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Fingerprint Watermarking using Bit plane slicing

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Abstract: *Internet revolution resulted in an explosive growth in multimedia applications. The rapid advancement of internet has made it easier to send the data/image accurate and faster to the destination. Watermarking biometric data is a still a relatively new issue, but it is of growing importance as more robust methods of verification and identification are being used. Using least significant bit technique isolating particular bits of pixel value in an image highlighting interesting aspects of that image. Higher order bits usually contain most of the significant visual images & lower order bits contain subtle details*
Keywords: *LSB plane, gray level slicing, MSB plane*

I. Introduction

Watermarking is defined as the action of hiding a message, text, logo or signature into an image, audio file, video or any or other work of media. Watermarking can be visible, such as the images are printed on money notes, or invisible, for which the watermark is hidden inside the media. Watermarking can be applied to physical objects, examples include: fabrics, garment labels, and product packaging that can be watermarked using special invisible dyes and inks, or as electronic signals. A fingerprint is an impression of the friction ridges of all or any part of the finger.

The paper watermark first appeared in 1282 in Italy. It all started by adding a thin wire to the paper mould which was introduced a transparent mark within the paper (making the paper identifiable or to be used as trademark). The meaning and purpose of the earliest watermarks are uncertain. They may have been used for practical functions such as identifying the moulds on which sheets of papers were made, or as trademarks to identify the paper maker. On the other hand, they may have represented mystical signs, or might simply have served as decoration. In the eighteenth century, the watermark on paper had become functional Europe and America. They were used as trademarks, to record the date that the paper was manufactured and to indicate the originality [1].

Watermarking is one of the most common solutions to make the data transferring secure from the Illegal interference.

II. Techniques Of Watermarking

Spatial Domain Techniques

The watermark can be detected by correlating the expected pattern with the received signal. Spatial domain watermarking is performed by modifying values of pixel.

Frequency Domain Watermarking

These methods are similar to spatial domain watermarking in that the values of selected frequencies can be altered. Because high frequencies will be lost by compression or scaling, the watermark signal is applied to lower frequencies, or better yet, applied adaptively to frequencies containing important elements of the original picture.

Spread Spectrums

This technique can be used for both spatial domain and frequency domain. The spread spectrum method has the advantage that the watermark extraction is possible without using the original unmarked image [4].

In other way, the digital watermarks can be divided into three different types as follows:

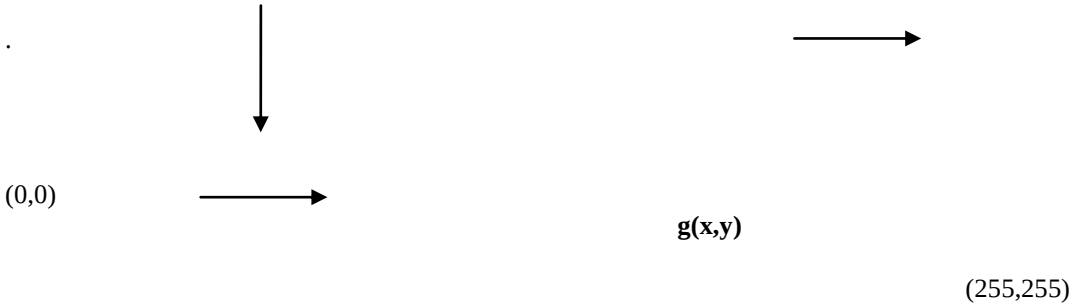
i. Visible watermark
ii. Invisible-Robust watermark
iii. Invisible-Fragile watermark

Spatial Domain Techniques

The word spatial domain implies working with the pixel values or working directly with available raw data. Let g(x,y) be the original image where g is the gray level value and (x,y) are the image coordinate for 8 bit

image can take values from 0 -255 where 0 represents black,255 represents white and all the intermediate values represents shades of gray. In an image of size 256 X 256 , x and y can take values from (0,0)to (255,255) the modified image can be expressed as under f (x,y)= T [g (x,y)] g (x,y) is the original image and T is the transformation applied to it to get a new modified image f(x,y). For all spatial domain technique it is simply T that changes. The general equation remains the same.

In an image of size 256 X 256, x and y can take values from (0,0) to (255,255)as shown in the figure below.



Spatial domain technique are those which directly work with the pixel valueto obtain a new image.
Spatial domain enhancement may be carried out in following two different ways.

1) Point processing
2) Neighborhood processing

In point processing work with single pixel, i.e. T is 1x1 operators. It means that the new value g (x,y) depends on the operator T and the present g (x,y).
Some of the important example of point processing is as under

1) Digital negative
2) Constant stretching
3) Thresholding
4) Gray level slicing
5) Bit plane slicing
6) Dynamic range compression

Bit plane Slicing:-
In this technique find out the contribution made by each bit to the final image. An image is defined as say 256 x 256x 8 image. In this 256 x 256 is the number of pixel present in the image and is the number of bits required to represent each pixel. 8 bits simply means 28 or 256 gray levels.
Now each pixel will be represented by 8 bits,for example black is represented 00000000 and white is represented as 11111111 and between them 254 gray levels are accommodated. In bit plane slicing, the importance of each in bit in the final image .This can be done as follows.
Consider the lsb value of each pixel and plot the image using only the LSB continue doing this for each bit till come to the MSB. Thus get 8 different image and all the 8 image will be binary.

Given a 3 x 3 image, plotting its bit planes.

1	2	0
4	3	2
7	5	2

Since 7 is the maximum gray level, require only 3 bits to represent the gray level. Hence will have 3 bits planes.
Converting the image to binary,
Binary imageLSB plane

Middle bit plane MSB plane

Often by isolating particular bits of the pixel values in an image we can highlight interesting aspects of that image

Higher-order bits usually contain most of the significant visual informationLower-order bits contain subtle details

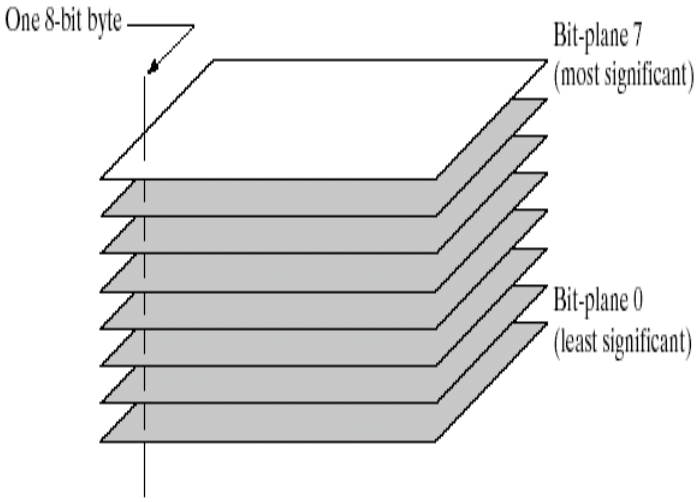


FIGURE 3.12
Bit-plane representation of an 8-bit image.

Fig Least Significant Bit Watermarking Technique

LSB watermarking describes a straightforward and basic way to integrate watermark information in, digital documents. Considering a basic grayscale image, the pixel and its values can be sliced up into significant and irrelevant levels. Because the significant levels merely represent a digital noise pattern, it could be easily used for digital watermarking. In changing selected pixel values of the noise pattern using a special or key-based algorithm, the watermarking information can be easily integrated. However, such technique is very insecure because the watermark can be easily destroyed. On the other hand, such technique can be useful in copy control and authenticity applications.

III. Experimental Results

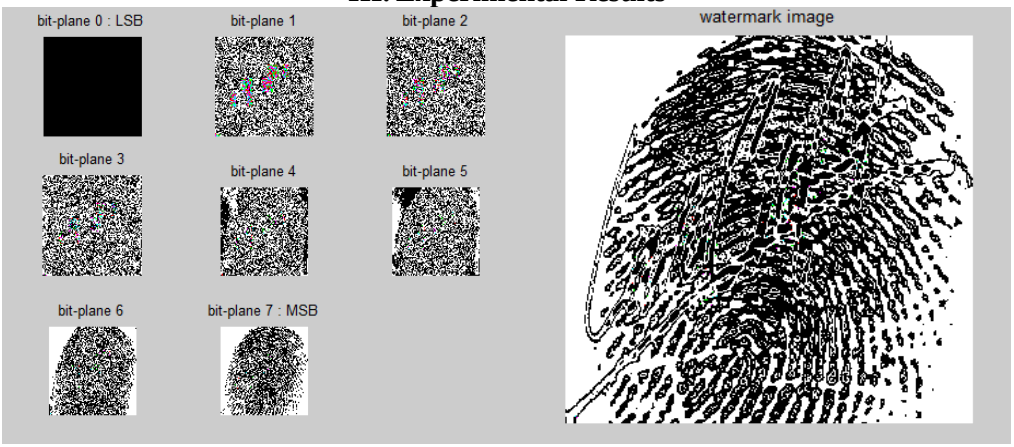


Table: Quality Measurements

sr no.	Image name	PSNR	MSE	Maxerr	L2rat
1	D_1.jpg	18.8359	850.1401	99	0.9575
2	D_2.jpg	18.1576	993.8458	99	0.9353
3	D_3.jpg	17.1881	1.24E+00	99	0.9289
4	D_4.jpg	17.747	1.09E+03	99	0.9436
5	D_5.jpg	19.0108	816.5761	99	0.9126
6	D_6.jpg	18.6838	880.4443	99	0.9141
7	D_7.jpg	19.0876	802.2744	99	0.931
8	D_8.jpg	19.0876	802.2744	99	0.931
9	D_9.jpg	18.93273301	8.31E+02	99	0.933618452
10	D_10.jpg	18.99452271	8.20E+02	99	0.903089778

IV. Conclusion

The first bit-plane is the least significant one (LSB) and most of the time is hardly related to the main shapes of the picture. On the other hand, the last bit-plane is the most significant one (MSB) and contains the main lines and edges of the picture. The resulting watermarked image has a good quality and the watermark is imperceptible.

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