LAB – 2

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Sem: VII

Roll No: CE046

Subject: Image Processing

Aim: Implement basic intensity transformation functions such as image negatives, log transformations, power-law transformations, contrast stretching.

Q. 1: Take your own grayscale photo and apply negative transformation.

- **Code:**

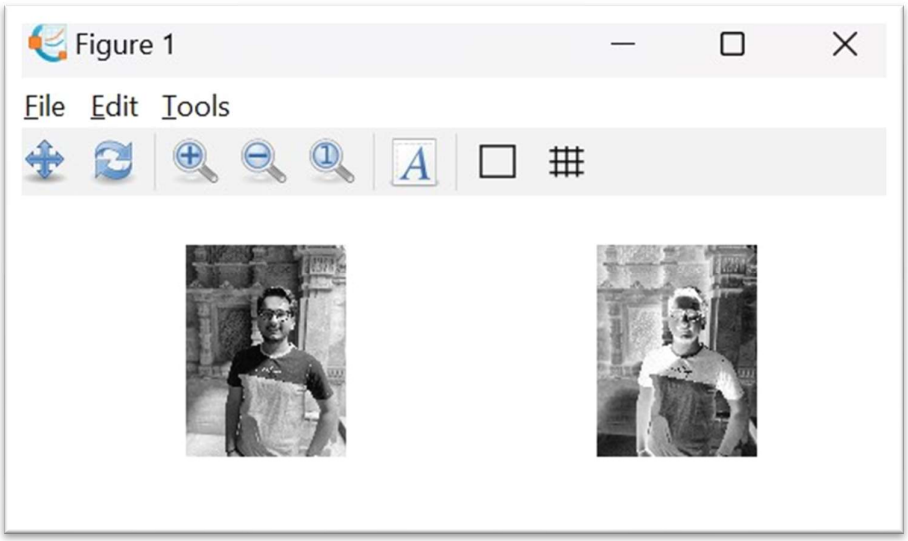
a_1.m

```
img = imread('Keval_Image.jpg');
gry = rgb2gray(img);

subplot(2, 2, 1);
imshow(gry);

neg_img = 255 - gry;
subplot(2, 2, 2);
imshow(neg_img);
```

- **Output:**



Q. 2: Consider image ex_log.tif. Enhance the image by applying log transformation.

- **Explanation:** After applying any transformation, if we apply mat2gray function, then we would be able to get the original image.

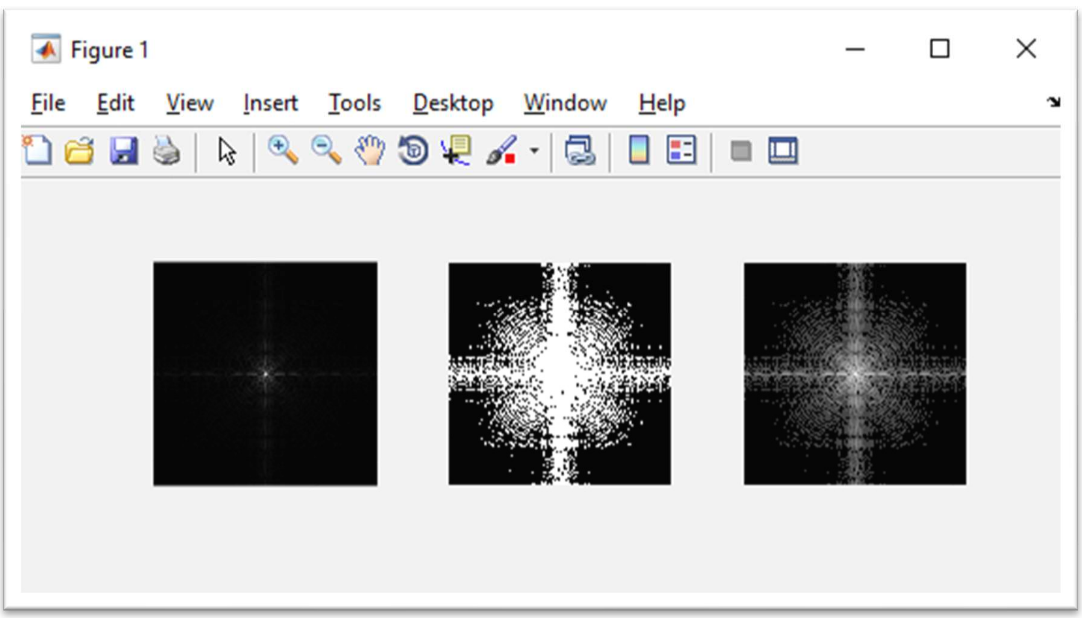
❖ Code:

```
img = imread('ex_log.tif');
img = double(img);
subplot(2, 3, 1);
imshow(img, []);

new_img = log(img + 1);
subplot(2, 3, 2);
imshow(new_img);

n_nrm = mat2gray(new_img);
subplot(2, 3, 3);
imshow(n_nrm);
```

❖ Output:



Q. 3: Consider images ex_power1.tif and ex_power2.tif and enhance them with power law transformation.

- **Explanation:** During enhancing the image, if we kept gamma greater than 1 then it will brighten the image and if we kept gamma less than 1 then it will lighten the image.

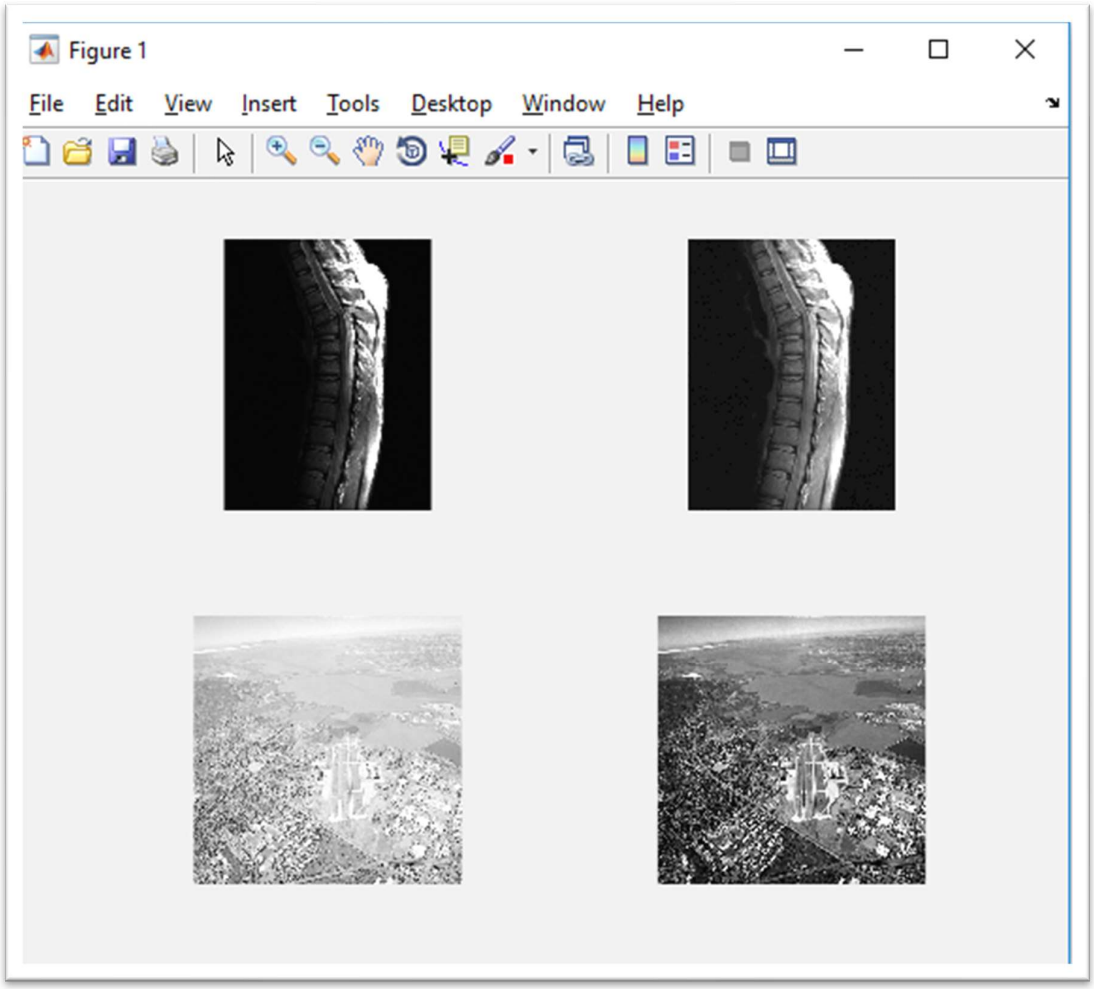
- **Code:**

Editor - E:\IP_LAB_2_CE018\a_3.m

a_1.m | a_2.m | a_3.m

```
1 -  img_power1 = imread('ex_power1.tif');
2 -  img_power1 = double(img_power1);
3
4 -  subplot(2, 2, 1);
5 -  imshow(img_power1, []);
6
7 -  new_power1 = power(img_power1, 0.5);
8 -  subplot(2, 2, 2);
9 -  imshow(new_power1, []);
10
11 -  img_power2 = imread('ex_power2.tif');
12 -  img_power2 = double(img_power2);
13
14 -  subplot(2, 2, 3);
15 -  imshow(img_power2, []);
16
17 -  new_power2 = power(img_power2, 3.8);
18 -  subplot(2, 2, 4);
19 -  imshow(new_power2, []);
20
```

❖ **Output:**



Q. 4: Consider your over exposed photo and enhance it by power law transformation. Specify the value of gamma which is suitable for this enhancement.

❖ **Explanation:** Over exposed image means there is too much light in it. Therefore, we need to enhance that image to get back original image. For that we can use power law transformation with the gamma value greater than 1 as it brightens the image.

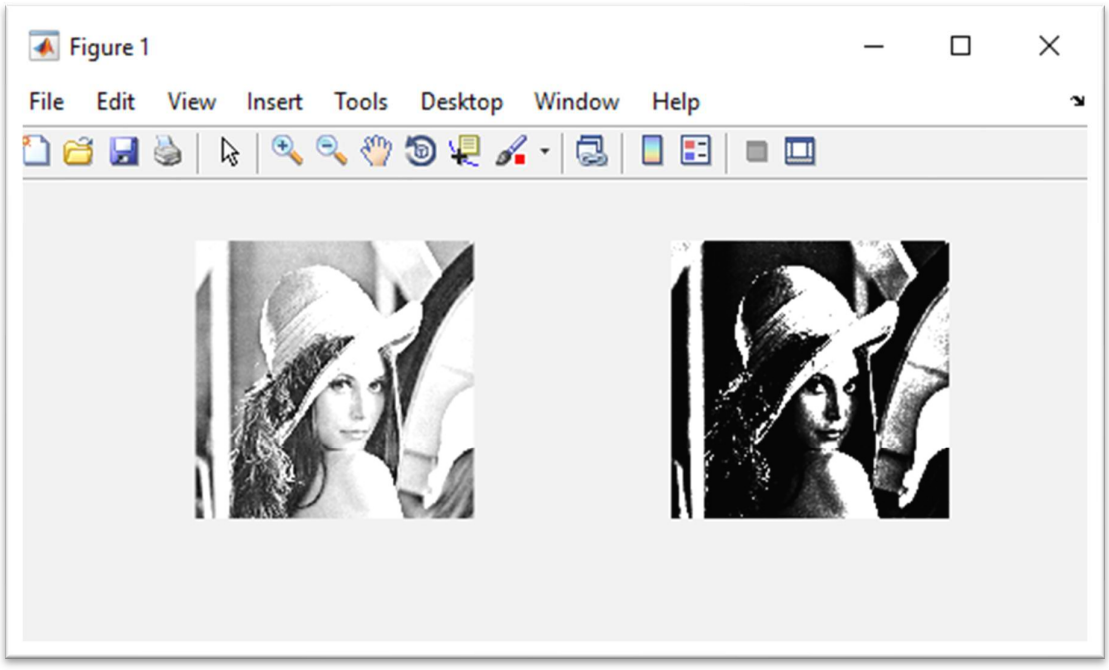
❖ **Code:**

Editor - E:\IP_LAB_2_CE018\a_4.m

a_1.m | a_2.m | a_3.m | a_4.m

```
1  -    img = imread('lenna_img.png');
2  -    img = rgb2gray(img);
3
4  -    overExposed = img + 100;
5  -    overExposed = double(overExposed);
6  -    subplot(2, 2, 1);
7  -    imshow(overExposed, []);
8
9  -    new_img = power(overExposed, 25);
10 -    subplot(2, 2, 2);
11 -    imshow(new_img, []);
```

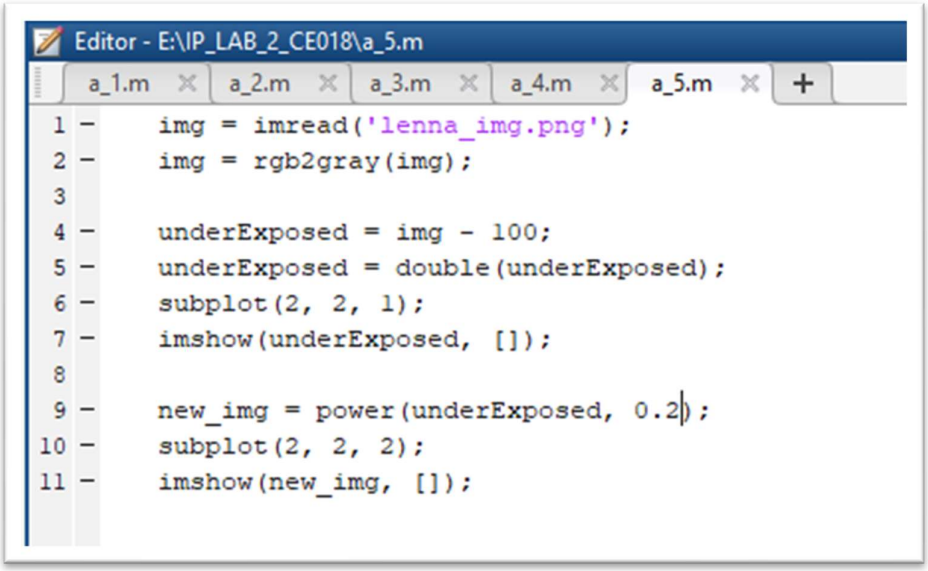
❖ **Output:**



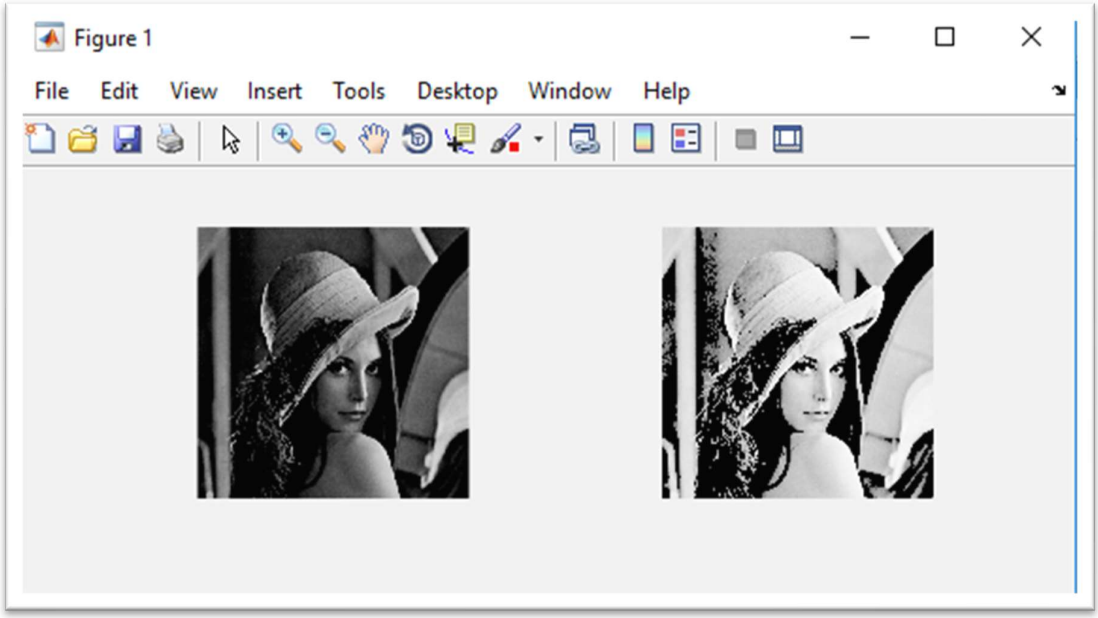
Q. 5: Consider your over exposed photo and enhance it by power law transformation. Specify the value of gamma which is suitable for this enhancement.

- **Explanation:** Under exposed image means there is not enough light in it. Therefore, we need to enhance that image to get back original image. For that we can use power law transformation with the gamma value less than 1 as it lightens the image.

- **Code:**



- **Output:**



Q. 6: Contrast stretching example: A 3 X 3 bits/pixel image is given by [7 12 8, 16 9 6, 10 15 1]. Apply contrast stretch to the image so that the new image has a dynamic range of [0, 255]. Also show the output image. Sketch the transformation you used for contrast stretching.

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Q-6

* Given Image matrix:

7	12	8
16	9	6
10	15	1

=> From the matrix: $r_{min} = 1$
$r_{max} = 16$

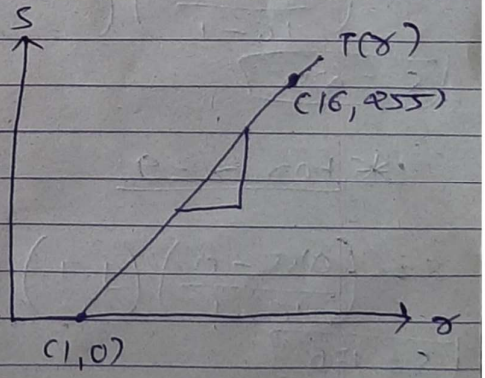
=> Also, $s_{min} = 0$ & $s_{max} = 255$

where r is original image and s is output image.

=> Now, r_{min} is mapped to s_{min} & r_{max} is mapped to s_{max}.

=> We know transformation function

$$s = \left(\frac{s_{max} - s_{min}}{r_{max} - r_{min}}\right)(r - r_{min}) + s_{min}$$



* For: $r = 7$

$$s = \left(\frac{255 - 0}{16 - 1}\right)(7 - 1) + 0$$

$$s = 102$$

* For $r = 12$:

$$s = \left(\frac{255-0}{16-1}\right)(12-1) + 0$$

$s = 187$

* For $r = 8$

$$s = \left(\frac{255-0}{16-1}\right)(8-1) + 0$$

$s = 119$

* For $r = 16$:

$$s = \left(\frac{255-0}{16-1}\right)(16-1) + 0$$

$s = 255$

* For $r = 9$:

$$s = \left(\frac{255-0}{16-1}\right)(9-1) + 0$$

$s = 136$

* For $r = 6$:

$$s = \left(\frac{255-0}{16-1}\right)(6-1) + 0$$

$s = 85$

* For $r = 10$:

$$s = \left(\frac{255-0}{16-1}\right)(10-1) + 0$$

$s = 153$

* For $r = 15$:

$$s = \left(\frac{255-0}{16-1}\right)(15-1) + 0$$

$s = 238$

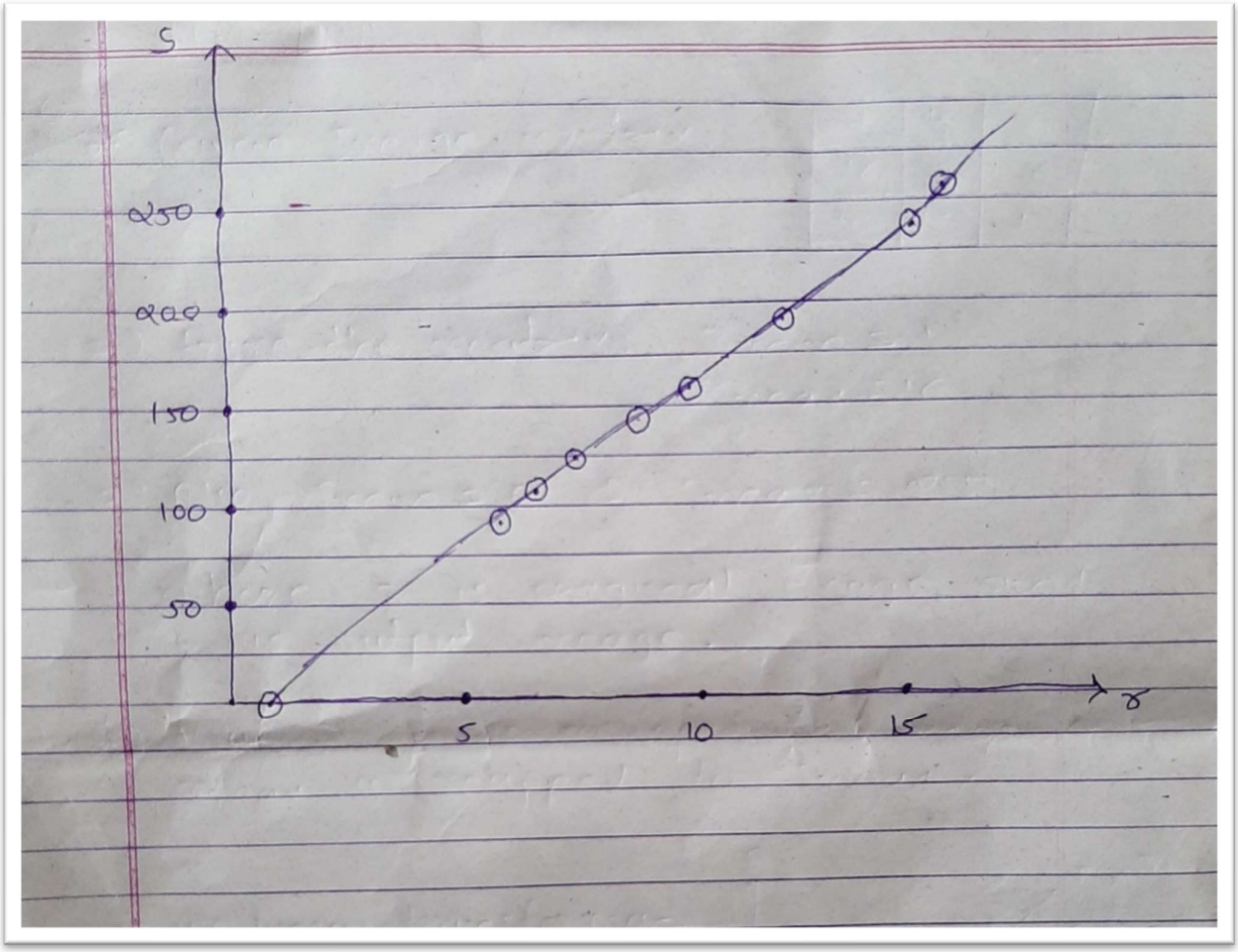
* For $r = 1$:

$$s = \left(\frac{255-0}{16-1}\right)(1-1) + 0$$

$s = 0$

* output image:

102	187	119
255	136	85
153	238	0


S
250
200
150
100
50
5
10
15
t

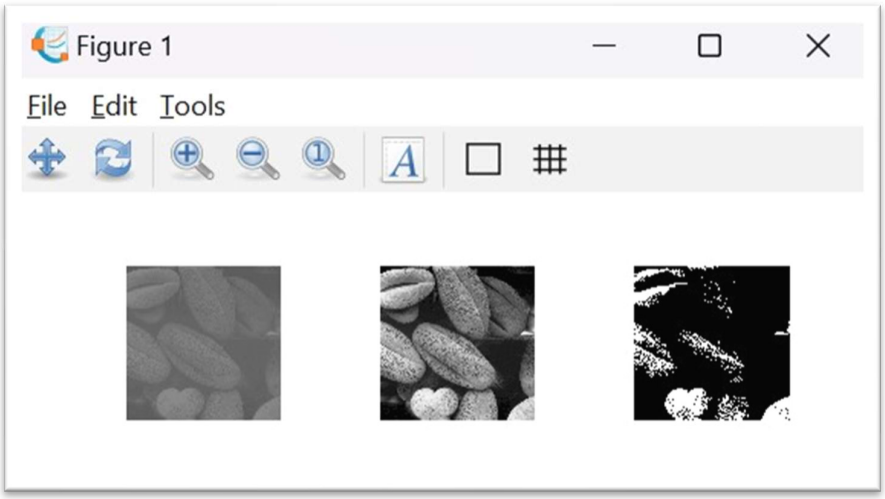
Q. 7: Do contrast stretching for the image ex_contrast.tif. Obtain contrast stretched image from low contrast image and apply thresholding.

❖ **Code:**

a_7.m

```
pkg load image

img = imread('ex_contrast.tif');

subplot(2, 3, 1);
imshow(img);

r_max = max(max(img));
r_min = min(min(img));

s_max = 255;
s_min = 0;

new_img = round(((s_max - s_min) / (r_max - r_min)) * (img - r_min) + s_min);
subplot(2, 3, 2);
imshow(new_img, []);

% applying thresholding
thresholdingImg = im2bw(new_img, 0.6);
subplot(2, 3, 3);
imshow(thresholdingImg);
```

❖ **Output:**



Q.8: Take any photo of yours:

a) Convert it into gray scale.

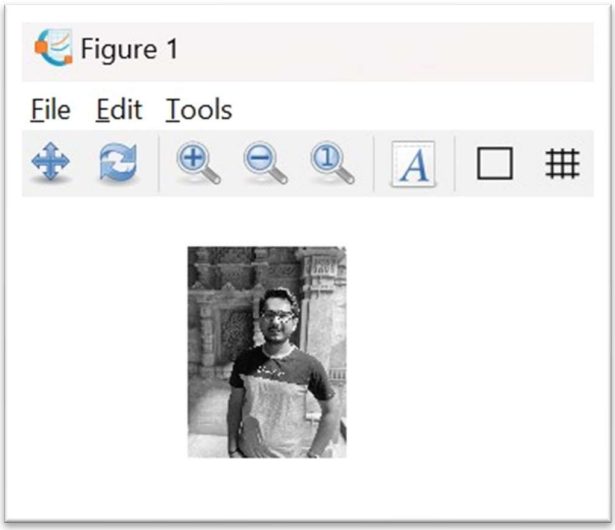
❖ **Code:**

Editor - D:\SEM - 7\IP\LAB - 2\a_8.m

a_8.m | decrease_contrast.m

```
1 -     img = imread('Keval_Image.jpg');
2 -     img = rgb2gray(img);
3 -     subplot(2, 3, 1);
4 -     imshow(img);
5 -     title('Grayscale Image');
```

❖ **Output:**



b) Create a function that would decrease the contrast of this image.

- **Code:**

a_8.m | decrease_contrast.m

```
1  img = imread('Keval_Image.jpg');
2  img = rgb2gray(img);
3  subplot(2, 3, 1);
4  imshow(img);
5  title('Grayscale Image');
6
7  lowimg = decrease_contrast(img);
8  subplot(2, 3, 2);
9  imshow(img);
10 title('Low Contrast Image');
```

Editor - D:\SEM - 7\IP\LAB - 2\decrease_contrast.m

a_8.m | decrease_contrast.m

```
1  function lowimg = decrease_contrast(img)
2      [m, n] = size(img);
3      r_max = max(max(img));
4      r_min = min(min(img));
5
6      for i = 1 : m
7          for j = 1 : n
8              lowimg(i, j) = ((155 - 0) / (r_max - r_min)) * (img(i, j) - r_min);
9          end
10     end
11 end
```

- **Output:**

c) Enhance the contrast of that image using piecewise linear operation for contrast stretching.

❖ Code:

a_8.m | decrease_contrast.m

```
13 -    range1 = [];
14 -    range2 = [];
15 -    range3 = [];
16 -    [r,c] = size(lowimg);
17 -    for i = 1 : r
18 -        for j = 1 : c
19 -            if(lowimg(i,j) < 110)
20 -                range1(end+1) = lowimg(i,j);
21 -            elseif(lowimg(i,j) < 140)
22 -                range2(end+1) = lowimg(i,j);
23 -            elseif(lowimg(i,j) < 255)
24 -                range3(end+1) = lowimg(i,j);
25 -            end
26 -        end
27 -    end
```

```
28
29 -     rmax1 = max(range1);
30 -     rmax2 = max(range2);
31 -     rmax3 = max(range3);
32 -     rmin1 = min(range1);
33 -     rmin2 = min(range2);
34 -     rmin3 = min(range3);
35
36 -     smax1 = 109;
37 -     smin1 = 0;
38 -     smax2 = 139;
39 -     smin2 = 110;
40 -     smax3 = 255;
41 -     smin3 = 140;
42
```

```
42
43 - for i = 1 : r
44 -     for j = 1 : c
45 -         if(lowimg(i,j) < 110)
46 -             new_img(i,j) = ((smax1 - smin1) / (rmax1 - rmin1)) * (lowimg(i,j) - rmin1) + smin1;
47 -         elseif(lowimg(i,j) < 140)
48 -             new_img(i,j) = ((smax2 - smin2) / (rmax2 - rmin2)) * (lowimg(i,j) - rmin2) + smin2;
49 -         elseif(lowimg(i,j) < 255)
50 -             new_img(i,j) = ((smax3 - smin3) / (rmax3 - rmin3)) * (lowimg(i,j) - rmin3) + smin3;
51 -         end
52 -     end
53 - end
54 - subplot(2,3,3);
55 - imshow(new_img);
56 - title('Piecewise Image');
```

❖ Output: