International Journal of Computational Engineering Research||Vol, 04||Issue, 3||

Survey of Steganalysis Technique for Detection of Hidden Messages

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ABSTRACT

Still and multi-media images are subject to transformations for image compression and steganographic hidding and digital watermarking. Here new measures and techniques for detection and analysis of steganographic embedded content. We show that both statistical and pattern classification techniques using our measures provide reasonable discrimination schemes for detecting embeddings of different levels. These measures are based on a few statistical properties of bit strings and wavelet coefficients of image pixels. There are Techniques for information hiding known as steganography are becoming increasingly more popular and spread over a large area.

The purpose of steganography is to send secret messages after embedding them into public digital multimedia. It is preferred to hide as many messages as possible per change of the cover-object. In general, for given messages and covers, the steganography that introduces fewer embedding changes will be less detectable, i.e., more secure. Two fields of study have been projected to develop the communication security: cryptography and information hiding. Although they are both applied to the protection of secret message, the major difference is the appearance of the transmitted data.

INDEX TERMS: *Steganography, Least significant bit (LSB), Exploiting Modification Direction (EMD), Diamond Encoding (DE), Optimal Pixel Adjustment Process (OPAP), Pixel Pair Matching (PPM), Adaptive Pixel Pair Matching (APPM).*

I. INTRODUCTION

All natural images have a lot of correlation among neighboring pixels. Image pixel data has statistical functionalities. All these are disturbed by the process of embedding. These are exploited in steganalysis of images.Data concealment may be a technique that conceals information into a carrier for transference secret messages confidentially [2], [3]. Digital pictures are wide transmitted over the Internet; thus, they usually functions a carrier for covert conversation. Pictures used for carrying information are termed as cover pictures and pictures with information embedded are termed as stego pictures. Once embedding, pixels of cover pictures are going to be changed and distortion occurs. The distortion caused by information embedding is named the embedding distortion [4]. A decent data-hiding methodology must be capable of evading visual and applied detection [5] whereas providing an adjustable payload [6]. The least vital bit substitution methodology, spoken as LSB during this study, may be a well-known data-hiding methodology. This method is easy to implement and is one of the favored hiding techniques. However, in LSB hiding, the pixels with even values are going to be accumulated by one or unchanged. The pixels with odd values are going to be decreased by one or unchanged. Therefore, the unbalanced embedding distortion emerges and is at risk of steganalysis [7], [8].

This technique embeds fixed-length secret bits into the least significant bits of pixels by directly replacing the LSBs of the cover image with the secret message bits. This technique is simple which typically effects noticeable distortion once the quantity of hidden bits for each pixel exceeds three. Many methods have been proposed to reduce the distortion induced by LSBs substitution. In 2004, Chan et al [9], Proposed a simple and efficient optimal pixel adjustment process (OPAP) method to reduce the distortion caused by LSB replacement. The LSB and OPAP methods employ one pixel as an embedding unit, and hide data into the rightmost r LSBs. Other group of data-hiding methods employs two pixels as an embedding unit to hides a message digit notational system and termed as data-hiding methods known as pixel pair matching (PPM). Here we study a new data hiding method to reduce the embedding impact by providing a simple extraction function and a more compact neighborhood set. The given technique embeds more messages and thus increases the hiding efficiency. The image quality obtained by the given technique not only performs better than those obtained by (OPAP) and Diamond Encoding (DE), but also brings higher payload with less detect ability.

II. BACKGROND

The approach of embedding information into a picture, image steganography techniques may be divided into the subsequent groups: Spatial Domain or Image Domain and Transform Domain or Frequency Domain.

2.1 Spatial domain techniques:-

Operate directly on pixels. Spatial domain reversible information activity is performed supported the ways Difference Expansion (DE) and Histogram modification. The previous methodology provides higher capability whereas the later provides higher quality image. In Difference Expansion (DE), the embedded bit stream includes a pair of elements. The primary half is that the payload that conveys the secret message and therefore the second half is that the auxiliary data that contains embedding data. The dimensions of the second half must be kept little to increase embedding capability.

LSB embedding is un-compressed pictures is of most interest. Hence, we have a tendency to concentrate fully on LSB information hidding and detection for uncompressed pictures. There are measure of few schemes that is slight variants of LSB replacement techniques. There are few techniques which are slight variants of LSB replacement techniques. Instead of replacing Least Significant Bit’s of pixel value, the pixel value is incremented or decremented depending upon bit of the data and value of the pixel. Embedding information into least significant bit won't be seen by the human eye. Therefore the stego image appears like original or cover image.

The drawback of LSB is though it is simplest and easiest way for embedding information into pictures, once more data is hidden, the image looses it quality. Statistical analysis of the stego image ends up in the suspicion of hidden data.

2.2 Transform domain techniques:-

Images are first transformed and then the message is hided into it. These are robust methods for data embedding. It is more complex method to hide secret message into an image. It performs data hiding by manipulating mathematical functions and transformations of image. Transformation of cover image is performed by tweaking the coefficients and inverts the transformation. Popular transformations include the two-dimensional discrete cosine transformation (DCT) [15]) discrete Fourier transformation (DFT) and discrete wavelet transformation (DWT) [14]) that are commonly used in image steganalysis.

It is accepted from Fourier theory that a signal will be expressed because the total of a, possibly infinite, series of sine’s and cosines. This total is additionally taken as a Fourier expansion. The important disadvantage of a Fourier expansion is that it's fully frequency resolution and no time resolution and it's advanced and has poor energy compaction (Is the ability to pack the energy of the spatial sequence into as few frequency coefficient’s as possible, this is very important for image compression, we represent the signal in the frequency domain if compaction is high we only have to transmit a few coefficients instead of the whole set of pixels). This suggests that though we would be ready to verify all the frequencies in a signal, we are not aware when they are present. To beat this downside within the past decade many solution are developed that are additional or less ready to represent a sign within the time and frequency domain at an equivalent time. The thought behind these time-frequency joint representations is to cut the signal of interest into many components then analyze the components singly. It's clear that analyzing a signal this fashion can provide additional data concerning the once and wherever of various frequency elements, however it results in a basic downside as well. Suppose that we wish to understand precisely all the frequency elements given at an explicit moment in time. We have a tendency to cut out fully this short time window a employing a Kronecker delta function, remodel it to the frequency domain and. The matter here is that cutting the signal corresponds to a convolution between the signal and therefore the cutting window. Since convolution within the time domain is same for multiplication within the frequency domain and since the Fourier transform of a Kronecker delta contains all doable frequencies the frequency elements of the signal are dirty out everywhere the frequency axis. If truth be told this case is that the opposite of the quality Fourier Transform since we have a tendency to currently have time resolution however no frequency resolution.

Discrete cosine transform (DCT) has become the most popular technique for image compression over the past many years. One of the major reasons for its popularity is its selection as the standard for JPEG. Discrete Cosine Transform's are most commonly used for non-analytical applications such as image processing and. signal-processing, applications such as video conferencing, fax systems, video's, and High Definition TV. Discrete Cosine Transform's can be used practically on a matrix of any dimension. Mapping an image space into a frequency space is the most common use of DCTs. For example, video is usually processed for compression/decompression as 8 x 8 blocks of pixels. Large and small features in a video picture are represented by low and high frequencies. An advantage of the DCT process is that image features do not normally change quickly, so many DCT coefficients are either zero or very small and require less data during compression algorithms. DCTs are fast, easy and has large energy compaction (Energy compaction means that most of the important information of the image is stored or compacted in top left corner of the image) [15]. Wavelets are considered better than DCT when it comes to getting better results in compression. With DCT, the picture blocks can lose their crisp edges, whereas, with wavelets the edges are very well explained.

The disadvantage of frequency domain (DCT) stego algorithms is that the hidden message length is very small. Also image quality decreases very fast, as concealed message size increases. Such techniques are comparatively easier to crack.

To further enhance our understanding of the result's of embedding, we study the behavior of discrete wavelet coefficients (DWT).Farid et al [11, 12] have shown that wavelet domain can capture image characteristics, like whether or not an image is a natural image or a computer generated one or may be scanned one. They have shown that the feature vector given by them are often be used for universal steganalysis. Their aim was fully to find whether or not an image contains any kind of hidden information.

The wavelet transform or wavelet analysis is probably the most recent solution to overcome the shortcomings of the Fourier transform C. Valens [14]. In wavelet analysis the use of a fully scalable modulated window solves the signal-cutting drawback. The window is shifted on the signal and for each position the spectrum is calculated. Then this method is repeated again and again with a little shorter (or longer) window for each new cycle. At the end the result will be a group of time-frequency representations of the signal, all with totally different resolutions. Due to this collection of representations we will speak of a multi resolution analysis. Within the case of wavelets we generally do not speak about time-frequency representations however about time-scale representations, scale being a method the alternative of frequency, as a result the term frequency is reserved for the Fourier transform.

III. EMBEDDING AND EXTRACTION ALGORITHM

3.1 Embedding Algorithm: We are studying embedding algorithm & Extraction algorithm

Let the cover image be I, S is that the message bits to be hide. Initially we calculate the minimum value so that all the message bits are often embedded. Then, message digits are linearly hided into pairs of pixels. The detailed procedure is listed as below.

Input: Cover Image I, Data D, Key K.
Output: Stego Image.
Step1. Get the Image and convert it into byte stream.
Step2. Generate RGB and Hue Saturation Value (HSV) map.
Step3. Generate the Pixel map.
Step4. Call the optimize function.
Step5. Map co-ordinate with x, y.
Step6. Generate the sequences.
Step7. Calculate modulus distance and replace with other respective pixel.
Step8. Repeat step7 till completed.
Step9. Forward for LWZ out generate function.

3.2 Extraction Algorithm: To obtain the hidden message digits, pixel pairs are scanned within the same order as in the embedding procedure. The hidden message digits are the values of extraction function of the pixel pairs. The brief detailed is listed as below:
Input: Stego Image.
Output: Secret bit Stream.
Step1. Get input Image.
Step2. Generate byte stream.
Step3. Generate pixel to coordinate map.
Step4. Construct the sequences.
Step5. Provide input keys.

Step6. Select mapped pixels.
Step7. Calculate the distance.
Step8. Repeat above step till output is obtained.

Step9. Combine input stream and generate for LWZ analysis.

IV. CONCLUSION

The studied stegano graphic method known as LSB matching allows an embedding of the same amount of information into the stego image. At the same time, the number of changed pixel values is smaller. When more number of information is hidden, the appearance of image degrades. There are some drawbacks of Fourier transform such as it is complex and has poor energy compaction and Cosine also has some drawbacks as hidden message length is small and image quality degrades very fast, as embedded message size increases. Such techniques are comparatively easier to crack.

Thus all the above drawbacks are overcome by Wavelet Transform. Hence Wavelet Transform is the mostly used Transform and it also requires less time.

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