International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 1, January - 2014

α Coefficient Method for Image Steganography Using DWT

V. Ramamohan Reddy [1], Dr. T. Sreenivasulu Reddy [2]

[1]*M.Tech student, Department of ECE, SVU college of Engineering, Tirupati, Andhra Pradesh, India*

[2]*Associate Professor, Department of ECE, SVU college of Engineering, Tirupati, Andhra Pradesh, India*

Abstract

Since the rise of the Internet one of the most important factors of information technology and communication has been the security of information. Cryptography was created as a technique for securing the secrecy of communication and many different methods have been developed to encrypt and decrypt data in order to keep the message secret. Unfortunately it is sometimes not enough to keep the contents of a message secret, it may also be necessary to keep the existence of the message secret. The technique used to implement this is called steganography. In image steganography the information is hidden exclusively in images. In this paper hiding of gray image in color image is explained. In this gray image is encrypted using DWT & Arnold cat map, this encrypted image is hide in color image using α coefficient algorithm. Efficiency of this algorithm is obtained by calculating peak signal to noise ratio (PSNR).

Keywords: steganography, DWT, Arnold cat map, PSNR.

1 .INTRODUCTION

Steganography is the art and science of invisible communication. This is accomplished through hiding information in other information, thus hiding the existence of the communicated information. The word steganography is derived from the Greek words "stegos" meaning "cover" and "grafia" meaning "writing" defining it as "covered writing". In image steganography the information is hidden exclusively in images.

1.1.Discrete Wavelet Transform(DWT):

1-D DWT can be extended to 2-D transform using separable low pass & high pass wavelet filters. With separable filters, applying a 1-D transform to all the rows of the input and then repeating on all of the columns can compute the 2-D transform. When one-level 2-D DWT is applied to an image, four transform coefficient sets are created. As depicted in Figure 2.1(c), the four sets are LL, HL, LH, and HH, where the first letter corresponds to applying either a low pass or high pass filter to the rows, and the second letter refers to the filter applied to the columns.

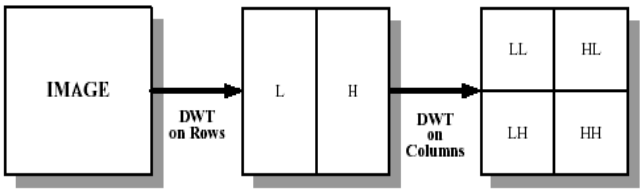

Fig 1. Block Diagram of DWT (a) Original Image (b) Output image after the 1-D applied on Row input (c) Output image after the second 1-D applied on row input

1.2.Arnold cat map (ACM):

Arnold cat map is simple mathematical relation which is used for image encryption by shuffling the image pixels. ACM rearranges the pixels of image. The ACM is mathematically represented by the following map,

$$\Gamma: \begin{bmatrix} x \\ y \end{bmatrix} \rightarrow \begin{bmatrix} 1 & p \\ q & pq+1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix};$$

Here we can see more clearly what p and q are. There are a few conditions for the parameters p, q, they both need to be integers and the

$$\det\left(\begin{bmatrix} 1 & p \\ q & pq+1 \end{bmatrix}\right) = 1,$$

Therefore making it area preserving, this will keep the size of the image the same throughout the iterations.

2. PROPOSED METHOD

Procedure for embedding is explained step by step below.

1). Secret image is encrypted using both DWT & Arnold cat map.

2). Encrypted image is embedded into colour image using α coefficient algorithm.

It is shown below by flow chart in fig2.

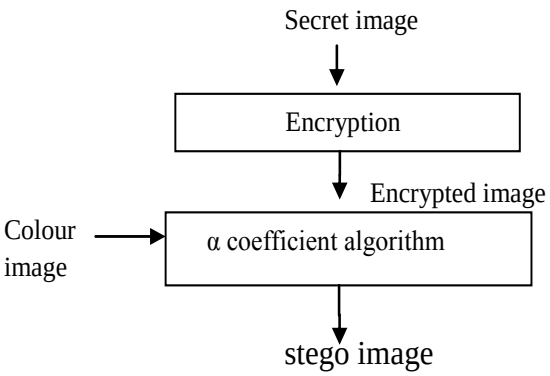

Fig 2. The algorithm for embedding

2.1.Encryption

Encryption of image is explained below step by step

1).one level DWT is applied to input mage .then we get the four sub bands LL, HL, LH, HH.

2).then apply the Arnold cat map to each sub band individually. By this pixels are shuffled.

3).then apply the inverse DWT for LL, HL, LH, and HH. Finally we get the encrypted image.

2.2.α-coefficient algorithm for embedding

This is explained below step by step as follows.

1) Take cover image of size 512X512 G-plane and apply one level haar DWT decomposition. Then we will get sub bands LL, HL, LH, and HH of size 256X256.

2) Take encrypted image of size 256X256.

3) Embedded image is obtained by 4X4 block processing the LL and encrypted image by following formula.

Embedded image block= ((1-α) * LL intensity value) + (α * encrypted image intensity value). Take α=0.05.

4).then apply IDWT for LL, HL, LH, and HH. Then insert this embedded image block in place of G-plane in cover image. Then we get the stego image

Calculate the PSNR value in order to check for visual quality of image.

PSNR = 10 log 10(255^2/MSR)

Where NMSR=mean squared difference between the cover image and stego image.

Procedure for extraction is explained step by step below.

1).encrypted image is extracted from stego image by using α coefficient algorithm.

2).secrete image is reconstructed from extracted encrypted image by using both DWT & Arnold cat map. It is shown by flow chart in fig2.

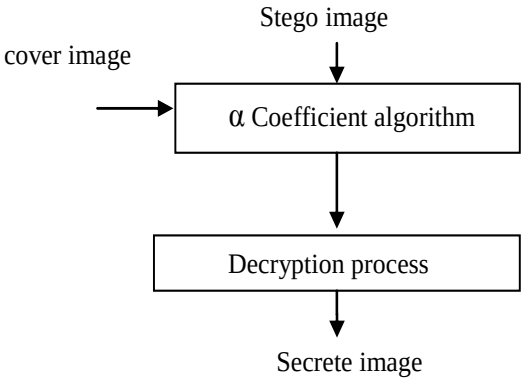

Fig3. The algorithm for reconstruction

2.3.α-coefficient algorithm for extraction:

This is explained below step by step as follows.

1) Perform one level haar DWT decomposition on stego image and cover image.

2) Calculate the PSNR for decomposed stego image as well as cover image for finding out in which sub band secrete image is embedded. on examining we will find out it is LL.

3) Process LL sub bands of cover image and stego image by 4X4 block by block. formula for getting encrypted mage is given below.

Encrypted image = (LL intensity value of stego image-((1-α)*LL intensity value of cover image))/α.

Take α=0.05

2.4.Decryption:

Decryption is explained below step by step as follows.

1).apply the one level haar DWT decomposition for extracted encrypted image.

2).then we can get original secrete image by applying Arnold cat map for each sub band. and then applying IDWT.

3. RESULTS:

Efficiency of this algorithm is obtained by calculatig the peak signal to noise ratio(PSNR) for stego image. PSNR value is obtained by the following formula.

PSNR=10*log10(255^2/MSE)

Where MSE is mean square error calculated between the cover image and stego image.

Fig 4. Cover image

Fig 5. Secret image

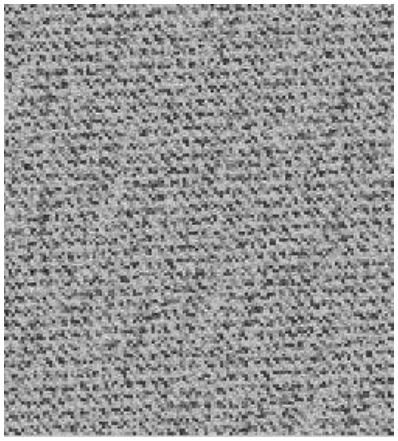

Fig 6 encrypted image

Fig 7. Stego image

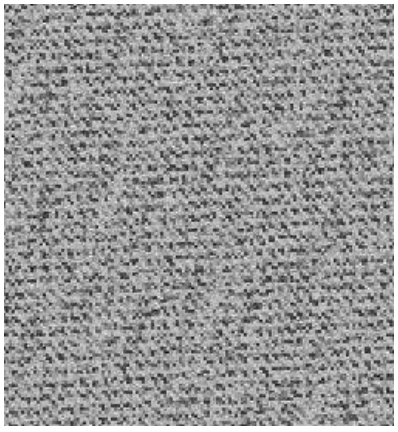

Fig 8. Extracted encrypted image

Fig 9.Reconstructed image

Mean sqare error (MSE) and peak signal to noise ratio (PSNR) is calculated for stego image with tespect to cover image. these values are tabulated below.

Table 1

S.No	Metric	Values obtained b/w fig 4 and fig 7
1	MSE	5.2
2	PSNR	40.9

4. CONCLUSIONS:

In this paper we proposed the novel algorithm for hiding of gray image in color image. In this gray image is encrypted using DWT & Arnold cat map, this encrypted image is hiding in color image using α coefficient algorithm and the corresponding MSE and PSNR values are calculated for the stego image.

5.REFERENCES

[1] "Discrete wavelet transform based steganography for transmitting images" IEEE-International Conference on Advances in Engineering, Science and Management (lCAESM -2012) March 30, 31, 2012 370

[2] "Block based approach of fingerprint image authentication using wavelets" European

Journal of Scientific Research: ISSN 1450-216X Vol. 88 No 2 October, 2012, pp.251-260s, G. K. Rajini *VIT University, Vellore, tamilnadu,*Email:lakshmirajini@rediff.com G. Ramachandra Reddy *SMIEEE, Professor, ECE Department, S.V.University, Tirupati* E-mail: grreddy@vit.ac.in.

[3] A. J. Menezes, P. C. V. Oorschot, and S. A. Vanstone, *Handbook of Applied Cryptography*. Boca Raton, FL: CRC Press, 1996.

[4] **"**Arnold's Cat Map**"** Gabriel Peterson Math 45 – Linear Algebra Fall 1997.

[5] **"**A Chaotic Image Encryption**"** Katherine Struss Mathematics Senior Seminar, 4901 Advisor: Barry McQuarrie Second Reader: Byungik Kahng University of Minnesota, Morris Spring 2009.

[6] K.P.Soman, K.I Ramachandran "insight into WAVELETS from theory to practice" second edition.

[7]Banoci, V.; Bugar, G.; Levicky, D. A novel method of image Steganography in DWT domain, Radioelektronika, 20 II 21st [International Conference]

[8] Dunbar, B., "Steganography techniques and their use in anOpen-Systems environment", SANS Institute, January 2002