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An Approach to Hide Information Using Wavelet Based Method

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ABSTRACT

Steganography is a way of invisible communication through a cover media so as not to look suspicion on an eavesdropper's eyes. It is a way to provide security with the help of multimedia object.The characteristics of a steganographic method is describable using it's imperceptibility towards counter measure(attacks).A high level secure steganographic method is proposed in Discrete Wavelet Domain to hide secret image with accepted level of distortion.Visual difference between the cover and stego object is null.To demonstrate the performance of the algorithm experimental results have been shown using PSNR and MSE.

Keywords : Steganography, Spatial Domain, Frequency Do-main, Discrete Wavelet Transform, PSNR, MSE

I. INTRODUCTION

Secure Data transfer become essential with the advancement of internet technology. To provide security, Cryptography and Steganography [1] are the most widely used. Cryptographic technique concerns with transforming data from one form to another, known as encryption whereas only intended receiver can do the decryption. On the other hand Steganography [2], [3] is the art of convert communication, means it makes the existence of the data invisible. It uses multimedia object like audios, videos or images for secure transmission of data. The multimedia object in which the information will be hidden is known as cover object. In this proposed method, we will use image as cover object for secretly sending confidential information. Spatial and frequency domain methods are two categories where steganographic techniques can be applied. Least Significant Bit technique is the first steganographic method, which was in spatial domain. We directly deal with pixel values in spatial domain, which increases the chances of attack. Performance of various steganographic methods can be rated by three Parameters: capacity, security and imperceptibility. So to offer more security we are proposing a frequency domain technique, which helps to spread the data in the entire image and makes steganalysis more difficult.

II. LITERATURE REVIEW

LSB is one of the widely popular spatial domain [4], [5] steganographic technique. In LSB steganography, the least significant bits of the cover medias digital data are used to conceal the message. The simplest of the LSB techniques is LSB replacement. LSB replacement steganography flips the last bit of each of the data values to reflect the message that needs to be hidden.

To embed message in frequency domain many methods have been proposed based on JPEG, which works on Discrete Cosine transform such as Jsteg and OutGuess. Present study is going on Discrete Wavelet Transform.Ali Al-Ataby and Fawzi Al-

Naima[9] proposed a modified high capacity image steganography based on wavelet transform.Their method applies DWT on the cover image and based on the threshold selects the pixel where redundant information can be hidden.Hemalatha et al.[11] proposed a color image steganography using DWT where they are converting RGB image into YCbCr colorspace and making a block matching on Cr component of the cover image with a gray scale secret image and hiding the index as key using LSB,but as we know there are no of steganalysis technique which can detect LSB hiding.Amitava Nag et al.[10] proposed a steganographic technique using DWT where the secret image is encoded using huffman encoding and 3-bit at a time is hidden in DWT coefficients of the cover imageprovide illustrations of the modifications.

III. INTEGER-TO-INTEGER WAVELET TRANSFORM

Discrete wavelet transform is widely used for steganographic work in frequency domain. One dimensional discrete wavelet transform (DWT) is nothing but a processed work of high and low-pass filtering on an object, which helps to produced a smoother version of the object by convolution. In 2d-DWT, first 1d-DWT is applied on rows followed by columns, results four level of details as approximation, horizontal, vertical and diagonal details. Normally image contains Integer value but after applying DWT the resulting output is a floating point value, which makes reconstruction difficult. Therefore, for our proposed algorithm we are using Integer-to-Integer wavelet transform (IWT) [6], [7]. Let the original Grayscale image IG is of size M X N and Integer Wavelet transform on IG gives us

$IGA_{i,j} = \lfloor IG_{2i,2j} + IG_{2i+1,2j/2} \rfloor$

$IGH_{i,j} = IG_{2i+1,2j} - IG_{2i,2j}$

$IGV_{i,j} = IG_{2i,2j+1} - IG_{2i,2j}$

$IGD_{i,j} = IG_{2i+1,2j+1} - IG_{2i,2j}$

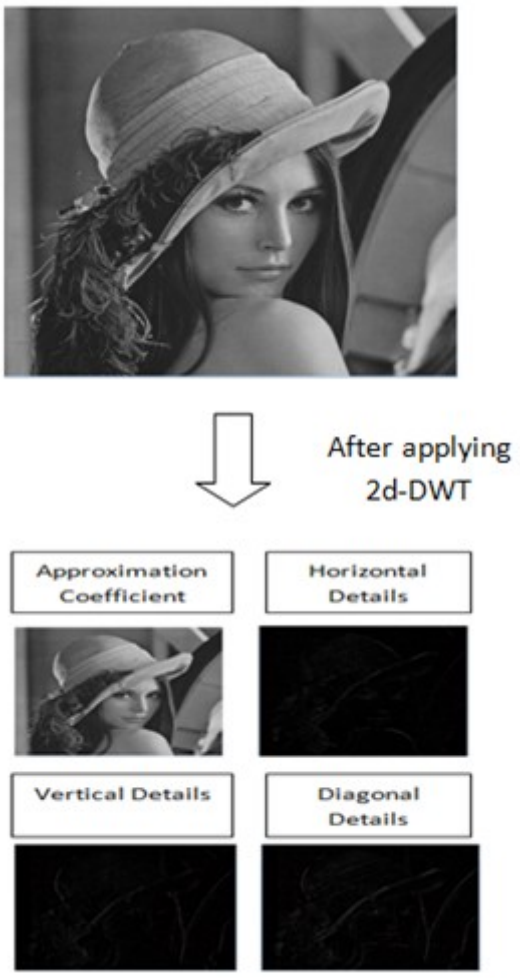

Figure 1. The embedding process of proposed algorithm.

IV. PROPOSED METHOD

In the proposed method, we are applying histogram adjustment on gray scale image. Adjusted image will be taken as cover image. Approximation, Horizontal, Vertical and Diagonal sub-images are extracted from cover and secret image through IWT. Apply Block matching on approximation coefficient of both the cover and secret message. The index value of best-matched block will be taken as a key. With the help of key select the most similar block from approximation sub-image and subtract it from approximation block of secret image which will lead to another new block, perform block matching in between new block and diagonal sub-image that will lead to another key. Hide both the keys in Vertical Subimage and apply inverse-IWT to get the stego

image. Figure 2 and 3 shows the block diagram of the proposed method.

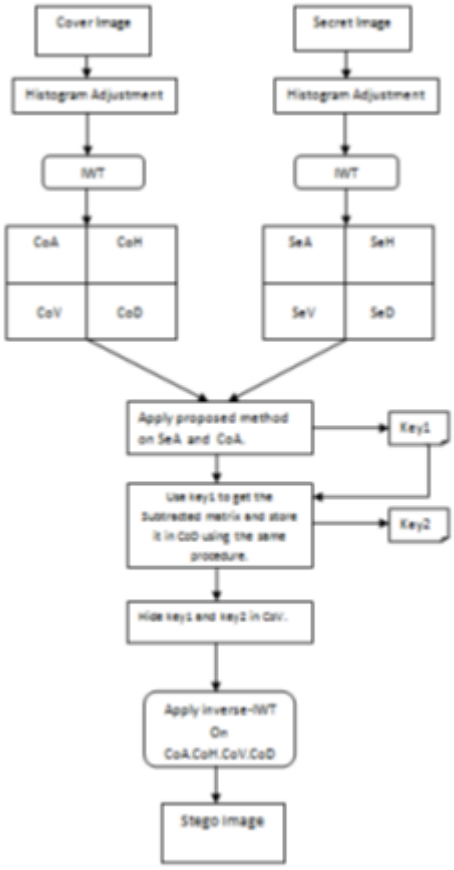

Figure 2. The embedding process of proposed algorithm.

A. Embedding process

1. Let Co is a gray scale cover image and we will apply Integer Wavelet Transform on it to get CoA, CoH, CoV, CoD sub-images. Same process is applied on secret image to get SeA, SeH, SeV, SeD sub-image.
2. Take 2-by-2 block of SeA and using the RSME find the best matched block from CoA. Make a secret key1 by taking the index value of best-matched block.
3. Using key1 find the difference between the block of SeA and CoA.This process gives another matrix of same size using the difference value.

DSeA=SeA-CoA

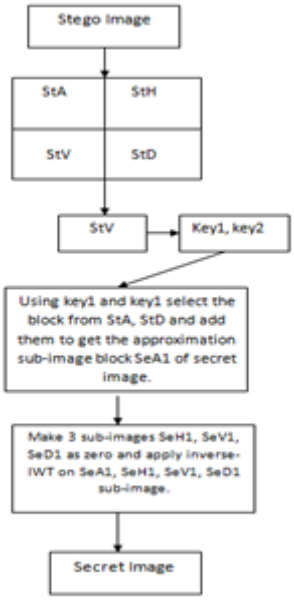

Figure 3. The extraction process of proposed algorithm.

a. Again, apply same procedure as step-2 for DSeA and CoD, which gives another secret key2.
b. Now, take key1 and key2 and hide them in CoV by taking 2 LSB of every coefficient.
c. Apply inverse-IWT on CoA, CoH, CoV, CoD and get the Stego Image.

B. Extraction process

1. Take the stego image St as input and apply IWT on it to get four sub-image StA, StH, StV, StD.
2. Extract the secret key1, key2 from SeV.
3. Using the key key1 and key2 extract all 2-by-2 block of StA and StD. Now subtract them to get the secret image SeA1.
4. After getting the sub-image SeA1 make 3 sub-image SeH1,SeV1,SeD1 as zero and apply inverse-IWT on four sub-image to get the secret image of actual size.

V. RESULT ANALYSIS

For analysis of the proposed algorithm, we took Lena, baboon, peppers image as cover image and moon, cameraman as secret message. After applying

the proposed algorithm, we got good quality stego image. Peak Signal-to-Noise Ratio (PSNR) is used to measure the image quality after embedding the secret message. PSNR value indicates the proposed algorithm produced good quality stego image. Histogram of the cover, stego images are shown in Fig 4 and 5 after hiding 128 x 128

Table 1. PSNR Values After aplying Proposed Method

Serial NO	Cover Image(256X256)	Secret Image1(128X128)	Secret Image2(128x128)
		moon	cameraman
1.	lena	50.6503	50.1583
2.	babbon	50.5735	49.8534
3.	peppers	49.5526	50.45551

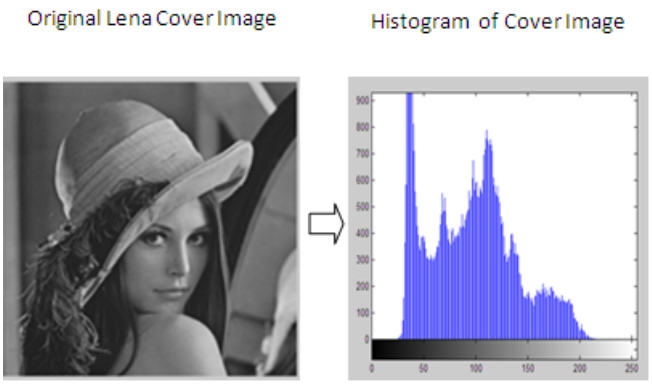

Figure 4. Histogram of Cover image.

VI. CONCLUSION

The proposed algorithms hides the key instead of hiding the secret image that helps to improve the stego image quality, which is one of the most important characteristics of steganography. The PSNR shows that the method gives high quality stego image. The algorithm uses block matching technique with the stego image which helps to extract the secret image with help of the key from stego image without hiding any information on it. In future we will try to implement the algorithm by applying it on color image to hide multiple secret image on a single cover image.

Figure 5. Histogram of Stego image with hidden data.

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