

Copyright Protection for Watermark Image Using LSB Algorithm in Colored Image

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Abstract

This paper, we introduce a new digital watermarking algorithm using least significant bit (LSB). LSB is used because of its little effect on the image. This new algorithm is using the third and the fourth least significant bits (LSB) technique and shifting the watermark of pixel coordinates of image before embedding the watermark. The proposed algorithm is flexible depending on the length of the watermark text. If the length of the watermark text is $(M \times N)/2$ the proposed algorithm will also embed the extra of the watermark text in the second and fourth LSB. We compare our proposed algorithm with the 1-LSB algorithm and Lee's algorithm using Peak signal-to-noise ratio (PSNR). This new algorithm improved its quality of the watermarked image. Experimental results show that the quality of the watermarked image is higher. PSNR value is 56.6db in proposed method this is very higher compare than another method.

Keywords: Digital watermarking; RGB images; secret data; LSB; PSNR.

1. Introduction

Illegal copying, modifying, tampering and copyright protection have become very important issues with the rapid use of internet [5]. Hence, there is a strong need of developing the techniques to face all these problems. Digital watermarking [9] emerged as a solution for protecting the multimedia data. Digital Watermarking is the process of hiding or embedding an imperceptible signal (data) into the given signal (data). This imperceptible signal (data) is called watermark or metadata and the given signal (data) is called cover work. The watermark should be embedded into the cover

work, so that it should be robust enough to survive not only the most common signal distortions, but also distortions caused by malicious attacks. This cover work can be an image, audio or a video file. A watermarking algorithm consists of two algorithms, an embedding and an extraction (or detection) algorithm. The idea of watermarking first appeared hundreds of years ago [7]. Watermarking technology was used to mark information authenticity by many different means. Watermarking technology has been used in computer as well. Most of the work on computer watermarking technology was for embedding a watermark into images, audio, and video files. Media watermarking research is a very active area and digital image watermarking became an interesting protection measure and got the attention of many researchers since the early 1990s [8].

2. Proposed Method

Fig. 1 shows the 1-bit LSB. In Fig. 1, the pixel value of the cover image is $141(10001101)_2$ and the secret data is 0. It applies to LSB-1 that the changed pixel value of the cover is $140(10001100)_2$. LSB can store 1-bit in each pixel. If the cover image size is 256×256 pixel image, it can thus store a total amount of 65,536 bits or 8,192 bytes of embedded data.

1	0	0	0	1	1	0	1			
Pixel value										
<table border="1" style="display: inline-table; vertical-align: middle;"> <tbody> <tr> <td>0</td><td>0</td><td>1</td> </tr> </tbody> </table>								0	0	1
0	0	1								
Secret Data										
1	0	0	0	1	1	0	0			
Change Pixel Value										

Fig. 1: Example of LSB.

Proposed method based on LSB technique, we propose a new watermarking algorithm. Most of researchers have proposed the first LSB and the third and fourth LSB for hiding the data but our proposed watermarking algorithm is using the third and fourth LSB for hiding the data. And using the RGB watermark image embedding in blue component of original image because of less sensitivity. This is because of the security reason. So, no one will expect that the hidden data in the third and the fourth LSB. Fig. 2 shows the framework of the proposed method. First, we select the image which is a colour image and we will transfer the data to binary value after typing it. Then, we hide the data in the image using the proposed algorithm. Fig. 3 shows the embedding algorithm in MATLAB. Then, we will get the watermarked image. Then, the receiver will retrieve the data back. Scramble applying before the process of embedding extraction and then descramble we received the output this is PSNR and MSE value. Fig. 4 shows the extracting algorithm in MATLAB. The data will be extracted from the watermarked image.

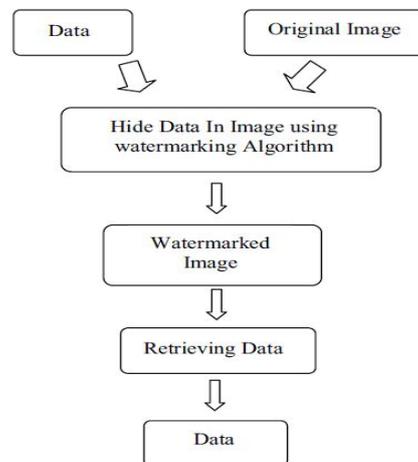


Fig. 2: The framework of the proposed method.

Watermark embedding: The proposed watermark embedding scheme is shown in Fig.2. In the proposed method, the watermark image is a binary image whereas the host image is an 8 bit color image. The watermark is embedded four times as shown in Fig.3 in different positions. The four embedded positions are chosen to hide the watermarks in order to be robust against cropping attack from the bottom, the top or the left or the right side of the watermarked image. The blue component is chosen to hide the watermark because it is less sensitive to human eyes. Suppose the original color image H with size of 512×512 pixels, which to be protected by the binary watermark W of size pixels 32×32 , the original image H is divided into a nonoverlapping blocks of 8×8 and each bit of the encoded watermark is embedded in a block, therefore one watermark is required 1024 blocks. The embedding process is described as follows:

- Step 1: The original image H is decomposed into R, G, and B components and then the B component is divided into a non-overlapping blocks with size of 8×8 pixels.
- Step 2: A private key is used to determine the positions of embedding the watermark
- Step 3: scramble on private image or secret image.
- Step 4: The encoded watermark W'' is embedded in the Blue component B. For each encoded watermark bit, a block of 8×8 is modified as follows:
 If $W''=1$; for all the pixels of the 8×8 blocks, $\{I'=I+\lambda\}$
 If $W''=0$; For all the pixels of the 8×8 blocks, $\{I'=I-\lambda\}$ Where I' is the modified pixel intensity and I is the original intensity and λ is a constant.
- Step5: The modified block of pixels is then positioned in its original location of the host image and then step 3 and 4 is repeated until all encoded watermark bits W'' are embedded. Step6: After embedding the all encoded watermark bits four times, the R, G, and B' components are composed to obtain the watermarked image.

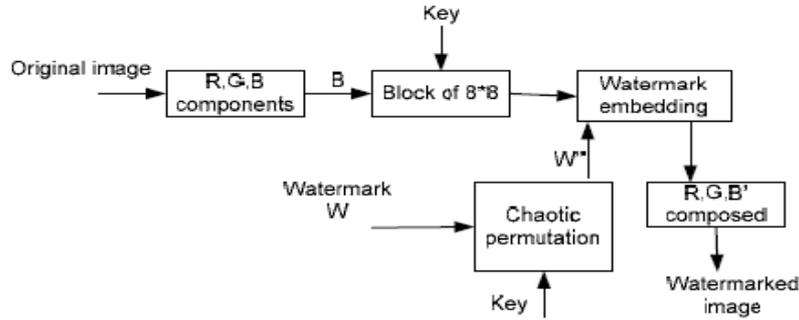


Fig. 3: Proposed embedding process.

Watermark extraction: The proposed watermark extraction is shown in Fig. 4. It is required the original host image and the original watermark, therefore, it is a non blind watermarking scheme. The proposed extraction is based on the probability (P_1 , P_0) of detecting '1' or '0' bit, which can be obtained by comparing each pixel (I') in a block of 8×8 of the watermarked image with the corresponding pixel (I) in the original image and then the probability of detecting '1' or '0' bit is calculated as follows:

$$P_1 = P_1 + 1/64 \text{ if } I' > I$$

$P_0 = P_0 + 1/64 \text{ if } I' \leq I$, According to the probability (P_1 , P_0), the extracted watermark bits W'' can be decoded as follows:

$$W'' = 1 \text{ if } P_1 \geq P_0$$

$$W'' = 0 \text{ if } P_1 < P_0$$

The extracted watermark bits for the four watermarks are decoded using Gray code and then, the decoded bits are XOR with random bits, which generated using the same secret key that was used during the watermark embedding.

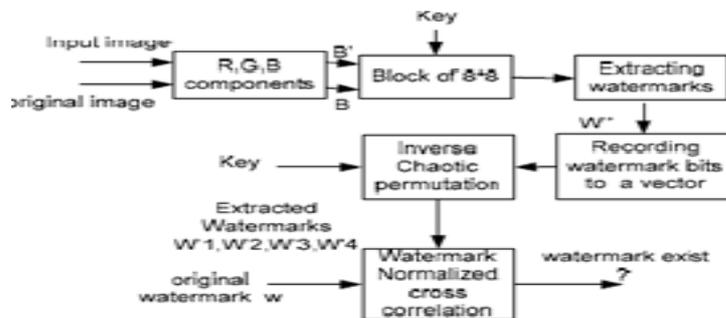


Fig. 4: Proposed extraction process.

3. Experimental Results and Analysis

In our experimental results, four 256×256 colour images which are shown in Fig. 6, Fig. 5 shows black and white images were used as original images. Once, we embed the secret data which contain from 128 bytes in determined pixels in the forth and the third LSB and then, this secret data is also be a colour images. We got the watermarked images without noticeable distortion and subtract the Watermarked

image from the original image to see the difference between them. The second time, we embed the same secret data which contain from 1023 bytes in the four images and also we also got watermarked images without noticeable distortion on them and subtract the watermarked image from the original image to see the difference between them. Fig.5 (a) (b) (C) and (d) four cover images and fig.6 show on secret images and difference or scramble the secret images. Show the original host image and the original watermark respectively, Fig 6 (a) and (b) show the cover image and the watermark image.



Fig. 5: The four cover images: (a) Dock (b) Forest (c) Waterfall (d) Toco Toucan.



Fig. 6: original image and watermark image.

Notice that, there is no difference between the original and watermarked images. No distortion occurs for watermarked images. We got good result and we calculate the Peak signal-to-noise ratio (PSNR). The PSNR value was used to evaluate the quality of the watermarked images. The phrase peak signal-to-noise ratio (PSNR) is most commonly used as a measure of quality of reconstruction in image compression [6]. It is the most easily defined via the Mean Squared Error (MSE) which for two $m \times n$ images I and K where one of the images is considered as a noisy approximation of the other. MSE is defined as the following equation (2) and the PSNR is defined in equation (1). Where MAX is equal to 255 in grayscale images, and MSE is the mean square error, which is defined as: where I is the original image and K is the watermarked image. Peak signal to noise ratio (PNSR) and the mean square error (MSE) are used to evaluate perceptual distortion of our watermark scheme. The equations used are defined as follows: MSE is defined as the following equation (2) and the PSNR is defined in equation (1).

$$PSNR = 10 \log_{10} \left(\frac{255^2}{MSE} \right)$$

$$MSE = \frac{1}{3 \times m \times n} \sum_{i=1}^m \sum_{j=1}^n \left[\left(r(i,j) - r^*(i,j) \right)^2 + \left(g(i,j) - g^*(i,j) \right)^2 + \left(b(i,j) - b^*(i,j) \right)^2 \right] \quad (2)$$

Where $r(i, j)$, $g(i, j)$ and $b(i, j)$ represents a color pixel in location (i, j) of the original image, $r^*(i, j)$, $g^*(i, j)$ and $b^*(i, j)$ represents a color pixel of the watermarked image and m, n denote the size pixels of these color images.

Table 1; Shows the results of the PSNR calculated. We apply proposed method in colored images for secret image and cover image, also selected different pixel sizes.

Pixel size	Proposed method	Other methods	Author's
64x64	56.093 MSE=0.162	36.3 33.19	David Asatryan(2011) A.J.Acatprh'method(2009)
128x128	56.78	61.84	Abdullah Bamatraf(2010)
256x256	57.66	49.88 44.06 38.4 36.7 41.78	Abolfaz Hajisami(2011) Huang'method(2010) Malay Kumar(2003) G.C.Langelar(1997) H.J.M.Wang(1998)
512x512	57.98	48.0026 22.0 43.2	Mr.P.B.Khatkale(2013) David Asatryan(2011) A.J.Acatprh'method(2009)
1024x1024	58.23	52.79	Abolfaz Hajisami(2011)

4. Conclusion

This paper proposed a new LSB based digital watermarking scheme with the fourth and third LSB in The color image. Scramble on watermarked image after we have embedded the secret Data in the third and fourth LSB in the image in determine coordinates, we got watermarked image without noticeable distortion on it. Descramble on embedding image extraction data this is original image. And this digital watermarking algorithm can be used to hide data inside image future works using proposed method on secure message in cyber and banking. Result is very highly compared than Ying's and Lee's method.

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