International Journal of Electronics and
Communication Engineering (IJECE)
ISSN(P): 2278-9901; ISSN(E): 2278-991X
Vol. 4, Issue 5, Aug - Sep 2015, 21-28

International Academy of Science, Engineering and Technology
Connecting Researchers; Nurturing Innovations

"DATA HIDING IN MOTION VECTORS OF COMPRESSED VIDEO-INTRODUCTION"

PRANITA P. KHAIRNAR[1] & V. S. UBALE[2]

[1]Department of Electronics, Amrutvahini College of Engineering, Sangamner, Affliated University of Pune, Maharashtra, India

[2]Assistant Professor, Department of Electronics, Amrutvahini College of Engineering, Sangamner, Affliated to University of Pune, Maharashtra, India

ABSTRACT

Steganography is the art of information hiding in video, images and audio helps to prevent an unauthorised copying directly. It can useful in Military communications and some other applications as well where rather than concealing the content of a message using encryption, look for to conceal its sender, its receiver or even the existence of some information.

The paper is implemented to deal with the information hiding in compressed video in motion vectors i.e we can say video steganography.

Because images and raw videos are vulnerable to attacks, in compressed video we focused on the motion vectors to hide the information by making use of forward predictive (P) frames and bidirectional (B) frames.

KEYWORDS: Video Steganography, Motion Vectors

INTRODUCTION

In this paper we will focus only on the necessary and related concepts and the idea of implementation through simplified flowcharts. The notations are mentioned which can be used for further coding.

Now a days characteristics that are generated by video compressing standards are mainly focused by data hiding in video. MPEG algorithms make use of motion vector based schemes. Encoder removes the temporal redundancies between frames by calculating the motion vectors. Such methods replace the original motion vector by another locally optimal motion vector to embed data. Different motion-compensation units available in sizes of 16×16, 16×8, 8×16, 8×8, and sub8×8 for the well recognized H.264 video coding standard .[4]

In this paper we propose a data hiding scheme, encoder hides the desirable data by focusing on the internal dynamics of video, specially the motion estimation stage. Use of motion estimation stage results in less vulnerable to attacks and hard to detect the data by steganalysis. The reason behind this is that its contents are internally processed during the video encoding or decoding, which is not prone to quantization distortion.

As said above, it mainly targets the frame compression of the video consequences which relates to the internal dynamics[1]. Here our main attentiveness lies in the estimation of motion in the frame sequences. This is the primary step in the video processing for the processing of the data internally. During the implementation of the pre primary step less loss of data takes place and it is difficult to decode the hidden data and it is far away from the quantization errors. So as per the literature point of view here the data is hidden in the video or specifically in the motion in between the frames of the video which is very relevant feature. The data is hidden on the video or the motion between the frames depending on the suitable threshold condition.[1]

So now here the pertinent features or the attributes are taken in to the consideration depending on the threshold level. Now here the above procedure is termed as the candidate motion vector (CMV) respectively. And one more important point is to be noted are taken in to the consideration that is the data or the value or the message bit are made hidden in the video where the motion between the frames takes place. If there is no motion in between the frames there is no chance of hiding the data or a message. Therefore finally we conclude as per this point of view is here the data is hided depending on the attributes of the motion in between the frames and are considered as the motion vectors respectively.

The first stage is to divide the video into blocks and next the message is come in to existence therefore the message can be encoded in the least significant part of the block. In this circumstances the data hiding and decoding is not a major task but the main thing we are supposed to contemplate is the clarity or the noise or mean square error (MSE) and loss of the data which comes under the artifact. We may call it as a quantization error and hence quantization is nothing but setting the predefined values or the rounding off to the nearest value. [2]

BASICS OF STEGANOGRAPHY

Steganography is sometimes inaccurately confused with cryptography, but there are some remarkable and individual differences between the both. Steganography is often preferred to cryptography sometimes because in cryptography the plaintext is converted to ciphertext and the attacker can estimate that encryption has been done i.e it do not deny the presence of hidden message thereby attempting to acquire the secret data. Cryptography often require high computations to perform encryption which causes a difficulty for small devices which do not use enough computing resources for encryption.

On the other hand, steganography is the process of hiding the secret data in cover media like images, audio, video etc. Steganography not only hide the secret information but also hide the presence of secret data travelling under the cover. As a result attacker do not realize the presence of message and thus it reduces the possibility of handling of data by malicious user [3]. Steganography has 4 steps as follows:

- Selection of the cover media to hide the secret data in it.
- The secret data which is intended to be mask under the selected cover.
- A function which will be used to hide the data and to retrieve the hidden data from cover.
- To authenticate the data and to retrieve it correctly a key or password used.

Classification of Steganography Based on Possible Cover Media

Steganography system uses mainly four kinds of cover media generally, that are text, image, audio, video etc. On this bases steganography can be categorised as follows

- Text Steganography
- Image Steganography

- Audio Steganography
- Video Steganography.

We are proposing here video steganography which can use Least Significant Bit(LSB) method to create the stego video. The LSB technique replaces the least significant bits of image by the bits of secret message to be hide.

RELATED AND NECESSARY CONCEPTS

Theory of Video Compression

Basically video is 3D array of color pixels. 2 dimensions i.e. horizontal and vertical, serve as spatial directions of the moving pictures, and remaining one dimension is the time domain. A set of all the pixels which correspond to a same or single moment of time is called as data frame. Mainly, a frame is same as still picture. Data in video has spatial and temporal redundancy. Similarities because of this can be encoded by simply calculating differences within frames i.e. spatial, and/or among frames i.e. temporal.

Video Compression Picture Types

In this field of compression a frames of video are compressed using many different algorithms with diverse advantages and disadvantages, but concentrating mainly on amount of the data compression. The various algorithms for video frames are called **frame types** or **picture types**. The major three picture types used in the different algorithms are **I**, **P** and **B** and they are different as the following characteristics:

I-frames ('Intra-coded picture') are the least compressible but do not require the other video frames to decode.

P-frames ('Predicted picture') more compressible than first and can use data from previous frames.

B-frames ('Bi-predictive picture') can use both previous as well as forward frames for reference so that to get the maximum amount of compression.

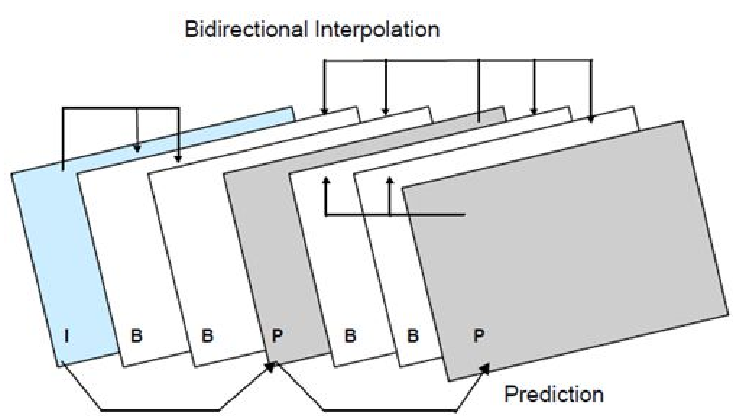

Figure 1: Structure of Frame Types

Motion estimation is the process in which helps determining motion vectors which shows the conversion from one image to another image; typically from adjoining frames in a video sequence (i.e. sequence of frames). The motion vectors may relate specific parts, such as arbitrary shaped patches, rectangular blocks or even per pixel or to the whole image.

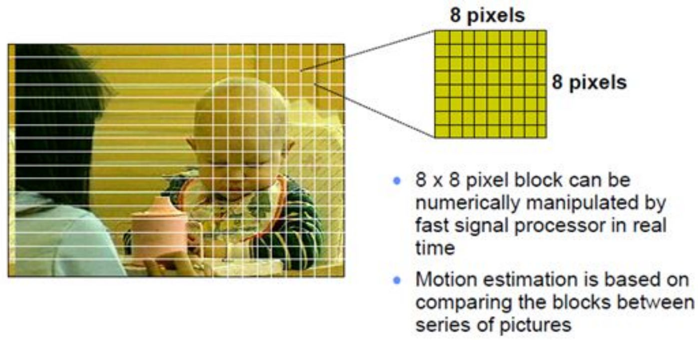

Figure 2: MPEG Compression is based on Processing 8 x 8 Pixel Blocks [5]

Motion Compensation

An algorithmic technique employed in the video data encoding for video compression is Motion compensation. The conversion of a reference picture into the current picture is described by the motion compensation. The reference picture or frame may be previous in time or may be from the future as well. The efficiency of compression can be improved if images can be accurately synthesised from previously stored/transmitted images.

How Motion Compensation Works

Motion compensation utilizes the statement that, frequently, for various frames of movie, the difference between the frames is the result of either an object in the frame moving or camera moving. Thus with reference to a video file, this means a large amount of the information that is used to represent one frame will be similar as the information used to represent the frame next to it.

By motion compensation, video stream will hold number of full frames(reference frames); because of this stored information for the frames in between will be the information needed to convert the previous frame into the next frame.

Macroblock and Motion Vector

For quantization MPEG-1 operates on video in a series of 8x8 blocks. Though, because chroma (color) is sub-sampled by a factor of 4, each one pair of (red and blue) chroma blocks corresponds to 4 different luma blocks. With a resolution of 16x16, this set of 6 blocks, is called a **macroblock**. A smallest independent unit of (color) video is the macroblock. Motion vectors operate exclusively at the macroblock level.

Based on the number of pixels, **motion vectors (MV)** record the distance between two areas on screen. MPEG-1 video uses a motion vector precision of one half of one pixel. The finer the precision of the MVs results in more accurate the match is likely to be, and thereby increasing efficient compression. Finer MVs gives larger data size, as larger numbers have to be stored in the frame for every single MV. This increased coding complexity by increasing levels of interpolation on the macroblock is essential for both the encoder and decoder.

Neighbouring macroblock is likely to have very similar motion vectors; as a result this redundant information can be compressed quite effectively. For each macroblock only the amount of difference between the MVs needs to be stored in the final bitstream.

BACKGROUND AND NOTATIONS

- I frames- Intrapredicted I-frames are used as reference frame for encoding P or B frames.
- $\mathfrak{B}_{ij}$-Using block based estimation, temporal redundancy between frames is exploited which is applied on macroblocks $\mathfrak{B}_{ij}$.
- $\mathbf{d}(\mathbf{x})$- With horizontal component d^x and vertical component d^y, the motion field can be represented in vector form by $\mathbf{d}(\mathbf{x})$ for variables x=(x, y).
- Compensated $\tilde{P}$ frames using (x+d(x)) must be associated with prediction error
- $E(\mathbf{x}) = (P - \tilde{P})(\mathbf{x})$ to reconstruct $P = \tilde{P} + E$ with less distortion at decoder.
- E-Size of image and using JPEG compression its data size is reduced.
- The motion vectors are attractive place to hide the message because they are lossless coded, therefore the message can be extracted blindly by special decoder.[1]

➢ $(\mathbf{d}, \tilde{E})$ - Decoder receives pair $(\mathbf{d}, \tilde{E})$ and form $\tilde{P}$ or by $\tilde{B}$ applying motion compensation and E_r is reconstructed by decompressing $\tilde{E}$

➢ Due to effect of quantization E and E_r will not be same, then the decoder will not able to reconstruct P identically, hence it reconstruct $P_r = \tilde{P} + E_r$.

➢ The mean squared error $P - P_r$ represents the reconstruction quality which is called as peak signal-to- noise ratio(PSNR) which is here denoted by $\mathfrak{R}$.

SIMPLIFIED FLOWCHARTS

1. At Encoder Side

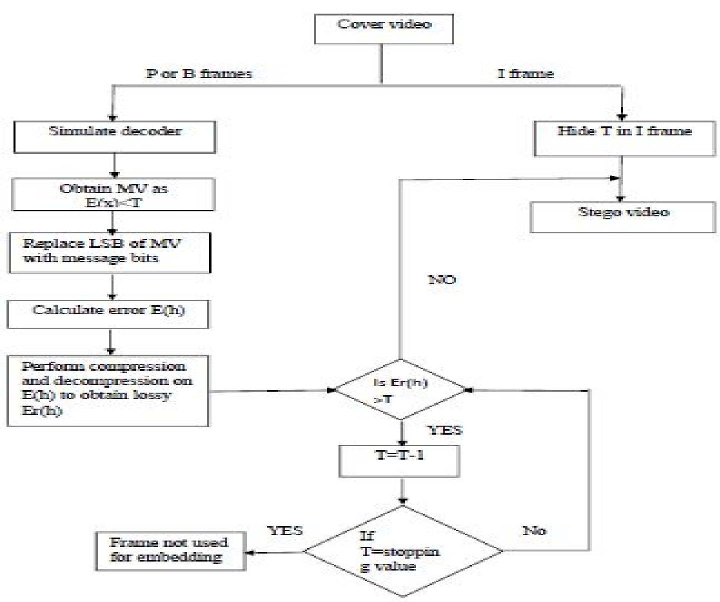

Figure 3: Flowcahart at Encoder Side

3. Decoder Side

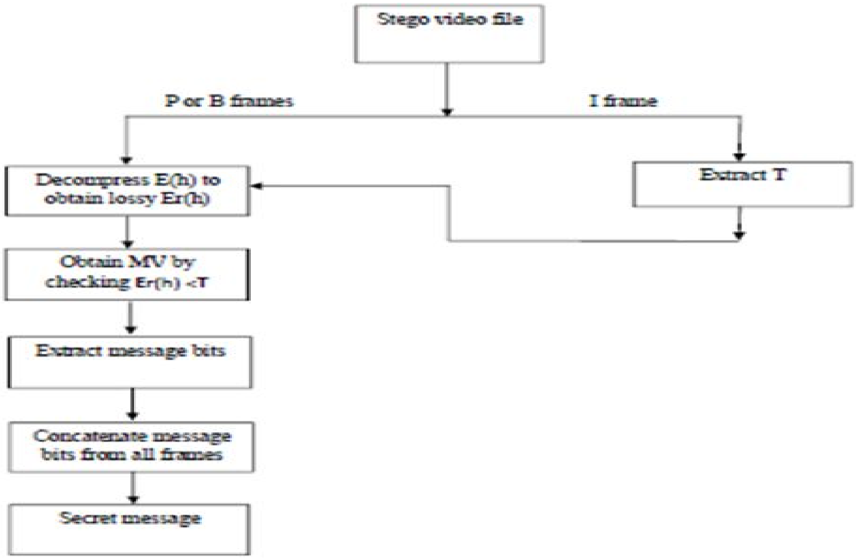

Figure 4: Flowchart at Decoder Side

The proposed method is suppose to deal with the two problems which can be defined as a metrics

- Increaesd data size- The diffrence between the data sizes before hididng the data and after hiding data gives an idea about the increased data size.[1]
- Degration in reconstruction quality- The reconstruction here is with the assmption of quality loss. It is denoted here by and it is PSNR differnce which is quality of relative error $P - P_r^h / P - P_r$ and $B - B_r^h / B - B_r$ for P and B frmaes respectively.

CONCLUSIONS EXPERIMENTAL RESULTS

Here in this paper we have collected together the related and necessary concepts regarding title. Flowcharts for embedding extracting the data will be implemented and the results will be tested for two metrics that are increase in data size of compressed video and another is the distortion in quality of the reconstructed video. Both these values should be close to zero. Future work will be intended for increasing data size which will be hidden by maintaining the robustness as well as less distortion.

REFERNCES

1. Data Hiding in Motion Vectors of Compressed Video Based on Their Associated Prediction Error.Hussein A. Aly, VOL. 6, NO. 1, MARCH 2011 IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY,
2. Stenography Analysis On Compressed Video Based On Prediction Motion Error, Thonduru Madhavi & Vijayalakshmi International Conference on Advancement in Engineering Studies & Technology, ISBN : 978-93-81693-72-8, 15th JULY, 2012, Puducherry.
3. A Survey on Various Techniques of Data Hiding and the Comparative Analysis, Harshavardhan Kayarkar

4. International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2, Issue4, July-August 2012, p.p.1577-1582- A robust secured data hiding technique in videos and associated estimated artifacts, M. Rama Koteswara Rao, Bhookya Nageswararao Naik /
5. Mauri Kangas 2002 MPEG-1,2.PPT/ 24.02.2002 / Mauri Kangas

AUTHOR'S PROFILE

Ms. Pranita P. Khairnar has completed her B.E (Electronics) & currently appear to M.E (Electronics) at Amrutvahini College of Engineering, Sangamner. Dist.- Ahmednagar, Maharashtra, India.

Prof. V. S. Ubale, has completed his M.E.(Electronics) & B.E. (E& TC). He is working as a Assistant Professor in Electronics Department, Amrutvahini College Of Engineering, Sangamner, Dist. Ahmednagar, Maharashtra, India. Prof Ubale has teaching experience of 12 years to Undergraduate, Graduate & Post Graduate Students. Prof V. S Ubale has Published 03 papers in International Journal,& presented 04 papers in International Conference & 03 papers in National Conferences