University of Engineering & Technology, Mardan

Department of Electrical Engineering

Assignment #01

Subject: EE411 Digital Image Processing   Instructor: Dr. Irfan Khan

Due Date: <u>20/03/2025</u>   Total Marks: 20 [CLO 1: PLO 1, C2]

Q2: Given the image

a) Plot the histogram of the above image
b) Write an algorithm to equalize the histogram of the above image. Compare the histograms of the equalized and original image.
c) Attach screen shots of your code and results

Matlab code:

```matlab
clear all
close all
clc
a = imread('ass_1.jpg');
f = rgb2gray(a);
figure(1);
imshow(f);
title('Original Grayscale Image');
% Compute the histogram of the grayscale image
h = imhist(f);
figure(2);
imshow(h);
bar(0:255, h);
title('Histogram of Original Image');
xlabel('Intensity levels');
ylabel('Number of Pixels');
% Compute the Probability Density Function (PDF)
pdf = h / numel(f);
% Plot PDF
figure(3);
plot(0:255, pdf, 'b', 'LineWidth', 1.5);
title('Probability Density Function (PDF)');
xlabel('Intensity level');
ylabel('Probability');
% Compute the Cumulative Distribution Function (CDF)
cdf = cumsum(pdf);
% Normalize CDF to range [0, 255]
cdf_min = min(cdf(cdf > 0)); % First nonzero value
cdf_normalized = (cdf - cdf_min) / (1 - cdf_min) * 255;
cdf_normalized = round(cdf_normalized); % Round to integer values
figure(4);
plot(0:255, cdf_normalized, 'r', 'LineWidth', 1.5);
title('Cumulative Distribution Function (CDF)');
xlabel('Pixel Intensity');
ylabel('Normalized Intensity Value');
% Histogram Equalization: Map original intensities to
% equalized intensities
```
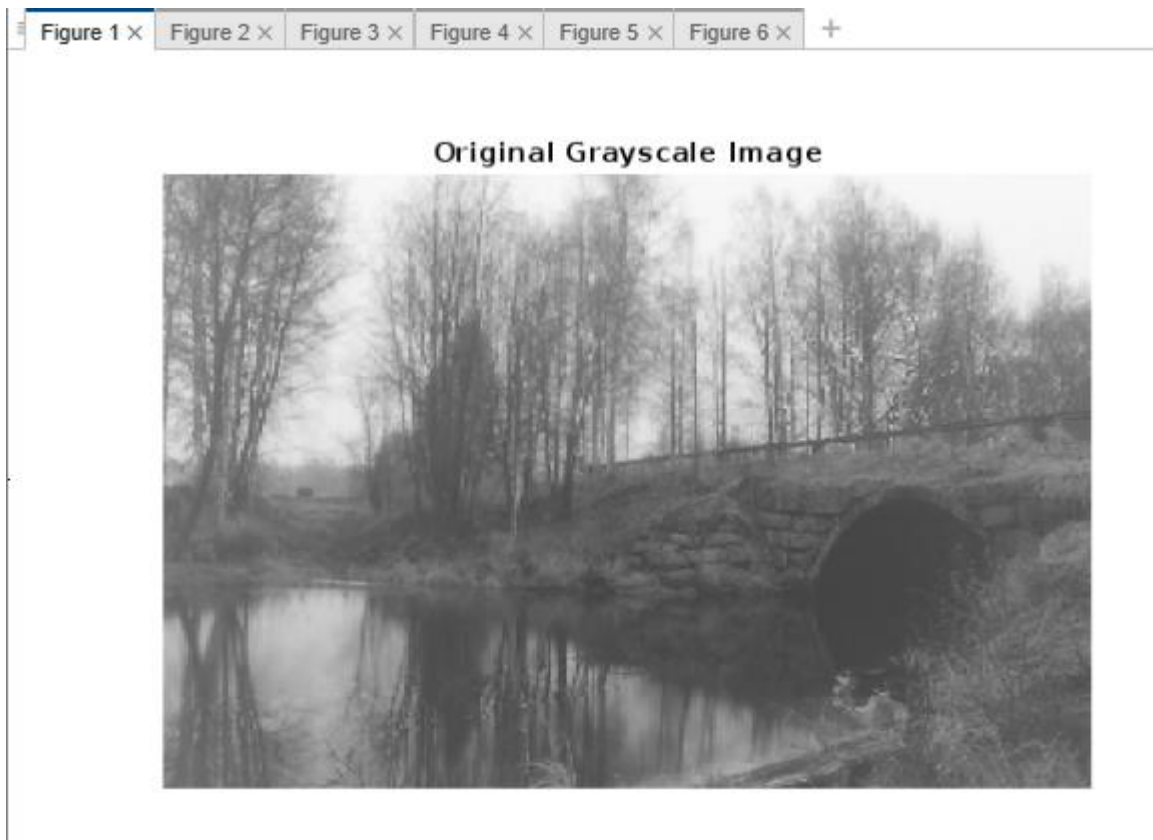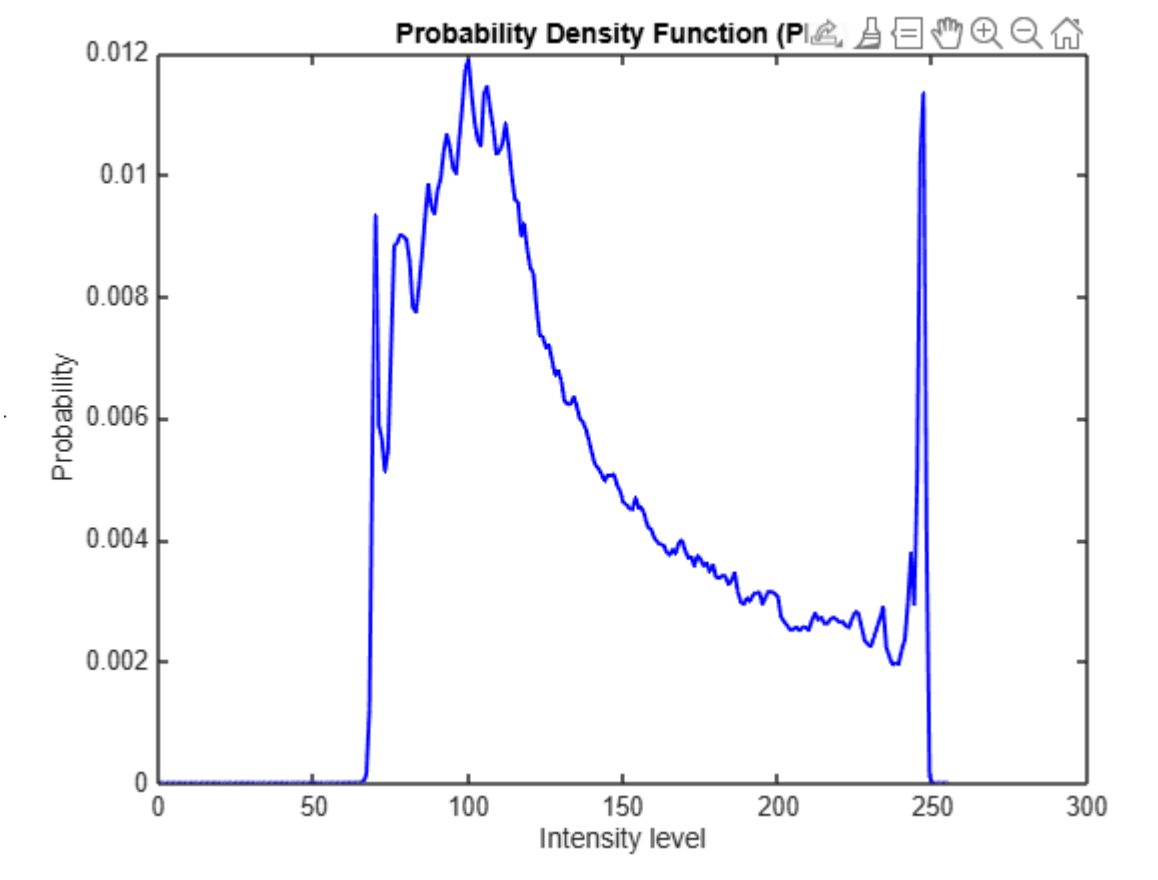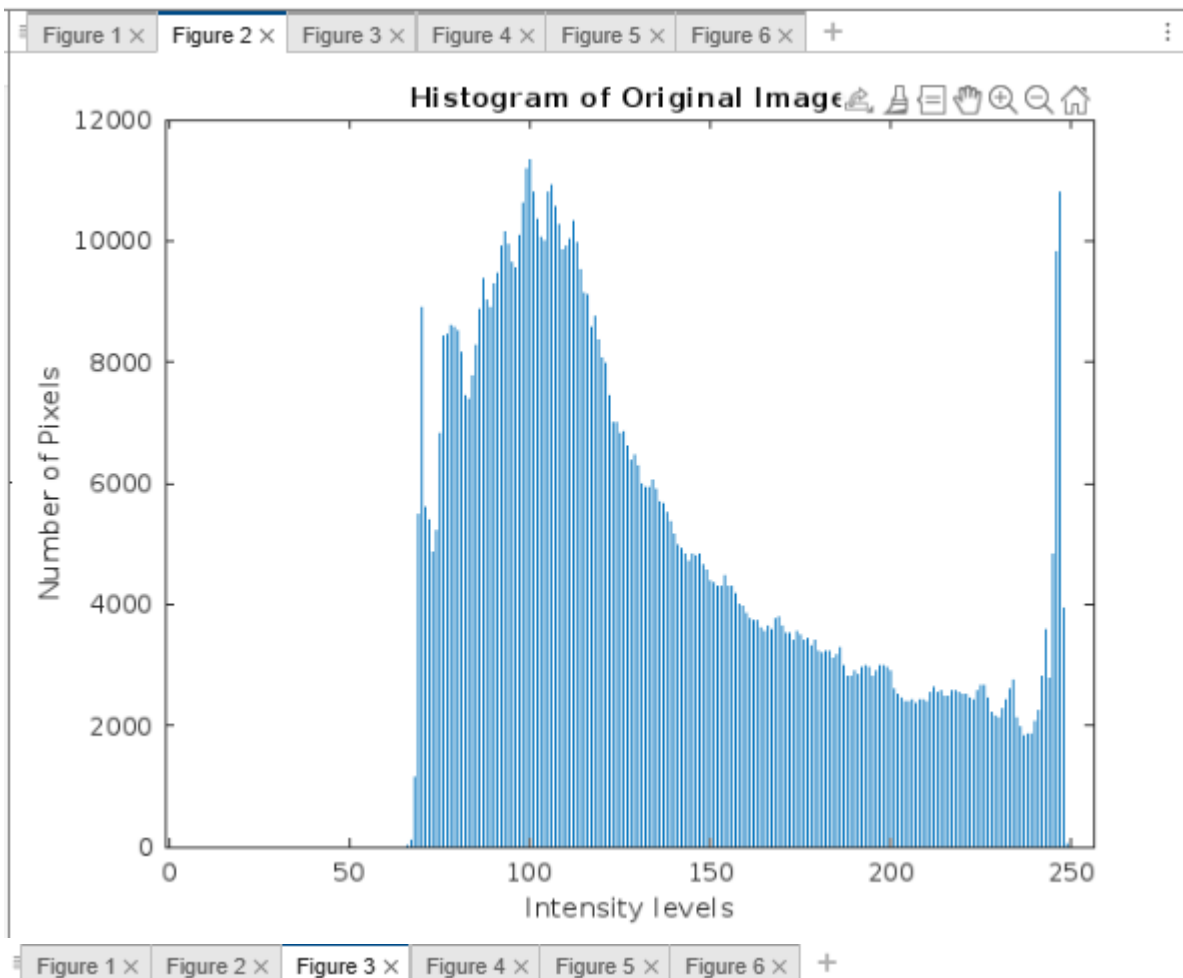
```
equalized_img = f; % Initialize output image
for i = 1:numel(f)
  equalized_img(i) = cdf_normalized(f(i) + 1); % Map pixels using CDF
end
% Display the equalized image
figure(5);
imshow(equalized_img);
title('Equalized Image');

% Compute histogram of the equalized image
equalized_hist = imhist(equalized_img);
% Plot equalized histograms
figure(6);
bar(0:255, equalized_hist);
title('Histogram of Equalized Image');
xlabel('Intensity level');
ylabel('No of pixels');
```
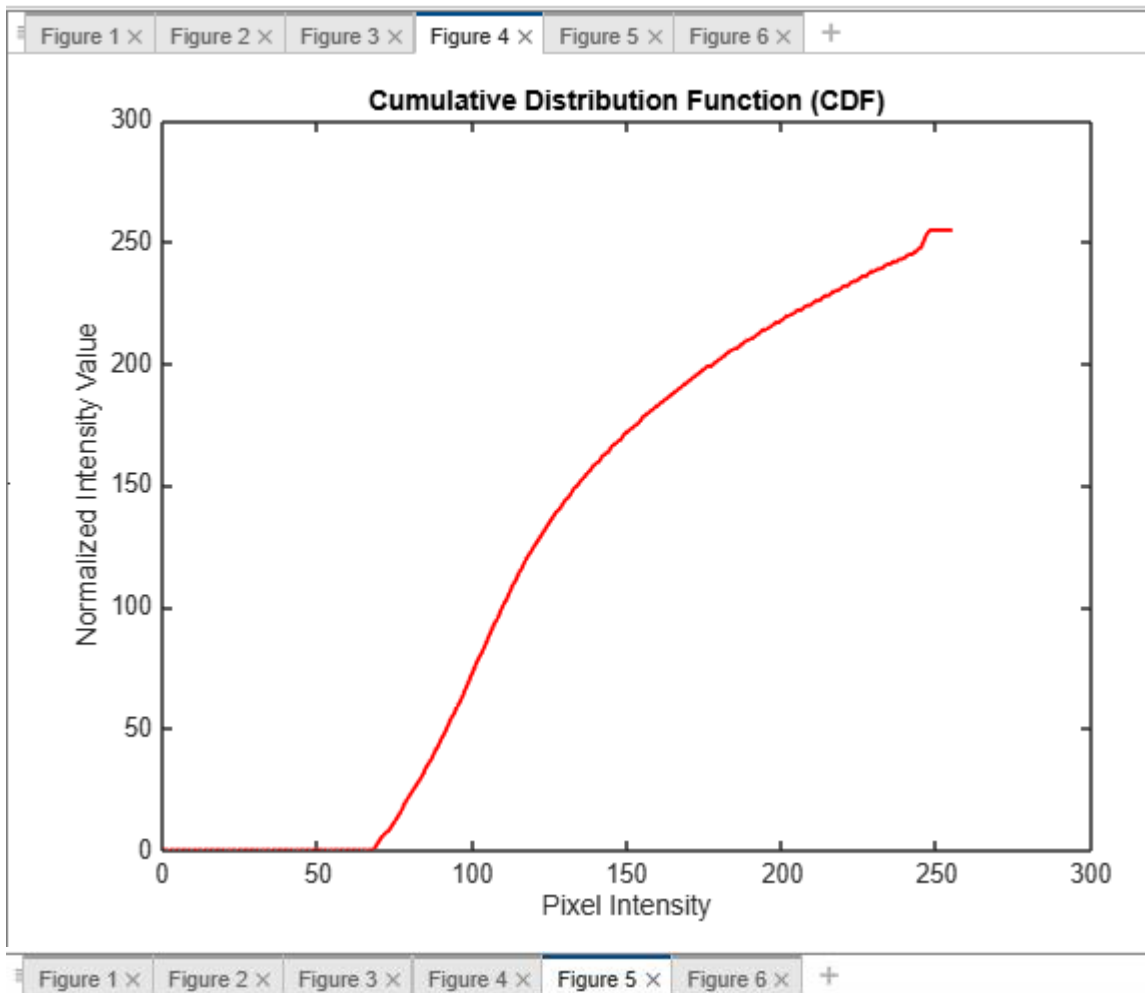
Results:

Original Grayscale Image

Figure 1 × | Figure 2 × | Figure 3 × | Figure 4 × | Figure 5 × | Figure 6 × | +

Histogram of Original Image

Number of Pixels vs Intensity levels

Figure 1 × | Figure 2 × | Figure 3 × | Figure 4 × | Figure 5 × | Figure 6 × | +

Probability Density Function (PDF)

Probability vs Intensity level

Figure 1 × | Figure 2 × | Figure 3 × | Figure 4 × | Figure 5 × | Figure 6 × | +

Cumulative Distribution Function (CDF)

Figure 1 × | Figure 2 × | Figure 3 × | Figure 4 × | Figure 5 × | Figure 6 × | +

Equalized Image

Figure 1 × | Figure 2 × | Figure 3 × | Figure 4 × | Figure 5 × | Figure 6 × | +

Histogram of Equalized Image