

DIGITAL IMAGE PROCESSING LABORATORY EXERCISE #5

Display of bit planes of an Image

The display of bit planes of an image involves representing each bit of the pixel intensity values as a separate image or plane. An 8-bit image, for example, has pixel values ranging from 0 to 255, and each pixel value can be represented as an 8-bit binary number. The display of bit planes involves creating binary images representing the contribution of each bit in the pixel values of an original image, allowing for a detailed analysis of the image's information distribution.

Here's how the display of bit planes works:

1. Bit Representation:

- An 8-bit image has pixel values represented in binary, e.g., pixel value=11011010pixel value=11011010 for an 8-bit binary number.
- Each bit in the binary representation corresponds to a power of 2. The leftmost bit represents 2⁷, the next bit 2⁶, and so on.

2. Bit Planes:

- A bit plane is a binary image that represents the contribution of a specific bit to the overall pixel values of the original image.
- For an 8-bit image, you would have 8-bit planes, each showing the significance of one bit.

3. Displaying Bit Planes:

- To display the bit planes, you take each bit of the pixel values and create a binary image.
- For the i -th bit plane, you set all pixels to 0 or 1 based on whether the i -th bit in the binary representation of the original pixel values is 0 or 1.

Example:

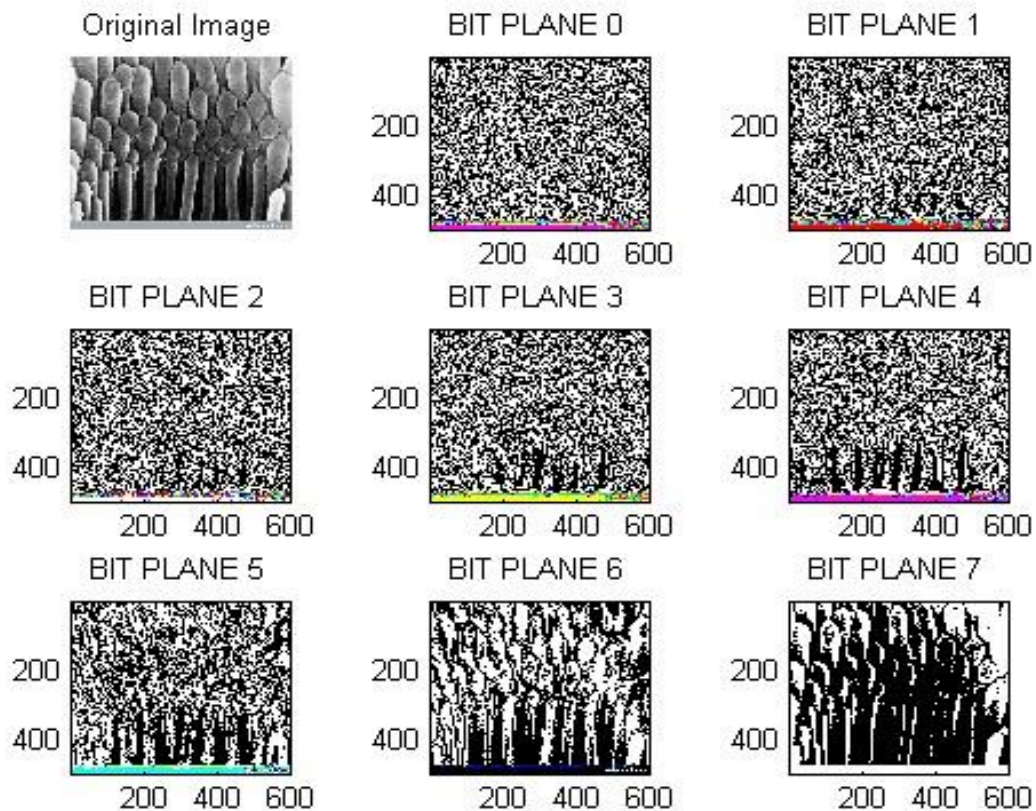
- a. Let's say you have an 8-bit image with a pixel value of 11011010.
- b. The 1st bit plane (least significant bit) would be a binary image where all pixels are set based on the least significant bit of the pixel values.
- c. The 8th bit plane (most significant bit) would be a binary image based on the most significant bit of the pixel values.

Visualization: Displaying bit planes helps visualize the contribution of each bit to the overall image. Lower bit planes contribute to fine details, while higher bit planes contribute to coarser details.

Purpose: Analyzing bit planes is useful for understanding the distribution of information in an image. It can highlight subtle details or noise, and it's often used in image compression, watermarking, and other image processing applications.

```
i=imread('earcell.jpg'); 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);subimage(b0);title('BIT PLANE 0');
subplot(3,3,3);subimage(b1);title('BIT PLANE 1'); subplot(3,3,4);subimage(b2);title('BIT PLANE 2');
subplot(3,3,5);subimage(b3);title('BIT PLANE 3'); subplot(3,3,6);subimage(b4);title('BIT PLANE 4');
subplot(3,3,7);subimage(b5);title('BIT PLANE 5'); subplot(3,3,8);subimage(b6);title('BIT PLANE 6');
subplot(3,3,9);subimage(b7);title('BIT PLANE 7');
```



Exercise #5

Display of bit planes of an Image

Name:

Year/Block:

Application/Software:

1. Codes
2. Output
3. Answer the following questions:
 - A. Displaying bit planes is a technique used for visualizing the contribution of individual bits to the overall pixel values in an image. Discuss how the display of bit planes can aid in identifying and analyzing image features at different scales. Provide examples of scenarios where analyzing specific bit planes might be particularly relevant in image processing applications.
 - B. Bit planes can reveal information about the distribution of details and noise in an image. Compare and contrast the visual characteristics of lower bit planes (e.g., least significant bits) and higher bit planes (e.g., most significant bits). How can the analysis of bit planes assist in understanding the impact of quantization and noise on the visual quality of images?
 - C. Analyze the practical implications of bit plane visualization in the context of image compression. How can the information from specific bit planes be leveraged to design more efficient compression algorithms? Discuss the trade-offs involved in using bit plane analysis for compression, considering both the preservation of image details and the reduction of data size.