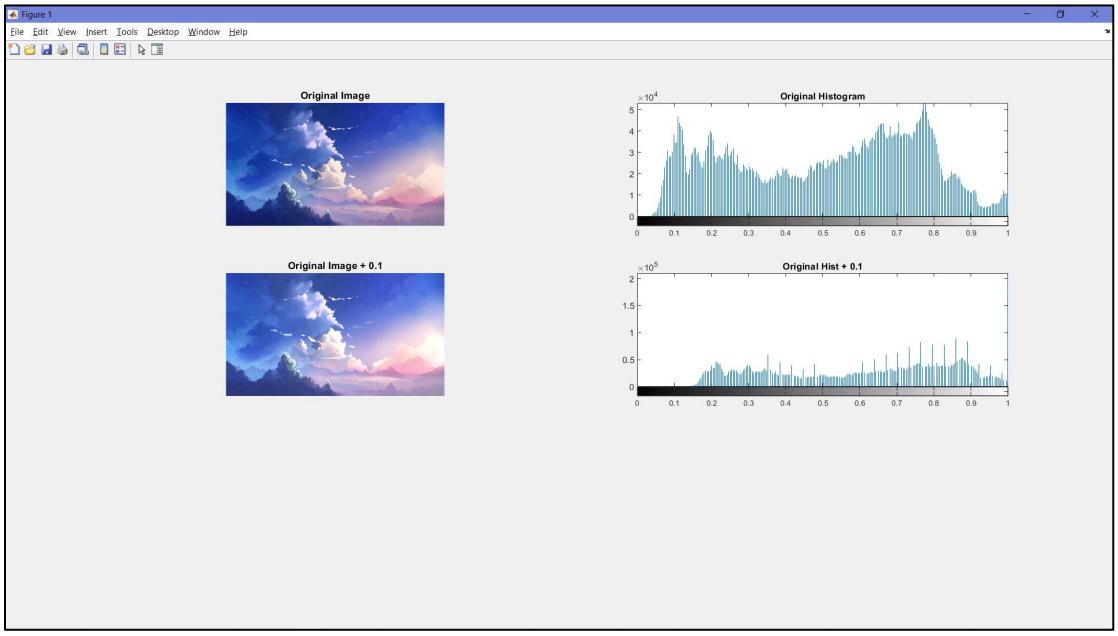
```
I = imread('dawn.png');
figure, subplot(2,2,1), imshow(I), ...
title('Original Image')
subplot(2,2,2), imhist(I), ...
title('Original Histogram')
I_eq = histeq(I,256);
subplot(2,2,3), imshow(I_eq), title('Equalized Image')
subplot(2,2,4), imhist(I_eq), title('Equalized Histogram')
```




```
I = imread('trees.jpg'); I_eq = histeq(I,256);
figure, subplot(2,2,1), imshow(I), title('Original Image')
subplot(2,2,2), imhist(I), title('Original Histogram')
subplot(2,2,3), imshow(I_eq), title('Equalized Image')
subplot(2,2,4), imhist(I_eq), title('Equalized Histogram')
```

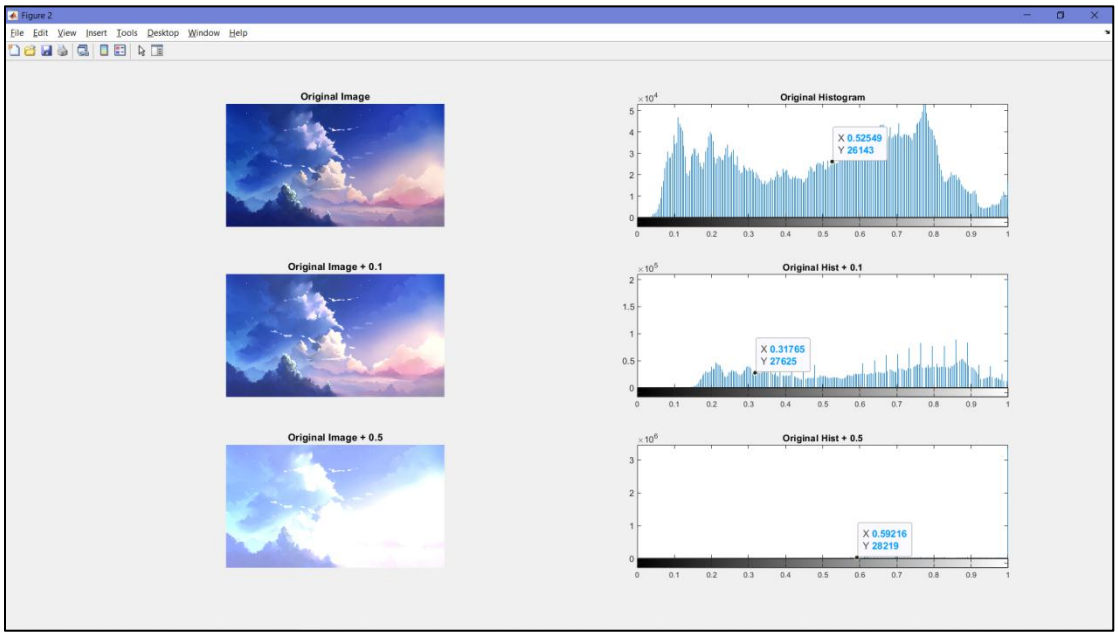
TUTORIAL 8

```
J = imread('C1.jpg');
I = im2double(J);
clear J
figure, subplot(3,2,1), imshow(I), title('Original Image')
subplot(3,2,2), imhist(I), axis tight
title('Original Histogram')
const = 0.1;
I2 = I + const;
subplot(3,2,3), imshow(I2), title('Original Image + 0.1')
subplot(3,2,4), imhist(I2), axis tight
title('Original Hist + 0.1')
```



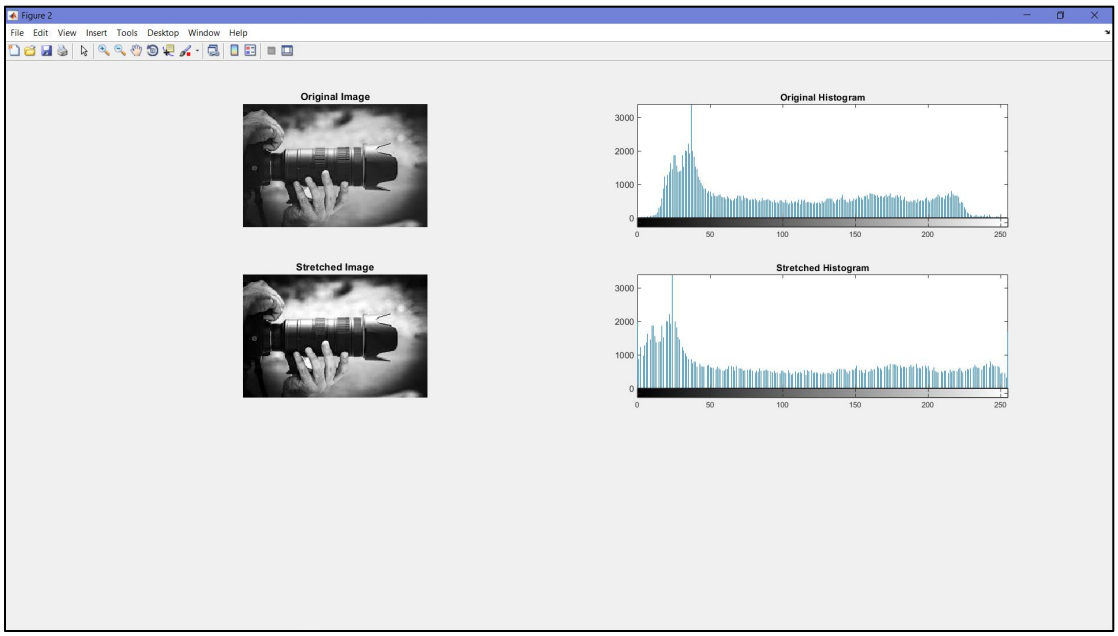
TUTORIAL 9

```
J = imread('C1.jpg');
I = im2double(J);
clear J
figure, subplot(3,2,1), imshow(I), title('Original Image')
subplot(3,2,2), imhist(I), axis tight
title('Original Histogram')
const = 0.1;
I2 = I + const;
subplot(3,2,3), imshow(I2), title('Original Image + 0.1')
subplot(3,2,4), imhist(I2), axis tight
title('Original Hist + 0.1')
const = 0.5;
I3 = I + const;
bad_values = find(I3 > 1);
I3(bad_values) = 1;
subplot(3,2,5), imshow(I3), title('Original Image + 0.5')
subplot(3,2,6), imhist(I3), axis tight
title('Original Hist + 0.5')
```



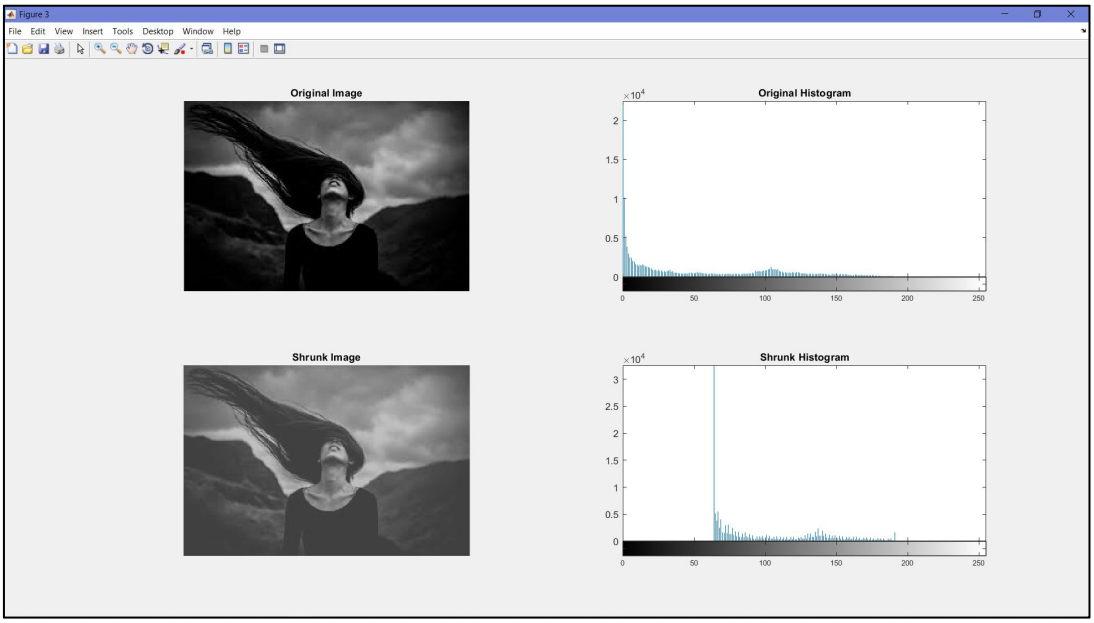
TUTORIAL 10

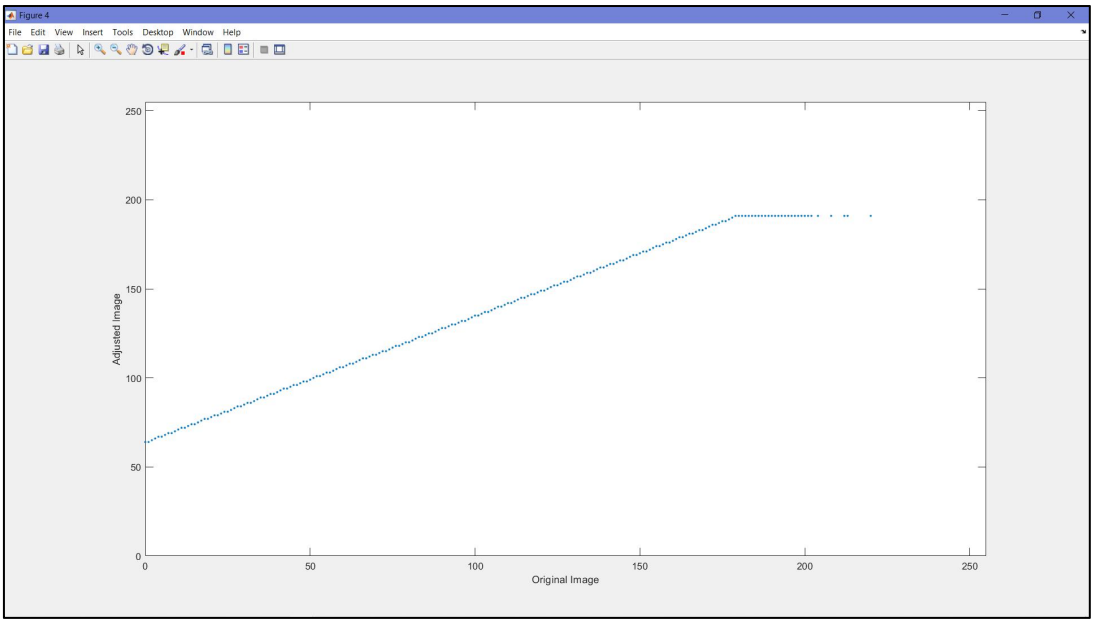
```
img_limits = stretchlim(I);
I_stretch = imadjust(I,img_limits,[]);
figure; subplot(3,2,1), imshow(I), title('Original Image')
subplot(3,2,2), imhist(I), axis tight, ...
title('Original Histogram')
subplot(3,2,3), imshow(I_stretch), ...
title('Stretched Image')
subplot(3,2,4), imhist(I_stretch), axis tight, ...
title('Stretched Histogram')
% Perform histogram stretching with _imadjust_ using default parameters and
% confirm that the results are identical to the ones obtained before.
I_stretch2 = imadjust(I);
subplot(3,2,5), imshow(I_stretch2), ...
title('Stretched Image')
subplot(3,2,6), imhist(I_stretch2), axis tight, ...
title('Stretched Histogram')
I_stretch_diff = imabsdiff(I_stretch, I_stretch2);
figure, imshow(I_stretch_diff,[])
min(I_stretch_diff(:))
max(I_stretch_diff(:))
```



TUTORIAL 11

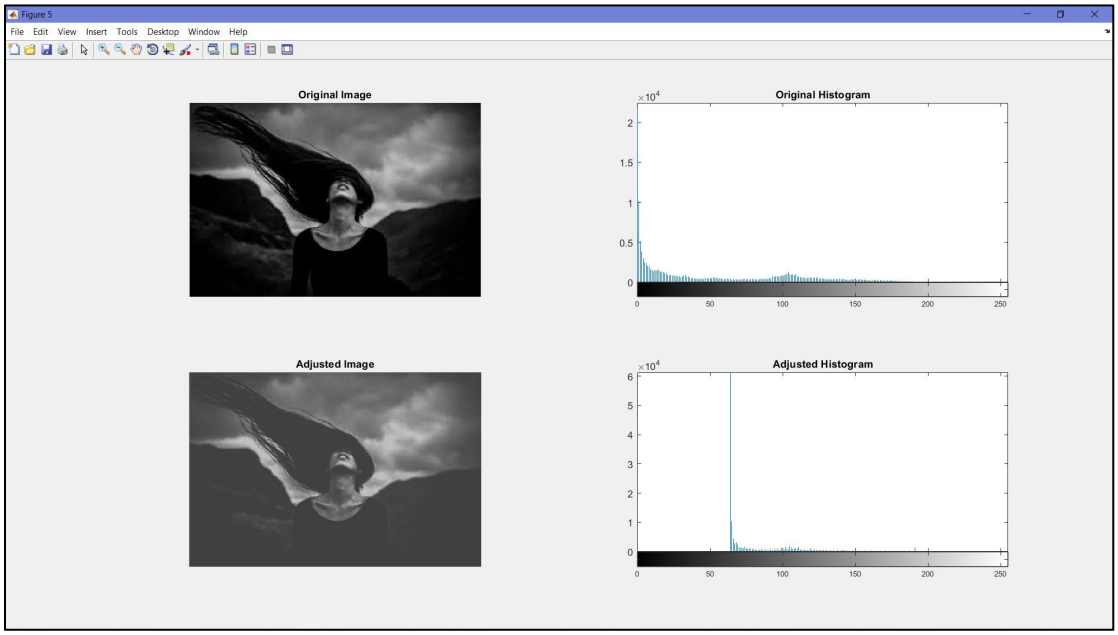
```
I = imread('hair.jfif');
I_shrink = imadjust(I,stretchlim(I),[0.25 0.75]);
figure; subplot(2,2,1), imshow(I), title('Original Image')
subplot(2,2,2), imhist(I), axis tight, ...
title('Original Histogram')
subplot(2,2,3), imshow(I_shrink), ...
title('Shrunk Image')
subplot(2,2,4), imhist(I_shrink), axis tight, ...
title('Shrunk Histogram')
X = reshape(I,1,prod(size(I)));
Y = reshape(I_shrink,1,prod(size(I_shrink)));
figure, plot(X,Y,'.')
xlim([0 255]); ylim([0 255]);
xlabel('Original Image');
ylabel('Adjusted Image');
```

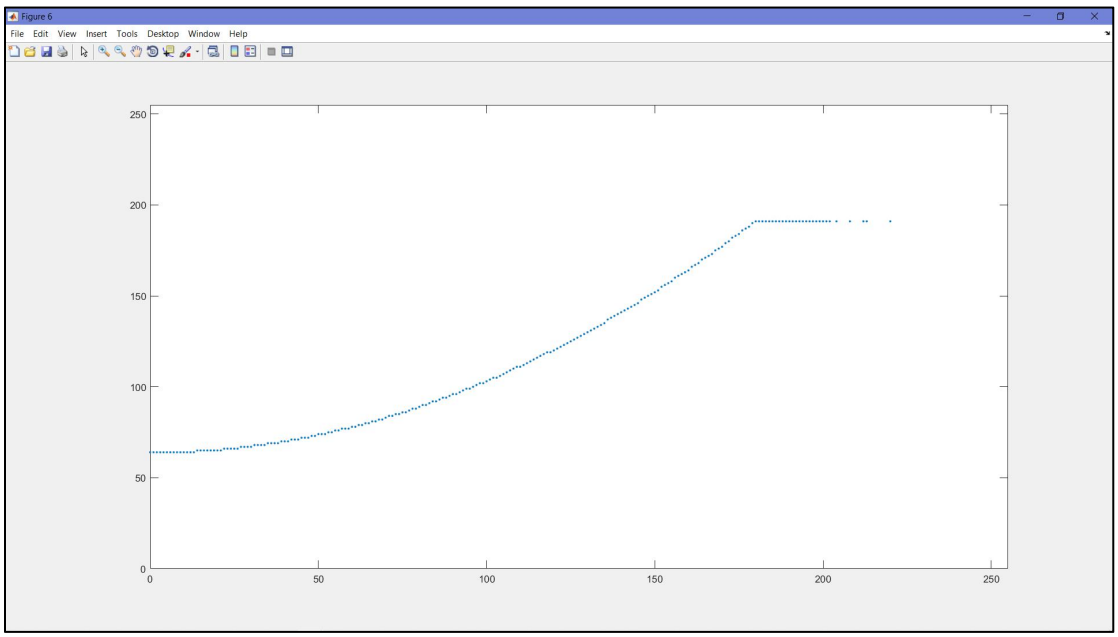




TUTORIAL 12

```
I_shrink = imadjust(I,stretchlim(I),[0.25 0.75],2);
X = reshape(I,1,prod(size(I)));
Y = reshape(I_shrink,1,prod(size(I_shrink)));
figure
subplot(2,2,1), imshow(I), title('Original Image')
subplot(2,2,2), imhist(I), axis tight, ...
title('Original Histogram')
subplot(2,2,3), imshow(I_shrink), title('Adjusted Image')
subplot(2,2,4), imhist(I_shrink), axis tight, ...
title('Adjusted Histogram')
figure, plot(X,Y,'.'), xlim([0 255]), ylim([0 255])
```

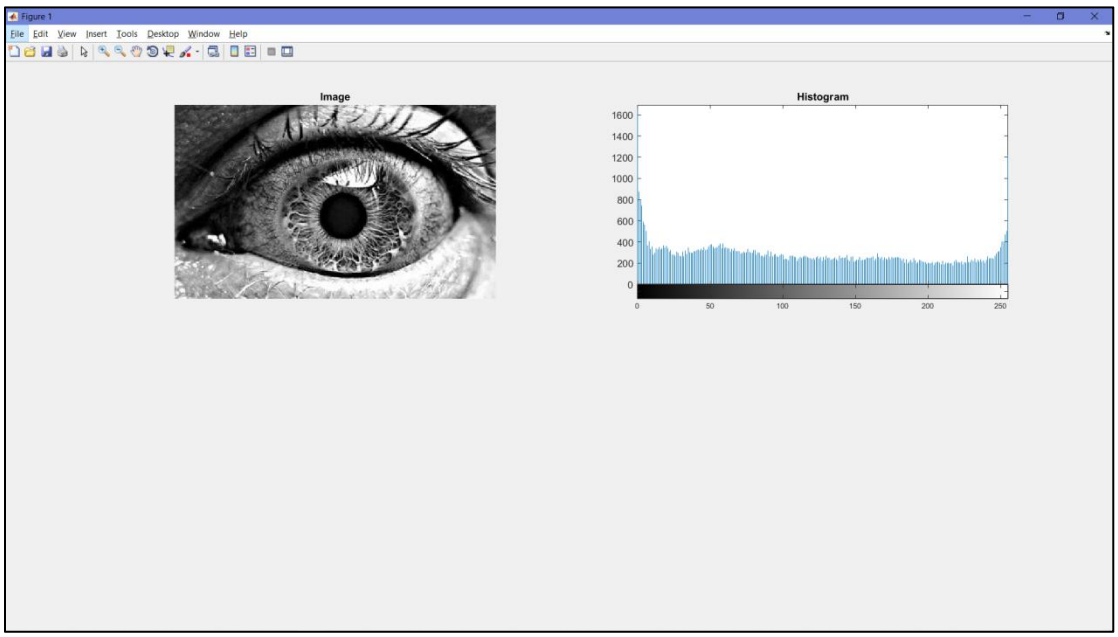




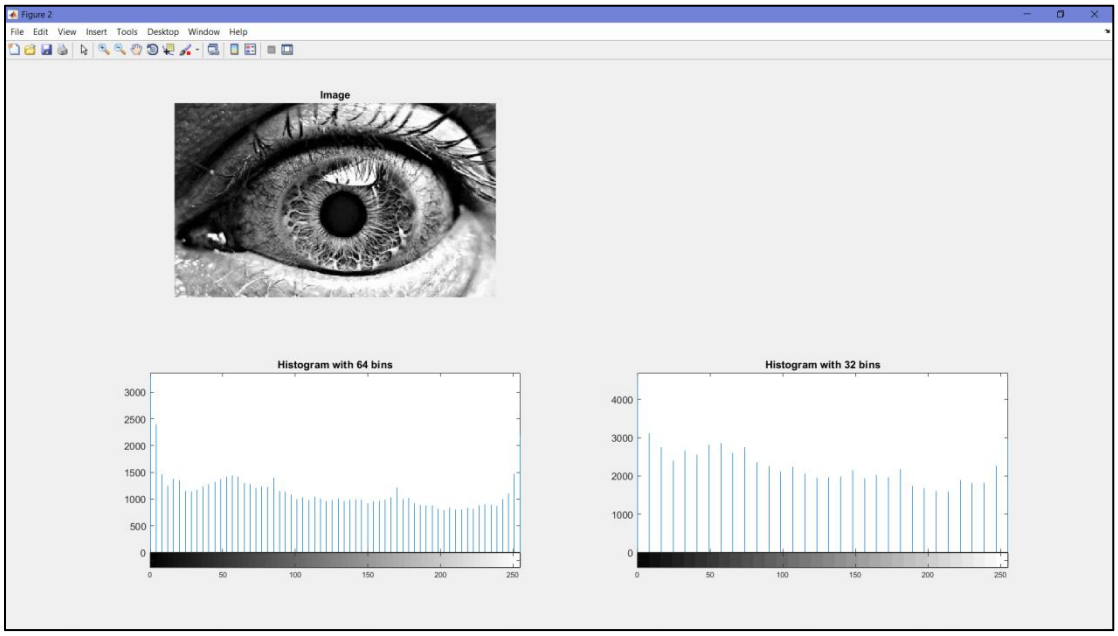
FIP LAB 4

TUTORIAL 1

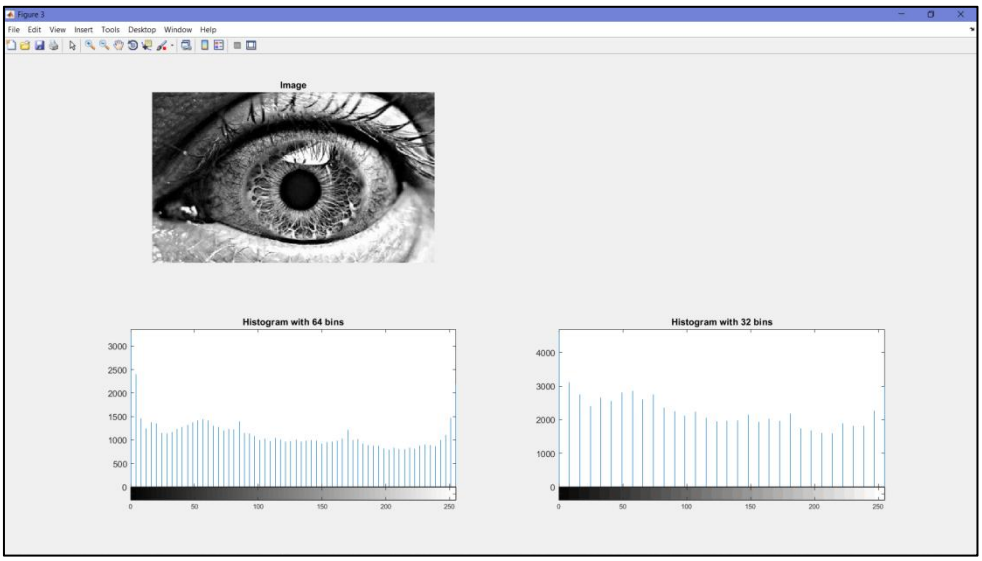
```
I = imread('eye.jpg');
figure, subplot(2,2,1), imshow(I), title('Image')
subplot(2,2,2), imhist(I,256), axis tight, title('Histogram')
```



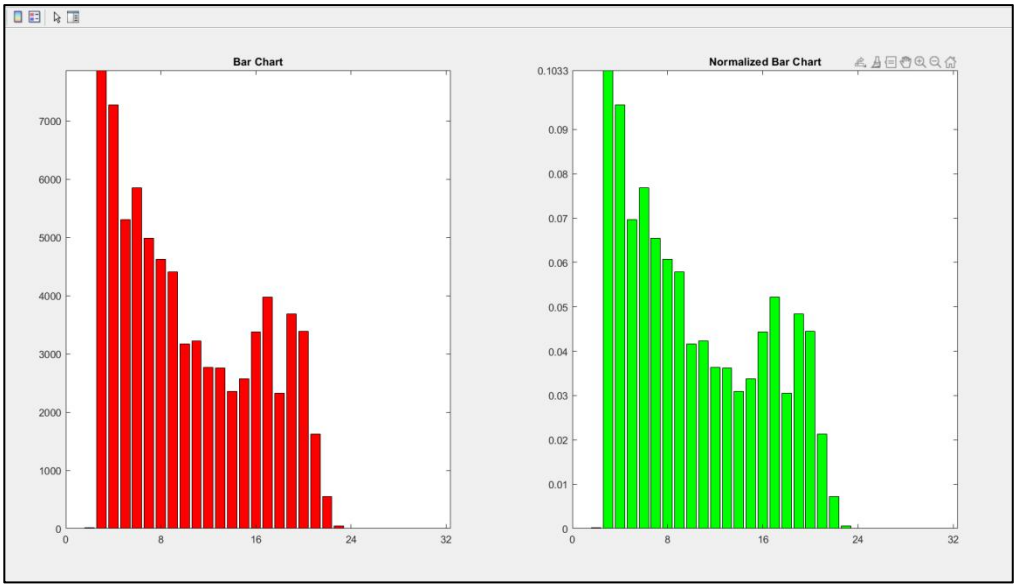

```
I = imread('eye.jpg');
figure, subplot(2,2,1), imshow(I), title('Image')
subplot(2,2,3), imhist(I,64), axis tight, ...subplot(2,2,3), imhist(I,64), axis tight, ...
title('Histogram with 64 bins')
subplot(2,2,4), imhist(I,32), axis tight, ...
title('Histogram with 32 bins')
```



```
I = imread('eye.jpg');
figure, subplot(2,2,1), imshow(I), title('Image')
subplot(2,2,3), imhist(I,64), axis tight, ...
title('Histogram with 64 bins')
subplot(2,2,4), imhist(I,32), axis tight, ...
title('Histogram with 32 bins')
c = imhist(I,32);
c_norm = c / numel(I);
```

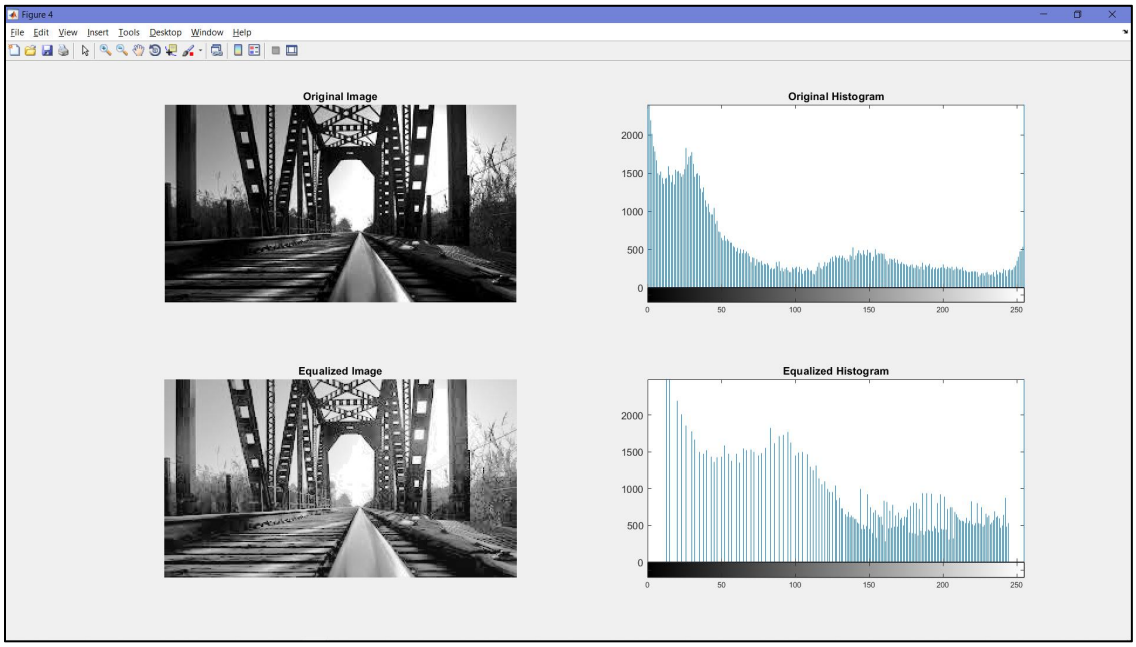



```
figure, subplot(1,2,1), bar_1 = bar(c);
set(gca, 'XLim', [0 32], 'YLim', [0 max(c)]);
set(gca, 'XTick', [0:8:32], 'YTick', ...
[linspace(0,7000,8) max(c)]);
set(bar_1, 'FaceColor', 'r'), title('Bar Chart')
subplot(1,2,2), bar_2 = bar(c_norm);
set(gca, 'XTick', [0:8:32], 'YTick', ...
[linspace(0,0.09,10) max(c_norm)])
xlim([0 32]), ylim([0 max(c_norm)])
title('Normalized Bar Chart')
set(bar_2, 'FaceColor', 'g')
```

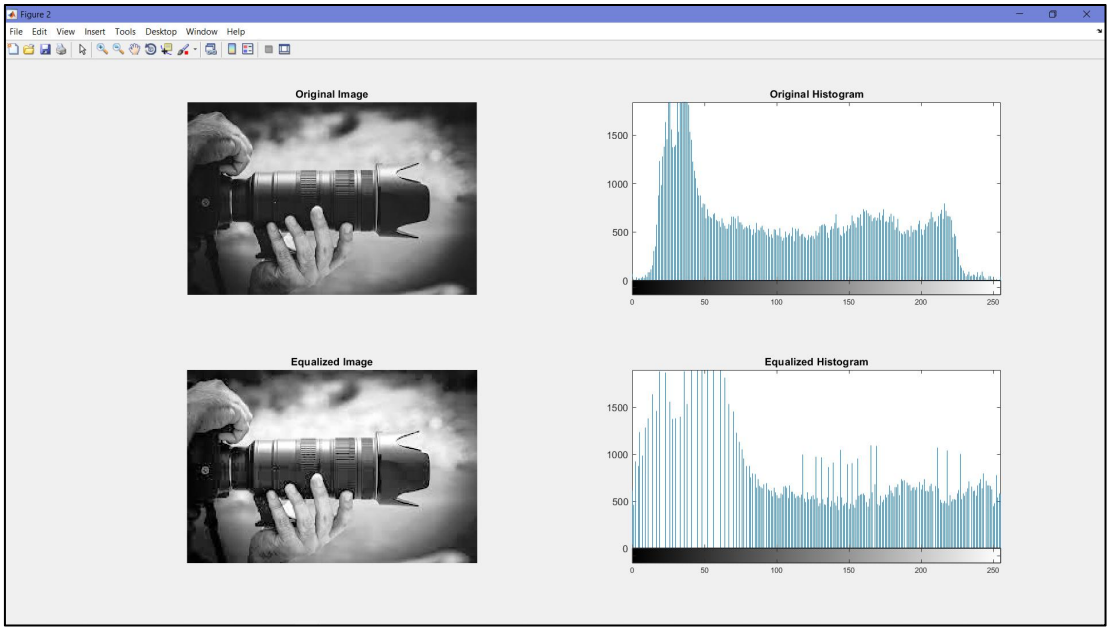


TUTORIAL 2

```
I = imread('bridge.jfif');
figure, subplot(2,2,1), imshow(I), ...
title('Original Image')
subplot(2,2,2), imhist(I), ...
title('Original Histogram')
I_eq = histeq(I,256);
subplot(2,2,3), imshow(I_eq), title('Equalized Image')
subplot(2,2,4), imhist(I_eq), title('Equalized Histogram')
```




```
I = imread('cam.jfif');
figure, subplot(2,2,1), imshow(I), ...
title('Original Image')
subplot(2,2,2), imhist(I), ...
title('Original Histogram')
I_eq = histeq(I,256);
subplot(2,2,3), imshow(I_eq), title('Equalized Image')
subplot(2,2,4), imhist(I_eq), title('Equalized Histogram')
I = imread('cam.jfif'); I_eq = histeq(I,256);
figure, subplot(2,2,1), imshow(I), title('Original Image')
subplot(2,2,2), imhist(I), title('Original Histogram')
subplot(2,2,3), imshow(I_eq), title('Equalized Image')
subplot(2,2,4), imhist(I_eq), title('Equalized Histogram')
```

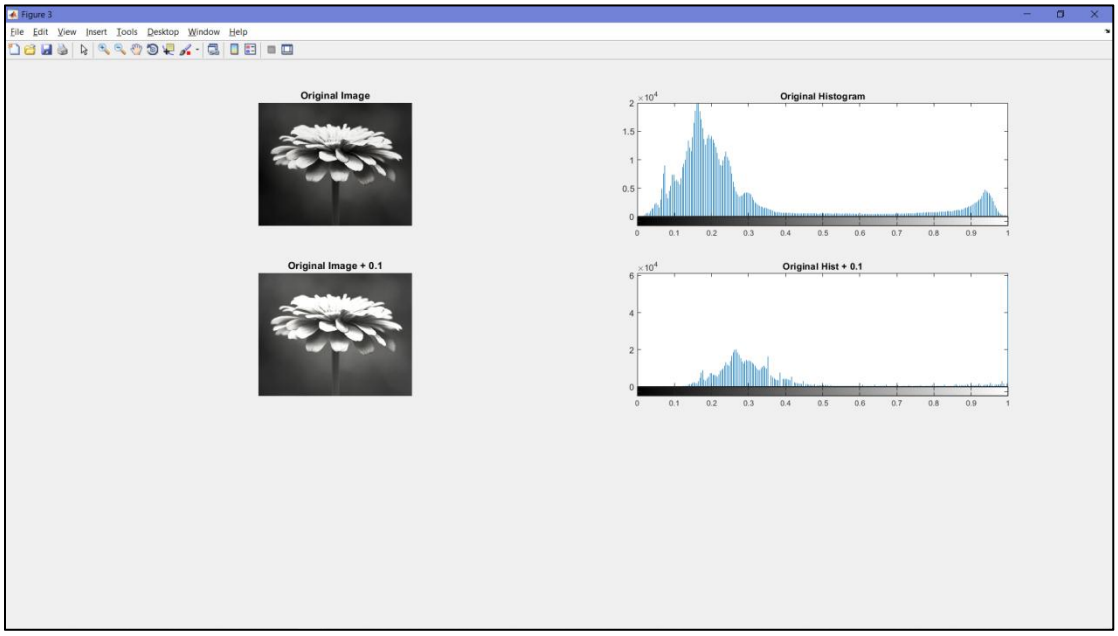


EXPLANATION

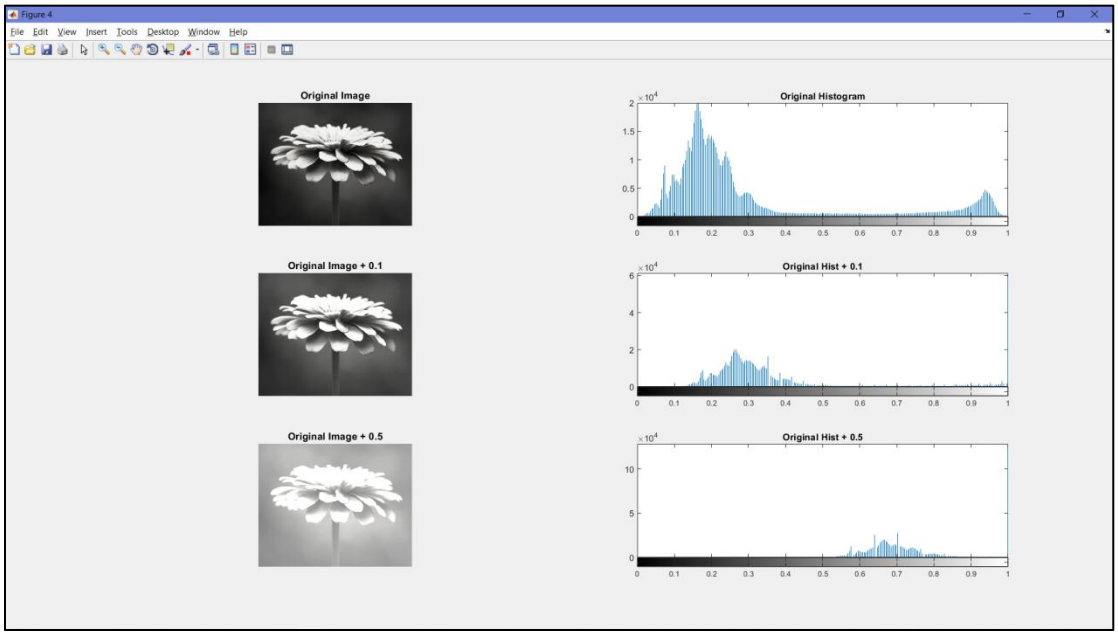
A histogram will be produced that is paired with the original image. Equalized image, which is an image that appears brighter and clearer than the original image, is paired with an equalized histogram, which we can see is different from the original histogram.

TUTORIAL 3

```
J = imread('flower.jpg');
I = im2double(J);
clear J
figure, subplot(3,2,1), imshow(I), title('Original Image')
subplot(3,2,2), imhist(I), axis tight, ...
title('Original Histogram')
const = 0.1;
I2 = I + const;
subplot(3,2,3), imshow(I2), title('Original Image + 0.1')
subplot(3,2,4), imhist(I2), axis tight, ...
title('Original Hist + 0.1')
```




```
J = imread('flower.jpg');
I = im2double(J);
clear J
figure, subplot(3,2,1), imshow(I), title('Original Image')
subplot(3,2,2), imhist(I), axis tight, ...
title('Original Histogram')
const = 0.1;
I2 = I + const;
subplot(3,2,3), imshow(I2), title('Original Image + 0.1')
subplot(3,2,4), imhist(I2), axis tight, ...
title('Original Hist + 0.1')
const = 0.5;
I3 = I + const;
bad_values = find(I3 > 1);
I3(bad_values) = 1;
subplot(3,2,5), imshow(I3), title('Original Image + 0.5')
subplot(3,2,6), imhist(I3), axis tight, ...
title('Original Hist + 0.5')
```

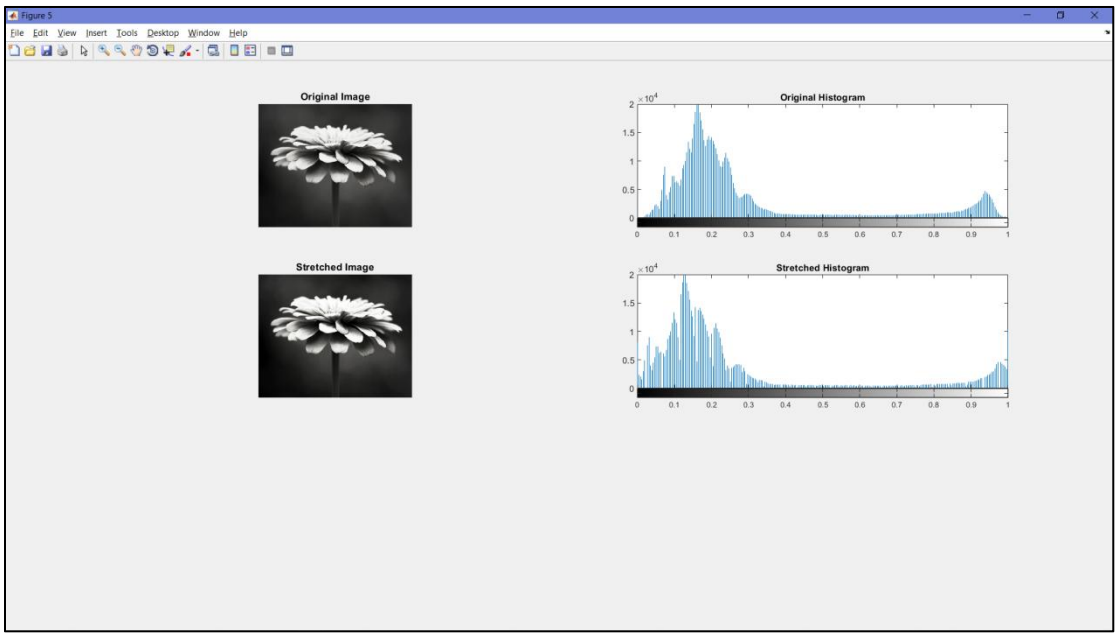


EXPLANATION

The brightness of the image will be increased. It is clearly shown that the original image, is very dark. When the image I is added with const, which is 0.1, the image will be processed and be brighter than the original image. Furthermore, when I is added with 0.5, it will turn out to be far more brighter than the original image and also the 0.1 processed image.

TUTORIAL 4

```
img_limits = stretchlim(I);
I_stretch = imadjust(I,img_limits,[]);
figure; subplot(3,2,1), imshow(I), title('Original Image')
subplot(3,2,2), imhist(I), axis tight, ...
title('Original Histogram')
subplot(3,2,3), imshow(I_stretch), ...
title('Stretched Image')
subplot(3,2,4), imhist(I_stretch), axis tight, ...
title('Stretched Histogram')
I_stretch2 = imadjust(I);
subplot(3,2,5), imshow(I_stretch2), ...
title('Stretched Image')
subplot(3,2,6), imhist(I_stretch2), axis tight, ...
title('Stretched Histogram')
I_stretch_diff = imabsdiff(I_stretch, I_stretch2);
figure, imshow(I_stretch_diff,[])
min(I_stretch_diff(:))
max(I_stretch_diff(:))
ans =
    0
ans =
    0
```

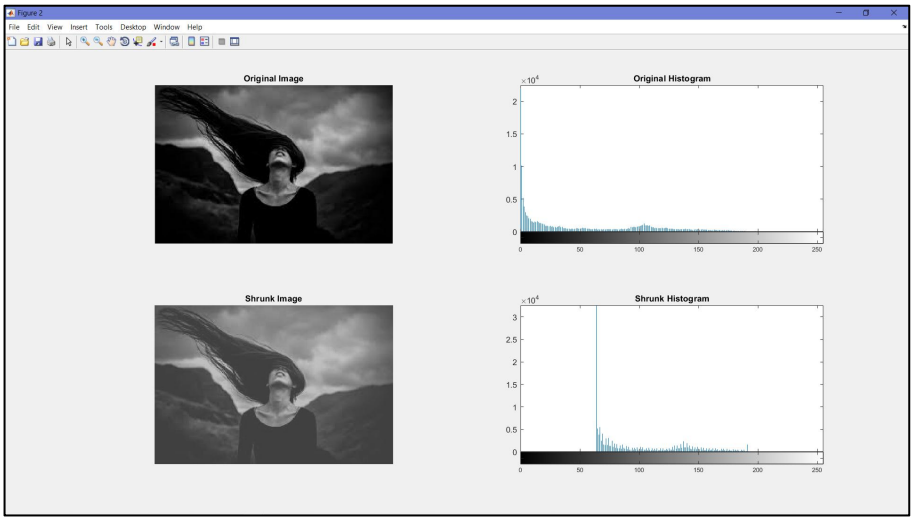


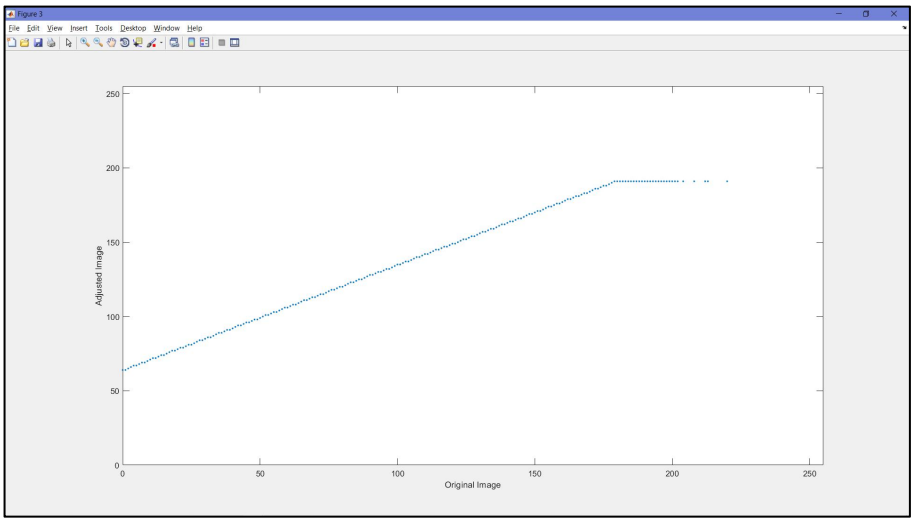
EXPLANATION

The processed image appears to be slightly stretched tan the original image. This results in a stretch seen at the histogram too. The histogram on the bottom has been stretched and is filled with more gaps unlike the histogram on the top.

TUTORIAL 5

```
I = imread('hair.jfif');
I_shrink = imadjust(I,stretchlim(I),[0.25 0.75]);
figure; subplot(2,2,1), imshow(I), title('Original Image')
subplot(2,2,2), imhist(I), axis tight, ...
title('Original Histogram')
subplot(2,2,3), imshow(I_shrink), ...
title('Shrunk Image')
subplot(2,2,4), imhist(I_shrink), axis tight, ...
title('Shrunk Histogram')
X = reshape(I,1,prod(size(I)));
Y = reshape(I_shrink,1,prod(size(I_shrink)));
figure, plot(X,Y,'.')
xlim([0 255]); ylim([0 255]);
xlabel('Original Image');
ylabel('Adjusted Image');
```



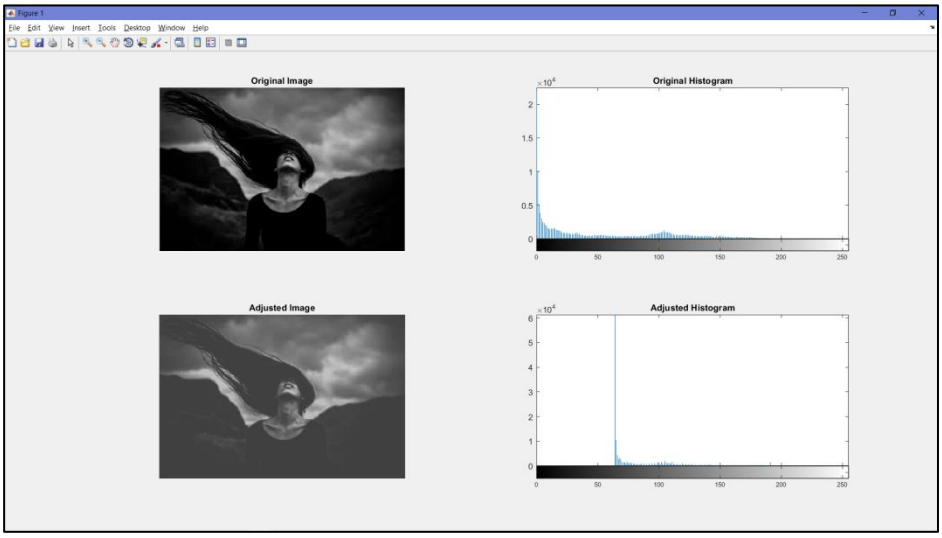


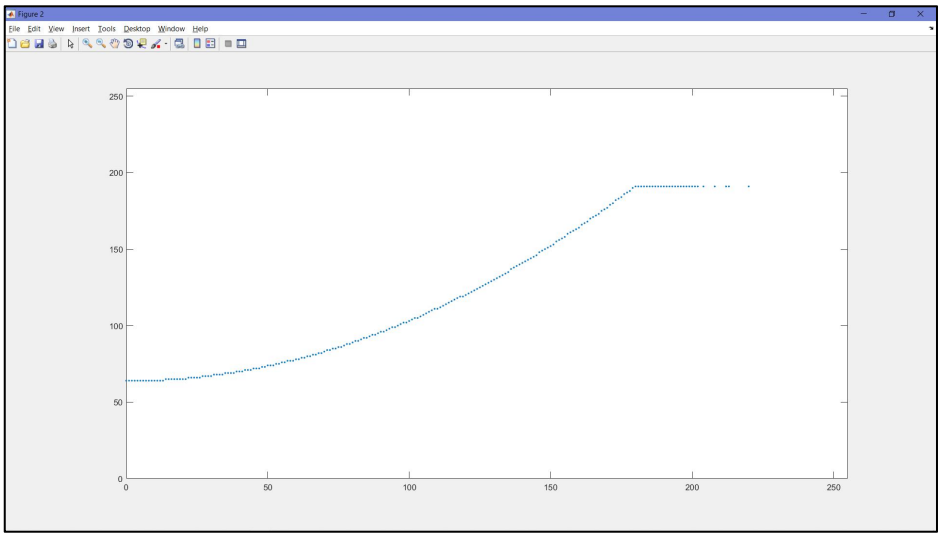
EXPLANATION

It is seen that the shrunk image appears to be slightly lighter than the original image. The line graph also shows that the shrunken the original image, the lighter the adjusted image will be.

TUTORIAL 6

```
I_shrink = imadjust(I,stretchlim(I),[0.25 0.75],2);
X = reshape(I,1,prod(size(I)));
Y = reshape(I_shrink,1,prod(size(I_shrink)));
figure
subplot(2,2,1), imshow(I), title('Original Image')
subplot(2,2,2), imhist(I), axis tight, ...
title('Original Histogram')
subplot(2,2,3), imshow(I_shrink), title('Adjusted Image')
subplot(2,2,4), imhist(I_shrink), axis tight, ...
title('Adjusted Histogram')
figure, plot(X,Y,'.'), xlim([0 255]), ylim([0 255])
```





EXPLANATION

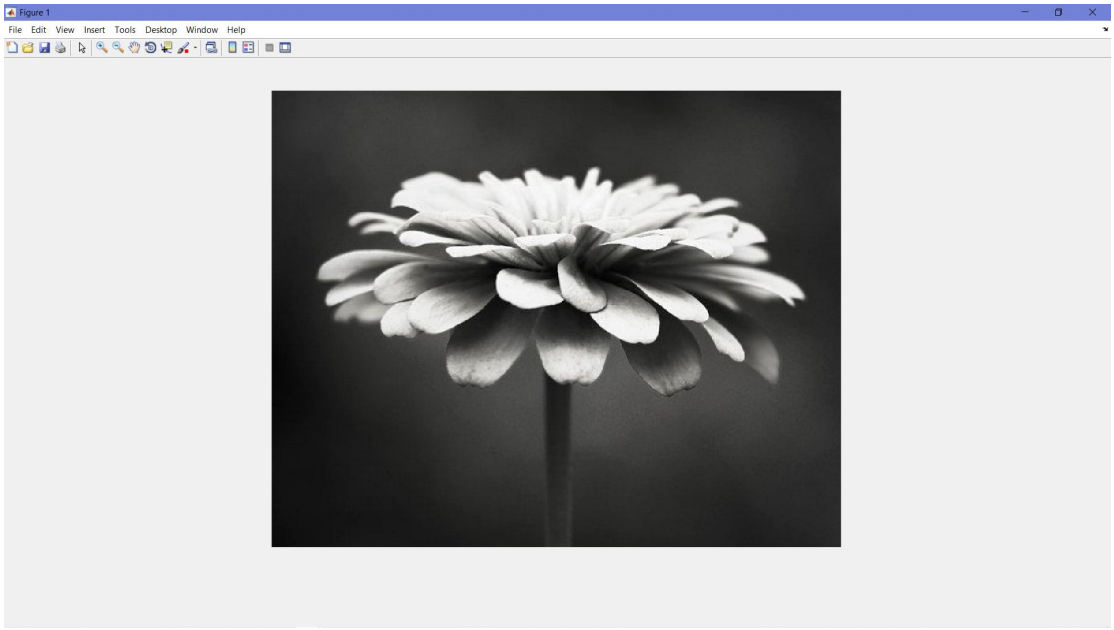
It is seen that the shrunk image appears to be slightly lighter than the original image. The line graph also shows that the shrunken the original image, the lighter the adjusted image will be. But as you can see, unlike the graph before, this graph is slightly curved, showing that the histogram of the adjusted image is more higher on the at 50 - 100 while the original image is higher at 0 - 50.

FIP LAB 4 : HALFTONING

TUTORIAL 1

```
function [ imgOut ] = half_toning( imgIn )
imgOut = zeros(size(imgIn)*2);
for i = 1 : size(imgIn, 1)
for j = 1: size(imgIn, 2)
if imgIn(i, j) > 50
imgOut(i*2, j*2 + 1) = 1;
end
if imgIn(i, j) > 101
imgOut(i*2 + 1, j*2) = 1;
end
if imgIn(i, j) > 152
imgOut(i*2 + 1, j*2 + 1) = 1;
end
if imgIn(i, j) > 203
imgOut(i*2, j*2) = 1;
end
end
end
end
```

```
A = imread('flower.jpg');
B = A;
B(130:160,:) = 255; B(:,130:160)=255;
C = imsubtract(B,A);
subplot(2,2,1);imshow(A);
subplot(2,2,2);imshow(B);
subplot(2,2,3:4);imshow(C);
```



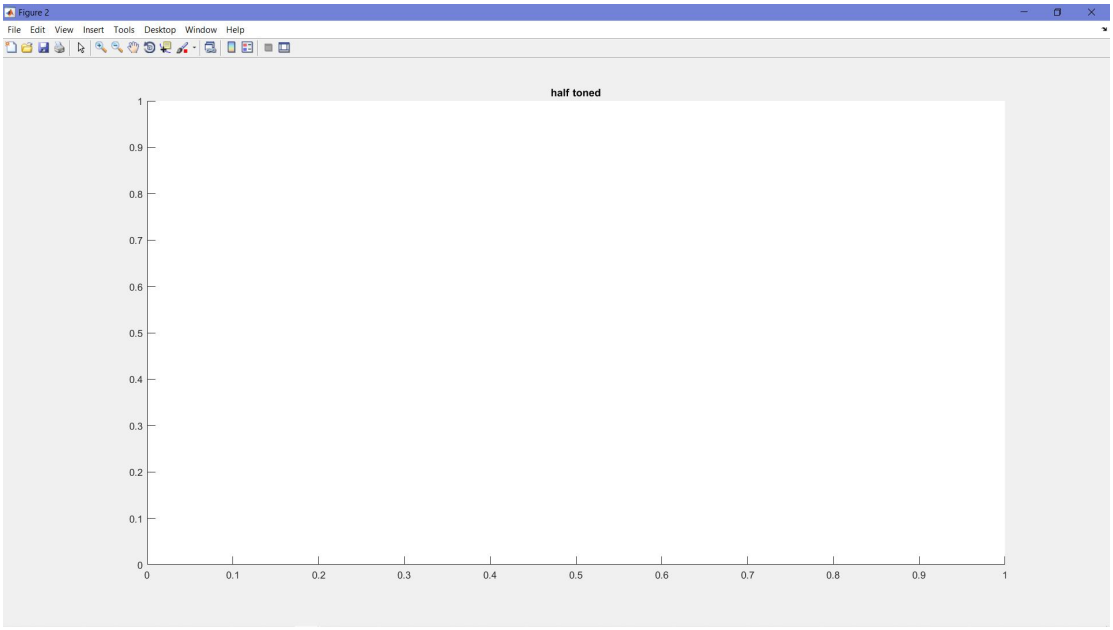


Figure 2
File Edit View Insert Tools Desktop Window Help
half toned
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

TEST YOUR UNDERSTANDING

1. What is the output image size if an image A of size 200x200 pixels is halftoning using 2x2 binary font using patterning method? using the same question above what is the size if using dithering method?

   Halftoning = 160,000 and Dithering = 40,000

2. Given pixels value of an image sample below. What is the new image portion below when applying patterning of 2x2 used in algorithm 1.0

51	40	106
245	125	255
62	170	162

```
1. Set all pixel of image size to 0 (indicating black)
2. Start loop based on size of row and column (i,j)
3. if image(i,j) > 50  // 50 is the threshold range
     Newimage(i*2,j*2+1) = 1;
   end
4. if image(i,j) > 101  // 101 is the threshold range
     Newimage(i*2+1 ,j*2) = 1;
   endif
5. if image(i,j) > 152  // 152 is the threshold range
     Newimage(i*2+1,j*2+1) = 1;
   endif
6. if image(i,j) > 203  // 203 is the threshold range
     Newimage(i*2,j*2) = 1;
   endif
7. Repeat until all pixels in the image are read.
```

0	**0**
0	0
0	**1**
0	0
0	**1**
1	0
0	**1**
1	1
1	**1**
1	1

1 0 2

4 2 4

1 3 3

3. Given pixels value of an image sample below. What is the new image when applying dithering matric of size 2x2 D1 below

51	40	106	100
245	125	255	50
62	170	162	23
100	210	33	150

$$\mathbf{D}_1 = \begin{bmatrix} 0 & 128 \\ 192 & 64 \end{bmatrix},$$

OUTPUT

1	0	1	0
1	1	1	0
1	1	1	0
0	1	0	1

FIP LAB 5 : FILTERING

TUTORIAL 1

```
I = imread('eye.jpg');
figure, subplot(1,2,1), imshow(I), title('Original Image');
fn = fspecial('average')
I_new = imfilter(I,fn);
subplot(1,2,2), imshow(I_new), title('Filtered Image');

fn =

   0.1111    0.1111    0.1111
   0.1111    0.1111    0.1111
   0.1111    0.1111    0.1111

fn2 = [1 2 1; 2 4 2; 1 2 1]
fn2 = fn2 * (1/16)

I_new2 = imfilter(I,fn2);
figure, subplot(1,2,1), imshow(I_new), title('Uniform Average');
subplot(1,2,2), imshow(I_new2), title('Non-uniform Average');

fn2 =

    1    2    1
    2    4    2
    1    2    1


fn2 =

   0.0625    0.1250    0.0625
   0.1250    0.2500    0.1250
   0.0625    0.1250    0.0625
```

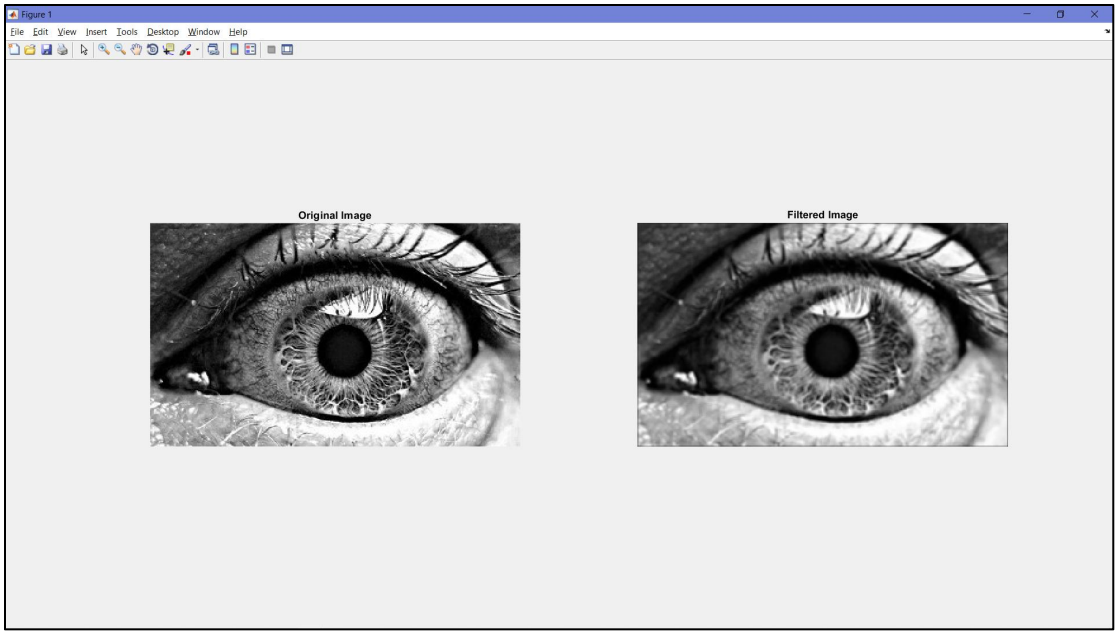


Figure 1
File Edit View Insert Tools Desktop Window Help
Original Image
Filtered Image

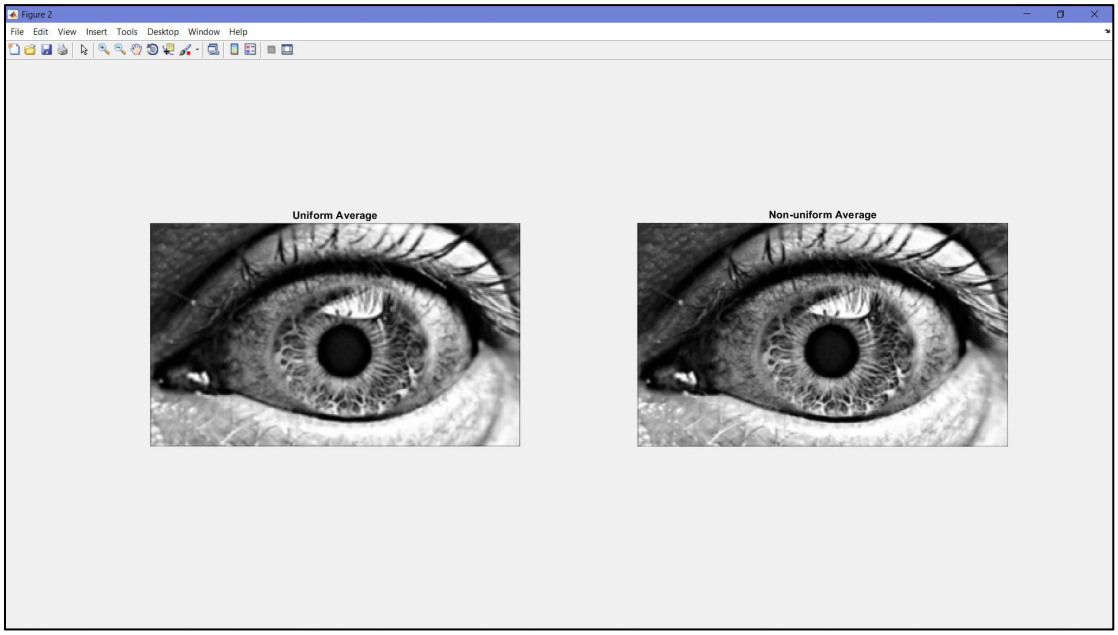
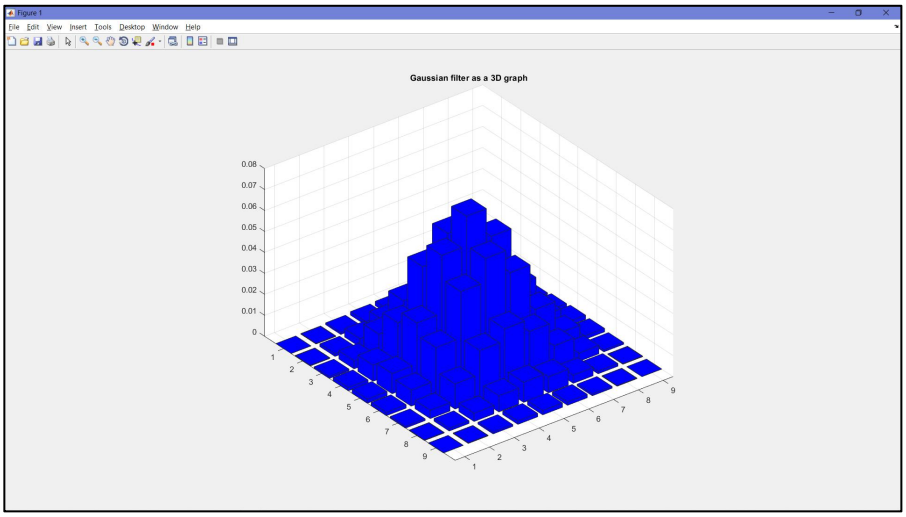


Figure 2
File Edit View Insert Tools Desktop Window Help
Uniform Average
Non-uniform Average

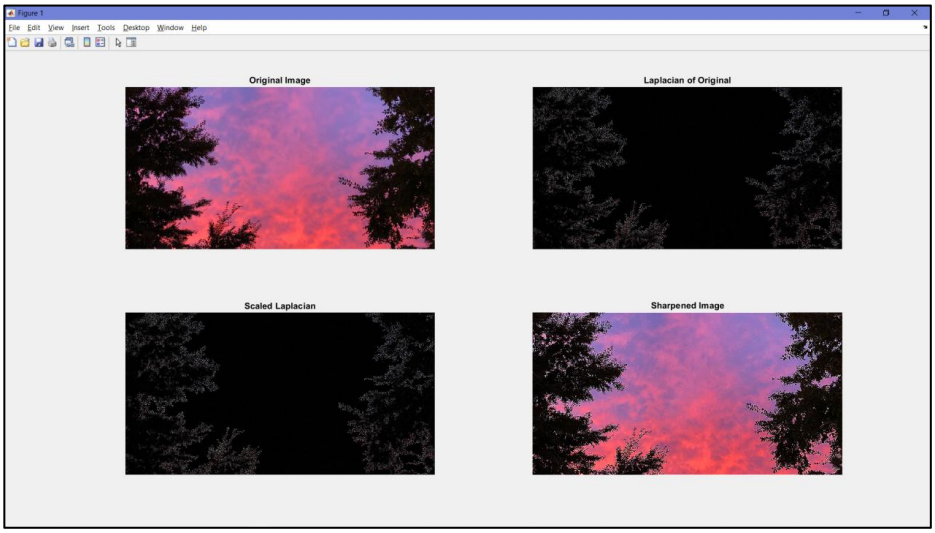
TUTORIAL 2

```
fn_gau = fspecial('gaussian',9,1.5);
figure, bar3(fn_gau,'b'), title('Gaussian filter as a 3D graph'); % apply on the cameran image
I_new3 = imfilter(I,fn_gau);
figure
subplot(1,3,1), imshow(I), title('Original Image');
subplot(1,3,2), imshow(I_new), title('Average Filter');
subplot(1,3,3), imshow(I_new3), title('Gaussian Filter');clear all;
close all;
```



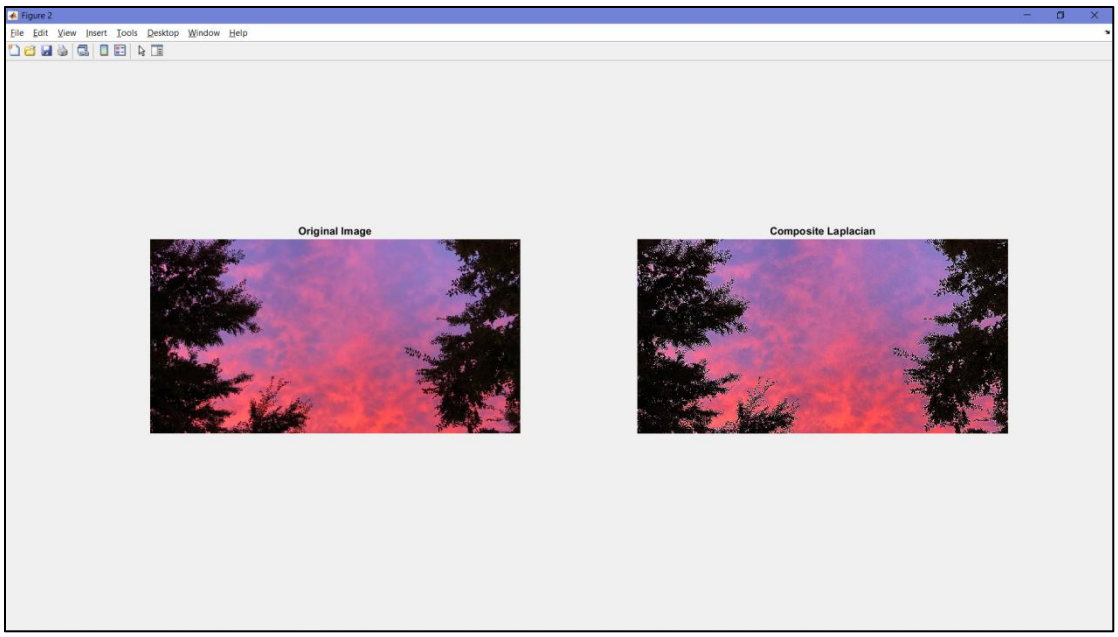
TUTORIAL 3

```
I = imread('sunset.jpg');
Id = im2double(I);
figure, subplot(2,2,1), imshow(Id), title('Original Image')
f = fspecial('laplacian',0);
I_filt = imfilter(Id,f);
subplot(2,2,2), imshow(I_filt), title('Laplacian of Original');
subplot(2,2,3), imshow(I_filt,[]), title('Scaled Laplacian');
subplot(2,2,3), imshow(I_filt,[]), title('Scaled Laplacian');
I_sharp = imsubtract(Id,I_filt);
subplot(2,2,4), imshow(I_sharp), title('Sharpened Image');
```



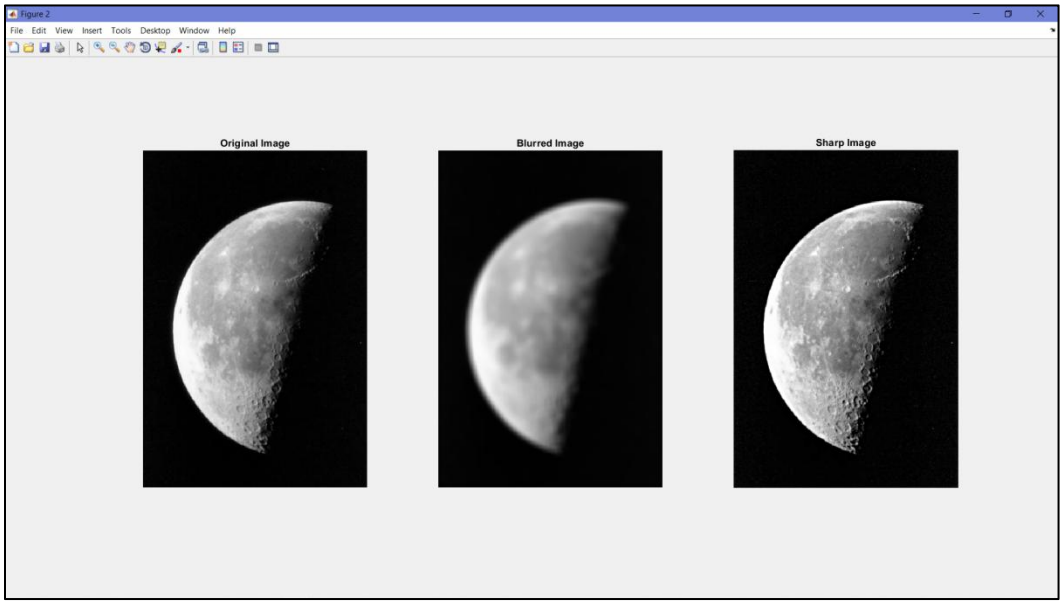
TUTORIAL 4

```
I = imread('sunset.jpg');
Id = im2double(I);
figure, subplot(2,2,1), imshow(Id), title('Original Image')
f = fspecial('laplacian',0);
I_filt = imfilter(Id,f);
subplot(2,2,2), imshow(I_filt), title('Laplacian of Original');
subplot(2,2,3), imshow(I_filt,[]), title('Scaled Laplacian');
subplot(2,2,3), imshow(I_filt,[]), title('Scaled Laplacian');
I_sharp = imsubtract(Id,I_filt);
subplot(2,2,4), imshow(I_sharp), title('Sharpened Image');
f2 = [0 -1 0; -1 5 -1; 0 -1 0]

f2 =

    0   -1    0
   -1    5   -1
    0   -1    0

I_sharp2 = imfilter(Id,f2);
figure, subplot(1,2,1), imshow(Id), title('Original Image');
subplot(1,2,2), imshow(I_sharp2), title('Composite Laplacian');
```



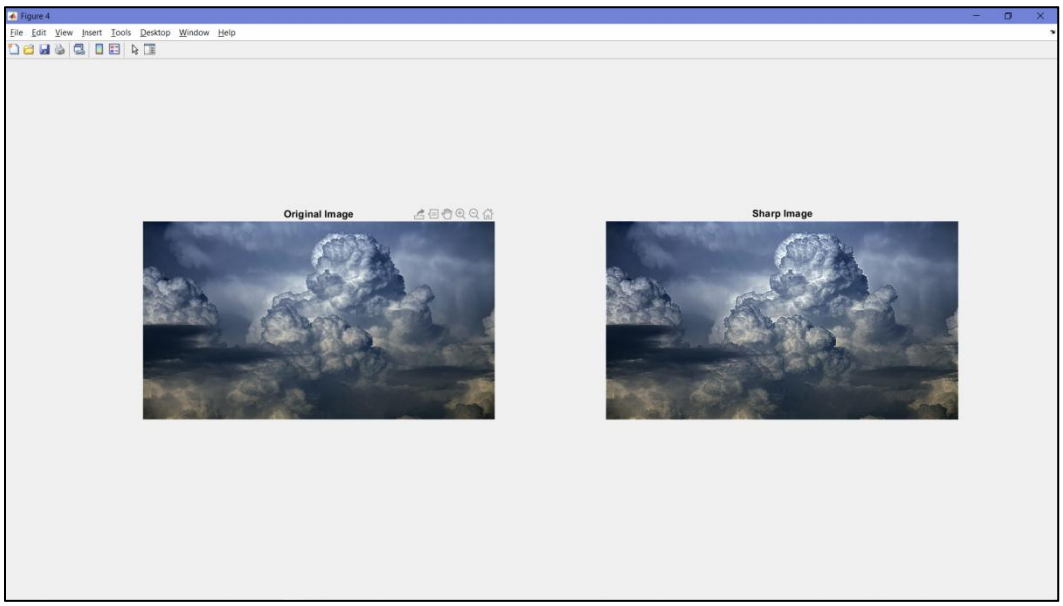
TUTORIAL 5

```
I = imread('moon.tif');
f_blur = fspecial('average',13);
I_blur = imfilter(I,f_blur);
figure, subplot(1,3,1), imshow(I), title('Original Image');
subplot(1,3,2), imshow(I_blur), title('Blurred Image');
I_blur_adj = imadjust(I_blur,stretchlim(I_blur),[0 0.4]);
I_sharp = imsubtract(I,I_blur_adj);
I_sharp_adj = imadjust(I_sharp);
subplot(1,3,3), imshow(I_sharp_adj), title('Sharp Image');
```



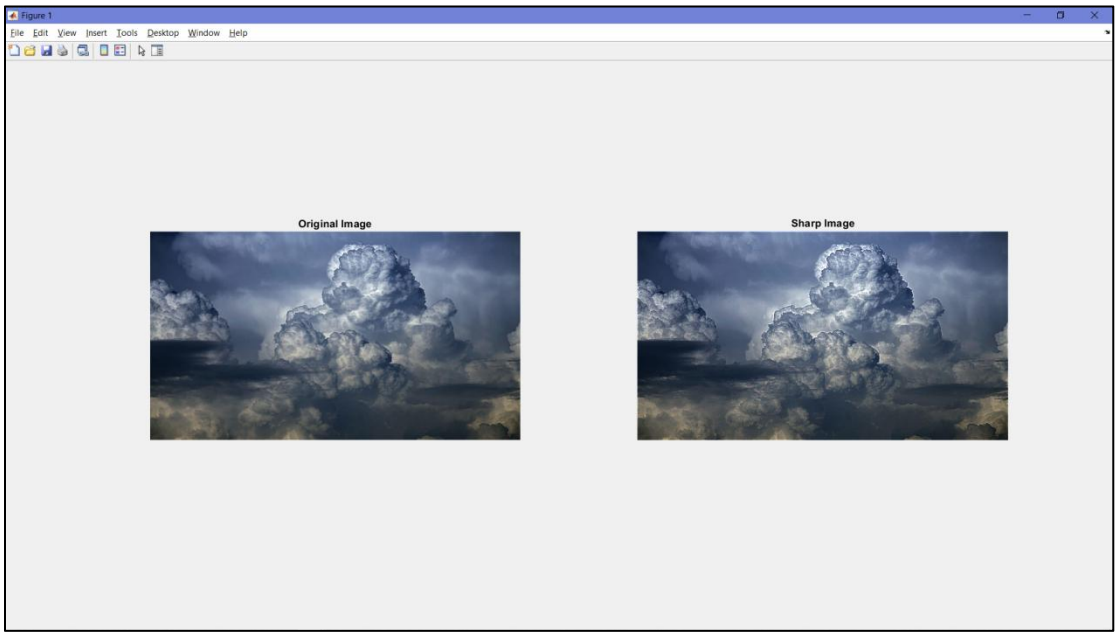
TUTORIAL 6

```
I_sharpening = imsubtract(I,I_blur);
I_sharp2 = imadd(I,I_sharpening);
figure, subplot(1,2,1), imshow(I), title('Original Image');
subplot(1,2,2), imshow(I_sharp2), title('Sharp Image');
```



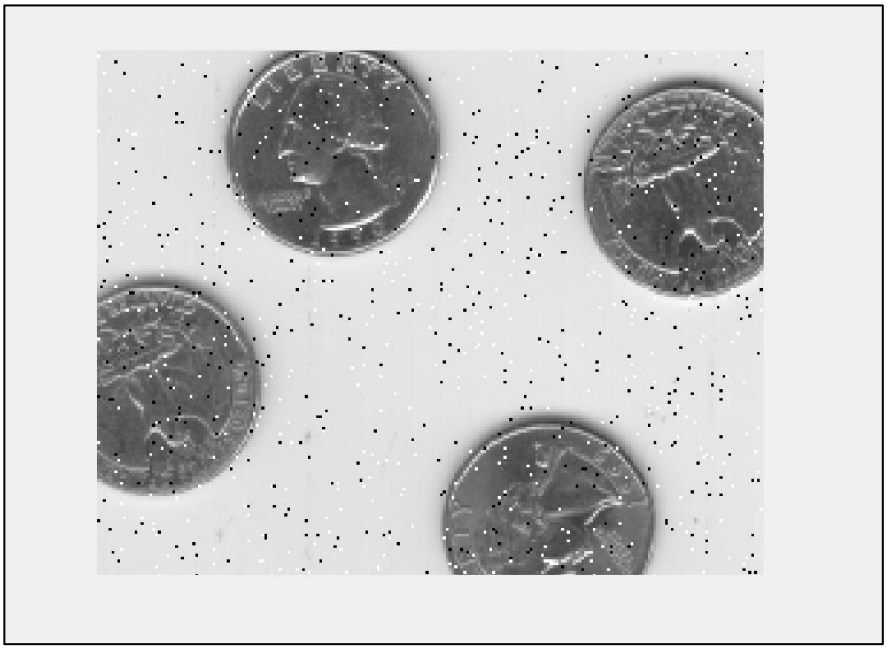
TUTORIAL 7

```
I_sharpening = imsubtract(I,I_blur);
I_sharp2 = imadd(I,I_sharpening);
figure, subplot(1,2,1), imshow(I), title('Original Image');
subplot(1,2,2), imshow(I_sharp2), title('Sharp Image');
```



TUTORIAL 8

```
I = imread('eight.tif');
J = imnoise(I,'salt & pepper',0.02);
K = medfilt2(J);
imshow(J), figure, imshow(K)
```



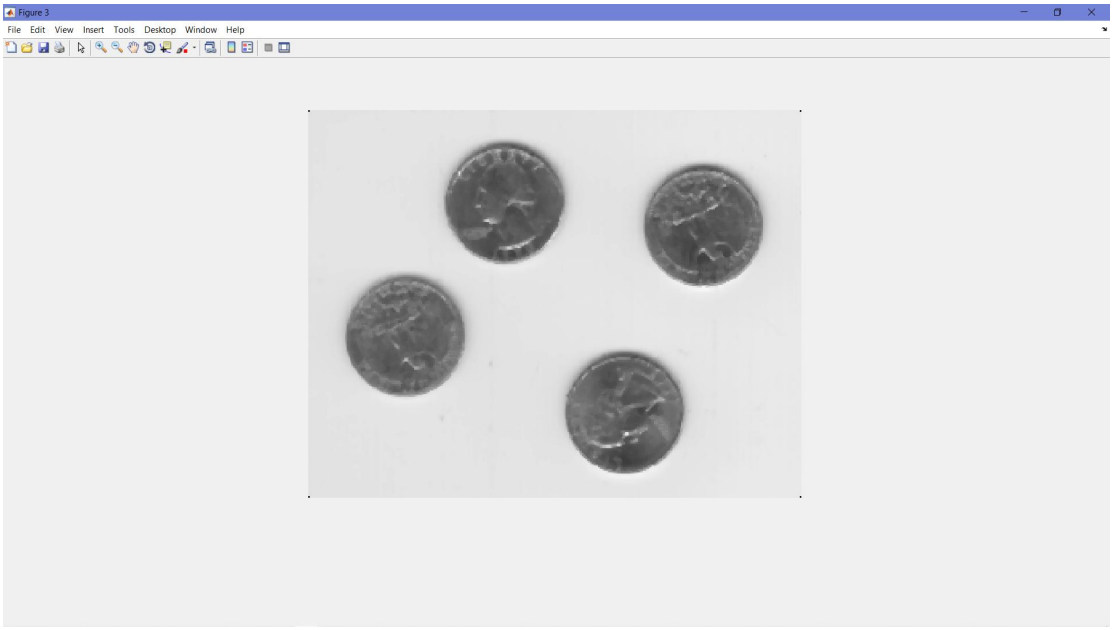
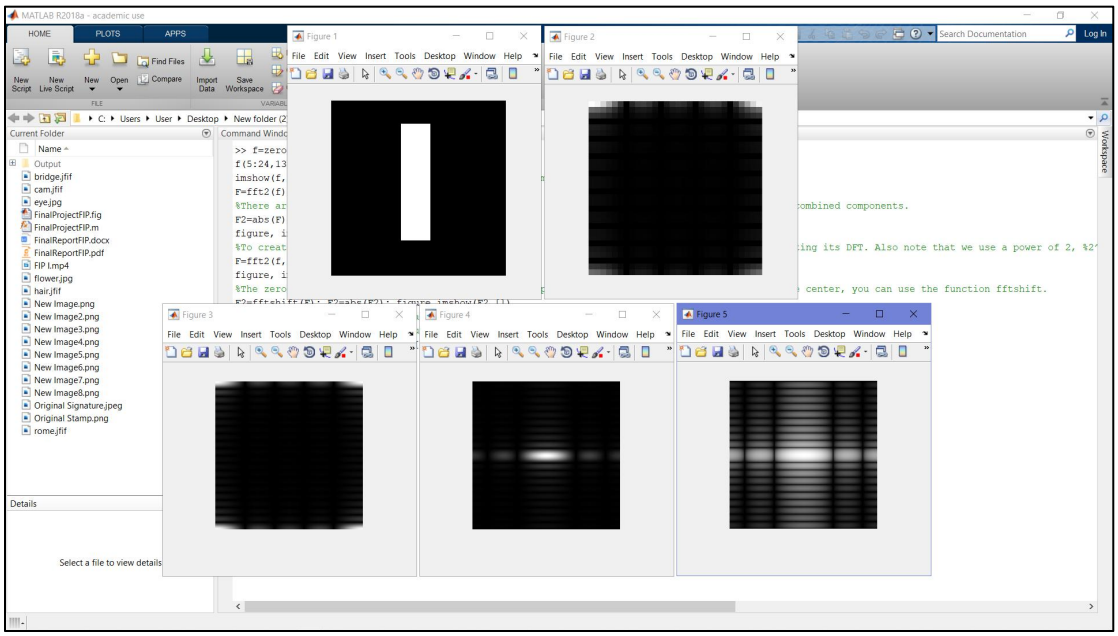


Figure 3
File Edit View Insert Tools Desktop Window Help

FIP LAB 6 : Frequency Domain

TUTORIAL 1

```
f=zeros(30,30);
f(5:24,13:17)=1;
imshow(f,'InitialMagnification', 'fit');
F=fft2(f);
F2=abs(F);
figure, imshow(F2,[], 'InitialMagnification','fit')
F=fft2(f, 256, 256); F2=abs(F);
figure, imshow(F2, [])
F2=fftshift(F); F2=abs(F2); figure,imshow(F2,[])
F2=log(1+F2); figure,imshow(F2,[])
```



TUTORIAL 2

```
footBall=imread('football.jpg');
footBall=rgb2gray(footBall);
imshow(footBall)
PQ = paddedsize(size(footBall));
D0 = 0.05*PQ(1);
H = lpfilter('gaussian', PQ(1), PQ(2), D0);
F=fft2(double(footBall),size(H,1),size(H,2));
LPFS_football = H.*F;
LPF_football=real(ifft2(LPFS_football));
LPF_football=LPF_football(1:size(footBall,1), 1:size(footBall,2));
figure, imshow(LPF_football, [])
Fc=fftshift(F);
Fcf=fftshift(LPFS_football);
S1=log(1+abs(Fc));
S2=log(1+abs(Fcf));
figure, imshow(S1,[])
figure, imshow(S2,[])
```

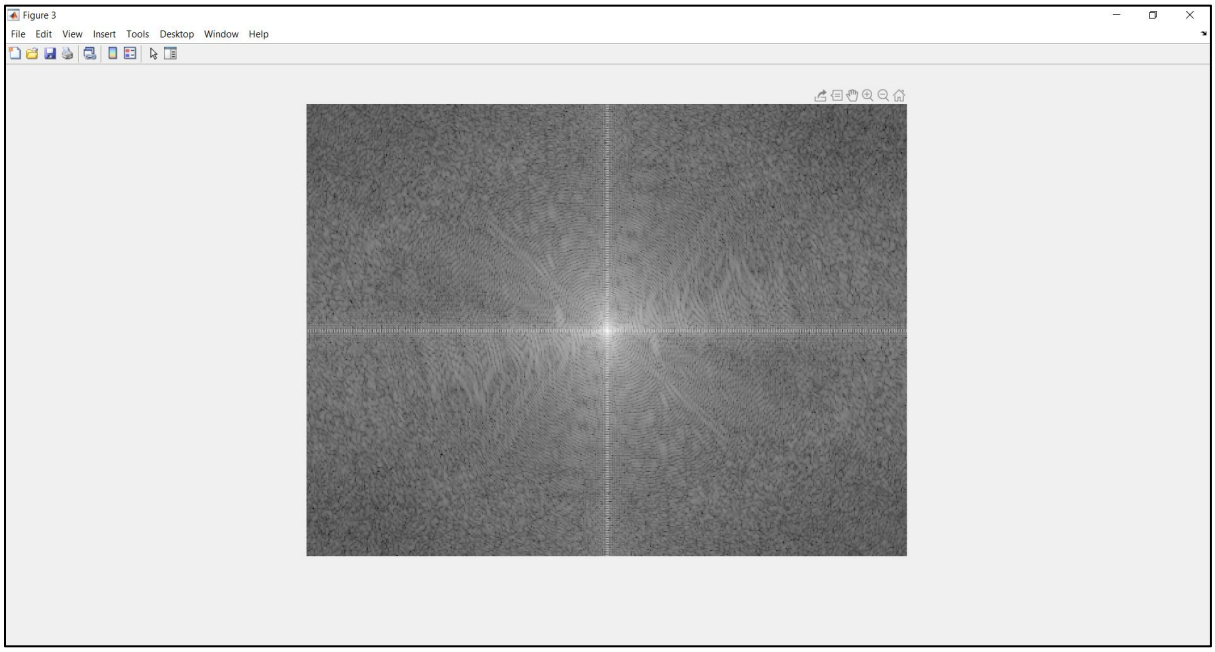


Figure 3
File Edit View Insert Tools Desktop Window Help

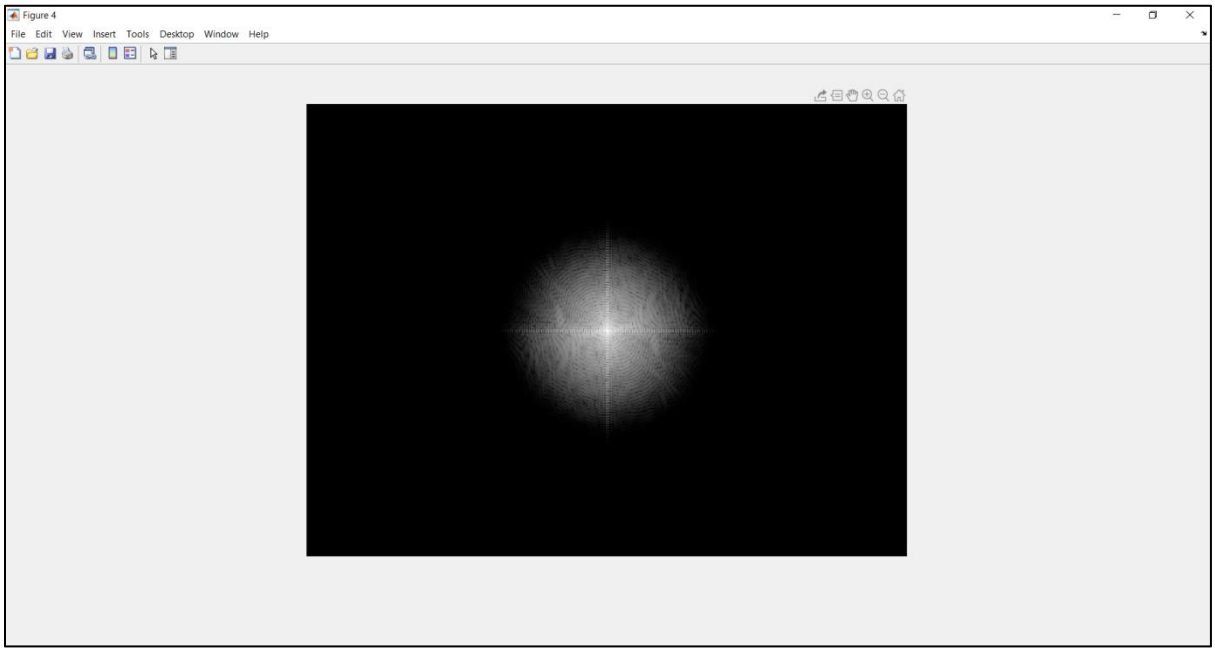
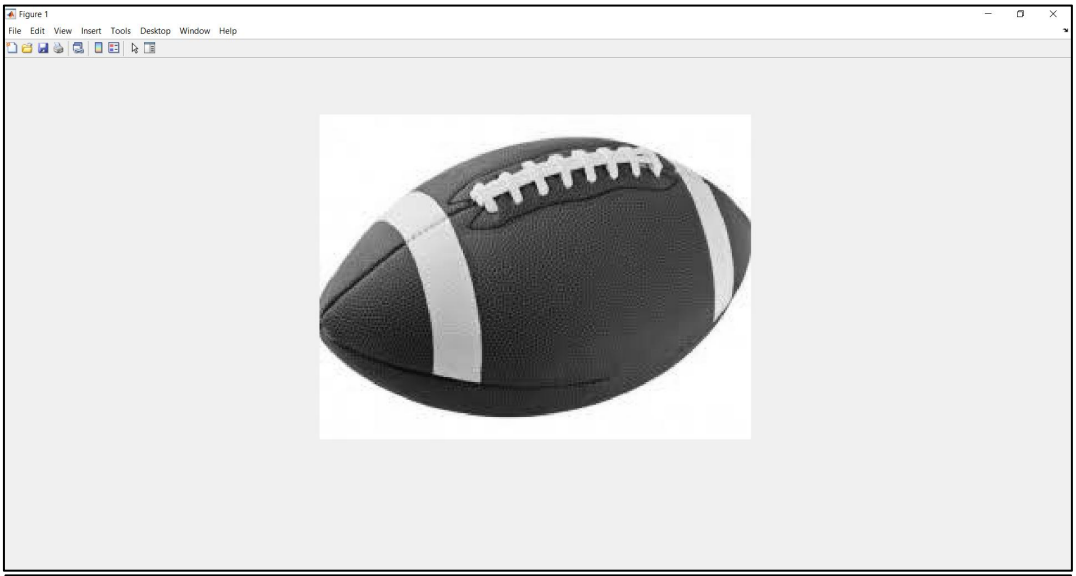
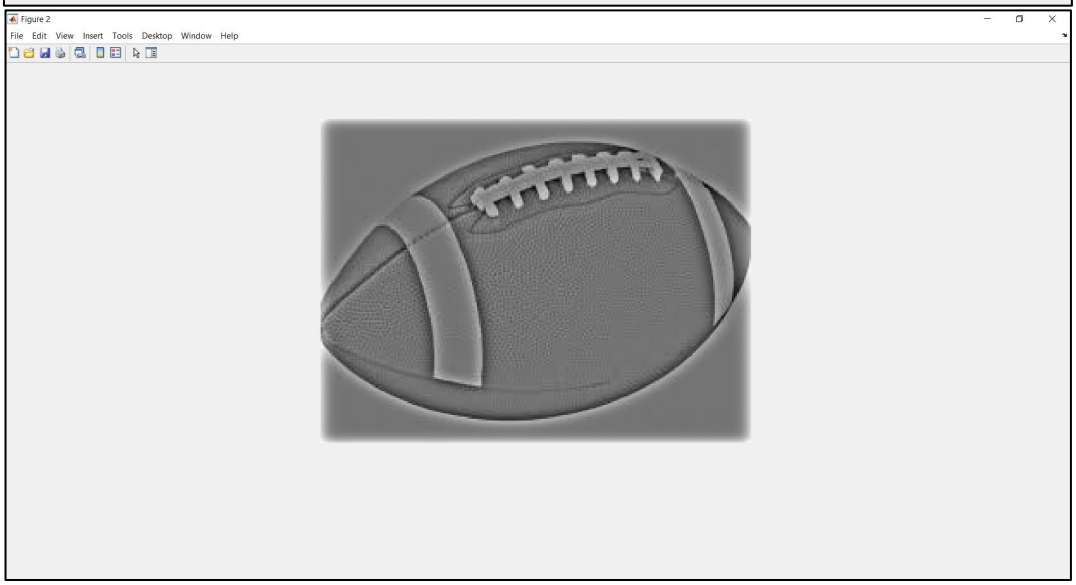


Figure 4
File Edit View Insert Tools Desktop Window Help

TUTORIAL 3

```
footBall=imread('football.jpg');
footBall=rgb2gray(footBall);
imshow(footBall)
PQ = paddedsize(size(footBall));
D0 = 0.05*PQ(1);
H = hpfilter('gaussian', PQ(1), PQ(2), D0);
F=fft2(double(footBall),size(H,1),size(H,2));
HPFS_football = H.*F;
HPF_football=real(ifft2(HPFS_football));
HPF_football=HPF_football(1:size(footBall,1), 1:size(footBall,2));
figure, imshow(HPF_football, [])
Fc=fftshift(F);
Fcf=fftshift(HPFS_football);
S1=log(1+abs(Fc));
S2=log(1+abs(Fcf));
figure, imshow(S1,[])
figure, imshow(S2,[])
```





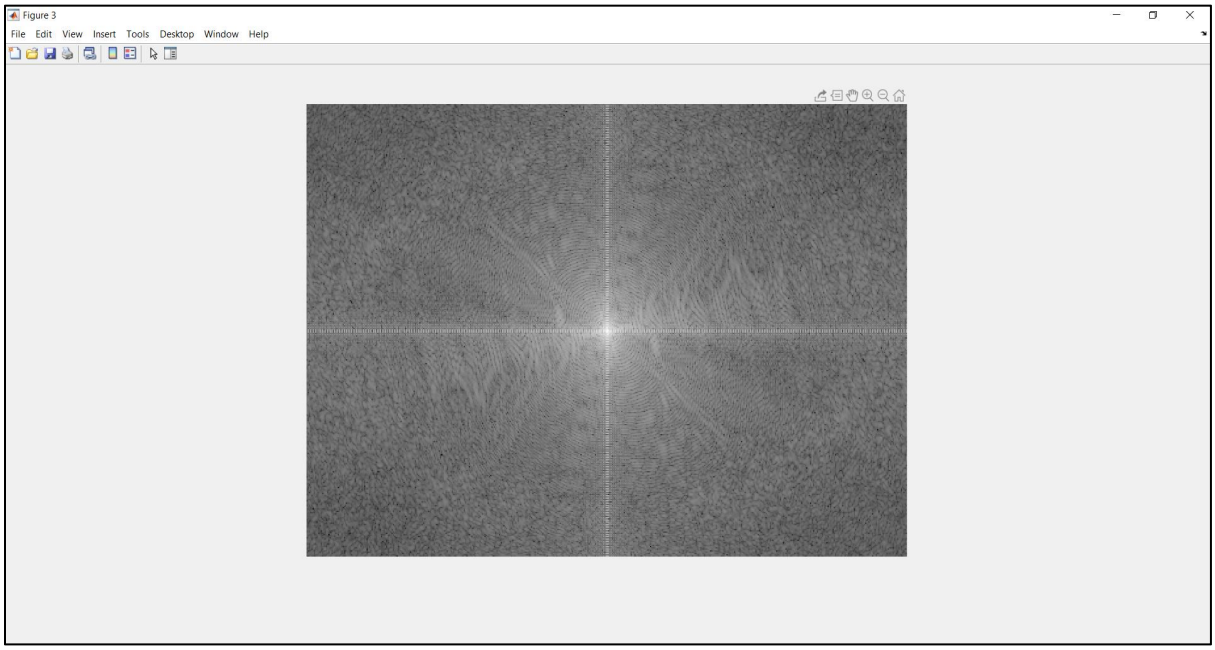


Figure 3
File Edit View Insert Tools Desktop Window Help

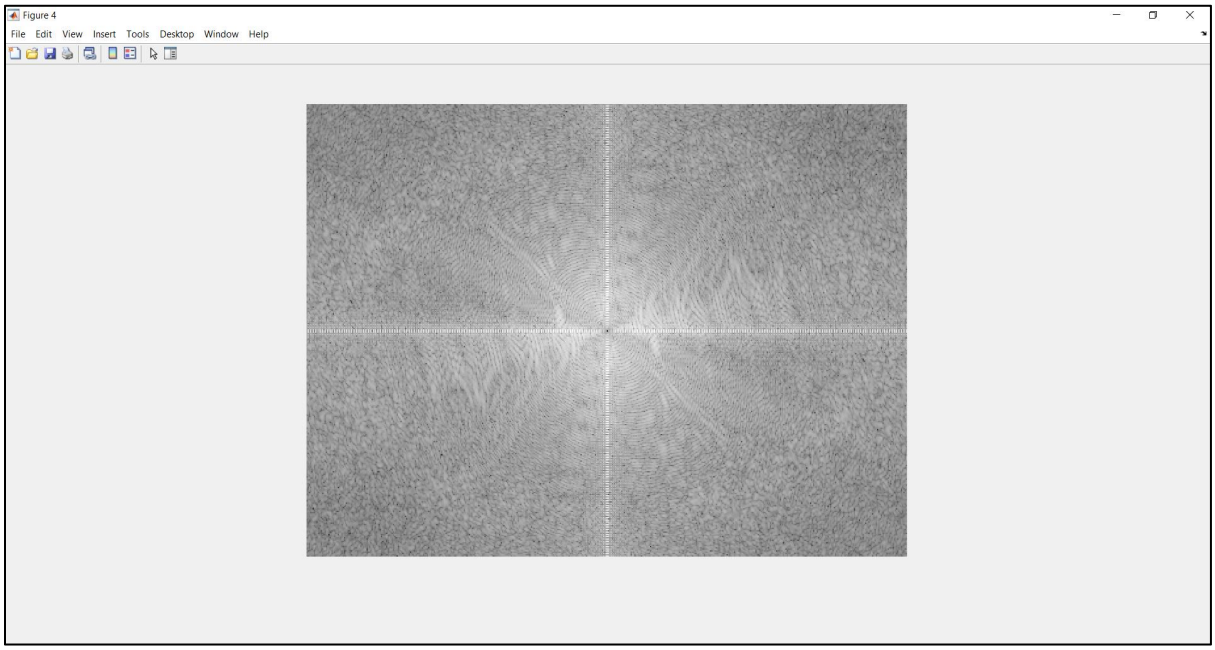
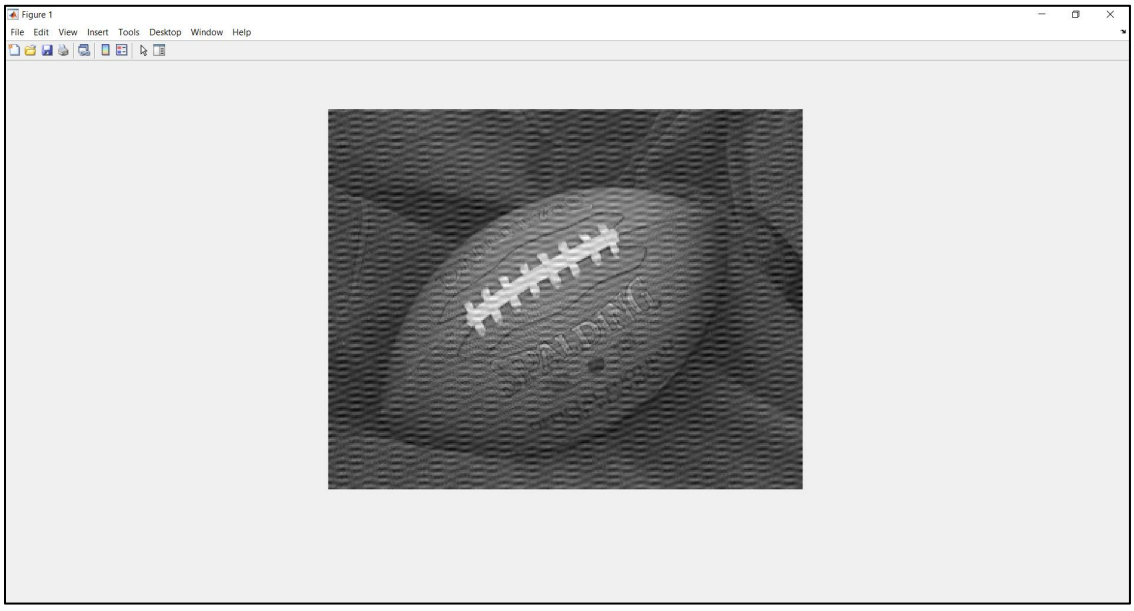


Figure 4
File Edit View Insert Tools Desktop Window Help

TUTORIAL 4

```
footBall=imread('noiseball.png');
imshow(footBall)
PQ = paddedsize(size(footBall));

H1 = notch('btw', PQ(1), PQ(2), 10, 50, 100);
H2 = notch('btw', PQ(1), PQ(2), 10, 1, 400);
H3 = notch('btw', PQ(1), PQ(2), 10, 620, 100);
H4 = notch('btw', PQ(1), PQ(2), 10, 22, 414);
H5 = notch('btw', PQ(1), PQ(2), 10, 592, 414);
H6 = notch('btw', PQ(1), PQ(2), 10, 1, 114);

F=fft2(double(footBall),PQ(1),PQ(2));

FS_football = F.*H1.*H2.*H3.*H4.*H5.*H6;

F_football=real(ifft2(FS_football));

F_football=F_football(1:size(footBall,1), 1:size(footBall,2));

figure, imshow(F_football,[])

Fc=fftshift(F);
Fcf=fftshift(FS_football);

S1=log(1+abs(Fc));
S2=log(1+abs(Fcf));
figure, imshow(S1,[])
figure, imshow(S2,[])
```



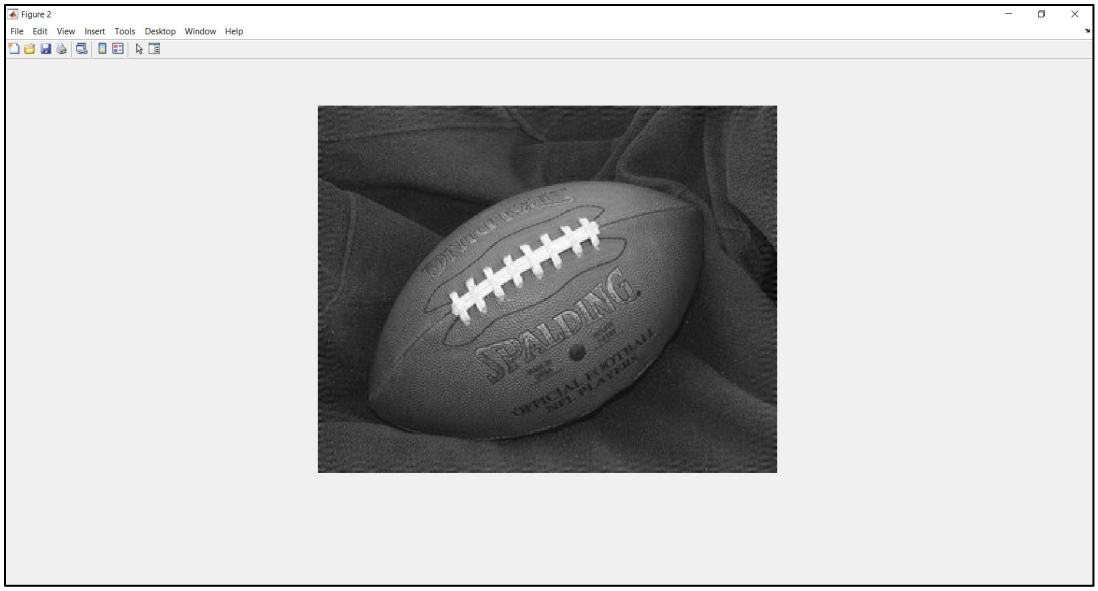


Figure 2
File Edit View Insert Tools Desktop Window Help
SPALDING
OFFICIAL FOOTBALL

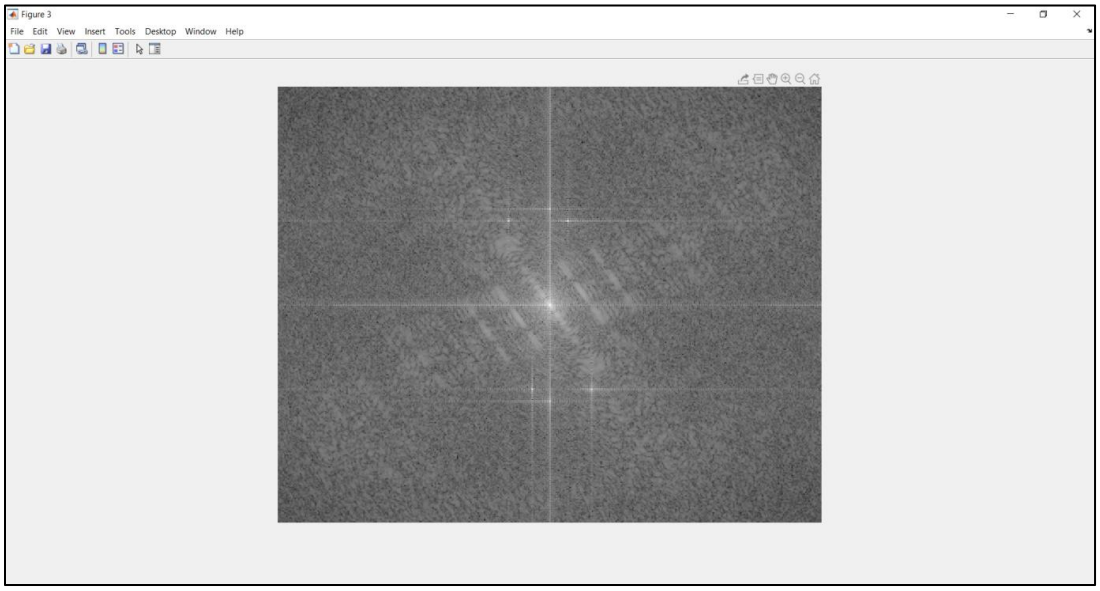


Figure 3
File Edit View Insert Tools Desktop Window Help

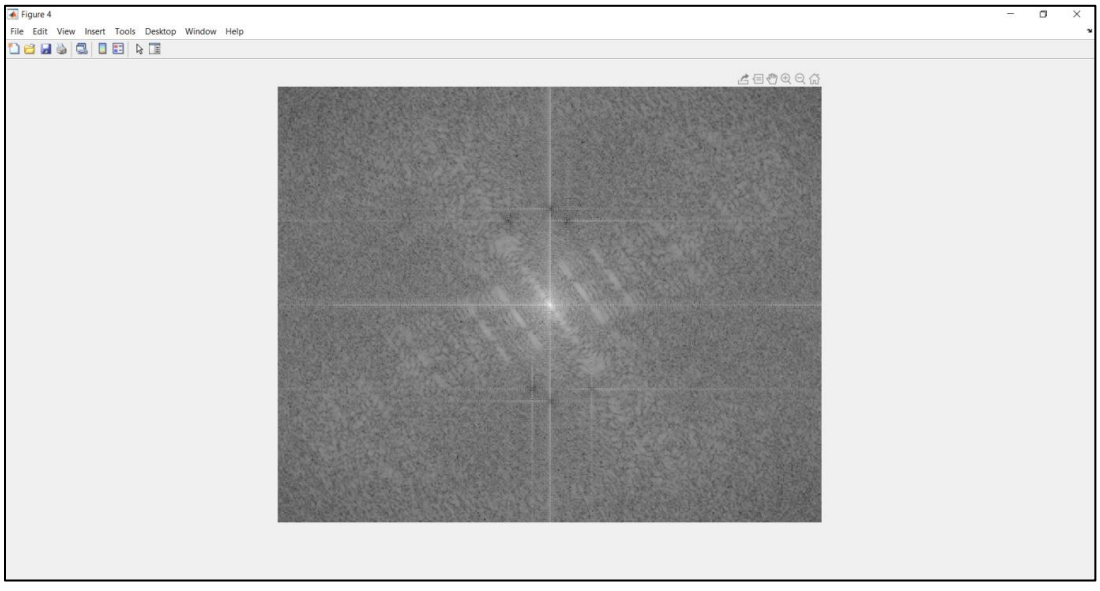


Figure 4
File Edit View Insert Tools Desktop Window Help