# LAB – 4

Name: Gandevia Keval Dharmeshbhai

Sem: VII

Roll No: CE046

Subject: Image Processing

**Aim:** Implement following image enhancement techniques: Intensity level slicing, Bit plane slicing & Reconstruction, Histogram Equalization.

## Q. 1: Take your own photo and separate out its bit planes.

### (a) Reconstruct your image using higher order 2-bit planes.

### (b) Reconstruct your image using higher order 4-bit planes.

### (c) Experiment with bit planes and derive your conclusions.

❖ **Conclusion:**

- ✓ Through bit plane slicing we can reconstruct an image with one or more number of bits used for each pixel.
- ✓ If we want to reconstruct an image with 2-bit plane then we need to take the 2 higher order planes for example C8 and C7.
- ✓ By taking more and more bit planes we get more and more enhanced image.

## ❖ Code:

```
img = imread("dollar_img.jpg");
img = rgb2gray(img);
img = double(img);

subplot(3, 4, 1);
imshow(img, []);
title("Original Image");

c1 = mod(img, 2);
c2 = mod(floor(img/2), 2);
c3 = mod(floor(img/4), 2);
c4 = mod(floor(img/8), 2);
c5 = mod(floor(img/16), 2);
c6 = mod(floor(img/32), 2);
c7 = mod(floor(img/64), 2);
c8 = mod(floor(img/128), 2);

subplot(3, 4, 2);
imshow(c1, []);
title("Bit Plane - 1");

subplot(3, 4, 3);
imshow(c2, []);
title("Bit Plane - 2");

subplot(3, 4, 4);
imshow(c3, []);
title("Bit Plane - 3");

subplot(3, 4, 5);
imshow(c4, []);
title("Bit Plane - 4");

subplot(3, 4, 6);
imshow(c5, []);
title("Bit Plane - 5");

subplot(3, 4, 7);
imshow(c6, []);
title("Bit Plane - 6");

subplot(3, 4, 8);
imshow(c7, []);
title("Bit Plane - 7");
```

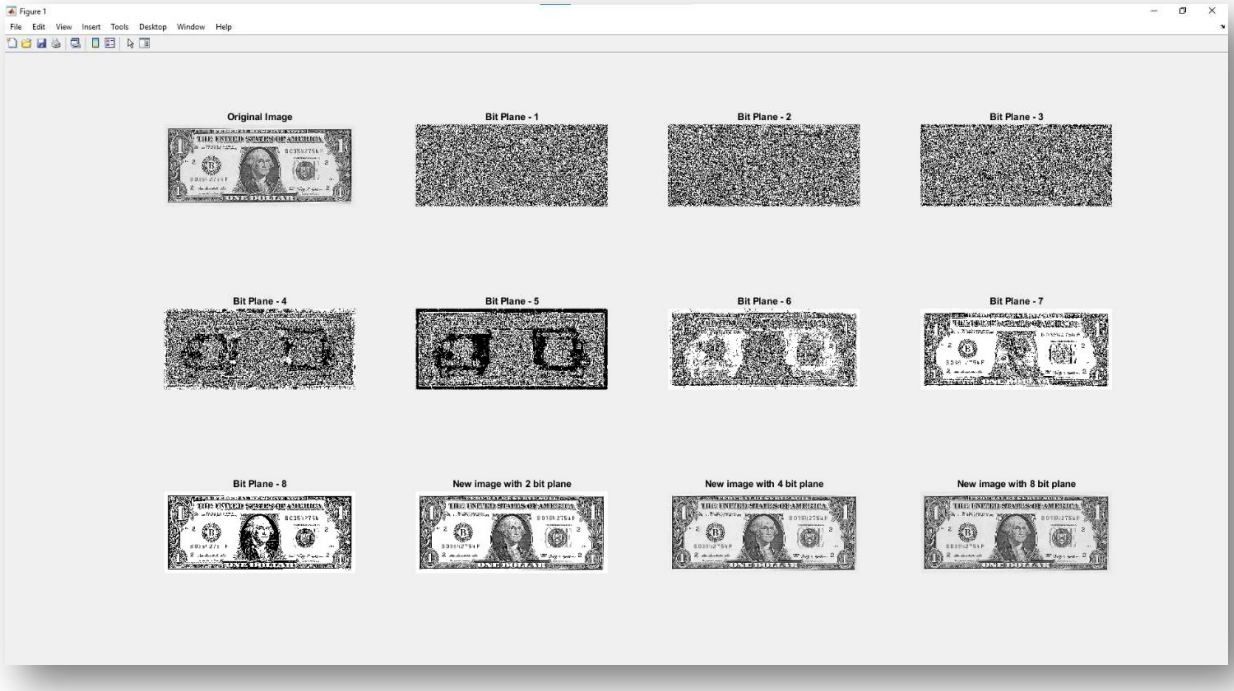
```
subplot(3, 4, 9);
imshow(c8, []);
title("Bit Plane - 8");


new_img = (c8 * power(2, 7)) + (c7 * power(2, 6));
subplot(3, 4, 10);
imshow(new_img, []);
title("New image with 2 bit plane");

new_img_1 = (c8 * power(2, 7)) + (c7 * power(2, 6)) + (c6 * power(2, 5)) + (c5 * power(2, 4));
subplot(3, 4, 11);
imshow(new_img_1, []);
title("New image with 4 bit plane");

new_img_2 = (c8 * power(2, 7)) + (c7 * power(2, 6)) + (c6 * power(2, 5)) + (c5 * power(2, 4)) + (c4 * power(2, 3)) + (c3 * power(2, 2)) + (c2 * power(2, 1)) + (c1 *
subplot(3, 4, 12);
imshow(new_img_2, []);
title("New image with 8 bit plane");
```

❖ **Output:**




## Q. 2: Consider the image kidney.tif and perform intensity level slicing transformation within the range (150-230).

### (a) Highlight the given intensity range and keep all other intensities to a lower level.

❖ **Code:**

a_2_1.m | a_2_2.m | a_3.m

```
1  img = imread("kidney.tif");
2  subplot(2, 2, 1);
3  imshow(img);
4  title("Original image");
5  [r, c] = size(img);
6
7  for i = 1 : r
8      for j = 1 : c
9          if(img(i, j) >= 150 && img(i, j) <= 230)
10             new_img(i, j) = 255;
11         else
12             new_img(i, j) = 0;
13         end
14     end
15 end
16
17 subplot(2, 2, 2);
18 imshow(new_img);
19 title("Output image");
```

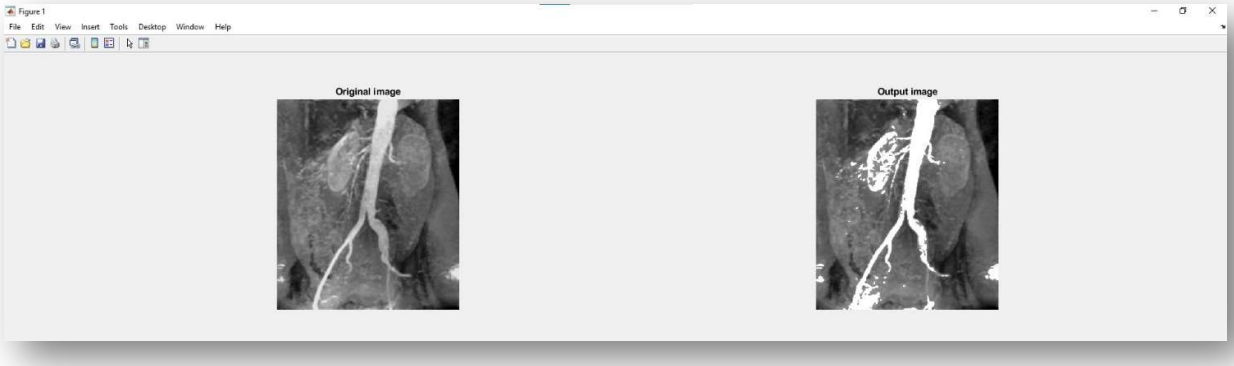
## ❖ Output:

## (b) Highlight the given intensity range and keep all other intensities as it is.

- **Code:**

```
a_2_1.m | a_2_2.m | a_3.m | +
1  img = imread("kidney.tif");
2
3  subplot(2, 2, 1);
4  imshow(img);
5  title("Original image");
6
7  [r, c] = size(img);
8
9  for i = 1 : r
10     for j = 1 : c
11         if(img(i, j) >= 150 && img(i, j) <= 230)
12             new_img(i, j) = 255;
13         else
14             new_img(i, j) = img(i, j);
15         end
16     end
17 end
18
19 subplot(2, 2, 2);
20 imshow(new_img, []);
21 title("Output image");
```

- **Output:**




## Q. 3: Can two visually different image have same histogram? If yes synthesize two grayscale images which are visually different but having the same histogram and also show the histogram. If no justify the answer.

### ❖ Conclusion:

- ✓ Certainly yes. Different images have same histogram. If we consider the different images with all of have the same white and black number of pixels then histogram of the all images would be same.

### ❖ Code:

```
r = 10;
c = 10;

for i = 1 : r
    for j = 1 : c
        if(mod(j, 2) == 1)
            new_img_1(i, j) = 0;
        else
            new_img_1(i, j) = 255;
        end
    end
end

for i = 1 : r
    for j = 1 : c
        if(j <= 5)
            new_img_2(i, j) = 0;
        else
            new_img_2(i, j) = 255;
        end
    end
end

for i = 1 : r
    for j = 1 : c
        if(mod(i, 2) == 1 && mod(j, 2) == 1)
            new_img_3(i, j) = 0;
        elseif(mod(i, 2) == 1 && mod(j, 2) == 0)
            new_img_3(i, j) = 255;
        elseif(mod(i, 2) == 0 && mod(j, 2) == 1)
            new_img_3(i, j) = 255;
        elseif(mod(i, 2) == 0 && mod(j, 2) == 0)
            new_img_3(i, j) = 0;
        end
    end
end
```

```
subplot(2, 3, 1);
imshow(new_img_1);
title("First image");

subplot(2, 3, 2);
imshow(new_img_2);
title("Second image");

subplot(2, 3, 3);
imshow(new_img_3);
title("third image");

subplot(2, 3, 4);
histogram(uint8(new_img_1));
title("Histogram of first image");

subplot(2, 3, 5);
histogram(uint8(new_img_2));
title("Histogram of second image");

subplot(2, 3, 6);
```

```
histogram(uint8(new_img_3));
title("Histogram of third image");
```

## ❖ Output:

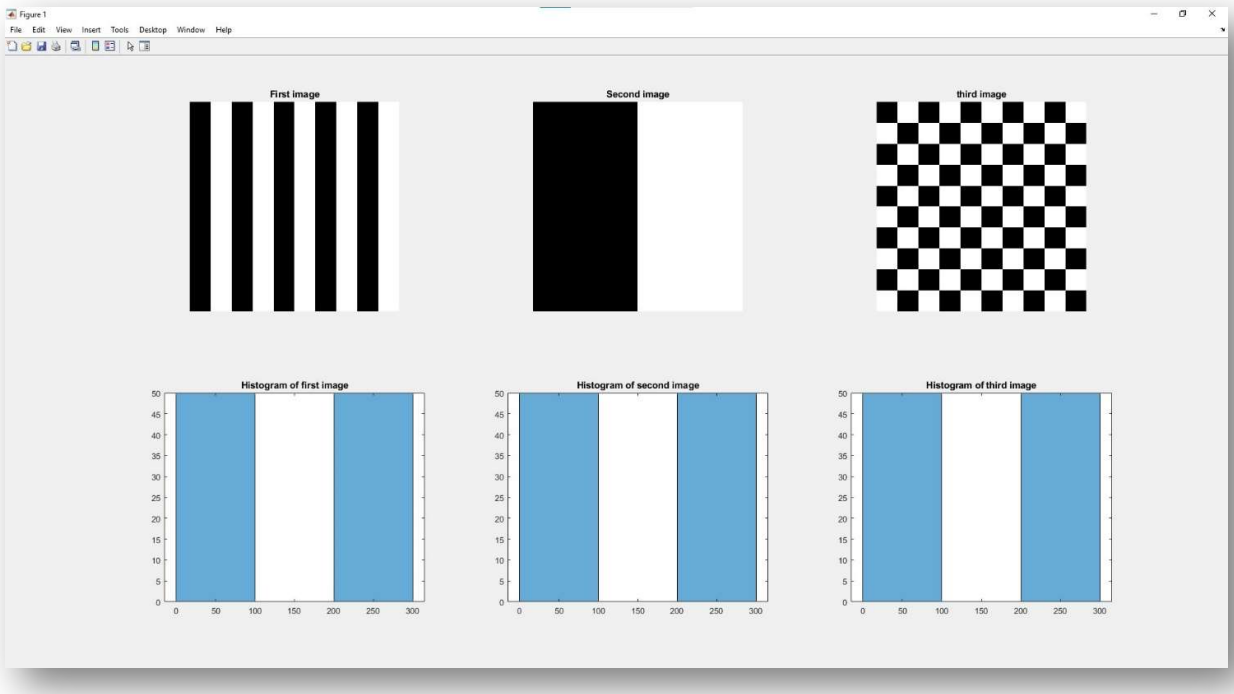


Figure 1
File Edit View Insert Tools Desktop Window Help
First image
Second image
third image
Histogram of first image
Histogram of second image
Histogram of third image