Histogram Based Color Image Authentication By Digital Image Watermark Technique

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Abstract

In the robust digital color image watermarking for RGB color image authentication, fragility or sensitivity of the embedded watermark to malicious attacks is an important problem. In this work the current researches propose Least significant bit substitution (LSB) based watermarking scheme for authenticating RGB color image.. Embedding distortion is minimized by adopting least significant bit (LSB) substitution scheme. The proposed scheme embeds watermark in three bit planes by changing original pixels with watermark pixels. The propose method give histogram of Red, Green, Blue histogram of original or watermark image separately .And also give the 3D representation of Red, Green, Blue component of original and watermark images. The paper presents the insertion algorithm and extraction algorithm to calculate the PSNR of original and watermarked image.

Keywords: Image authentication, watermark life cycle, histogram, LSB.

I. Introduction

Digital multimedia has been frequently used for various applications due to easy transmission, coping, editing and storage. Subsequent, illegal distribution of and / or alteration of multimedia product are becoming more and more pervasive and digital watermarking techniques have been proposed to solve such types of problems. Watermarking techniques can be divided into two broad types: robust watermarking and fragile/semi- fragile watermarking, which are used for different application purposes, from copyright protection to multimedia authentication .Fragile or semi-fragile watermark is commonly used for image authentication to verify whether the received image was modified during transmission or not. One may hide the watermark imperceptibly in the image before transmission and detect it after receiving to make sure that the received image is original or slightly modified.

Digital image can be manipulated in many ways. Even in some cases, it is difficult for expert uses to discern whether an image is genuine. To address this issue, fragile watermarking has been developed for authentication and integrity verification of digital image.

Ibrahim Nasir,Yin g Wen g,Jianmin Jiang 2010 ,proposed a new robust watermarking the least significant bit (LSB).I [10],the least significant scheme for color image based on a block probability in spatial domain. A binary watermark image is permuted using sequence numbers generated by a secret key and Gray code, and then embedded four times in different positions by a secret key. Each bit of the binary encoded watermark is embedded by modifying the intensities of a non-overlapping block of 8*8 of the blue component of the host image. The ex traction of the watermark is by comparing the in intensities of a block of 8*8 of the watermarked and the original images and calculating the probability of detecting '0' or '1 '.Tested by benchmark.[2]

Debjyoti Basu , Arindam Sinharay , Suryasarathi Barat, 2010 proposed Bit Plane Index Based Fragile Watermarking Scheme for Authenticating Color Image. Bit Plane Index Modulation (BPIM) based fragile watermarking scheme for authenticating RGB color image. To deal with counterfeiting attacks block wise division dependency is established. A content based color watermark is created. Embedding distortion is minimized by adopting least significant bit (LSB) alteration scheme. The proposed scheme embeds watermark in three bit planes by changing original pixels with watermark pixels. The proposed method comprise of encoding and decoding methods that can provide public detection capabilities in the absences of original host image and watermark image.[3]

Chuan Qin , Chin-Chen Chang ,, Pei-Yu Chen ,2011 proposed a novel fragile watermarking scheme with content restoration capability. Authentication-bits are produced using the image hashing method with a folding operation. The low frequency component of the non subsample contour let transform (NSCT) used coefficients are used to encode the restoration-bits for each block by the adaptive bit allocation mechanism. Two algorithms are utilized to adjust the block classification and the binary representations in order to guarantee that the numbers of the self-embedding authentication-bits and restoration-bits are exactly suitable for 1-LSB embedding capacity[4] RGB host image.

This scheme is capable of detecting any modification done in any of the three bit plane individually, as explained in the following paragraphs. The rest of the paper is organized as follows. Section 2 give brief of rgb model and 3&4 explain insertion algorithm and extraction algorithms, section 5 give brief of color histogram and section 6show the experiment data analysis, section 7 derives the conclusion and finally section 8 indicates the references

II. Tristimulus theory of color perception

Primary Colors: Red(R), Green(G) and Blue(B) are referred as the primary colors and when mixed with various intensity proportions, can produce all visible colors The primary colors can be mixed to generate secondary colors such as magenta (red+blue), cyan(green + blue) and yellow (red+green). Primary Colors-RGB

This is an *additive* model, i.e. the colors present in the light add to form new colors, and is appropriate for the mixing of colored light for example. The image on the left of figure shows the additive mixing of red, green and blue primaries to form the three secondary colors yellow (red + green), cyan (blue + green) and magenta (red + blue), and white ((red + green + blue).

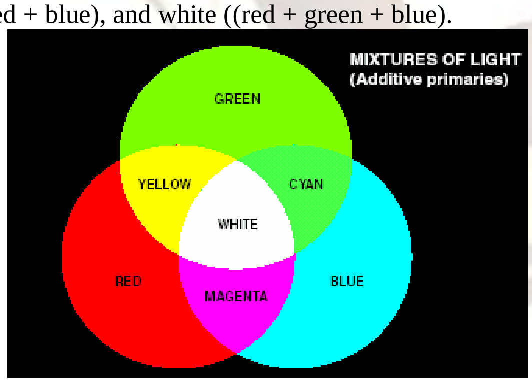


Figure 2.1 primary colors model.

The RGB Model

In the RGB model, an image consists of three independent image planes, one in each of the primary colors: red, green and blue. (The standard wavelengths for the three primaries are as shown in figure. Specifying a particular color is by specifying the amount of each of the primary components present. Figure shows the geometry of the RGB color model for specifying colors using a Cartesian coordinate system bit.

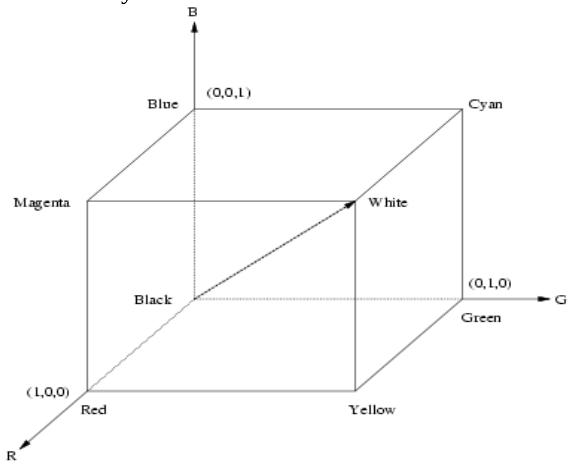


Figure 2.2: The RGB color cube. The grey scale spectrum lies on the line joining the black and white vertices.

III. Insertion Algorithm: Least Significant Bit Substitution Watermark Embedding

Symbolic Notations:

□ □ is main image

□ is watermarked image

□ is the message image (rounded unsigned integer)

W is created watermark

□ □ □ is the size operator

⊗ is the modulus operator

□ □ is bit set operator; □ (A,BIT,V) sets the bit at position BIT to the value V.V must be either 0 or 1.

Start

1. Read in the Main image □ *(x,y)*cover object where watermark to be inserted
2. Read in the message image □ (x,y)
   □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ (x,y) =□ □ (x,y)/25
3. Determine size of cover object
   Mc=□ □ □ (□ □ ,1) //Height
   Nc=□ □ □ (□ □ ,2) //Width
4. Determine size of message object
   Mm=□ □ □ (□ ,1) //Height
   Nm=□ □ □ □ □ □ ,2) //Width
5. Title the message object out to cover object size to generate watermark W

$$W(i,j)=\sum_{i=1}^{Mc}\sum_{j=1}^{Nc}\mu((i\otimes Mm)+1,(j\otimes Nm)+1)$$

6. Set the Least Significant bit of cover object □ (i, j) to the value of W(i, j)

$$W(i,j)=\sum_{i=1}^{Mc}\sum_{j=1}^{Nc}\mu((i\otimes Mm)+1,(j\otimes Nm)+1)$$

7. write the watermarked image □ □ out to a file

End

IV. Extraction Algorithm:

□ □ is main image

□ iswatermarked image

□ is the message image (rounded unsigned integer)

W is created/Recovered watermark

□ □ □ is the size operator

$\otimes$ is the modulus operator

□ □ □ is a bit get operator; □ □ (A,BIT) returns the value of the bit at position BIT in A. A must be an unsigned integer and BIT must be a number between 1 and the number of bits in the unsigned integer class of A.

Start

1. Read in watermarked image □ (x,y)

2. Determine size of watermarked image

Mw= □ (□ ,1) //Height

Nw= □ □ □ □ ,2) //Width

3. Use LSB of watermarked image to recover watermark

$$W(i,j)=\sum_{i=1}^{Mw}\sum_{j=1}^{Nw}\delta(\omega(i,j),1)$$

4. scale the recovered watermark

*W(x,y) =256*W(x,y)*

5. Read in original watermark

6. scale and display recovered watermark.

End

V. Color Histogram

- A color histogram is a 3D entity where each pixel of an image (rather than each sample) is placed into a bin.
- The color space is divided into volumetric bins each of which represents a range of colors.
- Each axis of the color space may be divided independently of the others. This allows the axes to have different resolutions.
- Color histograms are flexible constructs that can be built from images in various color spaces whether RGB, rg chromaticity or any other color space of any dimension. A histogram of an image is produced first by discretization of the colors in the image into a number of bins, and counting the number of image pixels in each bin. For example, a Red–Bluechromaticity.In image processing and photography, a **color histogram** is a representation of the distribution of colors in an image. For digital images, a color histogram represents the number of pixels that have colors in each of a fixed list of color ranges, that span the image's color space, the set of all possible colors.

The color histogram can be built for any kind of color space, although the term is more often used for three-dimensional spaces like RGB or HSV. For monochromatic images, the term **intensity histogram** may be used instead. For multi-spectral images, where each pixel is represented by an arbitrary number of measurements (for example, beyond the three measurements in RGB), the color histogram is *N*-dimensional, with N being the number of measurements taken. Each measurement has its own wavelength range of the light spectrum, some of which may be outside the visible spectrum.[8]

VI. EXRERIMENT

Experiments are done on five different images for psnr value on red component, green component, and blue component. A png image original of 800 x 600 is taken first and represent the histogram of original image or watermark image to extract R,G,B component separately. Also give th3Dhistogram representation of & psnr ratio and also the detected image clarity can be seen from the Figures.

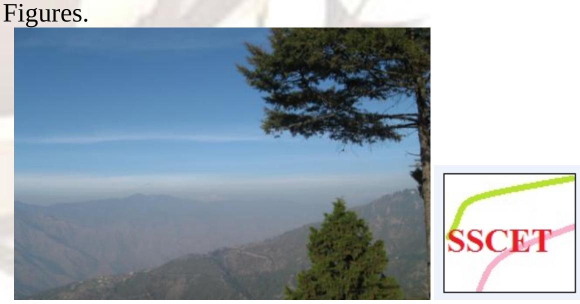
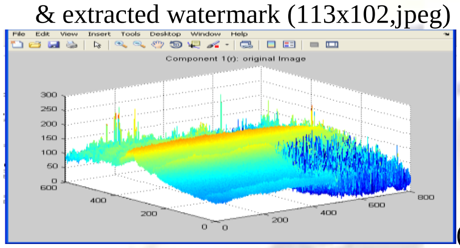
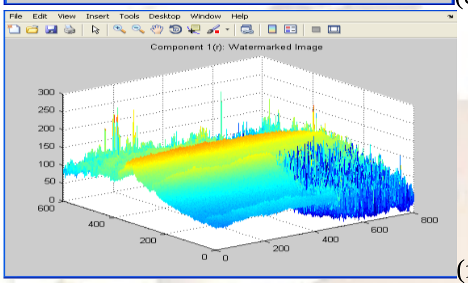


Figure (a) & (b) cover image : original scene (800x600,png)&watermark image(113x102,jpeg)


Figure (c) & (d) Recovered Watermark (800x600,png) & extracted watermark (113x102,jpeg)

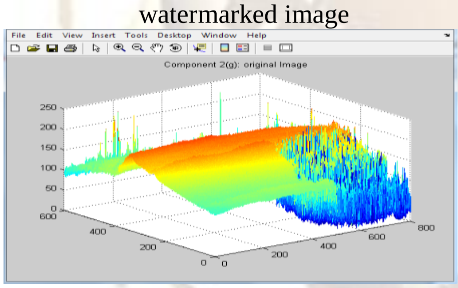


(e)

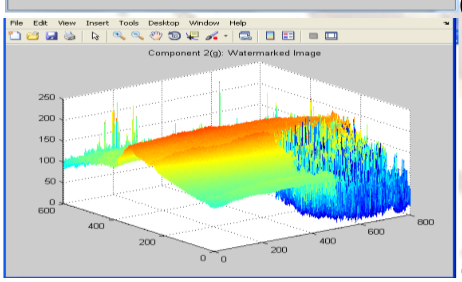


(f)

Figure (e) & (f) Red component of original & watermarked image

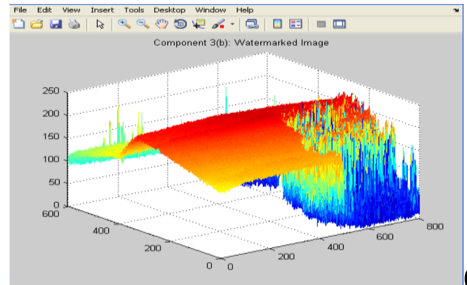


(g)

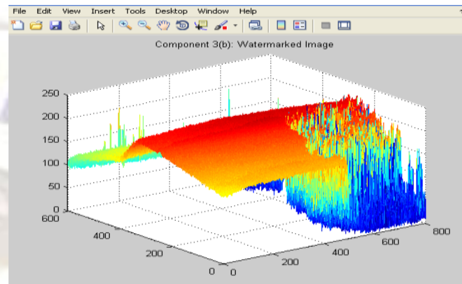


(h)

Figure (g) & (h) Green component of original & watermarked image.



(i)



(j)

Figure (i) & (j) Blue component of original & watermarked image.

6. 1Experimental Data Analysis

The current researchers use peak signal to noise ratio of parameter to analyze the effectiveness of the proposed set of algorithm.

6.1.1 Peak Signal to Noise Ratio (PSNR)

Peak Signal-to-Noise Ratio, often abbreviated **PSNR**, is term for the ratio between the maximum possible power of a and the power of corrupting noise that affects the fidelity of its representation. Because many signals have a very wide dynamic range, PSNR is usually expressed in terms of the logarithmic decibal scale.

PSNR is most commonly used to measure the quality of reconstruction of lossy compression codecs (e.g., for image compression). The signal in this case is the original data, and the noise is the error introduced by compression. When comparing compression codecs, PSNR is an approximation to human perception of reconstruction quality. Although a higher PSNR generally indicates that the reconstruction is of higher quality, in some cases the reverse may be true. One has to be extremely careful with the range of validity of this metric; it is only conclusively valid when it is used to compare results from the same codec (or codec type) and same content

PSNR is most easily defined via the (*MSE*). Given a noise-free $m \times n$ monochrome image I and its noisy approximation K, *MSE* is defined as:

$$MSE = \frac{1}{m\,n}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2$$

From MSE, the PSNR can be calculated using the following formula

$$PSNR = 10\log_{10}\left(\frac{MAX_I^2}{MSE}\right) = 20\log_{10}\left(\frac{MAX_I}{\sqrt{MSE}}\right)$$

Where MAX_I is the maximum possible pixel value of the image. If each pixel is represented by 8 bit stream then, $MAX_I = 255$.

6..2 Experimental Results

The table 1 below shows some of the experimented images with number of pixel,image dimension ,file format .

Table 1

Name	Size in KB	File format	Image dimension	Total no . of pixel
Original image	971	PNG	800X600	480000
Lena image	768	BMP	512x512	262144
Desert image	826	JPEG	1024x768	786432
Light house image	548	JPEG	1024x768	786432
Natural scene	51	JPEG	320x240	76800

The table 2 below depicts the name of some of the experimental images, with their size and their PSNR values of RGB components. The typical values of PSNR in between 30db to 40db.

Table 2

File Name	PSNR OF RED COMPONENT	PSNROF GREEN COMPONENT	PSNR OF BLUE COMPONENT
Original image	42.66	42.04	37.98
Lena image	42.32	35.23	42.15
Desert image	35.91	35.89	33.89
Light house image	33.57	34.28	34.85
Natural scene	32.89	34.67	33.89

VII. Conclusion

In this approach, LSB is used for watermarking and clarity is enhanced by modifying the algorithm slightly not making it complex. This work also enhances the visibility and robustness of the watermark.

In this work, we have proposed a new scheme for authenticating 24-bit RGB images. By embedding R, G, B component of watermarking image in the R, G, B component of original image, the scheme is capable of representing the 3d histogram of image. Histogram basically used for color enhancement, multi resolution histogram, resolution selection. The histogram of R, G, and B model is used in color monitor (CRT & LCD), video cameras.

References

[1] m.v.s.s.babu a robust watermarking algorithm for image authentication2012 international conference on information and network technology (icint 2012)ipcsit vol. 37 (2012) © (2012) iacsit press, Singapore
[2] W.L. Tai, C.M. Yeh, C.C. Chang, Reversible data hiding based on histogram modification of pixel differences, IEEE Transactions on Circuits and Systems for Video Technology 19 (6) (2009) 906–910.
[3] Rakesh Ahuja S.S. Bedi Himanshu Agarwal A Survey of Digital Watermarking Scheme MIT International Journal of Computer Science & Information Technology.
[4] Debjyoti Basu , Arindam Sinharay and Suryasarathi Barat Bit Plane Index Based Fragile Watermarking Scheme for Authenticating Color Image, 2010 First International Conference on Integrated Intelligent Computing
[5] Muhalim mohamed Aminsubariah Ibrahim mazleena sallehmohd rozi katmin information hiding using steganography university technology Malaysia 2003
[6] S. Radharani ,Dr. M.L.Valarmathi, A Study on Watermarking Schemes for Image Authentication International Journal of Computer Applications (0975 – 8887)Volume 2 – No.4, June 2010
[7] Adrian Perrig , Andrew Willmott 1998 describe Digital Image Watermarking in the \Real World", *Vol. 2, No. 1, Jan. 2012, pp. (52-59)*52
[8] M. U. Celik, C. Sharma, E. Saber, and A. M. Tekalp, "hierarchical watermarking for secure image authentication with localization," *IEEE Transaction on Image Processing*, vol. 11, no. 6, pp. 585-595, 2002.
[9] S. Katzenbeisser and F. A. E. Peticolus, *Information hiding technique for Steganography and Digital Watermarking.* Norwood MA: Artech House, 2000
[10] I.J. Cox, M. L. Miller, and J.A. Bloom, *DigitalWatermarking.* San Diego, CA: Academic, 2002

[11] M.D. Swanson, M. Kobayashi, and A. H. Tewfik,"Multimedia data embeddingand watermarking technologies," *Proc. IEEE* vol. 86, no. 6, pp. 1064-1087, June 1998.
[12] F.A.P. Peticolus, R.J. Anderson, and M.G.Kuhn, "information hiding - a survey," *Proc. IEEE* vol. 87, no. 7, pp. 1062-1078 July 1999
[13] J. Fredrick, "security of fragile authentication watermarks with localization," in *Proceedings of SPIE – The International Society for Optical Engineering*, Ca, USA, 2002, vol. 4675, pp. 691-700.
[14] S. Suthaharan, "Fragile image watermarking using a gradient image for improved localization and sec rity," Pattern Recognition Letters, vol. 25, no. 16, 1893-1903, 2004.
[15] WANG Zhiming, TAO Jianhua, "A Fast Implementation ofAdaptive Histogram Equalization", IEEE 2006, ICSP 2006
[16] Y. Wang, Q. Chen, B. Zhang, Soong-Der Chen, and Abd.Rahman Ramli, "Minimum mean brig htness error bihistogram equalization in contrast enhancement", IEEE Transactions Consumer Electron. vol. 49, no. 4, pp. 1310-1319, Nov. 2003.
[17] Md. Foisal Hossain, Mohammad Reza Alsharif, "Image Enhancement Based on Logarithmic Transform Coefficient and Adaptive Histogram Equalization", 2007 International Conference on Convergence Information Technology, IEEE2007.