CSC566

LAB 3

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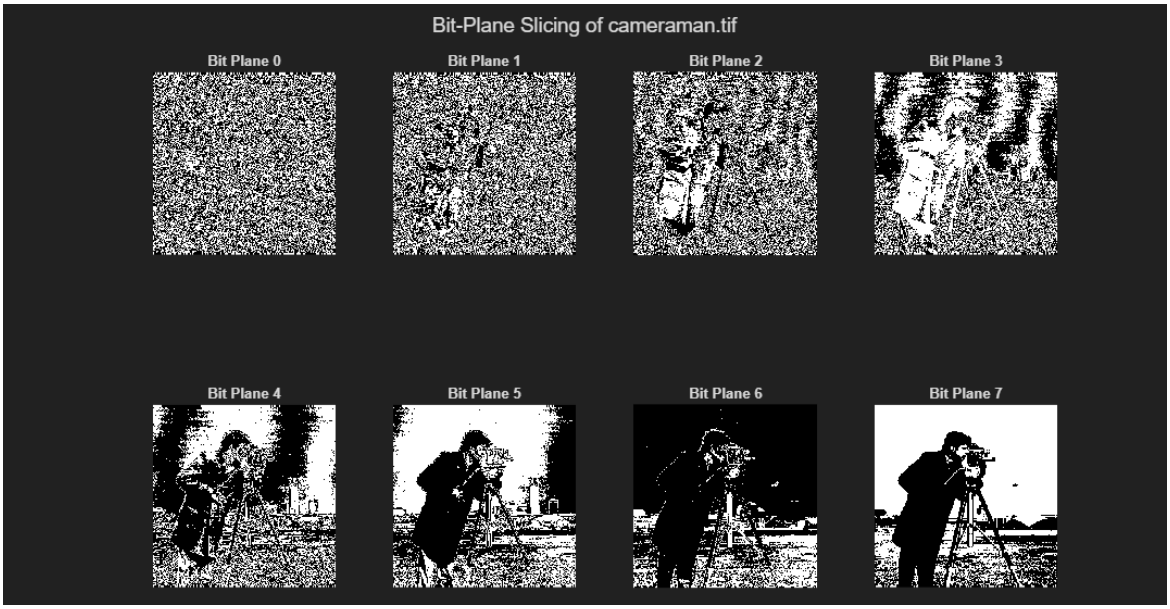
ASSIGNMENT

Assignment 1:

Perform bit-plane slicing on 'cameraman.tif' and display all the bit planes in one figure.

```
% Q1: Perform bit-plane slicing on 'cameraman.tif' and display all the bit planes in
one figure.

% 1. Read the image
I = imread('cameraman.tif');

% 2. Create a new figure window to hold all the subplots
figure('Name', 'Bit Planes of Cameraman.tif');

% 3. Loop through all 8 bit planes (from 0 to 7)
for b = 0:7
    % Calculate the bit plane 'b' using the formula from the document
    bit_plane = mod(floor(double(I) / 2^b), 2);

    % Select the subplot position. We use a 2x4 grid.
    % The index is b+1 because subplot indices start at 1, but our bit plane loop
starts at 0.
    subplot(2, 4, b + 1);

    % Display the binary bit plane image
    imshow(bit_plane, []);

    % Add a title to each subplot to identify which bit plane it is
    title(['Bit Plane ', num2str(b)]);
end

% Adjust the subplot spacing for better visibility
sgtitle('Bit-Plane Slicing of cameraman.tif'); % Add a super title for the whole
figure
```

Result:

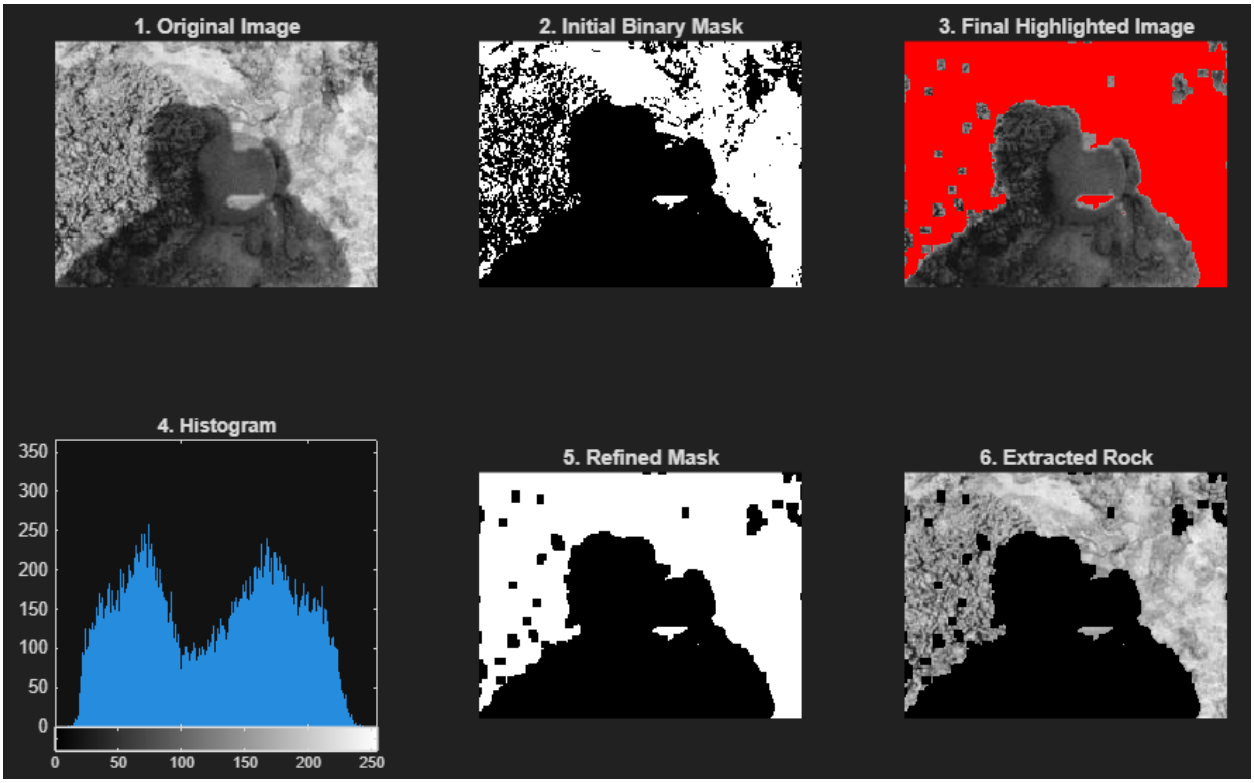

Bit-Plane Slicing of cameraman.tif
Bit Plane 0
Bit Plane 1
Bit Plane 2
Bit Plane 3
Bit Plane 4
Bit Plane 5
Bit Plane 6
Bit Plane 7

Assignment 2:

Extract or highlight the rock object from 'grayrock.jpg' image.

```
% Step 1: Load and analyze the image
I = imread('grayrock.jpg');
if size(I, 3) == 3
    I = rgb2gray(I);
end

figure('Name', 'Rock Extraction Process');
subplot(2, 3, 1); imshow(I); title('1. Original Image');
subplot(2, 3, 4); imhist(I); title('4. Histogram');

% Step 2: Choose a threshold and create a binary mask
threshold = 150;

% If the rock is darker, use: binary_mask = I < threshold;
binary_mask = I > threshold;

subplot(2, 3, 2); imshow(binary_mask); title('2. Initial Binary Mask');

% Step 3: (Optional) Refine the mask
se = strel('disk', 3);
refined_mask = imclose(binary_mask, se);

subplot(2, 3, 5); imshow(refined_mask); title('5. Refined Mask');

% Step 4: Highlight the rock
I_rgb = repmat(I, [1, 1, 3]);
I_rgb = im2double(I_rgb);
refined_mask = im2double(refined_mask);

red_layer = refined_mask;
highlighted_image = I_rgb;
highlighted_image(:, :, 1) = I_rgb(:, :, 1) + red_layer;
highlighted_image(:, :, 2) = I_rgb(:, :, 2) .* (1 - red_layer);
highlighted_image(:, :, 3) = I_rgb(:, :, 3) .* (1 - red_layer);
highlighted_image = min(highlighted_image, 1);

subplot(2, 3, 3); imshow(highlighted_image); title('3. Final Highlighted Image');

extracted_rock = I .* uint8(refined_mask);
subplot(2, 3, 6); imshow(extracted_rock); title('6. Extracted Rock');
```

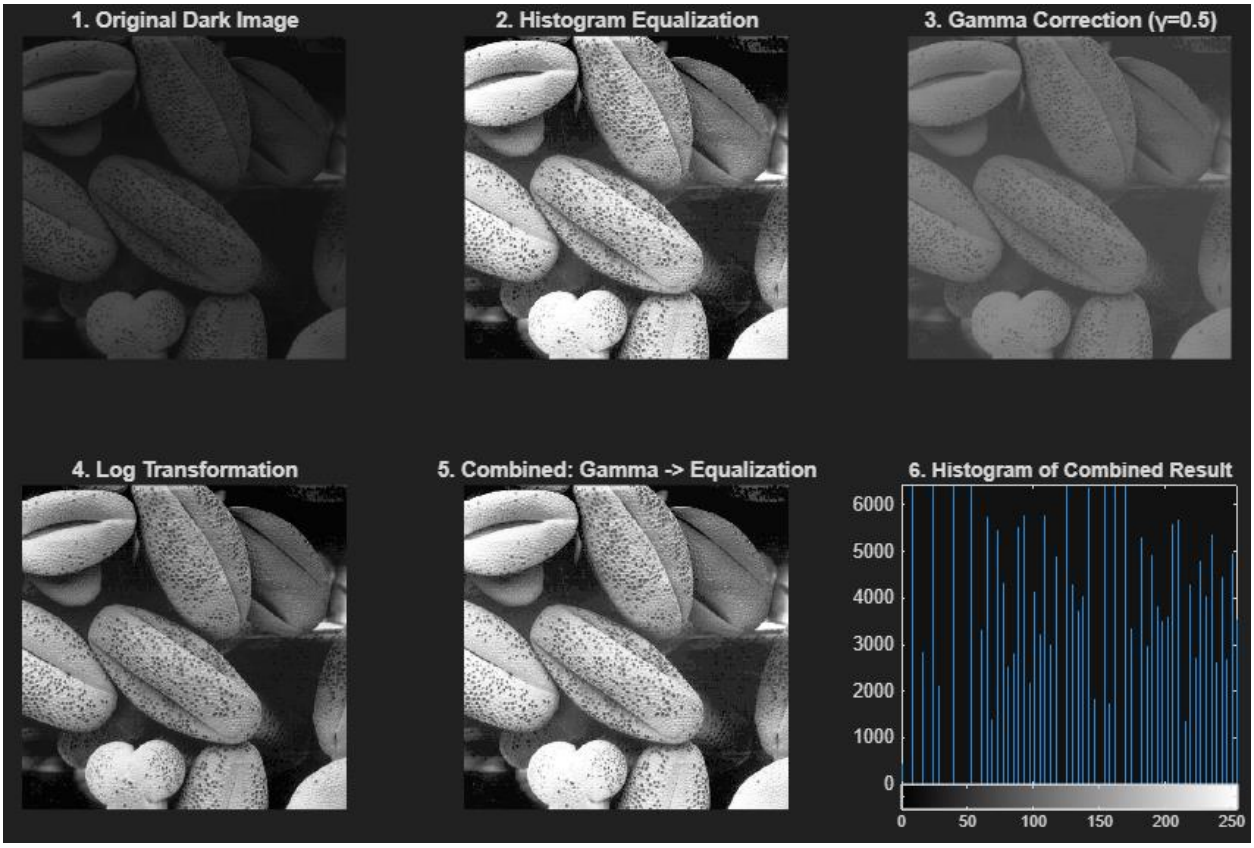
Result:


1. Original Image
2. Initial Binary Mask
3. Final Highlighted Image
4. Histogram
350
300
250
200
150
100
50
0
0
50
100
150
200
250
5. Refined Mask
6. Extracted Rock

Assignment 3:
Double the size of the image and change the bit depth of the image to 16 bits.
Save the image using a new name.

```
% Step 1: Load and analyze the original image
I_dark = imread('darkbean.jpg');
if size(I_dark, 3) == 3
    I_dark = rgb2gray(I_dark);
end

% Create a figure for comparison
figure('Name', 'Final Enhancement Comparison for darkbean.jpg');

% Display Original
subplot(2, 3, 1);
imshow(I_dark);
title('1. Original Dark Image');

% Method 1: Histogram Equalization
I_eq = histeq(I_dark);
subplot(2, 3, 2);
imshow(I_eq);
title('2. Histogram Equalization');

% Method 2: Gamma Correction
I_gamma = imadjust(I_dark, [], [], 0.5);
subplot(2, 3, 3);
imshow(I_gamma);
title('3. Gamma Correction (γ=0.5)');

% Method 3: Log Transformation
I_double = im2double(I_dark);
I_log = mat2gray(log(1 + I_double));
subplot(2, 3, 4);
imshow(I_log);
title('4. Log Transformation');

% Method 4: Combined Approach (Gamma -> Equalization)
I_gamma_step = imadjust(I_dark, [], [], 0.6);
I_combined = histeq(I_gamma_step);
subplot(2, 3, 5);
imshow(I_combined);
title('5. Combined: Gamma -> Equalization');


% Add a final subplot for a histogram of the best result
subplot(2, 3, 6);
imhist(I_combined);
title('6. Histogram of Combined Result');
xlim([0 255]);
```

Result:


1. Original Dark Image
2. Histogram Equalization
3. Gamma Correction (γ=0.5)
4. Log Transformation
5. Combined: Gamma -> Equalization
6. Histogram of Combined Result
6000
5000
4000
3000
2000
1000
0
0
50
100
150
200
250