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Digital Video Watermarking Techniques: A Review Study

Maninder kaur
M tech Scholar

Harjit singh,
Assistant Professor

Tarun Arora
Assistant Professor

Electronics and Communication, GNDU, Regional campus Gurdaspur, India

Abstract— Digital watermarking is defined as a data hiding technique where a message is hidden inside digital signal. One of the interesting field is video watermarking which provide authenticity and copyright protection methodology encrypted within an efficient video code. Thus, this technique is used for copy control, tracing of piracy, video authentication, broadcast monitoring, error resilience, and more. In this paper, we introduce the notion of video watermarking technology, including its applications, properties, performance requirements and typical algorithms.

Keywords-Digital Watermarking, Video Watermarking, SVD, Content Authentication, Copyright protection, DWT, DCT, DFT, watermarking

1. INTRODUCTION

The swift expansion of the Internet in the recent years has incremented the availability of digital data such as audio, images and videos .the algorithm of watermarking embeds watermark in different kind of audio, image and video etc The concept of robust watermarking of images is to embed or encrypt information within the image so that it is unable to perceived by the senses for human visual system and thus involves the protection from attacks. The main goal is to make an image that appears exactly the same to an eye of human but still leads to positive identification as compared to the owner's key if important. In fact any watermarking technique of image can be expanded to watermarking in videos, but in real video watermarking techniques have to meet other challenges like video coding, huge volume of information, detection of blind watermarking, some watermarking attacks like frame average, frame swap, statistical analysis and other features in real time rather than that in image watermarking scheme. [2][3][6].To be more effective watermark should own the properties such as

1) Robustness: it is impossible to remove watermark even if the watermarking algorithmic principle method is public. Any watermark can be removed with proper knowledge of that embedding process.

2) Unambiguous: The watermark which is retrieved should be uniquely identify the copyright owner of that particular content, or in case of applications of fingerprinting, an authorized recipient of that particular content.

3) Loyalty: A watermark is highly reliable, if it causes degradation that becomes very difficult to perceive for the viewer.

4) Computational Cost: Embedding as well as extraction of watermark from the video both should be fast and should posses low computational complexity.

5) Interoperability: For the compressed and decompressed operations watermark system must be interoperable.

II. WATERMARKING PROCESS

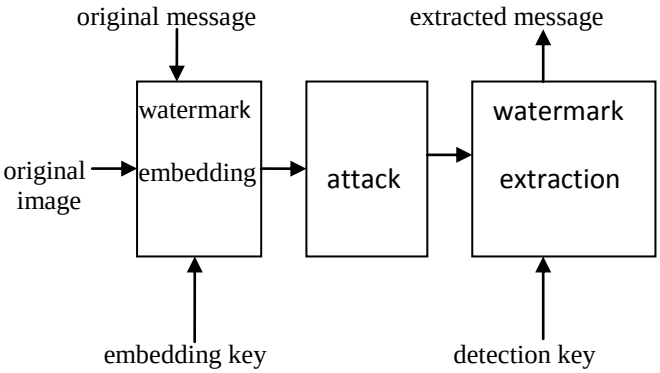

Fig.1: Block diagram of video watermarking system

1) Generation and Embedding: In embedding, the host is accepted by an algorithm and the data which is to be embedded, and generates a watermarked signal. The signal which involves the embedding of the watermark is called the host signal.

2) Distribution and Possible Attacks: The process of distribution can be seen during the transmission of the signal through the watermarked channel. Possible attacks in the broadcast of the channel can be intentional or causal.

3) Detection: Detection process involves the identification of the owner and provides information to the original recipient.

III. APPLICATION OF VIDEO WATERMARKING

The main applications of digital video watermarking involves video authentication, copyright protection broadcast

monitoring, fingerprinting, and enhance video coding. [1], [2] some of them are explained below:

A. Copyright protection: In digital media, watermarking is used as copyright protection to identify the owner of the copyright.
B. Video authentication: Authentication is defined as the hiding of the signature into the header section of the video, but the header field is still prone to tempering. So we can directly embed this particular type of authentication information directly as a watermark.
C. Broadcast monitoring: In television network different outputs are distributed over a channel. A system like broadcast observation must be built in so as to check the entire channel which is broadcasted. Watermark is used for broadcast monitoring system by using a unique watermark for broadcasting of each video.
D. Copy control: Watermarking system includes available technologies which secure the information into the header and also prevents from copying of secured data.
E. Fingerprinting: Video-on- demand and Pay-per-view are two real-time applications of video watermarking in which fingerprinting policy is enforce to use by digital watermarking.

IV. CLASSIFICATION OF DIGITAL VIDEO WATERMARKING TECHNIQUES

A .Based on types of carrier

According to the strategy of video watermark algorithm can be divided into three types Original image which is uncompressed based video watermarking (embed 1); embedding particular watermark in the video encoder (embed 2) and compression based video watermarking (embed 3).
1) Embed/Extract 1: In this type of watermarking, in Original video sequences watermark is directly embed and after that video sequence containing watermark is encoded. [6] Advantage of this type is watermark is easily embedded but the disadvantage is that the bit rate of video data stream is increased and also after compression of video watermark may lose.
2) Embed/Extract 2: In this type of watermarking, embedding and detection of watermark are done at the encoder and decoder. [4][6] different types of video compression standard are available today: MPEG-1, MPEG-4. Its main advantage is that the bit rate of video data stream remains constant and does not increase and it is a simple method of embedding a watermark in the transform domain.

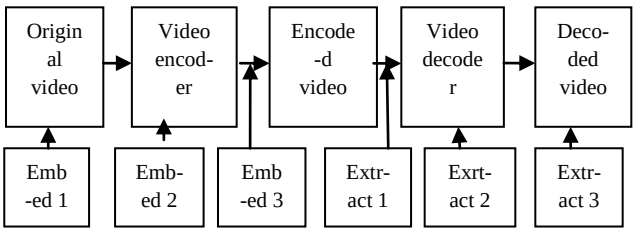

Fig.2 Block diagram of video watermarking according to types of carriers

3) Embed/Extract 3: In this type of watermarking, into the compressed domain the watermark is embedded. Its Advantage includes lower computational complexity compare to other types, but the disadvantage is that the size of the watermark data is confined by the compressed bit rate .

B .based on types of domain

Video watermarking techniques can be combined into two major classes based on the types of Domain; watermarking spatial-domain techniques and watermarking frequency- domain watermarking techniques.

In Spatial-domain techniques pixels are modified directly and a watermark is embedded into the frames of a particular video. These techniques are implemented easily and require few computational complexity; however, against the digital signal processing operations they are not robust such as video compression. On the other side, watermarking transform-domain techniques modifies the coefficients of the video frames according to predetermining of the embedding scheme. This technique disperse the watermark in the spatial domain of the frame of video, hence makes it very difficult to remove the watermark which is embedded.

a. *Spatial Domain Video Watermarking Techniques*

The designing of the watermark and the insertion procedures of the watermark does not involve any transformations. Simpler techniques such as addition and replacement are used for combining of watermark with the host signal and directly in the pixel domain embedding takes place

b *Least Significant Bit modification (LSB)*

Least Significant Bit (LSB) technique is the simplest method of this domain. In this scheme the embedding of the watermark simply takes place into the least significant bits of the original video or frames of the LSB. Due to its simplicity, it becomes the most popular scheme, but it includes some limitations like poor quality of the video being produced, inefficiently deals with the various attacks, lack of robustness and least imperceptibility.

c. *Correlation based techniques*

Pseudo-random noise pattern P(x, y) is added to the main cover image M(x, y), according to the equation

$$PM(x, y) = M(x, y) + k*P(x, y) \quad \ldots.(1)$$

In equation (1), k represents the gain factor and PM is the watermark. As the value of k is increased then the quality of watermarked content is expensed.

C Frequency Domain Video Watermarking Techniques:

In frequency domain method, the embedding of the watermark is done by modifying the coefficients being transformed of the frames of the particular video sequence. The commonly used transforms are Discrete Cosine

Transform (DCT), the Discrete Fourier Transform (DFT), and the Discrete Wavelet Transform (DWT). Generally, the main disadvantange of transform domain methods is their higher computational requirements.

a. *SVD Domain Video Watermarking Technique*:

Singular Value Decomposition (SVD) is a numeric technique for diagonalization of matrices in which the transform domain consists of basic states that is optimal in some sense. The SVD of an N1 x N1 matrix W is defined by the operation: W = U S V T where U and V Є R are unitary terms, and S Є R N1*N1 is a diagonal matrix. The entries which are diagonal of S are defined as singular values of W and are arranged in decreasing order where σ^i > σ^i +1.
If we embed watermark data in the diagonal elements of matrix U or elements of matrix V shows more robustness against noise attacks than embedding in elements of matrix S. The embedding in the second algorithm as block-wise allows larger watermark information to be hidden under the host video as compared with the embedding of the first algorithm diagonally.

b. *DFT Video Watermarking Technique*

In this approach the brightness of the watermarked frame is first extracted and then its full-frame DFT is computed by taking the magnitude of the particular coefficients. The composition of watermark is done by two alphanumerical strings. Firstly the DFT coefficient is altered and then IDFT.
Watermarking of only the first frame is done, which is composed of twelve frames, hence leaving the other ones with no corruption. It is robust to the usual image processing activities as linear and non-linear filtering, sharpening, compression of JPEG and resistance of geometric transformations such as scaling, rotation, straighten and cropping.
The designing of watermark and the insertion of watermark procedures does not involve any transformations. Simple techniques such as addition and replacement are used for the combining watermark.
Scheme based on DFT watermarking having the matching of template can easily resist various number of attacks, which includes removal of pixel, rotation and shearing. The aim of the template is enabling the resynchronization of the watermark information payload spreading sequence.

c. *Discrete Cosine Transform Video Watermarking Technique*:

It is a vital method for video watermarking. Various digital video watermarking algorithms embed the watermark information into this domain.
This transform is used more because mostly the video compression standards are DCT based and few other related transforms. In this domain DCT coefficients of the host video are selected and division is done into groups, and then watermark bits are embedded in each group. Various digital video watermarking algorithms embed the watermark information into this domain.

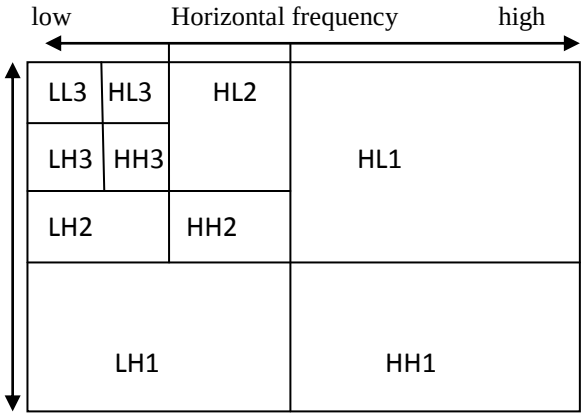

Fig. 3 DWT in square mode

4). Discrete Wavelet Transform Video Watermarking Technique: As shown in fig 3 the transformation of distributed frequency is done in each step of DWT, where L is represented as Low frequency, H is represented as High frequency and subscript present behind them represents the layers of transforms. LL sub graph represents the lower resolution of the original video, whereas high-frequency and mid-frequency sub graph LH, HL and HH represents vertical, horizontal and diagonal edge in details. The process may be repeated so as to compute the multiple SWD as represented in figure 3.
5). Principal Component Analysis Video Watermarking Technique: Principal component analysis (PCA) is procedure that uses a mathematical approach as an orthogonal transformation so as to convert a set of values correlated variables into a set of uncorrelated variables known as principal components. Plotting of the data by PCA into a new coordinated system where the data having maximum covariance are plotted together and is defined as the first principal component. Similarly, second and third principal components are present and so on. The first principal component has the maximum energy. In this scheme, a binary image is embedded in the LL sub-bands of DWT of level 2 of each decomposed frame in the host video. Also, the similar binary image is embedded into the HH of DWT sub-band of level 2 of each decompose frame. Embedding the watermark information in both LL and HH makes the technique robust to a variety of low and high frequency attacks. [7, 9]

V.CONCLUSION

In this paper we surveyed various video watermarking techniques proposed by researchers in different domains. Expectations for the new approaches to come out and may hybrid approach with existing approaches such as merging of two powerful watermarking techniques for an instance DWT and SVD which will enhance the robustness of watermarking approach.

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V1.REFERENCES

[1] S. Tripathi , R.C. Jain," Novel DCT and DWT based Watermarking Techniques for Digital Images", The 18th IEEE International Conference on Pattern Recognition, 2006

[2] F. Perez- Gonzalez and J.R. Hernandez, "A tutorial on Digital Watermarking", Dept. Technologies de las Comunicaciones, ETSI Telecom., Universidad de Vigo, 36200 Vigo, Spain [3] S. Bhattacharya, T. Chattopadhyay and A. Pal, "A Survey on Different Video Watermarking Techniques and Comparative Analysis with Reference to H.264/AVC", IEEE, 2006

[3] A.Essaouabi and F.regragui, "A Wavelet-Based Digital Watermarking for Video", International Journal of Computer Science and Information Security, Vol. 6, No.1, pp 29-33, 2009

[4] P. Goč-matis, T. Kanócz, R. Ridzoň and D. Levický, "Video watermarking based on DWT", 10th Scientific Conference of Young Researchers,2010

[5] C.I.Podilchuk, E.J. Delp "Digital watermarking: algorithms and applications," Signal Processing Magazine, Vol 18,pp. 33-46, IEEE, July 2001.

[6] G. Langelaar, I. Setyawan, and R. Lagendijk, "Watermarking Digital Image and Video Data: A State of - Art Overview," IEEE Signal Processing Magazine, vol., pp. 20-46, Sep. 2000.

[7] S.Sinha, P.Bardhan, S.Pramanick, A.Jagatramka, "Digital Video Watermarking using Discrete Wavelet Transform and Principal Component Analysis", International Journal of Wisdom Based Computing, Vol. 1 (2), pp. 7-12,August 2011

[8] T. Tokar, T. Kanocz, D. Levicky, "Digital watermarking of uncompressed video in spatial domain," 9th International Conference on Radio electronic, IEEE, pp. 319-322, 2009.

[9] N. I. Yassin, N. M. Salem, and M. I. E Adawy," Block Based Video Watermarking Scheme Using Wavelet Transform and Principle Component Analysis", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 1, No 3, pp. 296-301, January 2012 C.H. Li and S.S. Wang, "Transform-Based Watermarking for Digital Images and Video," IEEE International Conference, June1999.