New Combined Steganography technique using DWT and DCT

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***Abstract*— Steganography is a art of hiding that apply secret information in a multimedia carrier, and carrier may be image, audio, and video files but digital images are the most popular because of their high frequency on the Internet. Major issues in Image steganography are to increase the imperceptibility of secret information in stego image & increasing the robustness against steganalysis. In this paper, a new dwt-dct combined technique is proposed.**

***Index Terms*—** Steganography, DCT, Wavelet Transform

INTRODUCTION

Anderson proposed a the scheme of Least significant based hiding[1] which it is very easy for implementation but have lowest robustness against statistical attacks. Vijay Kumar and Dinesh Kumar analyzed the imperceptibility in different sub band as LH, HL, HH of Discrete Wavelet Transform (DWT) based image steganography in which results shows that HH sub-band band of DWT gives higher imperceptibility or PSNR compared to other band in DWT based image steganography[2]. R.O. El. Safy, H.H. Zayed & A. El Dessouki proposed an adaptive data hiding technique using the optimum pixel adjustment algorithm to increase the hiding capacity [3]. Elham Ghasemi, Jamshid Shanbehzadeh and Bahram ZahirAzami [4] proposed a scheme based on Integer Wavelet Transform and Genetic Algorithm which hide information using a mapping function based on Genetic Algorithm in 8x8 block of wavelet coefficient [4].

Related Work

a) Wavelet Transform

The wavelet transform decompose the image into four sub band (LL, LH, HL, HH) of different frequency groups. Coefficient of low frequency sub band is called approximate components which represents the characteristics of a image while coefficients of high frequency sub-band called detailed components which represents noise and redundancy in a image [5].

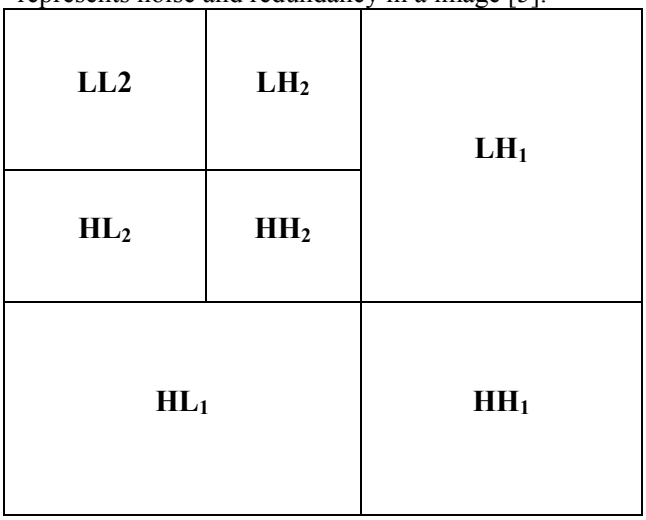

Figure 3: DWT decomposition with three levels

b) Discrete Cosine Transform

The 2D Discrete cosine transform of an M*N image is defined as following[6]:-

$$f(x,y) = \sum_{x=0}^{M-1}\sum_{y=0}^{N-1} \alpha(u)\alpha(v)F(u,v)\cos\left[\frac{\pi(2x+1)u}{2M}\right]\cos\left[\frac{\pi(2y+1)v}{2N}\right] \quad \ldots\ldots (1)$$

$$where\ u = 0,1,2,\ldots\ldots\ldots\ldots\ldots M-1\ and\ v = 0,1,2,\ldots\ldots\ldots\ldots\ldots N \quad 1$$

. Where

$$\alpha(u)and\ \alpha(v) = \begin{cases} \sqrt{\frac{1}{M}} & for\ u,v = 0 \\ \sqrt{\frac{2}{M}} & for\ u,v \neq 0 \end{cases} \quad \ldots.(2)$$

Proposed Work

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For achieving better imperceptibility with robustness against statics attacks, a combined DWT – DCT technique may be proposed in such a order which have higher PSNR value. Coefficients of HH sub band of a level of DWT are selected for embedding image embedding for achieving better the robustness against Gaussian noise attack, cropping attack and Salt & Pepper Noise attack without distortion in quality of image. After this, on the set of determined HH coefficients of wavelet transform, Discrete Cosine Transform is applied which convert wavelet matrix into DCT coefficient matrix. DCT matrix is converted into 8x8 block matrix which is embedded using interchanging of Mid-band coefficients.

Experiments & Results

In our experiments leena images, mostly in research papers of image steganography, is used for test. Leena image are 512x512 image which as shown in figure 4.2 and secret image is shown in figure 4.1. The algorithm presented in section III is implemented in MATLAB. The secret information is a image of size , which is shown in figure & PSNR is calculated on same payload capacity which unit is dB.

a) Measurement Matrices

Measurement units of imperceptibility are defined as following.

Imperceptibility: Quality of stego image after the embedding of secret information for robustness against visual Attacks is called imperceptibility of secret information which is proportional to PSNR (Peak Signal to Noise Ratio) [7] as defined in following equation.

$$PSNR = 10 * log \frac{P^2}{MSE}$$

$$Where\ MSE = \sum_{i=1}^{R}\sum_{j=1}^{C}(S_{ij} - C_{ij})^2$$

Where P:-Max. Value in Cover Image

S_{ij}: pixel value at ij position Matrix of Stego Image

C_{ij}:: pixel value at ij position in Cover Image.

M & N are the pixels in rows & column of Cover image respectively

Figure 4.1: Secret image for Experiment

Figure 4.2: Cover Image Lena 512*512 pixels for Experiment

Table 1: Completive Results proposed image steganography with other technique

Sno	Technique	Image Name	PSNR
1	Proposed technique	Leena	43 (appox.)
2	Vijaya K. [8]	Leena	39 (appox.)

Conclusion

Proposed method applied strength of two combined transform domain techniques DCT & DWT to obtain further imperceptibility and robustness. The idea of inserting embedding image in combined transform is based on fact that joint transform eliminates drawback of each other and thus an effective embedding image method can be obtained. From the results it is derived that proposed technique achieved PSNR value 43 while vijaya & vivek 's method provide PSNR 39. So proposed technique have higher imperceptibility or higher robustness against visual attacks.

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