Subject Name: Digital Image Processing
Code: MTCS-202 (C)
M.Tech (Computer Science)
2nd Semester
Faculty Name: Dr Satya Bhushan Verma

Bit Plane Slicing and Bit Plane Compression

Image is mainly grouping of pixel (dots) information. When we write that image is of 600 X 400 sizes, it means that image has 600 pixels in horizontal direction and 400 pixel in vertical direction. So, altogether there are 600 X 400 pixels and each pixel contains some information about image.

Pixel of grayscale image has a value lies in between 0 – 255 (Total 256 or 2^8 Levels) which decides at which position, if pixel value is 0, it means that pixel colour will be fully black and if pixel value is 255, then that pixel will be fully white and pixel having intermediate value will be having shades of black and white.

Since pixel value of grayscale image lies between 0 -255, so its information is contained using 8 bit So, we can divide those image into 8 planes (8 Binary Image). Binary image are those images whose pixel value can be either 0 or 1.

For an 8 bit image "0" is encoded in **00000000** and "255" is encoded in **11111111**

Example:

Apply bit plane slicing on the following image size (3X3)

167	133	111
144	140	135
159	154	148

Step 1: Binary format for above image is

10100111	10000101	01101111
10010000	10001100	10000111
10011111	10011010	10010100

For 1st digit: Binary format of the **167**

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

Step2: Bit plane slicing of above example

1	1	0
1	1	1
1	1	1

8bit
(MSB bit Plane)

0	0	1
0	0	0
0	0	0

7 bit

1	0	1
0	0	0
0	0	0

6 bit

0	0	0
1	0	0
1	1	1

5 bit

0	0	1
0	1	0
1	1	0

4 bit

1	1	1
0	1	1
1	0	1

3 bit

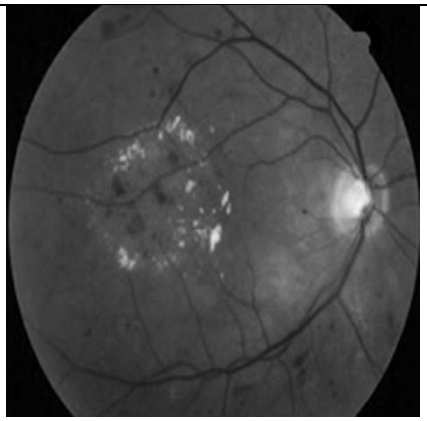
1	0	1
0	0	1
1	1	0

2 bit

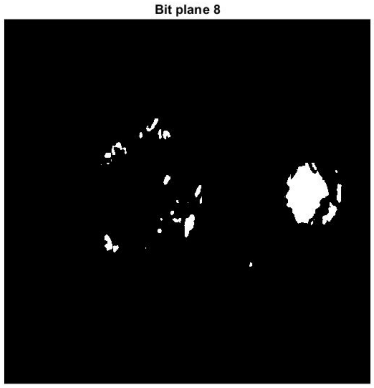
1	1	1
0	0	1
1	0	0

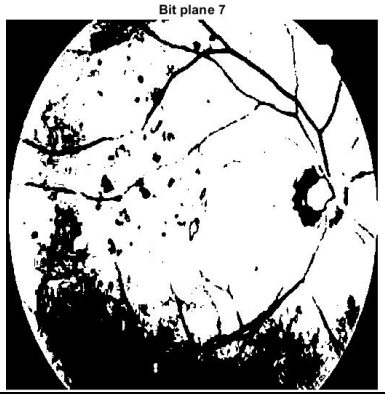
1 bit
(LSB bit Palne)

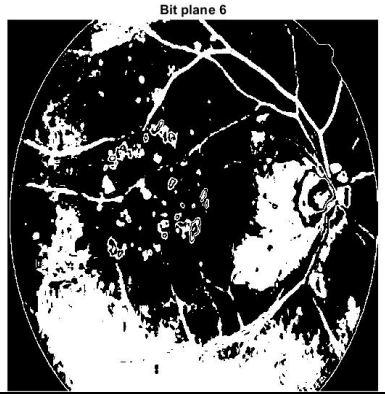
Example of Bit plane slicing

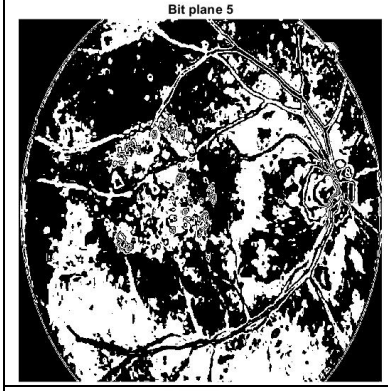


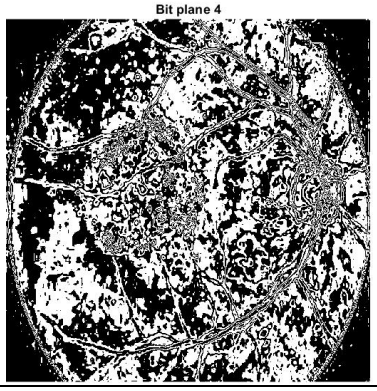
Original Grey Image

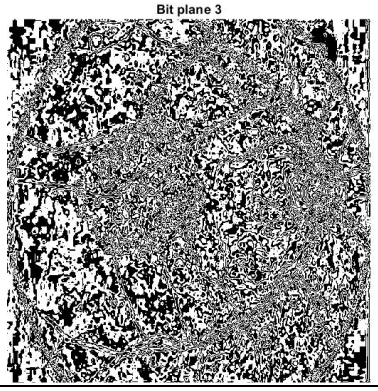


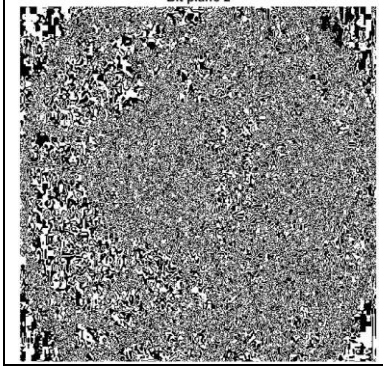


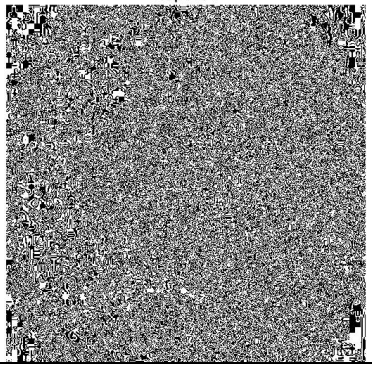












Bit plane Compression

this is a lossy data compression

Example:

Explain with a simple example how to encoding and decoding is carried out in bit plane compression.

In this example, the MSB (most significant bit) alone is considered and encoded.

Apply bit plane compression and decompression in following image.

180	1	80	33	201	28
120	224	160	33	67	144
224	160	180	11	133	144

Step1: Obtain binary of the values in the image

10110100	00000001	01010000	00100001	11001001	00011100
01111000	11100000	10100000	00100001	01000011	10010000
11100000	10100000	10110100	00001011	10000101	10010000

Step2: Extract the MSB (most significant bit)

1	0	0	0	1	0
0	1	1	0	0	1
1	1	1	0	1	1

Step3: Rearrange the MSB values such that each row contains 8 columns or 8 bits

1	0	0	0	1	0	0	1
1	0	0	1	1	1	1	0
1	1	0	0	0	0	0	0

{we have 3x6=18 values but we need 8 columns in each row. It achieved by padding the matrix with zeros in the end in order to form a matrix which has 8 columns in each row.}

Step4: Convert binary in each row to decimal number

10001001 = 137
10011110 =158
11000000 = 192

137
158
192

Decompression

Step1: Our compressed data =

137
158
192

Convert the decimal values to binary format

1	0	0	0	1	0	0	1
1	0	0	1	1	1	1	0
1	1	0	0	0	0	0	0

Step2: Remove extra zeros appended to the matrix

Step3: reshape the matrix to size of the original image.

1	0	0	0	1	0
0	1	1	0	0	1
1	1	1	0	1	1

Step4: Pre allocate a matrix of same size of original image and replace the MSB of each value in the matrix with the bit we decompressed in the previous step.

10000000	00000000	00000000	00000000	10000000	00000000
00000000	10000000	10000000	00000000	00000000	10000000
10000000	10000000	10000000	00000000	10000000	10000000

Step5: Display the final data

128	0	0	0	128	0
0	128	128	0	0	128
128	128	128	0	128	128

Original Image:

180	1	80	33	201	28
120	224	160	33	67	144
224	160	180	11	133	144

After applying compression and decompression:

128	0	0	0	128	0
0	128	128	0	0	128
128	128	128	0	128	128