Secure Communication based on SVD and 3DWT Watermarking

Ms. Ruchi Pachori, VITS, Jabalpur
Prof. Amit Mishra, Asst. Prof., VITS, Jabalpur

ABSTRACT: Watermarking is a type of security technique in obscurity: the art and science of hiding the available of a message between sender and intended recipient. But the techniques that are been developed in the area are based of complex and pattern based data hiding in pixels of images, later on key based approaches are also been developed, later on many combination (two different approaches cryptography and Watermarking working together) based method been developed. The proposed work is new concept for Watermarking that is analytical cum pattern based Image Watermarking the proposed method is been developed for achieving very high SNR and low MSE even if the size of original is less, actually the only problem with Watermarking is that it requires lots of data (a full image) for transmitting few original data, so proposed work aims to reduce the size of image while maintaining the size of original data same. Proposed paper is a unique DWT and SVD based method for Watermarking.

Keywords – Discrete Wave Transform, Discrete Cosine Transform, Watermarking, cryptography. Peak Signal to Noise Ratio (PSNR), MSE: Mean Square Error

I--INTRODUCTION

Wavelet transform is used to convert a spatial domain into frequency domain. The use of wavelet in image stenographic model lies in the fact that the wavelet transform clearly separates the high frequency and low frequency information on a pixel by pixel basis. Discrete Wavelet Transform (DWT) is preferred over Discrete Cosine Transforms (DCT) because image in low frequency at various levels can offer corresponding resolution needed. A one dimensional DWT is a repeated filter bank algorithm, and the input is convolved with high pass filter and a low pass filter. The result of latter convolution is smoothed version of the input, while the high frequency part is captured by the first convolution. The reconstruction involves a convolution with the synthesis filter and the results of this convolution are added. In two dimensional transform, first apply one step of the one dimensional transform to all rows and then repeat to all columns. This decomposition results into four classes or band coefficients.

The Haar Wavelet Transform is the simplest of all wavelet transform. In this the low frequency wavelet coefficient are generated by averaging the two pixel values and high frequency coefficients are generated by taking half of the difference of the same two pixels. The four bands obtained are approximate band (LL), Vertical Band (LH), Horizontal band (HL), and diagonal detail band (HH). The approximation band consists of low frequency wavelet coefficients, which contain significant part of the spatial domain image. The other bands also called as detail bands consists of high frequency coefficients, which contain the edge details of the spatial domain image.

Research into human perception indicates that the retina of the eye splits an image into several frequency channels, each spanning a bandwidth of approximately one octave. The single in these channels is processed independently. Similarly in a multilevel decomposition, the image is separated into bands of approximately equal bandwidth on a logarithmic scale. It is therefore expected that use of the DWT will allow independent processing of the resulting components without significant perceptible interaction between them, and hence makes the process imperceptibility marking more effective. For this reason the wavelet decompositions is commonly used for the fusion of images. Fusion technique include the simple method of pixel averaging to more complicated methods such as principal component analysis and wavelet transform fusion. Several approaches to image fusion can be distinguished; depending on whether the image is fused in the spatial domain or any other domains, and their transform fused. Image fusion is a process that produces a single image from a set of input images. The fused image contains more complete information, than any individual input. Since this is a sensor-compresses information problem, it follows that wavelets, classically useful for human visual processing, data compression and reconstruction are useful for such merging. Other important applications of the fusion of images include medical imaging, microscopic imaging, remote sensing, computer vision and robotics.
II--AVAILABLE WORK

Krishna Rao Kakkirala [1] proposed a block based blind image watermarking using DWT, SVD and Torus automorphism and also proved that this method is robust against different kinds of geometric and signal processing attacks technique extracts watermark without cover image and also proved that this method is robust against different signal and non signal processing attacks.

Tanmay Bhattacharyya et al [2] discussed that the Forward type Discrete Wavelet Transform is very good to find the areas in the covering image that where can be privet data can be hidden successfully because of its efficient space & frequency resolution properties Their Method for Watermarking has following steps also shown in figure2:-

1. Cover image is decomposed into four sub bands (LL, LH, HL and HH) using DWT.
2. Privet data are taken and converted into different 1D Vectors.
3. Pseudo random sequence generated by the session based key.
4. Each HL and HH sub band of the cover image are modified separately using corresponding sequence depending upon the content of the corresponding data 1D to be embedded.
5. Four sub bands including two modified sub bands are combined to generate the stego image using IDWT.

In year 2012 at Fifth International Workshop on Chaos-fractals Applications and Theories, Mr. Sandra Bazebo Matondo and Mr. Guoyuan Qi from Department of Electrical Engineering, Tshwane University of Technology Pretoria, South Africa proposed a new research work entitle “Two-Level Image Encryption Algorithm Based on Qi Hyper-Chaos [3].”

There work was supported by the grants of Incentive Funding of National Research Foundation of South Africa and Eskom Tertiary Education Support Program of South Africa

This work introduces a two-level encryption algorithm based on the high level of randomness of the Qi hyper-chaos and its sensitivity to initial condition. With DC based encryption and pixel permutation respectively the first and second level; the characteristics of the plain image have been hidden and kept safe from multiple types of attacks. The analysis show that the Qi hyper-chaos have bigger key space, faster encryption speed due to its faster pseudo random sequence generation rate compared with existing chaotic systems [3].

To check the correlation between two adjacent pixels they derive new formula demonstrate Pairs Analysis and compare its performance with the chi-square attacks.

\[ C_r = \frac{\sum_{i,j} (x_i + y_j) - \sum_{i,j} x_i \sum_{i,j} y_j}{\sqrt{(\sum_{i,j} x_i^2 + \sum_{i,j} y_j^2)(\sum_{i,j} x_i^2 + \sum_{i,j} y_j^2) - (\sum_{i,j} x_i y_j)^2}} \]

Their observed result was they took an image size of 512x512 and encrypt it to test their algorithm. Using their selective encryption, only 4096 DC coefficients gets encrypted to change the values of total 262144 pixels [3].

Belmeguenai Aissa, Derouiche Nadir, and Redjimi Mohamed present Image Encryption Using Stream Cipher Algorithm with Nonlinear Filtering Function, In their Work, a new algorithm based encryption scheme for image data was introduced, their simulations were carried out with different images. Their visual test indicates that their encrypted image was very different and has no visual information which can be deduced about the original image for all images. In addition, their method was very simple to implement, the encryption and decryption of an image. Their proposed algorithm can to resists the additive noises [4].
Base[1] Krishna Rao Kakkirala and Srinivasa Rao Chalamala, Block Based Robust Blind Image Watermarking Using Discrete Wavelet Transform, Proposed a blind image watermarking technique which embeds watermark into image in frequency domain using discrete wavelet transform, singular value decomposition and torus automorphism techniques. This technique extracts watermark without cover image and also proved that this method is robust against different signal and non signal processing attacks. They hide the watermark in Image with BER of 0.29 in JPG images.

Base[2] Tanmay Bhattacharya, Nilanjan Dey and S. R. Bhadra Chaudhuri, A Novel Session Based Dual Steganographic Technique Using DWT and Spread Spectrum, Their approach can be applied for colour image and also for audio Watermarking because DWT is applicable for any digital signal, they observed the PSNR of 27.3850.

Base[3] Mr. Sandra Bazebo Matondo and Mr. Guoyuan Qi, Two-Level Image Encryption Algorithm Based on Qi Hyper-Chaos, Their observed result was they took an image size of 512x512 and encrypt it to test their algorithm. Using their selective encryption, only 4096 DC coefficients gets encrypted to change the values of total 262144 pixels, the correlation found in cipher is images is 0.9830.

Base[4] Belmeguenai Aissa, Derouiche Nadir, and Redjimi Mohamed, Image Encryption Using Stream Cipher Algorithm with Nonlinear Filtering Function, Their method was very simple to implement, the encryption and decryption of an image. Their proposed algorithm can to resists the additive noises, the correlation found in cipher is images is 0.0975.

Table 1: Comparison of Published Stenographic Algorithms
SVD

U
V
W

Modified V

Inverse SVD

Watermark

Binary Conversion

Key

CIPHER IMAGE

IMAGE
III– TECHNIQUE ADOPTED

Figure 3 shows the proposed method. At first step the image is been taken through MATLAB and then in the MATLAB environment it gets converted into pixels form (integer numbers) for the data hiding as it is an analytical approach we required to convert it into frequency cum time domain which is possible with Wavelet transform only there are many transform techniques are available so it was our decision to make that up to what we required time or frequency resolution if we choose ‘db1’ then very good frequency resolution and if we choose ‘db10’ then time resolution gets better so we have chosen ‘db5’ wavelet which give adequate time and frequency resolution. After transform comes to new method to find out the area where one can hide pixels in image and it affects the original image negligibly for that we have chosen correlation of pair of three continuous pixels to search the required area where one can hide the data significant.

IV–RESULTS

Table 2: the observed results

<table>
<thead>
<tr>
<th>Data</th>
<th>Image size</th>
<th>Cover image size</th>
<th>MSE</th>
<th>SNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 kb</td>
<td>200 kb</td>
<td>0.089</td>
<td>85.2</td>
<td></td>
</tr>
<tr>
<td>14 kb</td>
<td>200 kb</td>
<td>0.098</td>
<td>84.8</td>
<td></td>
</tr>
<tr>
<td>22 kb</td>
<td>200 kb</td>
<td>0.102</td>
<td>83.1</td>
<td></td>
</tr>
<tr>
<td>25 kb</td>
<td>200 kb</td>
<td>0.154</td>
<td>82.9</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows the Mean square Error observed for the different size of Data and cover image and it also shows the Signal to Noise ratio (SNR) for different scenario, it can be easily seen that observed results that Maximum SNR is 98.2 which is quite good but it gets reduces when size if covering image increases after deeply analysing the results it can be said that results are as was expected and it is very clearly hiding the data image into the covering - stego-image.

IV–CONCLUSION

Major issue with available work that most of the stenographic technique did not care about stegno image follow same KEY based hiding approach for any stegno image or data, and method which are based on transform of stegno image before data hiding sometime did not use KEY or sometime use KEY but at HH band hiding with a fixed approach. Proposed work is a new approach of data hiding in Images with using DWT and also proposed work has new method adopted for computing correlation between the pixels of dwt HH band, we do that finding significant pixels where data can be hide at LSB and quality odd image affect negligible.