A Robust Data Hiding in Random Macro Blocks of Compressed Video

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Abstract: *Data hiding in compressed video. We target, finding the macro blocks randomly by Pseudo Random Generation Algorithm. Then encoded the video and reconstructed the frames both forward predictive (P)-frame and bidirectional (B)-frame in compressed video, which are very secured and Compared to data hiding in motion vectors of compressed video. A every frame is searched for achieve to robustness. The secret message bit stream is embedded in the random macro block in each frame of compressed video. The method is implemented and tested for hiding data in order of multiple GOP's and the results are evaluated. The proposed method is performing well.*

Keywords: *Data hiding, Pseudo Random Generation, Motion Picture Expert Group (MPEG), Group of pictures (GOP), steganography.*

I. INTRODUCTION

DATA hiding [1] in digital images seen widely this paper target the internal operation of video compression, specifically the random macro block estimation stage. This is processed internally during the video encoding/ reconstruction which can't to be detected by image steganalysis methods and most work applied on data hiding in the macro blocks randomly .In [2] and [3], the data bits of the message are hidden in macro blocks these are called the random block.

The data is encoded as a region where the estimation is only allowed, that specified region. Using the variable macroblock sizes (16x16, 16x8, 8x16, 8x8), the authors in [5] used for the message bit stream to select one of the four sizes for the estimation process. The authors in [6] and [7] embed the data in compressed video. The block matching is constrained to search within the selected sector. The methods in [2]–[7] focused on finding a direct reversible way to identify the at the decoder.

II. PROPOSED METHOD

In this section, we overview lossy video compression to define evaluation metrics. At the encoder, the I-frame is used as a reference frame for encoding a group of (P) frame or (B)-frames. The video is sequenced into groups of pictures (GOPs) whose frames can be encoded in the GOP sequence: [I,B,B,P,B,B,P,B,B]. Predicted (p)-frames are coded based on nearest I frame and P frame this technique is called forward prediction. B pictures are consider the forward and backward of I and B frames, this technique is called bidirectional predicted (B) frame. Generally, the video compression is assumed to be translational with horizontal component d^x and vertical component d^y and denoted in vector form by d(x) for the spatial variables x=(x,y) in the underlying image.

The search window is constrained by assigning limited n-bits for d; in other words, both $d^{x \text{ and}}$ which corresponds to pixels if the random macro blocks are computed with half-pixel accuracy. A search in the window can be done to find the optimal random estimation satisfying the search criterion which needs many computations, or suboptimal random block can be obtained using expeditious methods .This is based on the video encoding device processing power, the required compression ratio, and the reconstruction quality. Since d does not represent in the video then the frames are able to reconstruct with minimum distortion at the decoder in case of a P-frame. Similar operation is done for the B-frame but with the average of both the forward prediction from a previous reference frame and backward prediction from a next reference frame. E is of the size of an image and is thus lossy compressed using JPEG compression reducing its data size. For every random block estimation method, the pair (d, Ẽ) will be different and the data size of the compressed error E will be different. The macro blocks d are lossless coded and thus become an attractive place to hide a message that can be blindly extracted by a special decoder.

The decoder receives the pair (d,Ẽ) applies random generation to form P and B or and decompresses Ẽ to obtain a reconstructed E_r ,then the decoder in unable to reconstruct P identically but it alternatively reconstructs.

III. Data hiding

Data hiding in random estimation places at the encoder replaces the regular pair (d,Ẽ) due to tampering the motion vectors, to become (d^h,$\tilde{E}^h$) where the superscript h denotes hiding. We define data hiding in random macroblocks of compressed video in the context of super-channel [9]; the secret message m is hidden in the host video signal χ= (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, E^h). The message m should survive the video lossy compression and can be identically extracted from video. This robustness constrain should have low distortion effect on the reconstructed video as well as low effect on the data size (bit rate). Given that m can be identically extracted, in this paper, we use data-hiding algorithms in compressed video which are. The payload should be robust to the video compression.

These observations stimulated our proposal to rely directly on the random macro blocks, such that we choose our macroblocks E. If we tamper with these Blocks, then we will not hav effect on the video reconstruction quality. Since then our selection criteria in this paper can be thought of as in this direction, we choose the random estimation 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.

IV. Random Generation

Our data-hiding algorithm is applied at the encoder side, uses the regular pair $(d,\tilde{E})$ produced, tampers to become d^h and thus replaces them by the pair $(d^h,\tilde{E}^h)$ for each P and B-frame in the GOP. We propose pseudo random generation algorithm for secret message is hidden by random generator it can random generator, generates the random number of macro blocks with in the period, here we can implement the random logic for random blocks, are as good as truly random bits. The algorithm tests the robustness of the hidden message to the quantization effect of the JPEG compression. For the prediction frames E^h it performs the compression by the encoder followed by the decompression performed by the decoder, If the reconstructed prediction frames maintains the same criterion then can be identified by the data extractor for the given value of any macro block, then reconstructed d will be identified by the data extractor and the message will be extracted correctly. Hence, we use an this algorithm by iteratively decrementing for the frame until either the criterion is satisfied for all macro blocks or the stopping value is reached for which we embed no data in this frame, we hide the twenty four values in specified macro blocks of 24 bits i.e RGB have 24 bits in each pixel for that GOP. In the GOP, I-frame using any robust image data-hiding technique or sending them on a separate channel based on the application.

The decoder receives and it can decode without loss and decompresses to obtain a lossy reconstructed Version. During normal operation for viewing the video, the decoder is able to reconstruct or by suitable compensation from reference frame(s). Acting as a new kind of random macroblock estimation, will have two effects on the new compressed video: change in data size and reconstruction quality which are thoroughly. The data extractor operates to extract the hidden message as a special decoder and our proposal is straightforward. After data extraction from the consecutive GOPs the hidden message is reconstructed back by concatenation of the extracted bit stream.

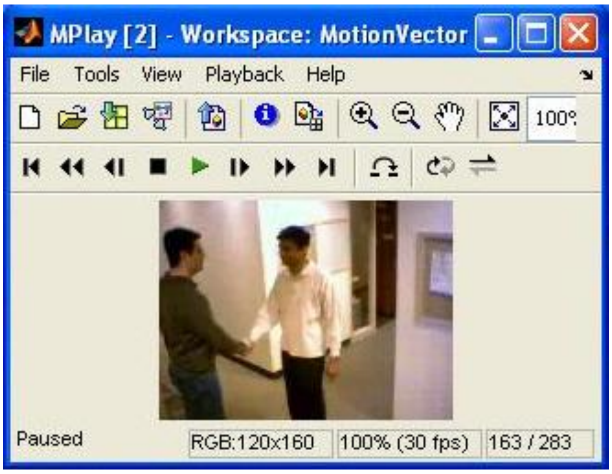
V. RESULTS

We implemented the hiding and extraction Algorithms are integrated them to the MPEG-2 encoder and decoder operation. We used . search Random macroblock estimation algorithms with pixel accuracy. Each test video sequence is organized into consecutive GOP organized as [I,B,B,P,B,B,P,B,B]. The compression to the I-frame and the prediction of the P- and B- frames are implemented. Our algorithm may hide a maximum of bytes per P-frame and B-frame. We evaluated our algorithm which is independent on a threshold T of the random estimation. We have chosen the pixel for [3] total number of embedded bytes (payload) to that of our algorithm for the whole test sequence. The payload for both methods and the associated threshold T of motion vector and Random Macroblock in values of pixels, For each sequence we calculated the overall frames the reconstructed video in effect to the hiding; results. Finally, the data size increase due to hiding the data is measured for each frame and the total data size increase which is accounted for our hiding criteria.

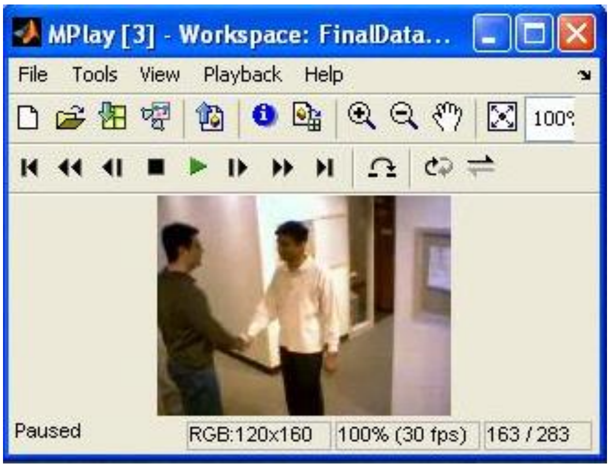
According to the GOP organization among I-, P-, and B, the random blocks of the B-frames can hold a bigger share of the payload than those of the P-frames. However, tampering the motion vectors of B-frames will have more distortive effect. Video than that by P-frames, as the B-frames are bi-directionally optimized to minimize the prediction error. We counted the percentage of hidden bytes in both the P- and B-frames. The usage of the macro blocks of the B-frames is an additional reason that accounts for the enhanced results of our method in both aspects of the data size and the quality of the reconstructed video.

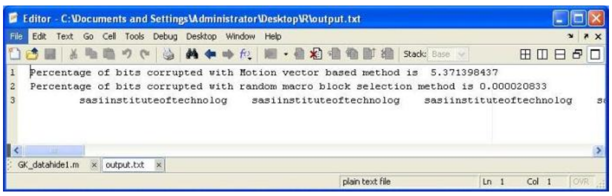
Simulation Results:

Motion vector video:



Random Block video:





We can observe the errors and hidden data in the above simulation output text file.

Data hiding in motion vectors of compressed video error is 5.371398437 when threshold value is 1, Random macro block method of compressed video error is 0.0000208330.

VI. CONCLUSION

We proposed a new data-hiding method in the random macroblock estimation of MPEG-2 compressed video. Unlike most data-hiding methods in the motion vectors, we chose a different approach that selects those random blocks whose random macro blocks error is low for hiding a bit. The embedding and extraction algorithms are implemented and integrated to the MPEG-2 encoder/decoder and the results are evaluated. This method is found to have very much secured compared with motion vector estimation because easy to guess the where the motion takes place. Hence by using this random macro block method we get very low error when compared to motion vector of compressed video method. So we propose the random estimation macro blocks for hiding and the quality of the video. Future work will be directed towards increasing the size of the embedded.

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