Experiment No.: 03

Experiment Name: Experimental Analysis of Image Enhancement in Spatial Domain Through Gray Scale Transformation and Piecewise Linear Transformation.

Objectives:

- To know about different types of images.
- To know about image enhancement through gray scale transformation.
- To know about Piecewise Linear Transformation.

1.1 Theory:

Enhancing an image provides better contrast and a more detailed image as compare to non-enhanced image. Image enhancement has very applications. It is used to enhance medical images, images captured in remote sensing, images from satellite etc.

The transformation function has been given as,

$$S = T(r)$$

where r is the pixels of the input image and s is the pixels of the output image. T is a transformation function that maps each value of r to each value of s. Image enhancement can be done through gray level transformations which are discussed below.

There are three basic gray level transformation,

- Linear
- Logarithmic
- Power – law

The gray level of each pixel in a digital image is stored as one or more bytes in a computer. For an 8-bit image, 0 is encoded as 00000000 and 255 is encoded as 11111111. Any number between 0 to 255 is encoded as one byte.

The bit in the far-left side is referred as the Most Significant Bit (MSB) because a change in that bit would significantly change the value encoded by the byte.

The bit in the far right is referred as the Least Significant Bit (LSB), because a change in this bit does not change the encoded gray value much.

1	0	1	0	0	1	1	1
MSB	7^{th} bit	6^{th} bit	5^{th} bit	4^{th} bit	3^{rd} bit	2^{nd} bit	LSB

1.2 Equipment:

- Computer
- MATLAB Software
- Images

1.3 Problems:

i. Piecewise Linear Transformation (Bit Plane Slicing).

Code:

```
clc;
clear;

A=imread('kobi.png');

subplot(2,4,1);
B=double(bitget(A,1));
imshow((B));
title('Bit plane 1 : LSB ', 'FontSize', 20);

subplot(2,4,2);
B=double(bitget(A,2));
imshow((B));
title('Bit plane 2', 'FontSize', 20);

subplot(2,4,3);
B=double(bitget(A,3));
imshow((B));
title('Bit plane 3', 'FontSize', 20);

subplot(2,4,4);
B=double(bitget(A,4));
imshow((B));
title('Bit plane 4', 'FontSize', 20);

subplot(2,4,5);
B=double(bitget(A,5));
imshow((B));
title('Bit plane 5', 'FontSize', 20);

subplot(2,4,6);
B=double(bitget(A,6));
imshow((B));
title('Bit plane 6', 'FontSize', 20);

subplot(2,4,7);
B=double(bitget(A,7));
imshow((B));
title('Bit plane 7', 'FontSize', 20);

subplot(2,4,8);
B=double(bitget(A,8));
imshow((B));
title('Bit plane 8 : MSB', 'FontSize', 20);
```

Output:

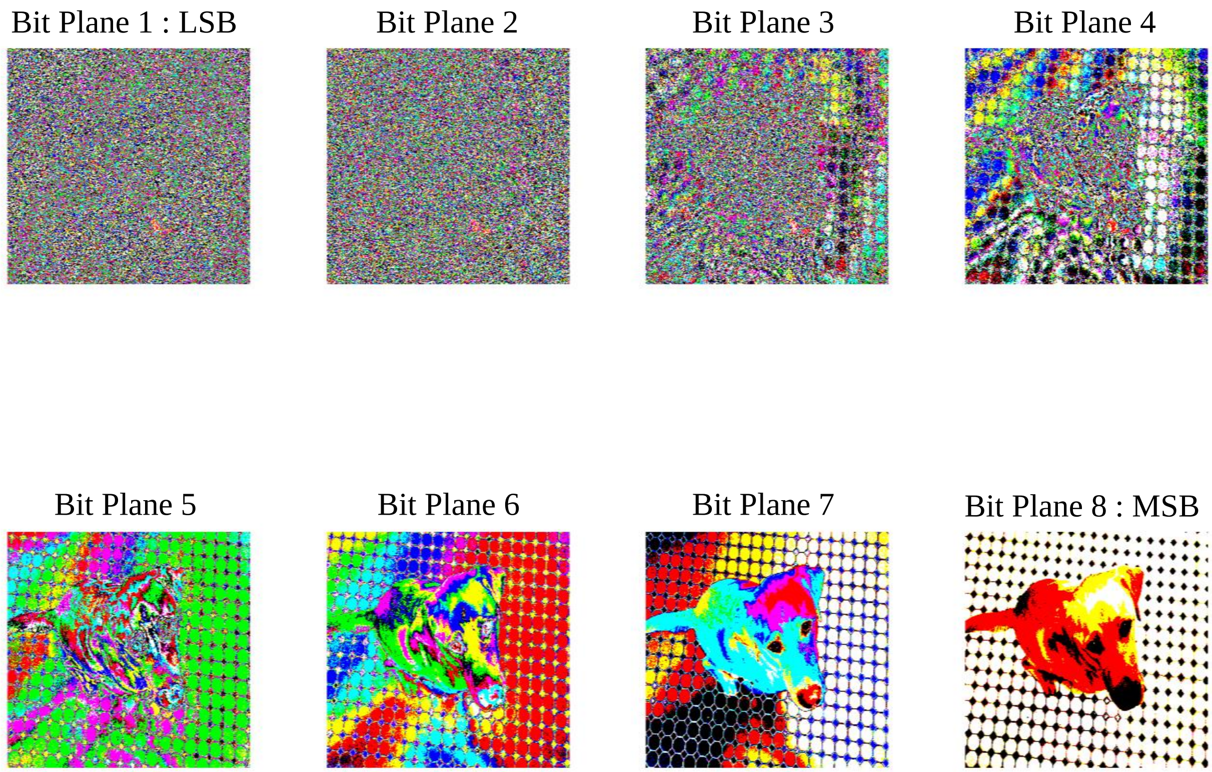

Fig 01: Bit Plane Slicing of an Image

1.4 Discussion:

In this experiment, we have analyzed image enhancement in spatial domain through gray scale transformation and piecewise linear transformation. First, we read an image from MATLAB built-in image. Then we perform bit plane slicing on the image where we divided the image into 8 planes. It is seen that the first bit plane gives the roughest but the most critical approximation of values of a medium, and the higher the number of the bit plane, the less is its contribution to the final stage. Thus, adding a bit plane gives a better approximation.