IMAGE AND VIDEO PROCESSING LAB EXERCISES

LAB-1

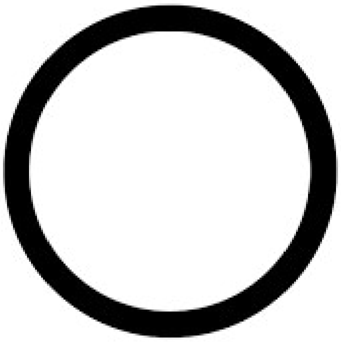
1. Read an image file cameraman.tif using imread('cameraman.tif').

Now, resize the image into a matrix of [64*64]. Arrange the pixels in such a way that brightest pixel is at the rightmost column and darkest pixel is at the leftmost corner. The order of arrangement is as shown in the figure below.

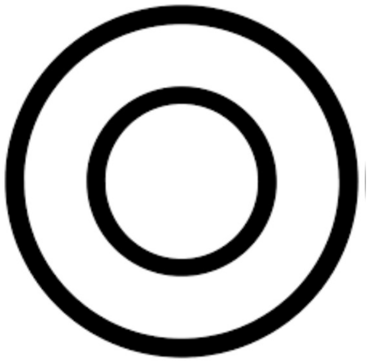
$$\begin{bmatrix} 1 & \cdots & 4033 \\ \vdots & \ddots & \vdots \\ 64 & \cdots & 4096 \end{bmatrix}$$

Here, pixel at location 1 is the darkest pixel and pixel at location 4096 is the brightest pixel.

2. A. Create a matrix of [256*256] having value of 255(maximum possible pixel value) at each location. Now change the pixel values of the matrix in such a way that the resultant matrix should be a patch of black circle having width 8 pixel and radius 40 pixel. The center of circle and matrix is coinciding. Don't use inbuilt function to draw circle. Graphical representation is shown in figure below.

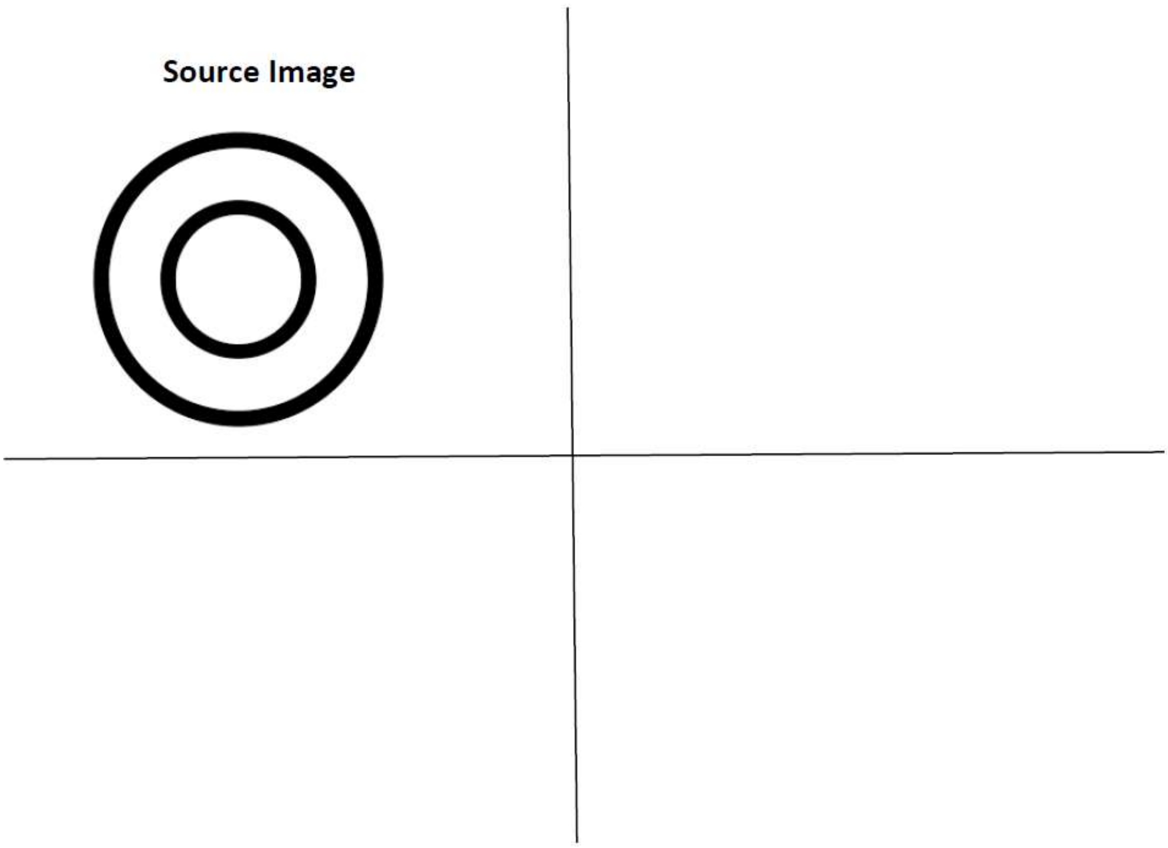


B. Now create concentric circles of same patch size with radius 28 pixel inside it as shown below.

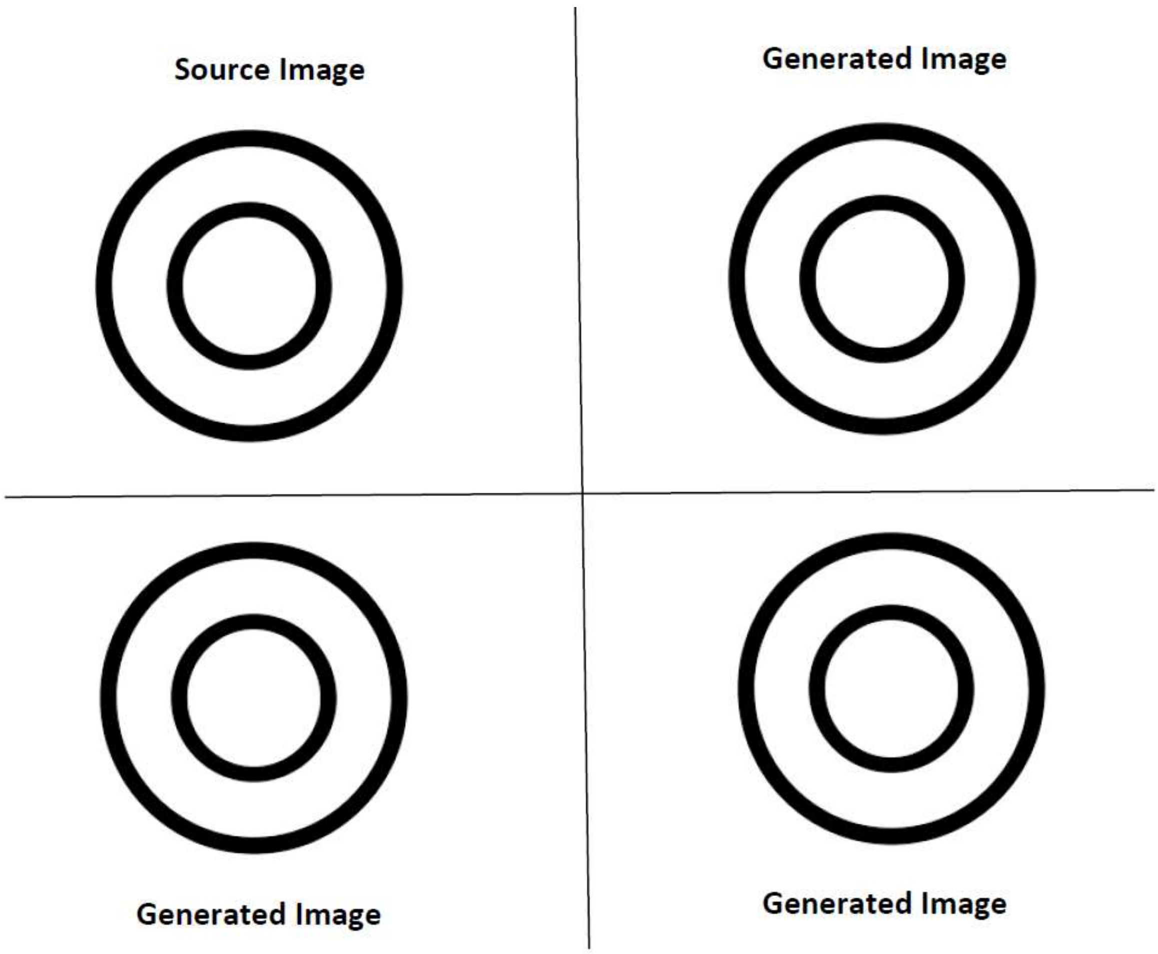


C. Divide the [256*256] matrix into 4 different quadrants. Copy the image generated in part B in First quadrant as shown below. Considering it to be input image regenerate the image in 3 different quadrant from the source image.

INPUT IMAGE:-



OUTPUT IMAGE:-


Source Image
Generated Image
Generated Image
Generated Image

LAB – 2

1. Read the image I1 and do the following without using any inbuilt function:
a. Calculate Mirror image (I2) of the original image (I1).Show both the images simultaneously.
b. Concatenate I1 and I2 horizontally and show the output image.
c. Concatenate I1 and I2 vertically and show the output image.

2. Read Lena image and convert it into gray scale(without using rgb2gray function). Check whether the image is 4-Connected, 8-Connected or m-Connected.
Given:-
- Set intensity values:- V = {1:86},
- Source point Coordinates:- P=Lena(37,6)
- Destination point Coordinates:- Q= Lena(33,10).

Do the following **if exists**:
- Plot the path for 4-connectivity. Is the path unique?
- Plot the path for 8-connectivity. Is the path unique if not then find the shortest path
- Plot the path for m-connectivity. Is the path unique? If not then find the shortest path

3. Find out the total region formed with 4, 8 or m connectivity in Lena image.

Given:-
- Set intensity values V = {1:86}

LAB – 3

1. Take Image named “1.jpg” and

a) Invert the image (take negative of the base image)

b) Rotate the image by 135° and display the full image (increase the base pixel size of the image, if needed)

2. Apply contrast stretching on the figure “2.jpg” to fit the image in 15-70% of the base image pixel range and display it.

3. Take the RGB image “3.jpg” and

a) double the intensity of the pixels lying in the R layer which have values within 0-33% of the total range of values in that layer

b) double the intensity of the pixels lying in the G layer which have values within 34-66% of the total range of values in that layer

c) double the intensity of the pixels lying in the B layer which have values within 67-100% of the total range of values in that layer

Finally, combine the 3 different layers into a final output RGB image.

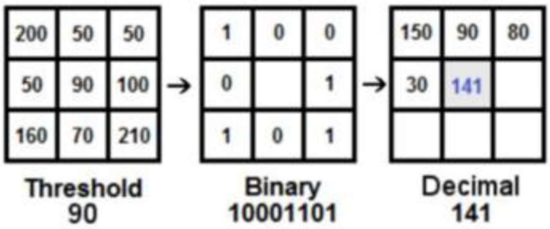
LAB – 4

1. Write the code for following transformation over the attached image “2.jpg”.
a. $S = 2*r^{\alpha}$ for α = .2,.3,.4,1,2 and 12
b. S = Max-r for r = 110 to 200 and S = r for others.
c. Show output of 6th 7th and 8th bit plane.

2. Plot the histogram without using any inbuilt function

LAB – 5

1. Consider the image attached in mail.
   a. Convert and normalize the image into 256*256 grey scale with maximum intensity value 256(here you can use inbuilt functions like resize).
   b. Now, Suppose if the reference pixel P(i,j) is having intensity value 90 then considering 90 as threshold value, compare P(i,j) with its 8-nearest neighbours (leave boundary pixels). Generate an eight-bit pattern as shown in figure below. Convert the 8 bit pattern into decimal value and replace it with the reference pixel P(i,j). Repeat the same for each pixel and generate another image of size 254*254(excluding boundary pixels).
   c. Generate the histogram of feature image (output of b part).
   d. Equalize the image and show all three outputs (of part b,c and d)



LAB – 6

1. Given image A, and the filter

2	1	9
7	18	6
0	1	87

Convolve the image with the filter in such a way that the image size remains unchanged on all 3 separate channels of the RGB image. Finally, create the output RGB image by combining the 3 channels.

2. Consider the image C. Generate another matrix G using the convolution operation over complete image matrix using the 5x5 Gaussian mask given. Note that the final image size should remain same as the input image size.
Now perform the steps of high boost filtering and generate the filtered image I’ and output it.

5	25	0	6	9
59	62	0	4	8
24	36	0	7	8
0	0	0	0	0
8	7	0	36	24
8	4	0	62	59
9	6	0	25	5

LAB – 7

1. Read the image “face_image.jpg”. Convert it into grayscale. Write a program to slice the image named into 8-bit planes and show all bit planes along with the original image. Implement dilation and erosion (without using any inbuilt function) for the image generated in 1st, 3rd and 7th bit plane. Assume the following matrix to be structuring element.

1	1	1
1	1	1
1	1	1

LAB – 8

1. Perform Opening and Closing operation on the morphology.tif image and show the results in subplots.
2. Use img1.jpg and extract the boundary of the image by performing appropriate operations.
3. Apply Hit-miss transform to the image “UTK.tif” with the structuring element “T.tif”.

LAB – 9

1. Consider Image A and apply Prewitt and Sobel Filters for detecting edges in the different directions (both diagonals). Subtract the result obtained from Prewitt filter from the result obtained from Sobel Filter and comment on the result.

2. Apply Canny Edge detector on Image B and obtain the result.

3. Obtain a 2D Fourier Transform on image C and comment on the result.

4. Consider Image D and separate the 3 R, G and B layers. Identify the 60% threshold of pixel intensity at each layer. Let this be ti for 0<=i<=2. For all values less than ti, calculate the avg value as ai and similarly, obtain bi for all values greater than ti. Calculate the avg as m = (ai + bi)/2 . Repeat the above steps again for each of the 2 regions (which now becomes 4) considering m as the new threshold. Keep doing this until the value of m falls below 10% of the initial highest value.

Once this is done, identify the number of pixel value levels obtained, and provide them with values equal to the total range of 0-255 (i.e., if there are 2 regions, the level values would be 0 and 255, if 4, it would be 0, 16, 64 and 255 and so on).

Finally, combine the 3 levels and obtain the final RGB image.

LAB – 10

1. a. Read the image “larry_page”. Convert it into gray scale and resize by [128 128]. Apply Gaussian low pass filter of filter size [5x5] for sigma = 0.5, 0.8 and 0.9. Subplot all three variations.

b. Apply the high boost filter(Laplacian) over smoothened image. Subtract smoothened images generated in part a and subplot all 3 results.

c. Add the output generated in part b with the original image and show the output.

2. Implement Laplacian of Gaussian (LoG) over “larry_page” step by step and show the output for all the three channels (R,G,B) respectively.

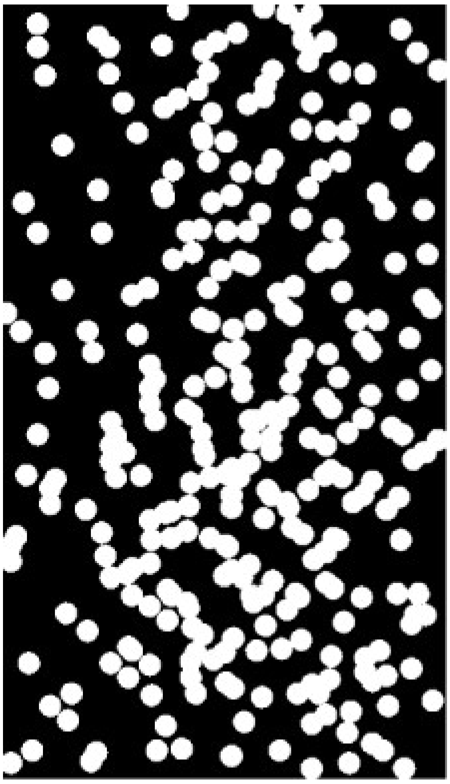
LAB – 11

1. A pre-processing step in an application of microscopy is concerned with the issue of isolating individual round particles from similar particles that overlap in groups of two or more particles (see the following image). Assuming that all the particles are of the same size, propose a **morphological algorithm** that produces three images consisting respectively of:

a. Only particles that have merged with the boundary of the image.

b. Only overlapping particles.

c. Only non-overlapping particles.



LAB – 12

1. Perform local processing on the Image A at 90 degree and 180 degree directions. After this, perform OR operation on the output images and obtain the final output. Calculate the threshold, as 40% of the average value of all the pixels in image A.
Provide output for the 2 initial images obtained as well as the final image obtained after the OR operation.

2. Perform variable thresholding using moving averages on Image B. Use n = 5, 15, 50 and 100 and display the results.

3. Apply Watershed Algorithm on Image C. Take the starting intensity bins at the lowest base pixel value. Display the result.