ECE-415 (Computer Vision I)

Name: Pavan Kumar Srikanth Naik
UIN: 669940624

Homework - 3

1). Histogram equalization

x - rows
y - columns
upper left corner pixel (1,1)

Image : 3 bit $\therefore 2^3 = 8$

0	1	2	3	4	5	6	7

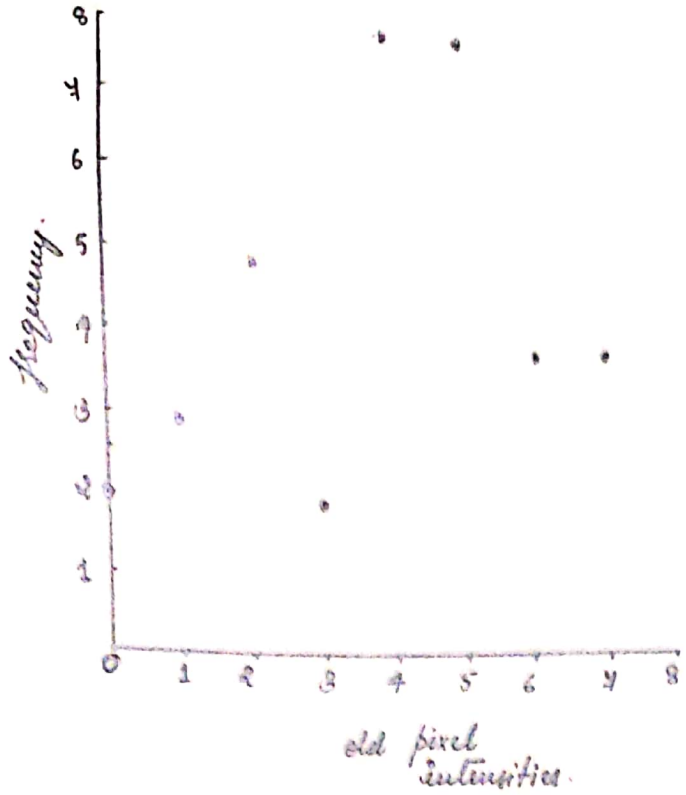
Intensity value z_i	Frequency n_i	PDF $p(z_i)$	CDF $c(z_i)$	$(L-1) \cdot c(z_i)$ $7 \cdot c(z_i)$	Round-off floor
0	2	0.0556	0.0556	0.3892	0
1	3	0.0833	0.1389	0.9723	0
2	5	0.1389	0.2778	1.9446	1
3	2	0.0556	0.3334	2.3338	2
4	8	0.2222	0.5556	3.8892	3
5	8	0.2222	0.7778	5.4446	5
6	4	0.1111	0.8889	6.2223	6
7	4	0.1111	1.0000	7.	7.

$\because p(z_i) = \frac{n_i}{N}$ n_i : number of pixels with intensity value z_i

N : total number of pixels in the image.

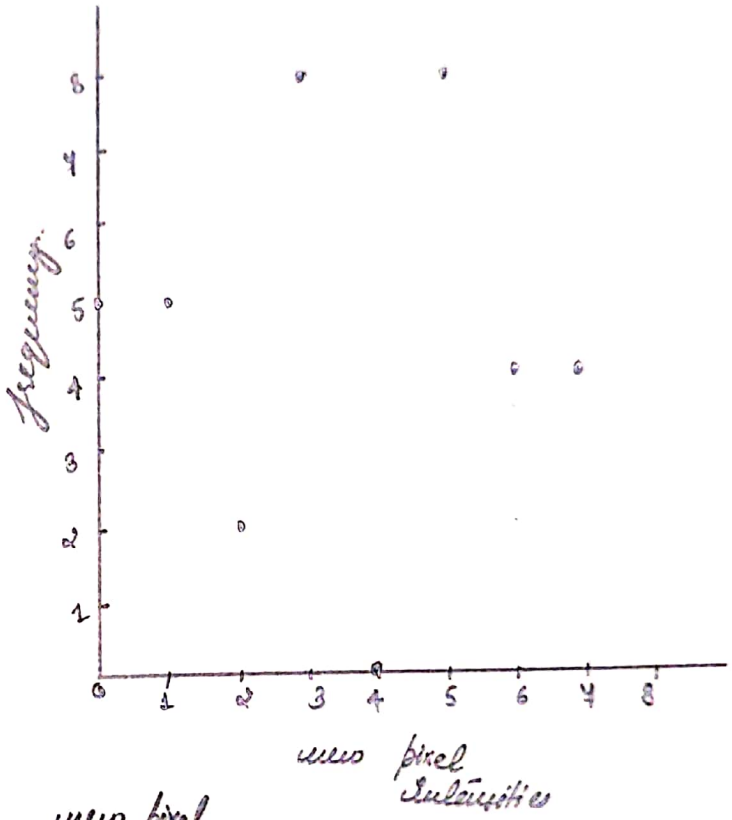
$$c(z_i) = \sum_{j=0}^{i} p(z_j)$$

old pixel intensities	frequency	new pixel intensities	frequency
0	2	0	5
1	3	1	5
2	5	2	2
3	2	3	8
4	8	4	0
5	8	5	8
6	4	6	4
7.	4	7	4



The new 6×6 image matrix

1	0	5	4	3	2
3	4	3	0	5	3
5	1	4	5	0	5
5	3	0	1	5	5
6	0	3	3	1	4
4	3	6	6	1	6



* Pixels after equalization

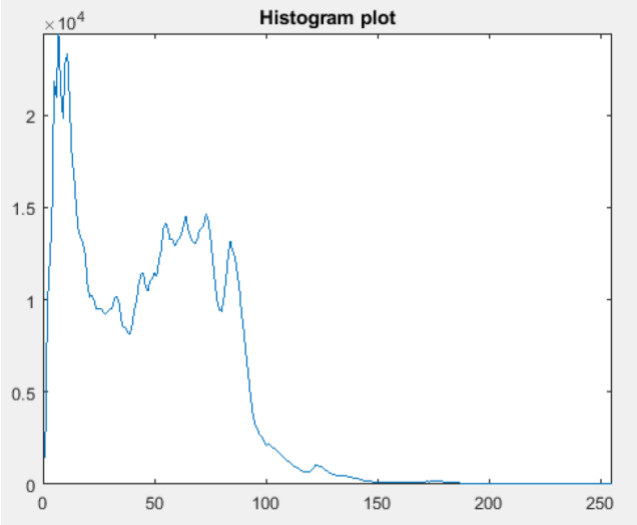
coordinate	pixel intensity	new pixel value.
(2,4)	1	0
(3,3)	3	2
(4,5)	5	5

Problem 2

1) Plot the image

2) Thresholding

a). Threshold values selected are T1 = 35 and T2 = 75.



I have selected the above thresholds as they are the valleys(dips) in the histogram of pixel intensities. Thus, providing the best thresholds.

Thus by taking T1 and T2 accordingly, we are able to assign the values outside of this range as zero and the values within this range as 255.

b). Plot the resulting image after thresholding.

c). Comment on effect thresholding had on the image

By applying thresholding on the given image, we can differentiate the background of the image and the objects present in the image.

Thresholding is done by assigning the values outside the range of T1 and T2 a value of 0, i.e. black, and the pixels inside the range of T1 and T2 a value of 255, i.e., white pixels.

3. Contrast Stretching

a). Perform contrast stretching on input image and plot the resulting image.

b). The range that was stretched is [6 95], for the c and d values respectively.

c). Applying contrast stretching to the image the range can be extended from [6 95] to [0 255] by mapping the pixel values in the extended range. Thus, the image is more defined as objects are distinguishable from the background.

4. Gamma Correction

a). Gamma is selected using the equation: $g(x, y) = c.\ f(x, y)r$.
The value of c is 28 and r is 0.4. Therefore, the gamma value selected is 0.4

b). Perform gamma correction on the input image and plot the resulting image.

c). As the gamma value selected is 0.4 < 1, the expected behavior is to have enhanced low intensity values. It can be observed that the basket, boxes in the frame are all much clearer and also brighter than in the original image.

5. Histogram Equalization

a). Perform histogram equalization on the input image and plot the resulting image.

b). Histogram equalization is the method of contrast adjustment using the image's histogram. It accomplishes this by effectively spreading out the most frequent intensity values, i.e. stretching out the intensity range of the image. This method usually increases the global contrast of images when its usable data is represented by close contrast values. This allows for areas of lower local contrast to gain a higher contrast.