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Task 4

My Function

```
function [out_img, hist_before, hist_after, mean_before, std_before,
mean_after, std_after] = myHistEq(img)
    % Convert image to double for calculations
    img = double(img);
    [rows, cols] = size(img);
    % --- Histogram before enhancement ---
    hist_before = zeros(1,256);
    for r = 1:rows
        for c = 1:cols
            intensity = img(r,c);
            hist_before(intensity+1) = hist_before(intensity+1) + 1;
        end
    end
    % --- Probability distribution (PDF) ---
    pdf = hist_before / (rows * cols);
    % --- Cumulative distribution function (CDF) ---
    cdf = zeros(1,256);
    cdf(1) = pdf(1);
    for i = 2:256
        cdf(i) = cdf(i-1) + pdf(i);
    end
    % --- Mapping function ---
    new_levels = round(cdf * 255);
    % --- Apply mapping to get enhanced image ---
    out_img = zeros(rows, cols);
    for r = 1:rows
        for c = 1:cols
            out_img(r,c) = new_levels(img(r,c)+1);
        end
    end
    out_img = uint8(out_img);
    % --- Histogram after enhancement ---
    hist_after = zeros(1,256);
    for r = 1:rows
        for c = 1:cols
            intensity = out_img(r,c);
            hist_after(intensity+1) = hist_after(intensity+1) + 1;
        end
    end
    % --- Mean and standard deviation before & after ---
    mean_before = sum((0:255) .* hist_before) / (rows * cols);
    std_before = sqrt(sum((0:255) .^ 2 .* hist_before) / (rows * cols) - mean_before.^2);
    mean_after = sum((0:255) .* hist_after) / (rows * cols);
    std_after = sqrt(sum((0:255) .^ 2 .* hist_after) / (rows * cols) - mean_after.^2);
end
```

```

    std_before = sqrt(sum(((0:255) - mean_before).^2 .* hist_before) / (rows * cols));
    mean_after = sum((0:255) .* hist_after) / (rows * cols);
    std_after = sqrt(sum(((0:255) - mean_after).^2 .* hist_after) / (rows * cols));
end

```

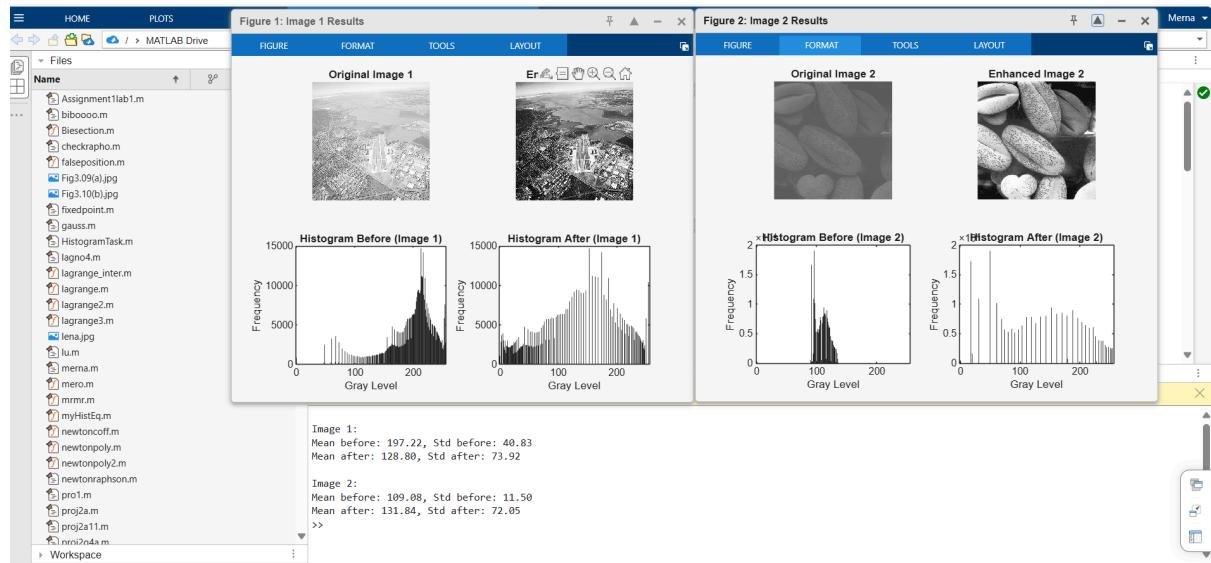
Read images and plot results

```

clc; clear; close all;
% Read input images
img1 = imread('Fig3.09(a).jpg');
img2 = imread('Fig3.10(b).jpg');
% Convert to grayscale if needed
if size(img1,3) == 3
    img1 = rgb2gray(img1);
end
if size(img2,3) == 3
    img2 = rgb2gray(img2);
end
% Perform custom histogram equalization
[enh1, hist1_before, hist1_after, mean_before1, std_before1, mean_after1,
std_after1] = myHistEq(img1);
[enh2, hist2_before, hist2_after, mean_before2, std_before2, mean_after2,
std_after2] = myHistEq(img2);
% Display results for Image 1
figure('Name','Image 1 Results');
subplot(2,2,1);
imshow(img1); title('Original Image 1');
subplot(2,2,2);
imshow(enh1); title('Enhanced Image 1');
subplot(2,2,3);
bar(0:255, hist1_before, 'k');
title('Histogram Before (Image 1)');
xlabel('Gray Level'); ylabel('Frequency');
subplot(2,2,4);
bar(0:255, hist1_after, 'k');
title('Histogram After (Image 1)');
xlabel('Gray Level'); ylabel('Frequency');
% Display results for Image 2
figure('Name','Image 2 Results');
subplot(2,2,1);
imshow(img2); title('Original Image 2');
subplot(2,2,2);
imshow(enh2); title('Enhanced Image 2');
subplot(2,2,3);
bar(0:255, hist2_before, 'k');
title('Histogram Before (Image 2)');
xlabel('Gray Level'); ylabel('Frequency');
subplot(2,2,4);
bar(0:255, hist2_after, 'k');
title('Histogram After (Image 2)');
xlabel('Gray Level'); ylabel('Frequency');

```

```
% Print mean and std results
fprintf('\nImage 1:\nMean before: %.2f, Std before: %.2f\nMean after: %.2f,
Std after: %.2f\n', ...
    mean_before1, std_before1, mean_after1, std_after1);
fprintf('\nImage 2:\nMean before: %.2f, Std before: %.2f\nMean after: %.2f,
Std after: %.2f\n', ...
    mean_before2, std_before2, mean_after2, std_after2);
```



The results

Image 1:

Mean before: 197.22, Std before: 40.83
Mean after: 128.80, Std after: 73.92

Image 2:

Mean before: 109.08, Std before: 11.50
Mean after: 131.84, Std after: 72.05

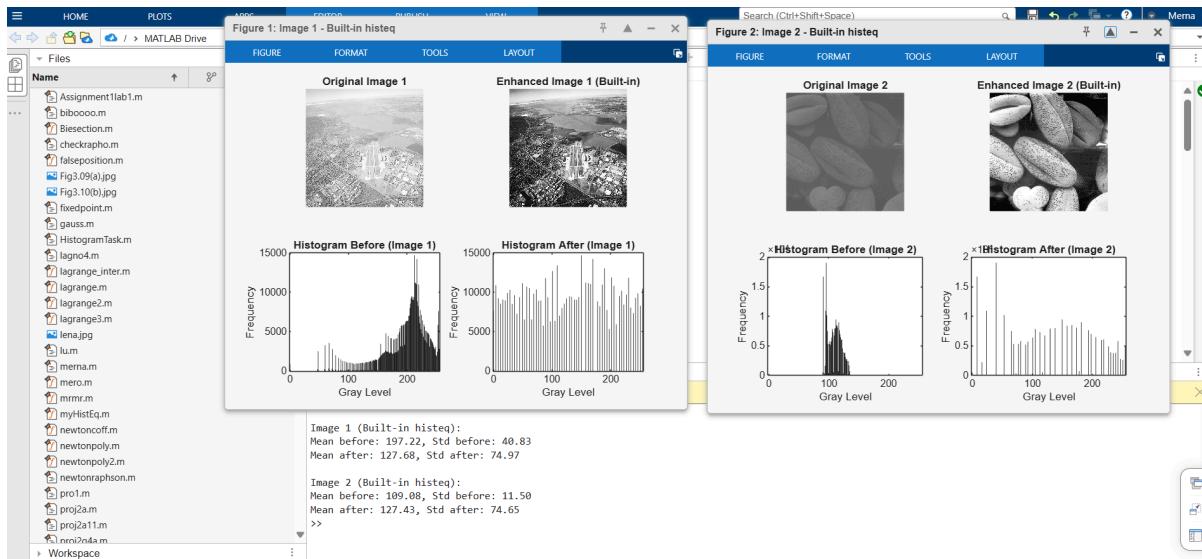
using built in function

```
clc; clear; close all;
% Read input images
img1 = imread('Fig3.09(a).jpg');
img2 = imread('Fig3.10(b).jpg');
% Convert to grayscale if needed
if size(img1,3) == 3
    img1 = rgb2gray(img1);
end
if size(img2,3) == 3
    img2 = rgb2gray(img2);
end
% Perform built-in histogram equalization
enh1 = histeq(img1);
enh2 = histeq(img2);
% --- Compute histograms manually for display ---
hist1_before = imhist(img1);
hist1_after = imhist(enh1);
hist2_before = imhist(img2);
hist2_after = imhist(enh2);
% --- Compute mean and std for both images ---
mean_before1 = mean(img1(:));
std_before1 = std(double(img1(:)));
mean_after1 = mean(enh1(:));
std_after1 = std(double(enh1(:)));
mean_before2 = mean(img2(:));
std_before2 = std(double(img2(:)));
mean_after2 = mean(enh2(:));
std_after2 = std(double(enh2(:)));
% --- Display results for Image 1 ---
figure('Name','Image 1 - Built-in histeq');
subplot(2,2,1);
imshow(img1); title('Original Image 1');
subplot(2,2,2);
imshow(enh1); title('Enhanced Image 1 (Built-in)');
subplot(2,2,3);
bar(0:255, hist1_before, 'k');
title('Histogram Before (Image 1)');
xlabel('Gray Level'); ylabel('Frequency');
subplot(2,2,4);
bar(0:255, hist1_after, 'k');
title('Histogram After (Image 1)');
xlabel('Gray Level'); ylabel('Frequency');
% --- Display results for Image 2 ---
figure('Name','Image 2 - Built-in histeq');
subplot(2,2,1);
imshow(img2); title('Original Image 2');
subplot(2,2,2);
```

```

imshow(enh2); title('Enhanced Image 2 (Built-in)');
subplot(2,2,3);
bar(0:255, hist2_before, 'k');
title('Histogram Before (Image 2)');
xlabel('Gray Level'); ylabel('Frequency');
subplot(2,2,4);
bar(0:255, hist2_after, 'k');
title('Histogram After (Image 2)');
xlabel('Gray Level'); ylabel('Frequency');
% --- Print mean and std results ---
fprintf('\nImage 1 (Built-in histeq):\nMean before: %.2f, Std before: %.2f\nMean after: %.2f, Std after: %.2f\n', ...
mean_before1, std_before1, mean_after1, std_after1);
fprintf('\nImage 2 (Built-in histeq):\nMean before: %.2f, Std before: %.2f\nMean after: %.2f, Std after: %.2f\n', ...
mean_before2, std_before2, mean_after2, std_after2);

```



The results

Image 1 (Built-in histeq):
Mean before: 197.22, Std before: 40.83
Mean after: 127.68, Std after: 74.97

Image 2 (Built-in histeq):
Mean before: 109.08, Std before: 11.50
Mean after: 127.43, Std after: 74.65