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Svd-Dwt Based Video Watermarking Technique

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Abstract: *The remarkable increase in the development of the digital communication make theprotection and illegal distribution of digitaldata, an important issue in this digital era. The advancement of Internet services and various improved technologies made video piracy as an increasing problem particularly when media is sharing through the internet. For these problems digital watermarking provides a solution. Basically digital watermarking involves embedding secret symbols known as watermarks within video data which can be used later for copyright detection and authentication verification purposesand by this we can avoid the illegal copying of digital data to a great extent. This paper presents the SVD (singular value decomposition) DWT (discrete wavelet transform) based video watermarking. In addition, it gives the information about main key performance indicators which include robustness, speed, capacity, fidelity, andimperceptibility.*

Keywords: *Video Watermarking, Singular Value Decomposition (SVD), Discrete Wavelet Transform (DWT), Robustnessand Imperceptibility.*

I. Introduction

The digital revolution has changed the model of multimedia distribution. High quality copies of digital data are produced and distributed through the internet by exploiting recent network and software technologies. A broad range of application achieved for video such as video broad casting, videoconferencing, DVD, video on-demand and high definition TV which has made a security issues, videos can be tampered, forged or altered easily. Illegal acts such as tampering, forging and altering violate the copyright and the security in respect with cases of authentication. Security techniques that are based on cryptography only provide assurances for data confidentiality, authenticity, and integrity during data transmission through a public channel such as transmission through an open network. However, such security techniques do not provide protection against unauthorized copying or transmitting of illegal materials. This leads to the need for digital watermarking technologies. Video Watermarking is a young and rapidly evolving field in the area of multimedia. Following factors have contributed towards the rising of interest in this field.

a) The society is contaminated by the tremendous privacy of digital data makes copying of digital media very easy.
b)This is an era where need has to fight against the"Intellectual property right violations".
c) Copyright protections have to be protected from malicious attacks.
d) Tamperingof the digital data needs to be kept secret at some point.

The requirement of secure communication and digital data transfer has potentially increased with the development of multimedia systems. Data integrity is not secure in image and video transfers. The main technique used for protection of an Intellectual Property rights and copyright protection is digital water marking. The copyright data may be in the form of text, image, audio, and video. Watermarking may be visible or invisible. It provides methods to solve the problem of illegal copying and manipulations in thedigital data.

Digital watermarking refers to embedding watermarks in a multimedia documents and files in order to protect them from illegal copying and identifying manipulations. This promising technology received a considerable attention for embedding copyright information in a wide range of multimedia applications. In particular, video proposed watermarking techniques embed small copyright information called a watermark in the digital video such that the watermark is imperceptible and robust against attempts to degrade it or remove it from the digital object. Thus avoidingthe copying of the digital data.

1.1 Watermarking Techniques

1.1.1: Discrete Wavelet Transform (DWT):

An image is decomposed into four subbands denoted by LL, LH, HL and HH at level 1 in the DWT domain, where LH, HL, and HH represents the finest scale wavelet coefficients and LL stands for the coarse-level coefficients .The lowest resolution level LL consists of the approximation part of the original image .The remaining three resolution levels consist of the detail parts and the LL subband can further be decomposed to obtain another level of decomposition. The decomposition process continues on the LL subband until the desired number of levels determined by the application is reached .LH, HL and HH are the finest scale wavelet coefficients. Since human eyes(HVS) are much more sensitive to the low-frequency part (the LL subband), the watermark can be embedded in the other three subbands to maintain better image quality. In the proposed algorithm, watermark is embedded into the host image by modifying the coefficients of high-frequency bands i.e.HHsubband.

1.1.2 Singular Value Decomposition (SVD):

Singular value decomposition is a mathematical tool used to decompose a matrix into two orthogonal matrices and one diagonal matrix consisting of the singular values of the matrix. From the point of image processing an image can be considered as a 2D matrix. Therefore, consider an image A to be an m × m matrix; the SVD of A can be given by A = USV, where U and V are orthogonal matrices, and S = diag (λ), is a diagonal matrix of singular values λi = 1, 2 . . . m arranged in decreasing order. The columns of V are the right singular vectors, whereas the columns of U are left singular vectors of the image A. In case of SVD based watermarking, SVD of the cover image is taken and then singular values of the matrix are modified by introducing the watermark. SVD approach has found use in watermarking field because of the fact that singular values obtained after decomposition of the image matrix are very stable and do not change on introduction of small perturbations. Moreover, singular values represent intrinsic algebraic image.

In linear algebra, the singular value decomposition (SVD) is an important factorization of a rectangular real or complex matrix, with several applications in signal processing and statistics. The spectral theorem says that normal matrices can be unitarily diagonalzed using a basis of Eigen vectors. The SVD can be seen as a generalization of the spectral theorem to arbitrary, not necessarily square, matrices.

Suppose M is an mx$n$matrix. Then there exists a factorization for $M = U\sum V^T$ of the form where, U is an mx$m$unitary matrix, the matrix Σ is mx$n$with nonnegative numbers on the diagonal and zeros on the off diagonal, and V^T denotes the conjugate transpose of V, an nxn unitary matrix. Such a factorization is called a singular value decomposition of M.

1. The matrix V thus contains a set of orthonormal ‘input’ vector directions for the matrix M.
2. The matrix U contains a set of orthonormal ‘output’ basis vector directions for the matrix M
3. The matrix Σ contains the singular values, which can be thought of as scalar ‘gain controls’ by which each corresponding input is multiplied to give a corresponding output.

II. Classification Of Video Watermarking Depends On Functionality Levels

A variety of watermarking approaches are proposed by researchers either in industry or academic setting which offer various functionality levels. Table 1 shows a classification of a watermarking system from different points of view.

<table>
<tr><td colspan="2">Host media</td><td colspan="2">Text, image, audio, video</td></tr>
<tr><td colspan="2">Visibility of watermark</td><td colspan="2">Visible, invisible</td></tr>
<tr><td colspan="2">Robustness of Watermarking</td><td colspan="2">Robust, semi-fragile, Fragile</td></tr>
<tr><td colspan="2">Watermark data types</td><td colspan="2">Noise, authentication Information, image</td></tr>
<tr><td rowspan="4">Embedding Method</td><td>Spatial domain</td><td colspan="2">LSB, image check sum, Random function</td></tr>
<tr><td rowspan="2">Frequency Domain</td><td colspan="2">Look-up table</td></tr>
<tr><td>Spread Spectrum</td><td>DCT, Wavelet(dwt), Fourier(DFT)</td></tr>
<tr><td>Compression Domain</td><td colspan="2">Mpeg-1, mpeg-2, Mpeg-4, jpeg2000</td></tr>
<tr><td colspan="2">Detection</td><td colspan="2">Blind, non-blind, Semi-blind</td></tr>
</table>

Figure 1: Classification of Watermarking

This section contains a brief review of the current video watermarking techniques based on watermarking domain namely spatial domain, frequency domain and mpeg coding.
We have developed a scheme for SVD-DWT based video watermarking that is extremely defend towards attacks in the channel during communications.

III. Dwt-Svd Based Watermarking

Robustness, capacity and imperceptibility are the three important requisites of an efficient watermarking scheme. Ordinary SVD based watermarking scheme has high imperceptibility. Although the SVD based scheme withstands certain attacks, it is not resistant to attacks like rotation, sharpening etc. Also SVD based technique has only limited capacity. These limitations have led to the development of a new scheme that clubs the properties of DWT and SVD.DWT based technique is one of the most popular transform domain techniques.

This particular algorithm proves to be better than ordinary DWT based watermarking and ordinary SVD based watermarking scheme. The above mentioned SVD-DCT scheme has enormous capacity because data embedding is possible in all the sub-bands. Watermark was found to be resistant to all sorts of attacks except rotation and achieved good imperceptibility. The disadvantage is that the embedding and the recovery are time consuming process because the zigzag scanning to map the coefficients into four quadrants based on the frequency, is a time consuming process. Alternatively if we apply DWT we get the four frequency sub-bands directly namely; approximation, horizontal, vertical and diagonal bands .So the time consumption will be greatly reduced.

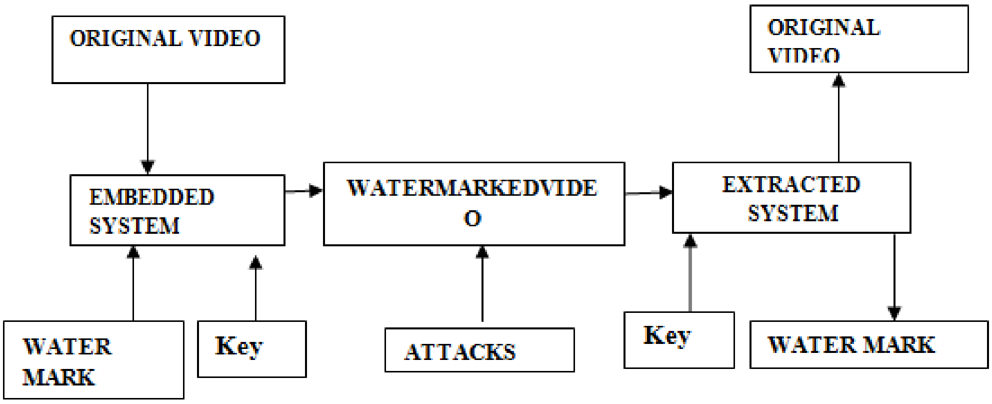

Fig 3.1: Block diagram of Video Watermarking

3.1:Watermark embedding:

1. Load the original video and watermark imageand adjust the alpha value for result
2. Read the watermark image in double and take the information about the first frame of video and double it.
3. Apply DWT as [CA,CH,CV,CD]=DWT2(X,'wname') computes the approximation coefficients matrix CA and coefficients matrices CH, CV, CD, obtained bywavelet decomposition of the input matrix X. 'wname' is a string containing the wavelet name.
4. After that again resize watermarked image as per size ofthe coefficient and apply SVD.
5. Convert the Matlab movie format in avi format and save in harddisk.

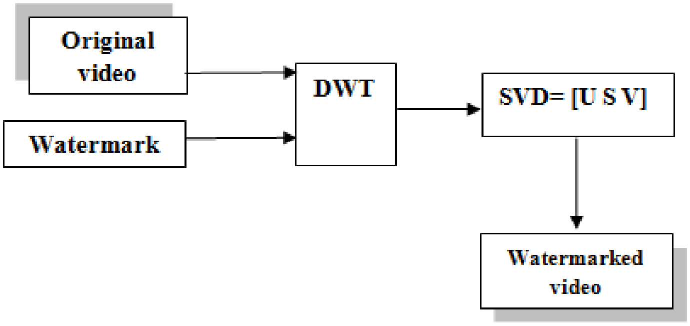

Fig 3.2:Embedding Watermark

3.2 :Extraction of watermark:

The proposed method of extraction algorithm is used.First convert the watermarked video in to frames. Take the frame and apply DWT and use SVD and resize s1 and get the new value of SVD. After getting the new watermark values and displays the recovered message.
1. Load watermarked video.

2.Take any one of the frames of watermarked video, double it and apply DWT.
3.Use switch values forSVD values.
4.Get the new values of s1 and get the new values of matrix.
5. Thenfind new value ofWatermark=(matrix-s1/alpha).
6. Display recovered watermark image.

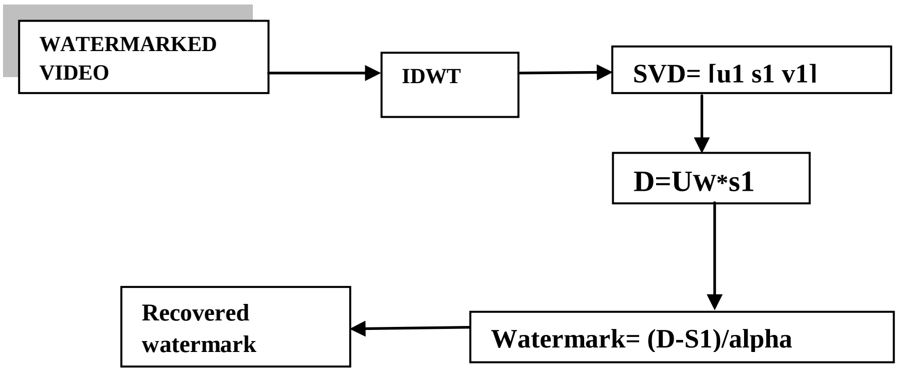

Fig: 3.3 Extraction of Watermark

3.3:Aspects of video watermarking:

A. Fidelity:An effective watermarking system should meet a high level fidelity as one the main requirements of watermarking. The distortion made through the watermark should be less.
B. Robustness: Robustness refers to that watermark should not be destroyed if someone performs the common manipulations and any malicious attacks.
C. Use of the key:The improvement of security by using a secret key is involved with cryptography techniques which enhance the robustness of the watermarking algorithm
D. Speed:With development of high speed hardware's and computing technologies, speed became as a least requirement is a watermarking system.
E. Capacity: Capacity refers to a maximum number of bits are allowed to embed in a cover media. The size of the watermark depends on application which determines the type of watermark data and embedding policy.
F. Statistical imperceptibility: The watermark should be statistically imperceptible. It means a statistical analysis should not be able to reveal the watermark.

IV. Experiment Results

The figure shows the original video, watermarked video and the watermark is removed from the watermarked Image.

Fig 4.1: Original Video frame

Fig 4.2: Watermarked Video frame

Fig 4.2: Recovered Watermark and Videoframe

The experimental results of DWT-SVD basedwatermarking is as shown in table below:

PARAMETERS	VALUES
Duration of video	105.4302
Bits/pixel	24
Frame rate	25
Height	240
No. of frames	2619
Video format	RGB24
Width	320

Table 2: Experimental Results

This result shows that DWT-SVD has more robustness when compared to all other techniques.

V. Conclusion

In this paper we proposed method of digital video watermarking based on the concept ofDWT-SVD. The DCT based method is very time consuming when compared to the DWT-SVD though it offers the better capacity and imperceptibility. The new method was found to satisfy all the aspects like robustness, imperceptibility andfast processing time. The results demonstrated the blindness and robustness of our proposed method as it successfully extracted the watermark from each frame without using the original video. The extracted watermark was exactly the same as the embedded original watermark.

References

[1]. 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.

[2]. G. Doerr and J. Dugelay, "A Guided Tour to Video Watermarking," Signal Processing: Image Communication, vol. 18, pp. 263-282, 2003.

[3]. D. Kundur, K, Su, and D. Hatzinakos, "Digital Video Watermarking: Techniques, Technology, and Trends," in Intelligent Watermarking Techniques , chapter 10, P. Pan, H. Huang, and L. Jain, eds., World Scientific Computing, pp. 265-314, 2004.

[4]. H. Andrews and C. Patterson, "Singular Value decompositions and Digital Image Processing," IEEE Trans. on Acoustics, Speech, and Signal Processing, vol. 24, no. 1, pp. 26-53, Feb. 1976.

[5]. M. Rehan et al, A New Motion-Estimation Technique for Efficient Video Compression, IEEE Pacific Rim Conference, No. 1, pp. 326-330, 1997.

[6]. H. Hartung and B. Girod, "Watermarking of Compressed and H. Hartung and B. Girod, "Watermarking of Compressed and Un-Compressed Video," Signal Processing, vol. 66, no. 3, pp. 283-301, May 1998. Cox, I. J., Miller, M. L., and Bloom, J. A. Digital Watermarking. Morgan Kaufmann Publishers, San Francisco, CA, 2002, pp. 26–36.

[7]. P Chan and M. Lyu, "A DWT-Based Digital Video Watermarking Scheme with Error Correcting Code," in Proceedings of the 5th International Conference on Information and Communications Security, 2003, pp. 202-213

[8]. X. Niu and S. Sun, "A New Wavelet-Based Digital Watermarking for Video," in Proceedings of the 9th IEEE Digital Signal Processing Workshop, 2000, pp. 241-245.

[9]. E. Ganic and A. M. Eskicioglu, "Secure DWT-SVD Domain Image Watermarking: Embedding Data in All Frequencies," ACM Multimedia and Security Workshop 2004, Magdeburg, Germany, September 20-21, 2004.