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Review Article

Data Embedding in a moving Compressed Video

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Abstract: The proposed work deals with data hiding in compressed video. Unlike data hiding in images and raw video which operates on the images themselves in the spatial or transformed domain which are vulnerable to steganalysis, we target the motion vectors used to encode and reconstruct both the forward predictive (P)-frame and bidirectional (B)-frames in compressed video. The choice of candidate subset of these motion vectors are based on their associated macro block prediction error, which is different from the approaches based on the motion vector attributes such as the magnitude and phase angle, etc. A greedy adaptive threshold is searched for every frame to achieve robustness while maintaining a low prediction error level. The secret message bit stream is embedded in the least significant bit of both components of the candidate motion vectors. The method is implemented and tested for hiding data in natural sequences of multiple groups of pictures and the results are evaluated. The evaluation is based on two criteria: minimum distortion to the reconstructed video and minimum overhead on the compressed video size. Based on the aforementioned criteria, the proposed method is found to perform well and is compared to a motion vector attribute-based method from the literature.
Keywords: Tomography, Least Bit significant, DCT , Hoffman code, stego system

INTRODUCTION

Data hiding and watermarking in digital images and raw video have wide literature. This paper targets the internal dynamics of video compression, specifically the motion estimation stage. Digital video refers to the capturing, manipulation, and storage of moving images that can be displaced on computer screens. This requires that the moving images be digitally handled by the computer. The word digital refers to a system based on discontinuous events, as opposed to analog, a continuous event. Computers are digital systems; they do not process images the way the human eye does. We have chosen this stage because its contents are processed internally during the video encoding decoding which makes it hard to be detected by image steganalysis methods and is lossless coded, thus it is not prone to quantization distortions

BACKGROUND WORK OF IMAGE COMPRESSION

The image compression is mainly used for image transmission and storage. Image transmission applications are in broadcast television; remote sensing via satellite, air-craft, radar or sonar; teleconferencing; computer communications; and facsimile transmission.

Image storage is required most commonly for educational and business documents, medical images that arise in computer tomography (CT), magnetic resonance imaging (MRI) and digital radiology, motion pictures, satellite images, weather maps, geological surveys, and so on.

Image Compression Model

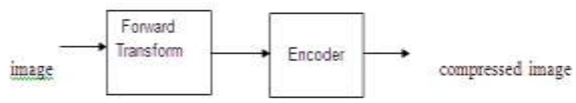


Figure a) Block Diagram of Image compression

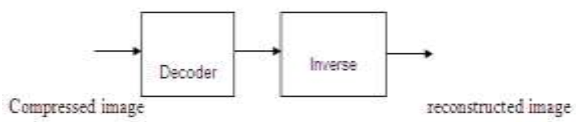


Figure b) Block Diagram of Image Decompression

And the image compression is calculated by using Bo as Bits before compression & $B1$ as Bits after compression shown below

Compression ratio = B_0/B_1

There are two types' image compression techniques.

1. Lossy Image compression
2. Lossless Image compression

Lossy Image compression

Lossy compression provides higher levels of data reduction but result in a less than perfect reproduction of the original image. It provides high compression ratio. Lossy image compression is useful in applications such as broadcast television, videoconferencing, and facsimile transmission, in which a certain amount of error is an acceptable trade-off for increased compression performance.

Lossless Image compression

Lossless Image compression is the only acceptable amount of data reduction. It provides low compression ratio while compared to lossy. In Lossless Image compression techniques are composed of two relatively independent operations:

(1) Devising an alternative representation of the image in which its interpixel redundancies are reduced .

(2) Coding the representation to eliminate coding redundancies.

Lossless Image compression is useful in applications such as medical imaginary, business documents and satellite images.

This section II is explain about Background knowledge of image compression and as same the remaining section III explains the problem statement of this paper, section IV about proposed system, section V shows the experimental results and the section VI gives the conclusion.

Problem Statement

The goals for this Project have been the following.-

One goal has been to compile an introduction to the subject of steganography. There exist a number of studies on various algorithms, but complete treatments on a technical level are not as common. Material from papers, journals, and conference proceedings are used that best describe the various parts.

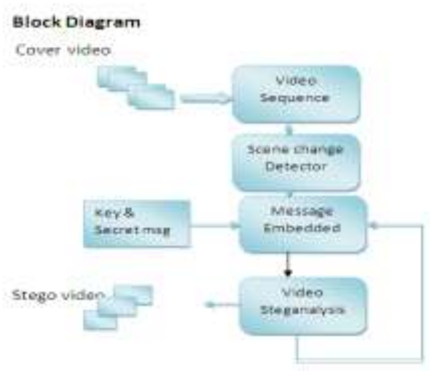
The second goal has been to search for algorithms that can be used to implement for the detection of steganographic techniques.

A third goal is to evaluate their performance. These properties were chosen because they have the greatest impact on the detection of steganography algorithms

If we observe the below block diagram is shows it is possible to hide data in motion vector of video compression by using steganalytic system.

- The first is an innocent looking scene that will hold the hidden information, called the cover image.

- The second file is the message – the information to be hidden

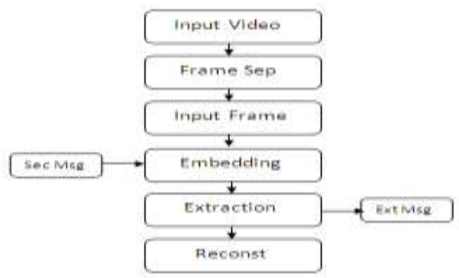


Proposed Method

The secret message bit stream is embedded in the least significant bit of both components of the candidate motion vectors. By means of simple rules applied to the frame markers, we introduce certain level of robustness against frame drop, repeat and insert attacks.

- LSB Algorithm
- Embedding data, which is to be hidden, into an image requires two files.

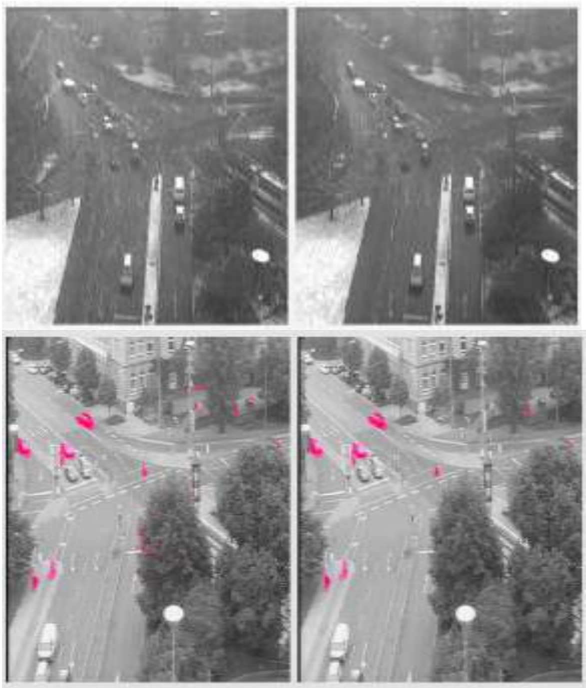
The following block diagram is about entire proposed system going to take place during the implementation of our system. And we can't discuss each every step in detailed. But we can explain what are new methods used for lossless compression of data hiding in motion vector of a video.



Frame Separation

Frame processing is the first step in the background subtraction algorithm, the purpose of this step is to prepare the modified video frames by removing noise and unwanted object's in the frame in order to increase the amount of information gained from the frame and the sensitivity of the algorithm.

Preprocessing is a process of collecting simple image processing tasks that change the raw input video info a format. This can be processed by subsequent steps. Preprocessing of the video is necessary to improve the detection of moving object's For example, by spatial and temporal smoothing, snow as moving leaves on a tree, can be removed by morphological processing of the frames after the identification of the moving object's as shown in the following figure 1.



Another key issue in pre processing is the data format used by the particular background subtraction algorithm. Most of the algorithm handles luminance intensity, which is one scalar value per each pixel, however, color image, in either RGB or HSV color space, is becoming more popular in the background subtraction algorithms.

Coding for Frame Separation

```
file=aviinfo('movie1.avi');
frm_cnt=file.NumFrames
str2='.bmp'
   h = waitbar(0,'Please wait...');
for i=1:frm_cnt
   frm(i) =aviread(filename,i);
   frm_name=frame2im(frm(i));
   frm_name=rgb2gray(frm_name);
   filename1=strcat(strcat(num2str(i)),str2);
   imwrite(frm_name, filename1);
   Waitbar (i/frm_cnt,h)
End
Close (h)
```

Image embedding method description

Take any input video, and then convert that video in to no. of frames, after converting user need to select any one of the frame for embedding the secret data. For hiding process we r going to use LSB technique. Embedded image is called as “Stego image” Then we are going to reconstruct that frames to videos.

Least-Significant-Bit (LSB) Matching Method

In order to keep the embedding of the same amount of information as LSB matching and detect the secret data harder than the conventional LSB matching method, Mielikainen proposed a robust LSB matching method in 2006.

$$f(l-1,n) \neq f(l+1,n), \forall l,n \in Z.$$

$$f(l,n) \neq f(l,n+1), \forall l,n \in Z.$$

Therefore, embedding message is performed for two pixels X and Y of a cover image at a time and then adjusting one pixel of the (X, Y) to embed two secret bits message s1s2. The embedding flowchart is shown in Fig.2 and the embedding procedure is described as following:

Step 1. If the LSB of X is the same as s1, go to step 2. Otherwise, go to step 3.

Step 2. If the value of f (X, Y) is the same as s2, do not change any pixel. Otherwise, the value of pixel Y is increased or decreased by 1.

Step 3. If the value of f (X −1, Y) is the same as s2, the value of pixel X is decreased by 1. Otherwise, the value of pixel X is increased by 1.
Where the function f (X, Y) is defined as Eq.1:

$$f(X',Y') = LSB\left(\left\lfloor \frac{X'}{2} \right\rfloor + Y'\right)$$

Since this new LSB matching method just only increase or decrease 1 in two adjacent pixels, the difference of the two neighborhood pixel between cover image and stego-image is very small. Hence, it can keep high quality while hiding data.

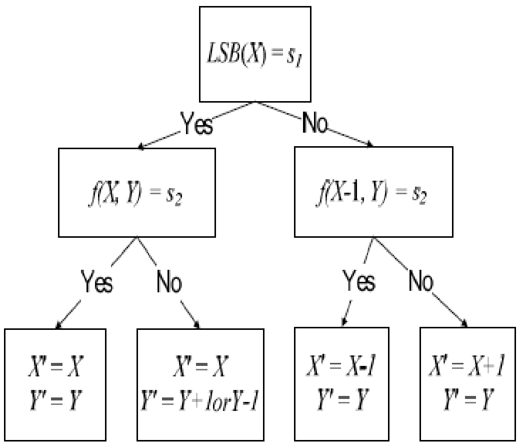


FIGURE 2: The LSB matching embedding procedure.

Discrete Cosine Transform

DCT coefficients are used for JPEG compression. It separates the image into parts of differing importance. It transforms a signal or image from the spatial domain to the frequency domain. It can separate the image into high, middle and low frequency components.

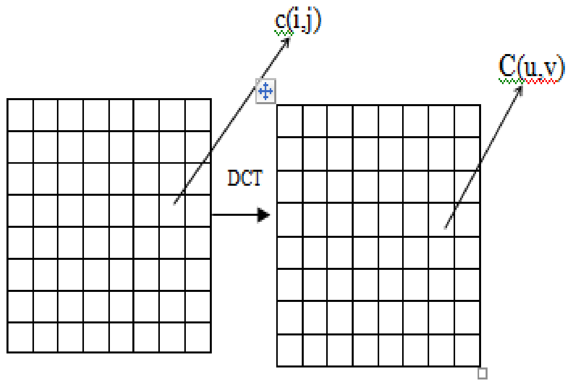


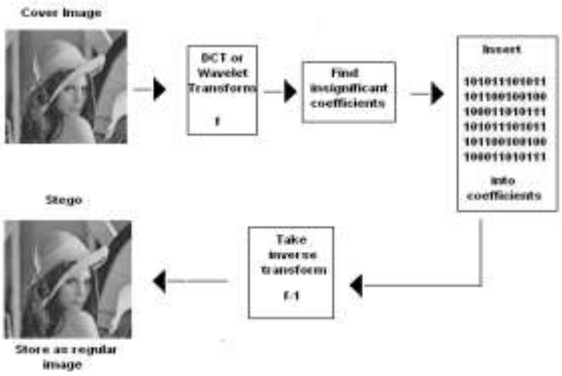
Fig. 3: Discrete Cosine Transform of an Image

DCT is used in Steganography as-

Image is broken into 8×8 blocks of pixels. Working from left to right, top to bottom, the DCT is applied to each block.

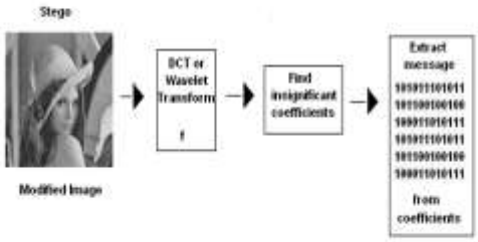
Each block is compressed through quantization table to scale the DCT coefficients and message is embedded in DCT coefficients.

To Encode the Hidden Data:



- Take the DCT or wavelet transform of the cover image
- Find the coefficients below a certain threshold
- Replace these bits with bits to be hidden (can use LSB insertion)
- Take the inverse transform
- Store as regular image

To Decode the Hidden Data:



- Take the transform of the modified image
- Find the coefficients below a certain threshold
- Extract bits of data from these coefficients
- Combine the bits into an actual message

I. Experimental output is:

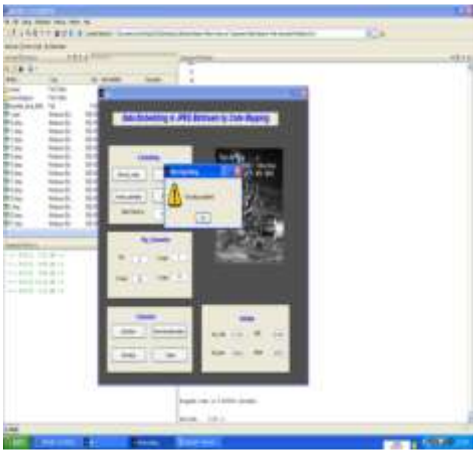
1. Input video by selecting browse video option

2. Frame separation of browsed video

Total frames count= 80

3. Embedding data successfully and encryption time is 18.24 sec

Compressed file size = 42012



4. Decoding time is 11.27 sec and before decoding we have extract the embedded data. And it will save in retrieve.txt file

5. Here is reconstructed output is shown. If we observe clearly the secret msg is exactly embed with that frame.

CONCLUSION

In this paper, a data hiding method by simple LSB substitution with an optimal pixel adjustment process is proposed. The image quality of the stego-image can be greatly improved with low extra computational complexity. Extensive experiments show the electiveness of the proposed method. The results obtained also show significant improvement than the existing method with respect to image quality and computational efficiency.

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