Batch: C1 Roll No.:_ 16010121221

Experiment No. 4

Grade: AA / AB / BB / BC / CC / CD /DD

Signature of the Staff In-charge with date

Title: Implement the following point processing techniques in spatial domain:

- Image Negative.
- Thresholding.
- Gray level slicing with and without background
- Bit plane slicing

Objective: To learn & understand point processing techniques.

Expected Outcome of Experiment:

CO	Outcome
CO4	Design & implement algorithms for digital image enhancement, segmentation & restoration.

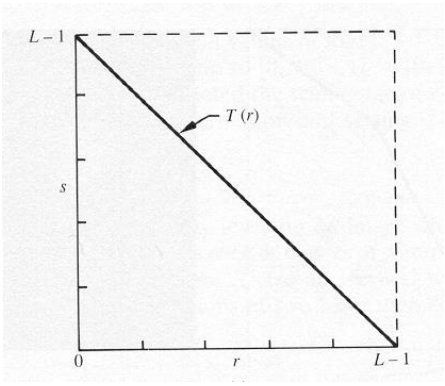
Books/ Journals/ Websites referred:

1. http://www.mathworks.com/support/
2. www.math.mtu.edu/~msgocken/intro/intro.html.
3. R. C.Gonsales R.E.Woods, “Digital Image Processing”, Second edition, Pearson Education
4. S.Jayaraman, S Esakkirajan, T Veerakumar “Digital Image Processing “Mc Graw Hill.
5. S.Sridhar,”Digital Image processing”, oxford university press, 1st edition."

Pre Lab/ Prior Concepts:

Image Negative:

Negative images are useful for enhancing white or grey detail embedded in dark regions of an image. Image negatives are obtained by using the transformation function s=T(r).

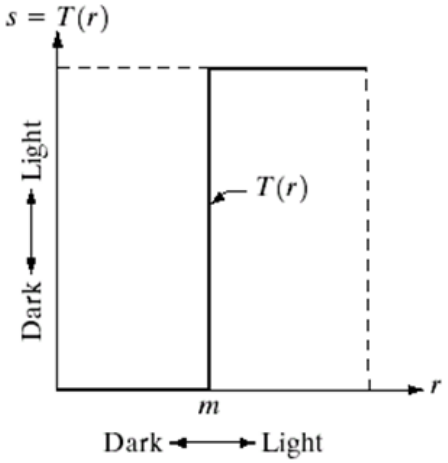


[0,L-1] is the range of gray levels

$S = L\text{-}1\text{-}r$

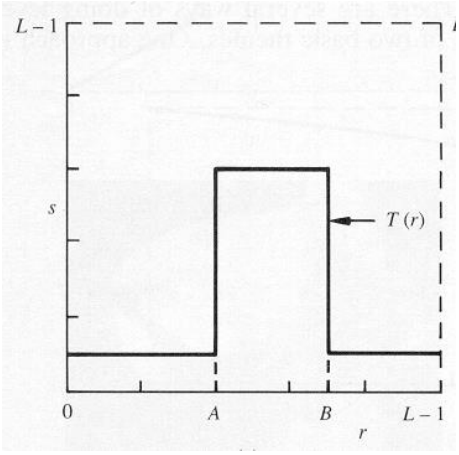
Thresholding

From a grayscale image, thresholding can be used to create binary images. The simplest thresholding methods replace each pixel in an image with a black pixel if the image intensity is less than some fixed constant T or a white pixel if the image intensity is greater than that constant.

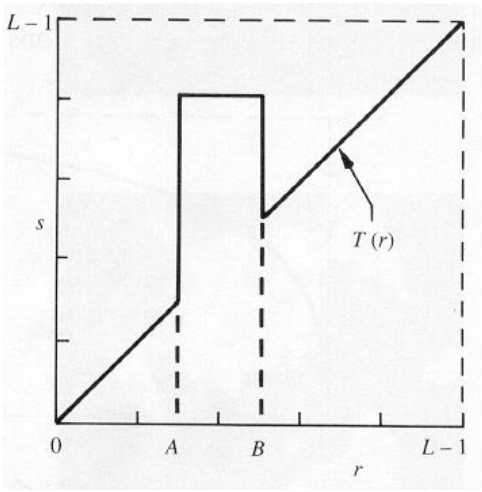


Gray Level Slicing

To highlight a specific range of gray levels in an image (e.g. to enhance certain features). One way is to display a high value for all gray levels in the range of interest and a low value for all other gray levels (binary image).

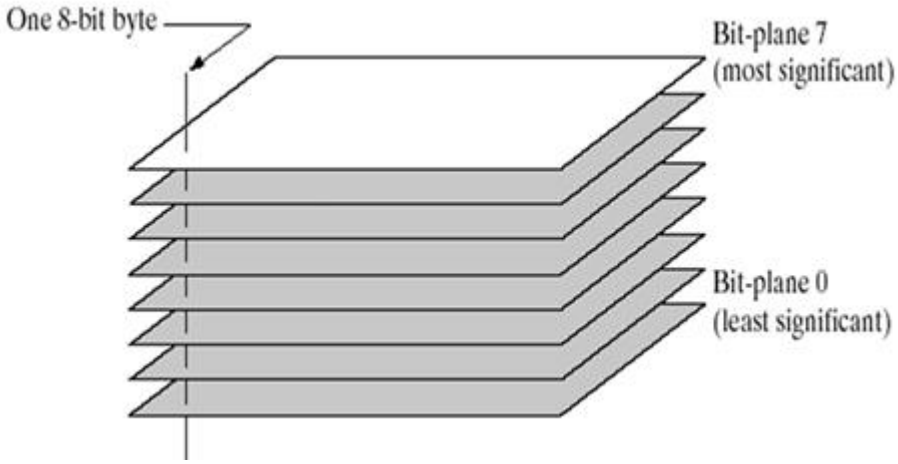


The second approach is to brighten the desired range of gray levels but preserve the background and gray-level tonalities in the image:



Bit plane slicing

Bit plane slicing is used to highlight the contribution made to the total image appearance by specific bits. Assuming that each pixel is represented by 8 bits, the image is composed of 8 1-bit planes. Plane 0 contains the least significant bit and plane 7 contains the most significant bit. Only the higher order bits (top four) contain visually significant data. The other bit planes contribute the more subtle details. Plane 7 corresponds exactly with an image thresholded at gray level 128.

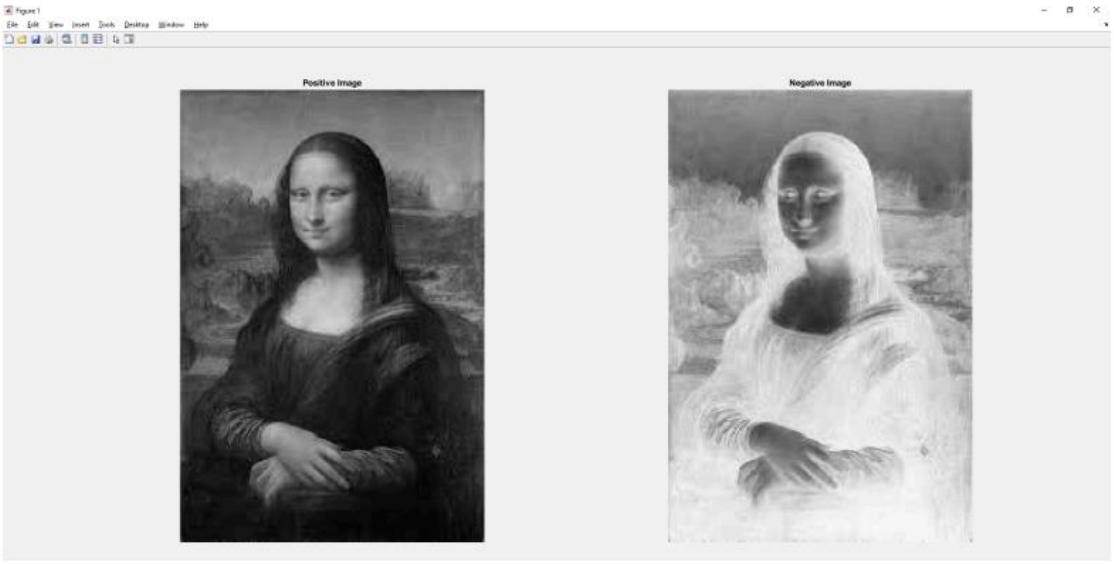


Implementation steps with screenshots:

1) Digital Negative:

```
clear all;
close all;
A = imread('C:/Users/kjsce/Downloads/download.jpg');
A = rgb2gray(A);
z = 255 - A;
figure(1);
subplot(1,2,1)
imshow(A);
title("Positive Image");
subplot(1,2,2)
imshow(z);
title("Negative Image");
```

Output:

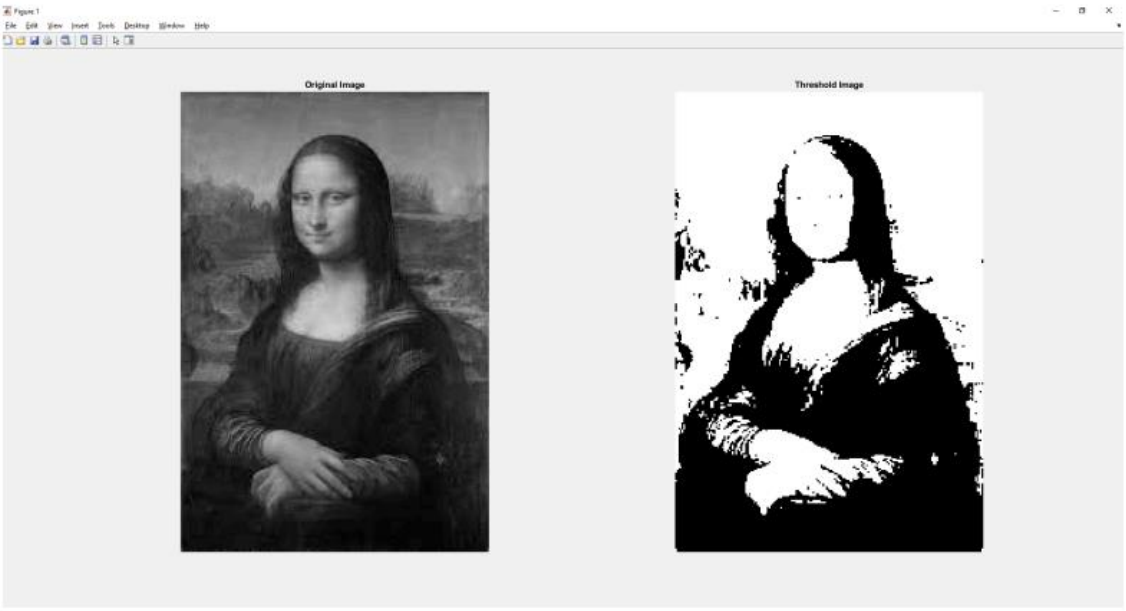


2)Thresholding:

```
clear all;
close all;
A = imread('C:/Users/kjsce/Downloads/download.jpg');
A = rgb2gray(A);
P = A;
[r c] = size(A)
T = input('Enter the value of threshold: ');
for i=1:1:r
for j=1:1:c
if(P(i,j)<T)
A(i,j) = 0;
else
A(i,j) = 255;
end
end
```

```
end
figure(1);
subplot(1,2,1)
imshow(P);
title("Original Image");
subplot(1,2,2)
imshow(A);
title("Threshold Image");
```

Output:

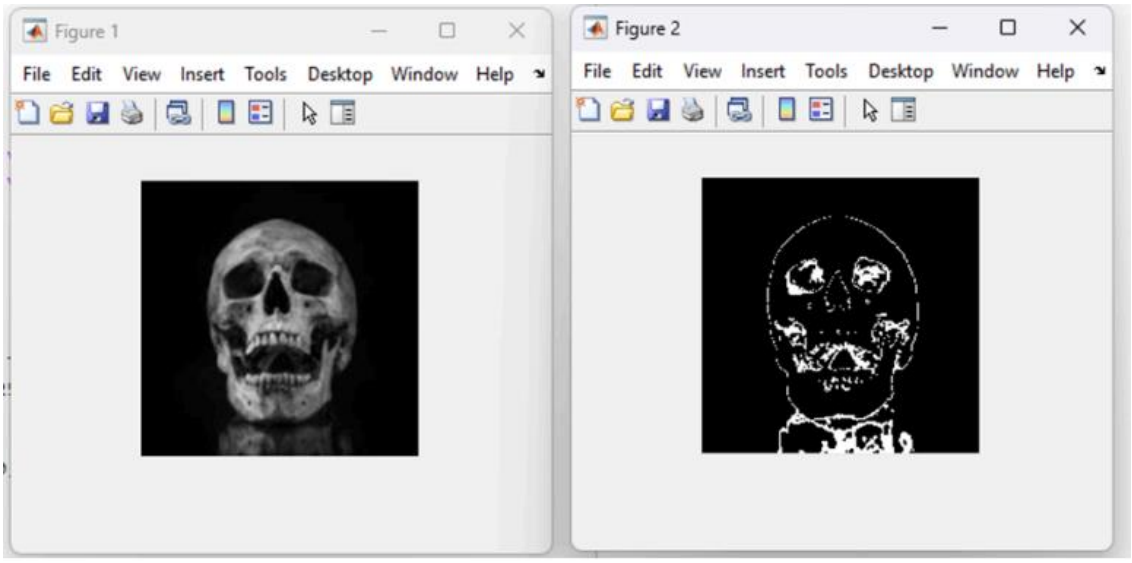


3)Grey-level slicing (With Background):

```
clear all;
close all;
A = imread('C:/Users/kjsce/Downloads/download.jpg');
A = rgb2gray(A);
P = A;
[r c] = size(A)
```

```
T1 = input('Enter the value of threshold T1: ');

T2 = input('Enter the value of threshold T2: ');

for i=1:1:r

for j=1:1:c

if((P(i,j)>=T1) && (P(i,j)<=T2)) %without background

A(i,j) = 255;

else

A(i,j) = 0;

end

end

end

figure(1);

subplot(1,2,1)

imshow(P);

title("Original Image");

subplot(1,2,2)

imshow(A);

title("Gray Level Slicing Image");
```

Output:

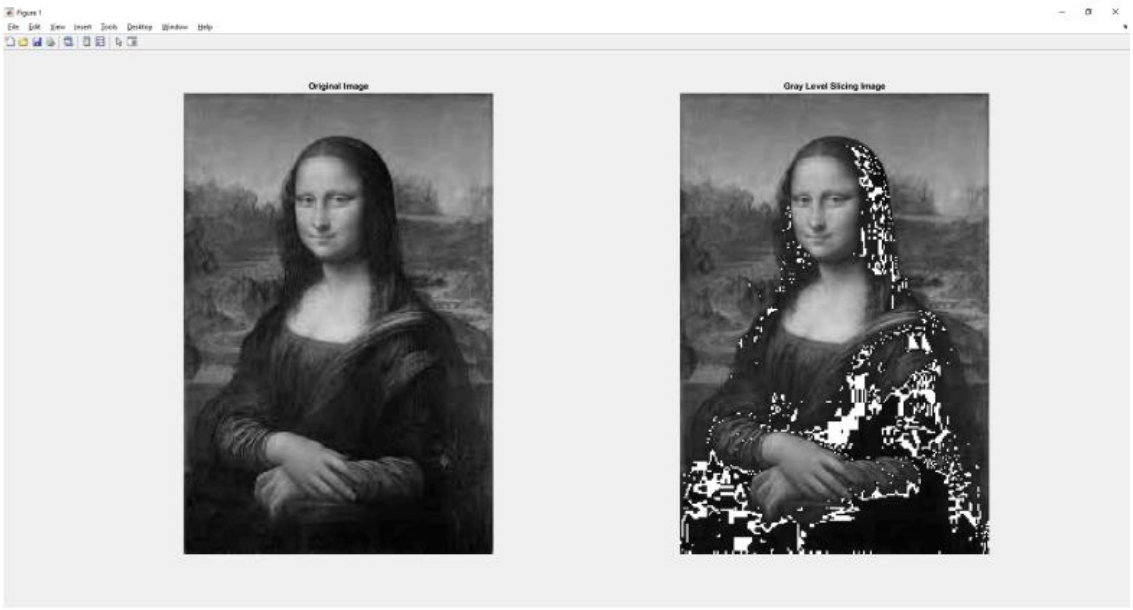


3b) Gray-level slicing(without background):

```
clear all;
close all;
A = imread('C:/Users/kjsce/Downloads/download.jpg');
A = rgb2gray(A);
P = A;
[r c] = size(A)
T1 = input('Enter the value of threshold T1: ');
T2 = input('Enter the value of threshold T2: ');
for i=1:1:r
for j=1:1:c
if((P(i,j)>=T1) && (P(i,j)<=T2)) %with background
A(i,j) = 255;
else
A(i,j) = P(i,j);
end
end
end
```

```
figure(1);
subplot(1,2,1)
imshow(P);
title("Original Image");
subplot(1,2,2)
imshow(A);
title("Gray Level Slicing Image");
```

Output:



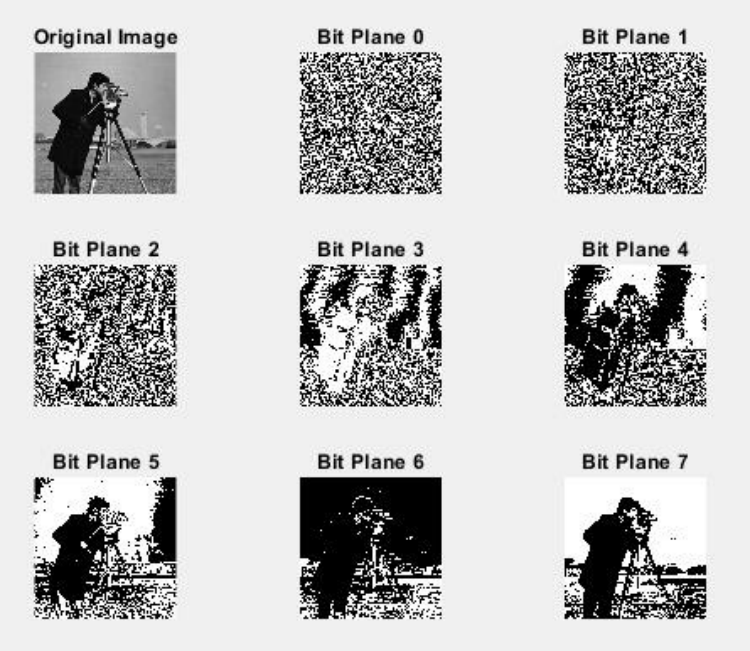
4) Bit plane slicing:

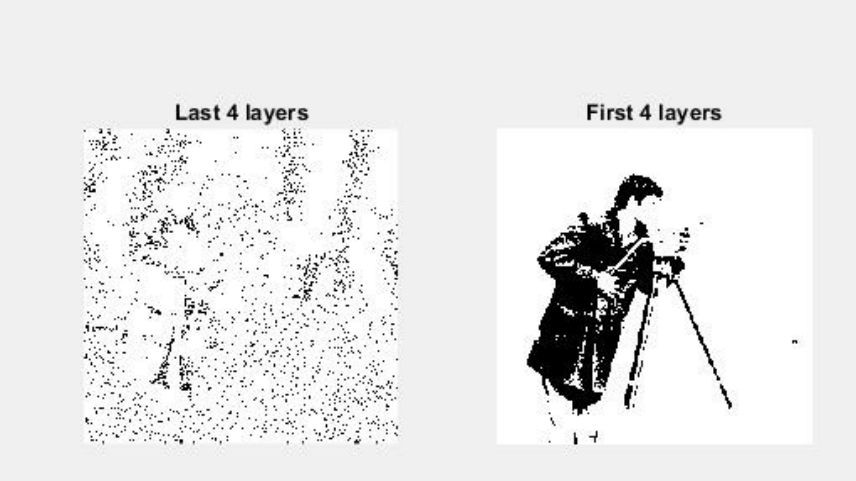
```
i = imread('cameraman.tif');
b0 = double(bitget(i, 1));
b1 = double(bitget(i, 2));
b2 = double(bitget(i, 3));
b3 = double(bitget(i, 4));
b4 = double(bitget(i, 5));
```

```
b5 = double(bitget(i, 6));
b6 = double(bitget(i, 7));
b7 = double(bitget(i, 8));
subplot(3,3,1);
imshow(i);
title('Original Image');
subplot(3,3,2);
imshow(b0);
title('Bit Plane 0');
subplot(3,3,3);
imshow(b1);
title('Bit Plane 1');
subplot(3,3,4);
imshow(b2);
title('Bit Plane 2');
subplot(3,3,5);
imshow(b3);
title('Bit Plane 3');
subplot(3,3,6);
imshow(b4);
title('Bit Plane 4');
subplot(3,3,7);
imshow(b5);
title('Bit Plane 5');
subplot(3,3,8);
imshow(b6);
```

```
title('Bit Plane 6');
subplot(3,3,9);
imshow(b7);
title('Bit Plane 7');
subplot(1,2,1);
imshow(b0+b1+b2+b3);
title("Last 4 layers");
subplot(1,2,2);
imshow(b4+b5+b6+b7);
title("First 4 layers");
```

Output:





Conclusion:-

Following point processing techniques were implemented in Matlab:

- Image Negative.
- Thresholding.
- Gray level slicing with and without background
- Bit plane slicing.

Date: _____18/02/2024_____ **Signature of faculty in-charge**

Post Lab Descriptive Questions

1. Explain the role of bit plane slicing in achieving Steganography concept.

Ans) BPCS-steganography (Bit-Plane Complexity Segmentation steganography) is a type of digital steganography.

Digital steganography can hide confidential data (i.e. secret files) very securely by embedding them into some media data called "vessel data." The vessel data is also referred to as "carrier, cover, or dummy data". In BPCS-steganography true color images (i.e., 24-bit color images) are mostly used for vessel data. The embedding operation in practice is to replace the "complex areas" on the bit planes of the vessel image with the confidential data. The most important aspect of BPCS-steganography is that the embedding capacity is very large. In comparison to simple image based steganography

which uses solely the least important bit of data, and thus (for a 24-bit color image) can only embed data equivalent to 1/8 of the total size, BPCS-steganography uses multiple bit-planes, and so can embed a much higher amount of data, though this is dependent on the individual image. For a 'normal' image, roughly 50% of the data might be replaceable with secret data before image degradation becomes apparent.

2. Explain the use of gray level slicing.

Ans) Gray level slicing is a technique used in image processing to extract a set of pixels from an image based on their gray level values. This technique can be used to select a specific range of gray levels from an image, or to select all pixels with a gray level value above or below a certain threshold.
Gray level slicing is commonly used in image processing tasks such as image thresholding, where a specific range of gray levels is selected from an image and all other pixels are set to black or white. This technique can also be used to extract features from an image, or to remove background noise.

In a photograph, a gray level ranges from gray to black to red. Slicing is a type of filtering that takes band passes to a different level. Rest or maintaining the intensity level at the same level is used for controlling the effect. Bit plane slicing is an approach that generates binary images by converting gray-level images into binary. Every grey level's map is made up of high-quality maps calculated from a variety of factors. A bit plane is a position in digital discrete signals such as images or sounds in binary numbers. Photos with log transformations show darker patches of the image. Identity transformation is the process of changing one's identity.