



CSE 3113 / CSE 3214

INTRODUCTION TO DIGITAL IMAGE PROCESSING

SPRING 2024

Homework 2 Report

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Programming Environment

Programming Language :GNU Octave, version 8.4.0

System Model: VivoBook_ASUSLaptop X515DAP_D515DA

Processor: AMD Ryzen 3 3250U with Radeon Graphics (4 CPUs), ~2.6GHz

Video Card name: AMD Radeon(TM) Graphics

Results

Original



Modified



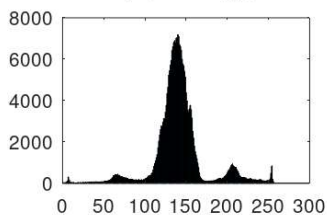
Original



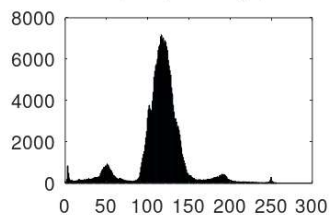
Modified



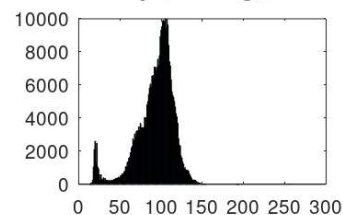
Original Histogram



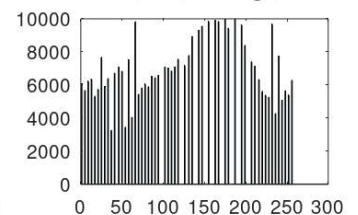
Modified Histogram



Original Histogram



Modified Histogram



Original



Modified



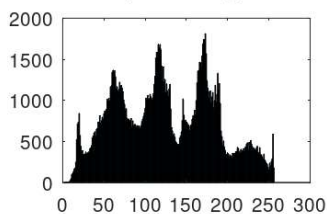
Original



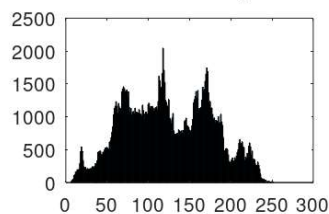
Modified



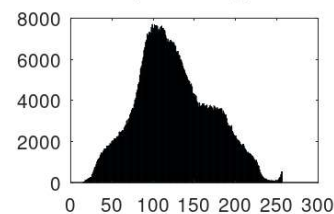
Original Histogram



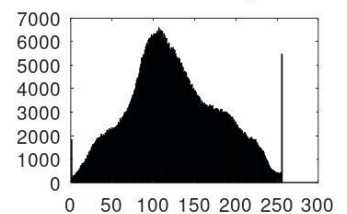
Modified Histogram



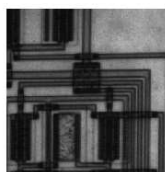
Original Histogram



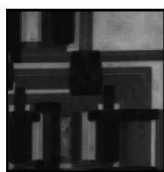
Modified Histogram



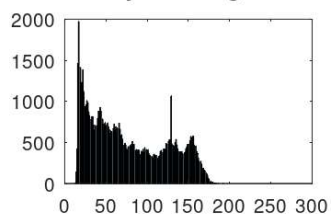
Original



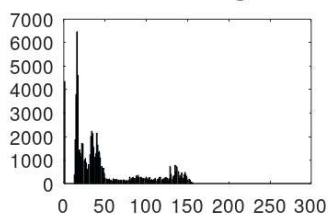
Modified



Original Histogram



Modified Histogram



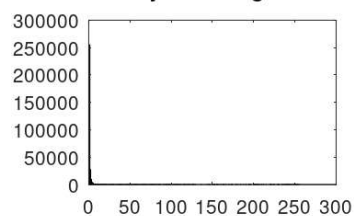
Original



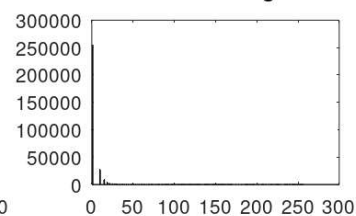
Modified



Original Histogram



Modified Histogram



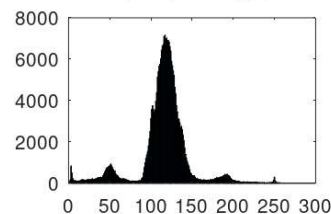
Modified



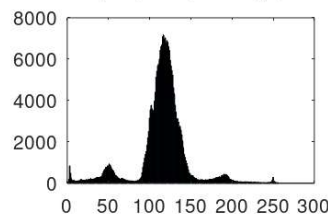
Reproduced



Modified Histogram



Reproduced Histogram



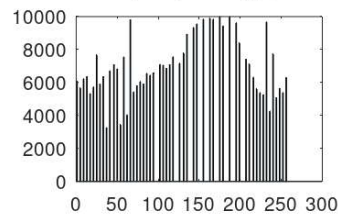
Modified



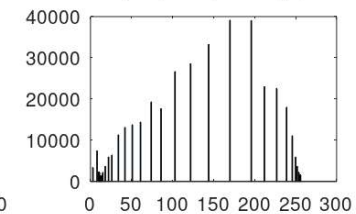
Reproduced



Modified Histogram



Reproduced Histogram



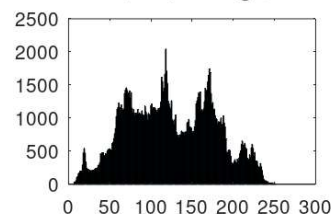
Modified



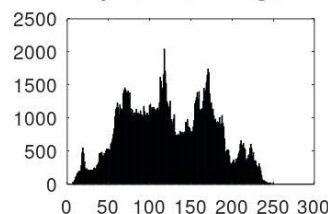
Reproduced



Modified Histogram



Reproduced Histogram



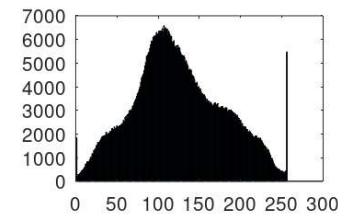
Modified



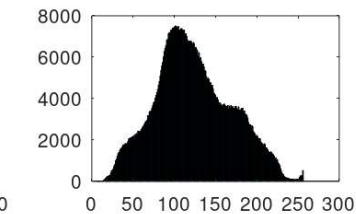
Reproduced

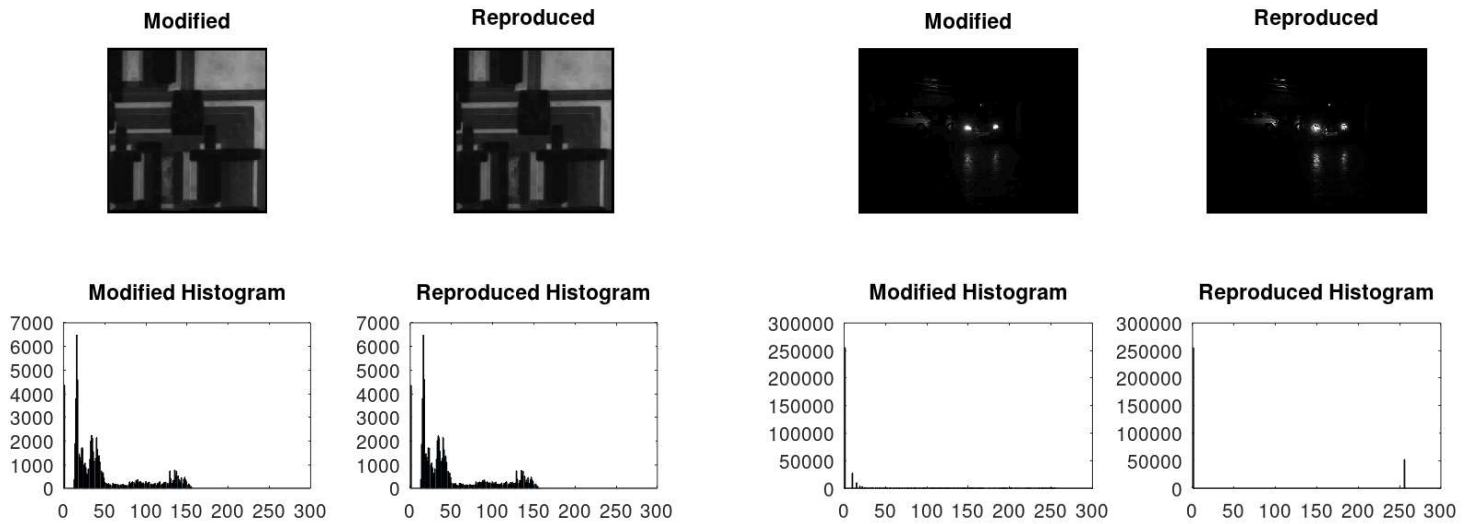


Modified Histogram



Reproduced Histogram





Discussion

A)

- Spatial Domain Technique: The modification applied here is taking the complement of the original image.
- Parameters: I did not give any parameters.
- Result: The reproduced image is exactly the same as the modified one.

B)

- Spatial Domain Technique: Histogram equalization was used.
- Parameters: I did not give any parameters.
- Result: The reproduced image is an approximation of the modified one.

C)

- Spatial Domain Technique: Blurring using an average filter.
- Parameters: The size of the blurring filter (w) is set to 15.
- Result: The reproduced image is exactly the same as the modified one.

D)

- Spatial Domain Technique: Sharpening by subtracting Laplacian of the original image from the original.
- Parameters: Laplacian filter set $f = \begin{bmatrix} 0.1667 & 0.6667 & 0.1667 \\ 0.6667 & -3.3333 & 0.6667 \\ 0.1667 & 0.6667 & 0.1667 \end{bmatrix}$.
- Result: The reproduced image is an approximation of the modified one.

E)

- Spatial Domain Technique: Applying Minimum filter.
- Parameters: A 9X9 minimum filter is used.
- Result: The reproduced image is exactly the same as the modified one.

F)

- Spatial Domain Technique: Bit-plane Slicing.
- Parameters: I did not give any parameters.
- Result: The reproduced image is an approximation of the modified one.

Reflections

I tried to do it using the opencv library in python, but I had to use Gnu Octave because some values caused problems. When using Gnu octave, I used normal histogram equation because there is no CLAHE(for B).

Source Code

```
originalA = imread('./Original_Photos/A_original.png');
originalB = imread('./Original_Photos/B_original.png');
originalC = imread('./Original_Photos/C_original.png');
originalD = imread('./Original_Photos/D_original.png');
originalE = imread('./Original_Photos/E_original.png');
originalF = imread('./Original_Photos/F_original.png');

modifiedA = imread('./Modified_Photos/A_modified.png');
modifiedB = imread('./Modified_Photos/B_modified.png');
modifiedC = imread('./Modified_Photos/C_modified.png');
modifiedD = imread('./Modified_Photos/D_modified.png');
modifiedE = imread('./Modified_Photos/E_modified.png');
modifiedF = imread('./Modified_Photos/F_modified.png');

% A's operation
reproducedA = imcomplement(originalA);

figure, subplot(1,3,1), imshow(originalA), title('Original');
subplot(1,3,2), imshow(modifiedA),title('Modified')
subplot(1,3,3), imshow(reproducedA), title('Reproduced'); %display

% A' s process by taking complement

%B's operation
reproducedB= histeq(originalB);

figure, subplot(1,3,1), imshow(originalB), title('Original');
subplot(1,3,2), imshow(modifiedB),title('Modified')
subplot(1,3,3), imshow(reproducedB), title('Reproduced'); %display
```

%B's operation is CLAHE but i did not find in octave

%C's operation

w=15; %size of blurring filter

f=fspecial('average',w); %create a blurring filter

reproducedC=imfilter(originalC,f); %blur the original image

figure, subplot(1,3,1), imshow(originalC), title('Original');

subplot(1,3,2), imshow(modifiedC),title('Modified')

subplot(1,3,3), imshow(reproducedC), title('Reproduced'); %display

%C's operation is blurring

%D's operation

f=[0.1667 0.6667 0.1667; 0.6667 -3.3333 0.6667; 0.1667 0.6667 0.1667]

llap=imfilter(originalD,f);

reproducedD=imsubtract(originalD,llap);

figure, subplot(1,3,1), imshow(originalD), title('Original');

subplot(1,3,2), imshow(modifiedD),title('Modified')

subplot(1,3,3), imshow(reproducedD , []), title('Reproduced'); %display

%D's operation is sharpening

%E's operation

reproducedE = ordfilt2(originalE,1,true(9));

figure, subplot(1,3,1), imshow(originalE), title('Original');

subplot(1,3,2), imshow(modifiedE),title('Modified')

subplot(1,3,3), imshow(reproducedE), title('Reproduced'); %display

%E's operation is Min filtere

%F's operation

reproducedF = zeros(size(originalF));

for i = 1:6

bit_i = double(bitget(originalF,i));

*bit_i_shifted = bit_i * 2^(i-1);*

reproducedF = reproducedF + bit_i_shifted;

end

figure, subplot(1,3,1), imshow(originalF), title('Original');

subplot(1,3,2), imshow(modifiedF),title('Modified')

subplot(1,3,3), imshow(reproducedF,[]), title('Reproduced'); %display

%F's operation is bitplane slicing