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DWT AND LSB ALGORITHM BASED IMAGE HIDING IN A VIDEO

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Abstract
Video Steganography is a method of hiding data into a carrying Video file. This data can be text, audio, image or a video itself. The video based Steganography is better than the other existing methods because of its high data security and it can accommodate large amount of secret data. The Discrete Wavelet Transformation (DWT) and the Least Significant Bit (LSB) Algorithm based data insertion into a video make the video Steganography a robust method of embedding information in a carrier file. The DWT technique converts the cover image as 4 x 4 blocks in which LL, LH, HL, and HH sub band images are developed. In the current project, using the DWT technique we hide the data in the specific location of the selected frame and by using LSB algorithm we replace the last bit of the original pixel value of the selected region with the secret data. Once the data is embedded into the seleted Frame it is called as a Stego frame. This stego frame is inserted in the place of the cover frame and the video is reconstructed.

I. INTRODUCTION

Data hiding and watermarking have a wide literature in the field of digital images and raw video. In the current paper we are targeting the internal dynamics of any video specifically the motion estimation stage. We have selected this stage as the contents of this stage are processed internally during the video encoding or decoding. Thus it makes it difficult to detect data by means of image steganalysis techniques and it is lossless coded. Due to this it is not prone to quantization distortions. Major part of the work is focused on data hiding in motion vectors. The data bits of the secret message are embedded in some of the motion vectors whose magnitude is above a threshold value. These motion vectors are also called as candidate motion vectors (CMVs). In the least significant bit of the of each CMV candidate motion vector, a single bit is hidden. The data is encoded as a region where the estimation of motion is allowed only to generate motion vectors in that particular region.

Here we have embedded the data in video using the DWT and LSB techniques. Based on the magnitude of the motion vectors these CMV are selected. The regions between CMV's, a message bit stream is encoded as phase angle difference. The block that is matching is restricted to search within the selected sector for a magnitude to be larger than the predefined threshold.

Finding the direct reversible method to identify any CMV's at the decoder is dependent on the attributes of the motion vectors. In this paper, we take an alternative approach that is applied to achieve the highest distortion to the prediction error and the size of the data overhead. This method is dependent on the associated prediction error and here we face the difficulty of solving the nonlinear quantization process. Thus as discussed in Proposed method, we use DWT and LSB Algorithms.

The paper is organized as follows: in introduction we have an overview of the terms compression and decompression of video. The existing methods explain the problem definition along with the evaluation criteria that is used in the paper. The proposed method describes the technique which we used in this paper. It is followed by the results and analyses in. Finally, the paper is concluded with advantages of the existing methods.

II. EXISTING METHODS

Here we have an overview of lossy video compression to define our notation and evaluation metrics. The intra predicted which is an (I) is-frame is used to encode using a regular image compression techniques similar to JPEG but with different quantization table and step at the encoder; and thus the decoder can reconstruct it independently. The I-frame is used as a reference frame for encoding a group of forward motion-compensated prediction (P) - or bi directionally predicted (B)-frames. In Motion Picture Expert Group (MPEG-2) which is commonly used standard [8], the video is

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arranged into groups of pictures (GOPs) and the frames of it can be encoded in the sequence: [I,B,B,P,B,B,P,B,B]. The temporary redundancy that exists between frames is exploited using block-based motion estimation which is applied on macro blocks of size b×b in P or B and searched in target frame(s). In general, in video compression the motion field is assumed to be translational with horizontal component and vertical component and is denoted in vector form by d(x) for the spatial variables in the underlying image. The search window is constrained by assigning limited which corresponds to the pixels if the motion vectors are computed with half-pixel accuracy. In the window of size b+ 2^n × b+ 2^n, an exhaustive search can be done to find the optimal motion vector satisfying the search criterion which needs many computations, or suboptimal motion vectors can be obtained using expeditious methods such as three steps search, etc. This is based on the processing power of video encoding device , the quality of the reconstruction and the required compression ratio. Since d does not represent the true motion in the video then the compensated frame P̃ using (x + d(x)) must be associated with a prediction error E (x)=(P-P̃)(x) in order to be able to reconstruct P=P̃ +E with minimum distortion at the decoder in case of a P frame. For the B-frame similar operation is done but with the average of both the backward compensation from a next reference frame and the forward compensation from a previous reference frame. The size of an image is E and thus it is lossy compressed using JPEG compression by reducing the size of data. The lossy compression quantization stage is a nonlinear process. Hence for every motion estimation method, the pair (d, E) will be different and the data size of the compressed error E will be different.

The motion vector are coded lossless and hence become an attractive place to hide a message that can be blindly extracted by a special decode. The decoder receives the pair (d,Ẽ), and applies motion compensation to form P̃ or B̃ , and then decompresses Ẽ to obtain a reconstructed 〖E〗_r. Since E and E_r are different by the effect of the quantization, then the decoder is unable to reconstruct identically but it alternatively reconstructs

P_r= P̃ + E_r. The reconstruction quality is usually measured by the mean squared error

P- P_r, represented as peak signal- to-noise ratio (PSNR).

III. DRAWBACKS IN EXISTING SYSTEM

At the encoder, the regular pair (d,Ẽ), is replaced by data hiding in motion vectors due to tampering the motion vectors, to become 〖(d〗^h,Ẽ ^h), where the superscript h denotes hiding. Data hiding in motion vectors of compressed video id defined in the context of super-channel [9]. 'm' is the secret message which is hidden in the host video signal x=(d,E) to produce the composite signal s =d^h,E^h. The composite signal is subject to video lossy compression to become y =(d^h,Ẽ ^h). The message m should survive the lossy compression of video and it can be extracted identically. This robustness constrain should have low distortion effect on the video that is reconstructed and it should also have low effect on the data size (bit rate). Given that m can be identically extracted, here in this paper, we use two metrics in order to evaluate data-hiding algorithms in compressed video which are increase in data size represents the overhead price that is paid for the embedded data.

Drop in the quality of reconstruction: this reconstruction done here is with loss of quality than that without data hiding and is expressed as the as peak signal- to-noise ratio difference which is also the quantity of the relative error P-P_r^h / P-P_r and B-B_r^h / B-B_r for P- and B-frame, respectively.

Our objective is to provide a good data-hiding algorithm that should maintain close to zero as possible for a given data payload. The payload should be robust to the video compression, specifically the quantization step applied to the prediction error E.

The selection of the CMV is the key difference between different methods. For instance [2] and [3] choose the CMV based on their magnitude$\bar{d} = \{d : ||d|| < threshold\}$. On the other hand [6] and [7] rely on the magnitude and the phase between consecutive motion vectors. Their idea is that motion vectors with large magnitude are less likely to represent the real underlying motion accurately and thus their associated macro block prediction error E is expected to be large. Tampering these CMVs will not affect the reconstruction quality that much. Analyzing this relation, we found it not to be usually correct as shown in Fig. 1 for a sample from the car-phone sequence:

Not all motion vectors with large magnitude are associated with macro blocks of high prediction error; and

There are motion vectors whose magnitude is small but their associated macro block prediction error is high.

These observations stimulated our proposal to rely directly on the associated macro block prediction error, such that we choose our CMV associated with macro blocks of high prediction error. If we tamper with these CMVs, then we will not have poor effect on the video reconstruction quality. Since

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PSNR is a reciprocal of the mean squared error (mse), then our selection criteria in this paper can be thought of as $\bar{d} = \left\{d : 10\log_{10}\left(b^2/\sum \beta_{i,j}E(x)\right) \le \tau\right\}$. In this direction, we choose the CMV based on the pair (d, E) and not d alone. However, this incurs the difficulty that E is lossy compressed and what we have at the decoder after decompression is actually E_r.

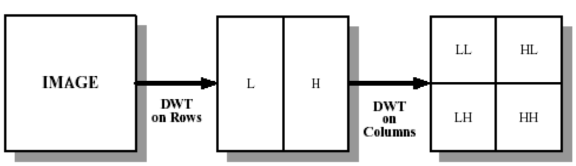
IV. PROPOSED METHOD

Discrete Wavelet Transformation:

The wavelet transformation is applied to the digital world using the discrete wavelet transformation (DWT) technique. The behavior of the continuous wavelet transform is analyzed by the Filter banks. The decomposition of the signal is done with help of a high-pass filter and a low-pass filter. The coefficients of the filters are computed using the mathematical analysis.

The wavelet decomposition of an image is done by considering the rows first and then columns. Consider an example where we have P x Q image. We first filter out each row and down-sample the image to obtain two P x (Q/2) images. We do the same for each column and subsample the filter output to obtain four (P/2) x (Q/2) images of the original image.

The output image derived by the low-pass filtering the rows and columns is referred to as the LL image. The output image derived by the high-pass filtering the rows and low-pass filtering the columns is called the HL image. The output image derived by the low-pass filtering the rows and high-pass filtering the columns is referred to as the LH images. The output image derived by high-pass filtering the rows and columns is referred to as the HH image. The same technique can be used to obtain four more images by considering one of the LL image. This technique can be used until we get the desired sub band structure.



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.

Wavelet transformation is a multi-resolution tool which can be used for the analyzing of the palm print image in different decomposition levels. Level one of the palm print decomposition technique is used to extract the fine lines of the palm print. The greater the value decomposition level, the coarser the extracted palm lines will be, such as wrinkles and principal lines. Haar wavelet is used to find out the discontinuity between the two pixels. It is not calculation expensive compared to other types of wavelet such as Daubechies wavelets, Mexican hat wavelets and Morlets wavelets.

Embedding Process:

Spatial steganography technique mainly uses Least Significant bit (LSB) algorithm for data embedding. In this technique for the insertion process a cover frame is selected. The least significant bit that is the 8th bit of some or all of the bytes of a binary image is modified to form the secret message.

Basically there are many kinds of power level transforms that exist to transfer an image to its frequency domain, some of which are Discrete Cosine Transform and Discrete Wavelet Transform.

COVER FRAME

STEGO FRAME

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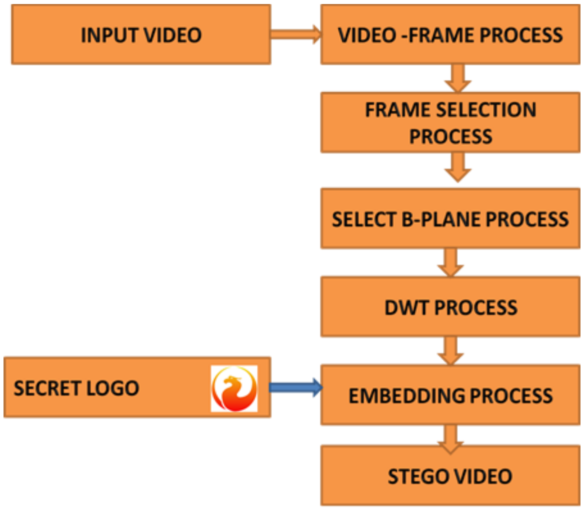
Block Diagram of Embedding an Image into a Video



DWT Algorithm

Step 1: Read VIDEO.

Step 2: Convert to Frames.

Step 3: Select cover Frame.

Step 4: Convert to any single Plane process.

Step 5: For that Plane convert to DWT Process.

Step 6: Select Secret Logo

Step 7: Embed that Secret logo with Key

Step 8: Write STEGO frame.

Step 9: Reconstruct Video

LSB Algorithm

Step 1: Read the cover Frame and Image which is to be hidden in the cover image.

Step 2: Convert the Image into binary format.

Step 3: Calculate the Least Significant Bit(LSB) of every pixels of the cover image.

Step 4: Replace the Most Significant Bit(MSB) of cover image with secret message by using Least Significant Bit(LSB) Algorithm for the secret image which is to be embedded.

Step 5: Write the STEGO Frame.

Algorithm for Extraction Process:-

Step 1: Read the STEGO Frame.

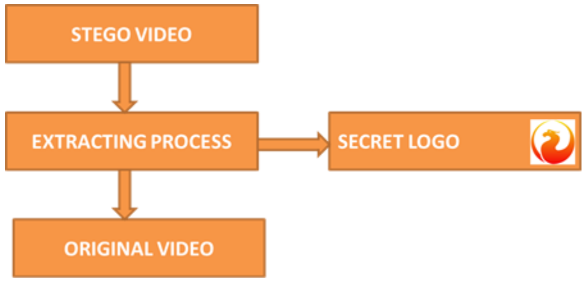
Step 2: STEGO Frame is broken into Logo and cover Frame.

Step 3: Calculate LSB of each pixels of STEGO Frame.

Step 4: Retrieve bits and convert each 8 bit into one character.

Step 5: Extract the Secret Logo.

Block Diagram for Extraction Process



V. EXPERIMENTAL RESULTS FOR VIDEO RETRIEVAL

Integration Bit Error Rate (BER):-

For the successful recovery of the hidden information the communication channel must be ideal but for the real communication channel, there will be error while retrieving hidden information and this is measured by BER. The cover image is represented as COVER and STEGO image as STEGO in the given equation,

BER=1/|frame (x)| {∑|frame(x)-frame(y)|}

Here, |frame(x)|=COVER FRAME each PIXEL.

|frame(y)|=STEGO FRAME each PIXEL.

Mean Square Error (MSE):-

It is defined as the square of error between cover image and the stego frame. The distortion in the image can be measured using MSE.

MSE=∑∑ [A(i,j)- B(i,j)]^2

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N X N

Here, A(i.j)= COVER FRAME.

B(i.j)= STEGO FRAME

N X N=row and column of image intensity of pixel vales (255 255) image size.

Peak Signal to Noise Ratio:

It is the ratio of the maximum signal to noise in the stego frame.

PSNR=20log10{(255X255) / (√MSE)}

VI. CONCLUSION AND FUTURE SCOPE

In this paper, we have used a new method of real-time steganography that is the DWT and LSB based Algorithms by considering video bit streams. The basis of this method is using the combination of video, audio, text. With this method, the data should be transferred in a more secured manner. In order to hide the secret information in the video, one can make use of other methods of steganography, which is less secure. By improving this method, we can get the video files without any noise distraction. A new secure and preserving the file-size compressed domain steganography is proposed in this paper. Embedding the secret data and detection of the hidden secret data are both done entirely in the compressed domain to meet the real time requirement. Changing the spatial pixel values causes the variance that can be estimated in the compressed domain, and the payload is allotted by considering the variance of each cover frame so that the correlation value of the continuous frames is not changed. The performance of the LSB and DWT algorithm is studied and the output results showed. This scheme can be applied on videos without any noticeable degradation in visual quality.

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