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Implementation of Watermarking System to Embed the Information within Video Streams for Security Purpose

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Abstract— Now a day's security is main concern when we entered into digital world but the steps to develop such security system and how we take optimum use of available or rather advanced techniques for developing such systems that can also fulfils our requirement are much important. As we are discussing about digital world we must take into account about the multimedia object such as text, image, audio and video. In above all form of data, video data security is challenging issue so dealing with digital watermarking in video for security is focus of paper. Technology can be carried out by various algorithms like DWT, DCT in frequency domain. In this paper, combined DWT and DCT transforms are used to watermark data in video with minimum quality loss. Combined approach makes system robust as making use of multi-resolution DWT with energy compaction DCT. Results are evaluated for every frame in video by three parameters PSNR, MSE and NC. Design of proposed scheme is using MATLAB R 2013a.

Index Terms—DWT and DCT transform MSE, NC, PSNR, Watermark.

I. INTRODUCTION

Security in any respect whether it regarding commercial, industrial or it may be military purpose have its vital role. We people always concern about our confidential document, Industry person take care of their data in secured format so that illegal user can't misuse it. In military it's very much important to secure data with proper format and in discipline manner otherwise authorized user interference lead to such damage that will really difficult to recover. We must consider all factors regarding security and their related issues as they are going to affect on our system if they are not handled in time. In conventional approach data transmission was time consuming, less secured, and inefficient task as it was carried out by person to person. At ancient time sufficient techniques were not developed for transmission, reception and hiding of information, however as growing demand ends up in invention greater potency but as growing demand results to invention of new technology with greater efficiency. This new technology has modified the format of data. Now a day's data available is all in digital format and with this invention security related issues are also becoming digital so to overcome all these issues and affecting factor there should be adaptive technology.

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Digital format involves text, image, audio and video. Video in above all format is most influential format in the entertainment industry, commercial work and in military purpose. With the advancement in technology user required more features in video for faster and easier distribution. However problems regarding security of video leads to need of protecting it against manipulations and alterations in digital data. To deal with such issue, a data hiding technique known as watermarking is one of the methods [1]-[2]. Data hiding methods known as watermarking can be divided into two categories. One is spatial-domain approach and other is frequency-domain. Watermarking is embedded in the image pixels directly in case of spatial domain. The most common methods are histogram-based and least-significant bit (LSB) techniques in the spatial domain. In the frequency domain, the common well-known methods for data hiding are discrete cosine transformation (DCT)-based, discrete wavelet transformation (DWT) [3]. This paper focuses on combined approach of DWT and DCT. The paper is formatted as below. Introduction is in part I. Review of papers in part II. Proposed methodology is discussed in part III. Evaluation of results and conclusion after analysis of results is described in parts IV and V respectively.

II. RELATED WORK

Yiqi Tew et al., [1] have represent information hiding methods in the H.264/AVC compressed video domain. In their research work they select the video criteria such as motion alleviation, GOP size and bitrates. The general framework of information hiding is conceptualized by sequences of bits. Mapping rules, Bit plane replacement, spread spectrum, Matrix encoding, histogram manipulation, and divisibility are various data representation scheme to illustrate the concept of information hiding. Sonjoy Deb Roy et al., [2] proposed hardware implementation of watermarking system in discrete cosine transform. Proposed method generates the watermark sequence by scrambling techniques and embedded into video using frequency domain DCT. It uses MPEG techniques for video compression. Pallavi Patil et al., [3] have present in her paper regarding watermarking technique for digital images using DWT method. Using the 3 level DWT method they embed the secret data into cover images. Embedding and extraction methods are include in it. Results are concluded by PSNR and MSE parameters. Aditi Agarwal et al., [4] proposed watermarking scheme using DWT and DCT.

Technique is implemented in frequency domain in which second level DWT decomposition is carried out which is followed by DCT applied on DWT coefficients in high frequency band to provide compression robustness.

III. PROPOSED METHOD

The proposed work involves use of two most preferred frequency domain techniques discrete wavelet transform and discrete cosine transform for video watermarking. DCT is effective transform because it has energy compaction property. In DCT solely few frequency components are accountable to explain the image. Here, original image is dividing into 8*8 blocks. For every input image DCT calculates its corresponding frequency component. It provides three frequency element which are as follows low, mid and high. Low frequency components are most significant part of image and high frequency components can be easily removed through compression and attacks. The watermark is embedded into middle frequency to avoid quality loss of reference video. Simultaneously, DWT approach makes our system robust and strong. DWT decompose image into four non-overlapping sub-bands. They are LL, LH, HL, and HH respectively which is known as first level decomposition of DWT. Watermark is embedded into LH and HL sub-bands to avoid the degradation of host video. DWT has multi-resolution property which makes it suitable to use as best algorithm for embedding purpose. As so much therefore in discussion, combined approach of DWT and DCT makes system most powerful than by using separate approach.

A] Embedding Algorithm:

Embedding algorithm is proposed with diagram illustration for the host video as shown in fig.1. Frame is extracted from given video on which watermarking is to be carried out. Embedding procedure is formatted in block diagram in fig.1. Watermark image goes through DWT and DCT transforms from which mid frequency coefficients are altered by low frequency of DWT of reference video frame. Inverse DWT is applied to embedding image to construct the watermarked video streams.

Algorithm

1. Read and display the cover image or video frame from host video.
2. Read and display watermark image which is to be embedding into cover image.
3. Apply Discrete Wavelet Transform on video frame.
4. Video frame get decomposed into LL, LH, HL and HH band.
5. Apply Discrete Cosine Transform on watermark image.
6. Apply the Discrete wavelet transform on mid frequency of discrete cosine transform.
7. DWT has first level decomposition converting mid frequency of DCT into LH and HL band.
8. Embed the watermark into the LH and HL wavelet band.
9. Apply IDWT to construct watermarked video.
10. Read and display watermarked video.

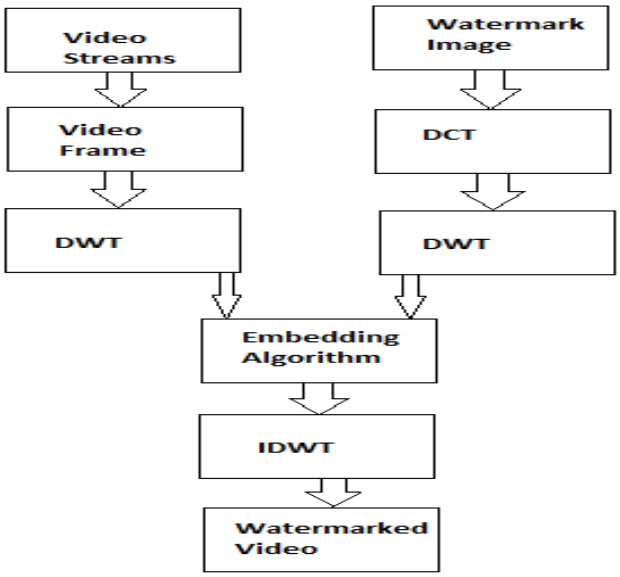

Figure 1: Block diagram of embedding algorithm for video

B] Extraction Algorithm:

The generalized block diagram for extraction process is shown in fig. 2. Extraction process is carried out to extract the watermark from watermarked video.

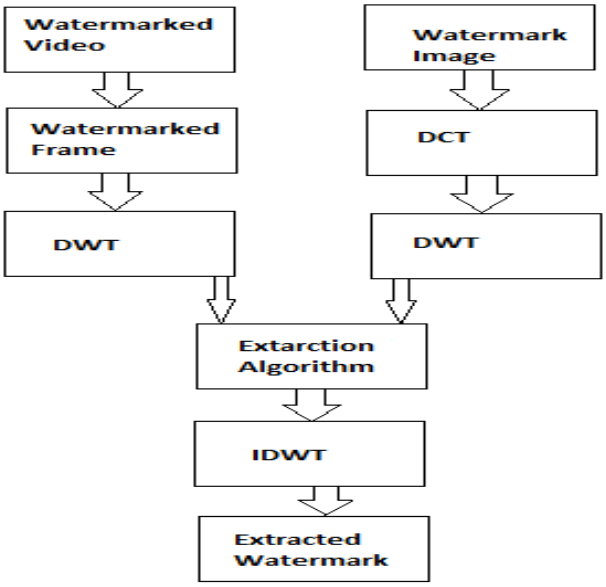

Figure 2: Block diagram of extraction algorithm for video

Algorithm

1. Extract the watermarked frame from watermarked video.
2. Apply discrete wavelet transform to watermarked frame.
3. Watermarked frame is decomposed into LL, LH, HL and HH band.
4. Apply the discrete cosine transform to watermark image followed by discrete wavelet transform.
5. Extraction the watermark from LH and HL sub-band
6. Apply IDWT to reconstruct the watermark.
7. Watermark is extracted from watermarked video.

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IV. EXPERIMANTAL RESULTS AND DISCUSSION

Proposed technique is simulated with the help of MATLAB R2013a. Results are discussed using three parameters - MSE, PSNR and NC. MSE: Mean Square Error is additive error between watermarked and original image. The square of difference between original image and watermarked image gives mean square error. MSE is reciprocally proportional to PSNR. MSE is calculated by using below formula [3].

$$MSE = \frac{1}{MN}\sum_{y=1}^{M}\sum_{x=1}^{N}[I(x,y) - I'(x,y)]\text{^}2$$

Where,
I(x,y) is original image and I'(x,y) is watermarked image
M & N are dimensions- height and width of image. PSNR: Peak Signal Noise Ratio is ration between maximum possible power of signal and power of corrupting noise that effects signal. Higher value of PSNR and lower value of MSE suggest that implementation of system is effective and robust. PSNR is calculated as follow [3].

$$PSNR = 10log\left(\frac{255^2}{MSE}\right)$$

NC: Normalized coefficients give a measure of robustness of watermarking. Its peak value is 1. It is calculated using below formula [5].

$$NC = \frac{\sum_i \sum_j W(I,J).W'(I,J)}{\sqrt{\sum_i \sum_j W(I,J)}\sqrt{\sum_i \sum_j W'(I,J)}}$$

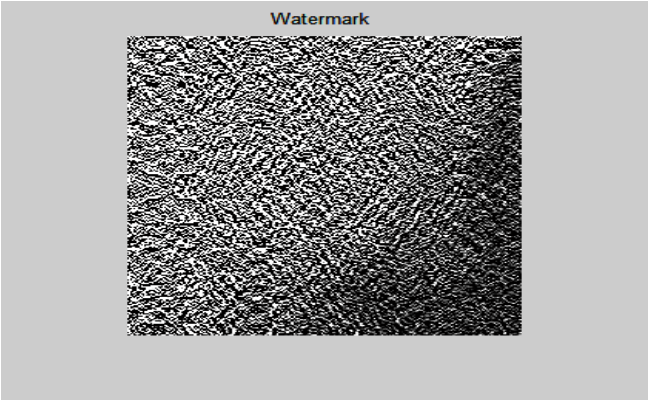
Where,
W (I,J) and W'(I,J) are original and extracted watermark. Value of PSNR, MSE and NC are calculated for each frame in video. In given video there are 120 frames it means there are 120 values for each parameters. In this paper, it describes only first five frames in video. Following Table shows calculation of NC, MSE, PSNR and PSNR in db for first five frames in video.

Frame num.	NC value	MSE value	PSNR value	PSNR value db
1	5.6778e+03	40.5897	1.6146e+03	64.1613
2	5.6792e+03	40.5867	1.6147e+03	64.1619
3	5.6816e+03	40.5973	1.6143e+03	64.1596
4	5.6829e+03	40.6173	1.6135e+03	64.1554
5	5.6867e+03	40.7077	1.6099e+03	64.1361

Table No.1 Calculations of parameters

MATLAB simulation gives watermarked video which is shown below.

Original frame is from host video and watermarked frame is from Watermarked video after embedding watermark image into original video. Used watermark image is as below shown



V. CONCLUSION

Video is vital digital in today's communication world and in its security also. Developed system described video watermarking in easy and straight forward method with optimum use of efficient algorithm. In given system image is used as watermark data and watermark is done in video. System has combined approach of DWT and DCT algorithm for video watermarking. Multi-resolution property of DWT and energy compaction property of DCT makes system robust and effective than any other. Algorithms which are taking part to embed and extract watermark from video works successively. Results are evaluated and analyzed in three factors like-PSNR, MSE and NC to analyze the system. High value of PSNR which means low value of MSE shows that system has high noise ratio with less degradation quality of host video. With these parameters evaluation, it concluded system has better efficiency. Simulation process carried out using MATLAB R2013a.

REFERENCES

[1] Yiqi Tew & KokSheik Wong, "An Overview of Information Hiding in H.264/AVC Compressed Video" IEEE Transactions On Circuits And Systems For Video Technology, Vol. 24, No. 2, February 2014
[2] Sonjoy Deb Roy, Alexander Fish, Orly Yadid-Pecht, Xin Li & Yonatan Shoshan ," Hardware Implementation of a Digital Watermarking System for Video Authentication" IEEE Transactions On Circuits And Systems For Video Technology, Vol. 23, No. 2, February 2013.
[3] Ms Pallavi Patil & Dr. D.S.Bormane, "DWT Based Invisible Watermarking Technique for Digital Images" International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-4, April 2013.
[4] Aditi Agarwal, Ruchika Bhadana and Satish Kumar Chavan., "A Robust Video Watermarking Scheme using DWT and DCT" (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 2 (4) , 2011, 1711-1716.
[5] Prachi V. Powar, "Design Of Digital Video Watermarking Scheme Using Matlab Simulink" IJRET: International Journal of Research in Engineering and Technology ISSN: 2319-1163.
[6] A. V. Subramanyam, Sabu Emmanuel and Mohan S. Kankanhalli, "Robust Watermarking of Compressed and Encrypted JPEG2000 Images" IEEE Transactions On Multimedia, Vol. 14, No. 3, June 2012.
[7] G.Prabakaran, R.Bhavani & M.Ramesh , "A Robust QR- Code Video Watermarking Scheme Based On SVD and DWT Composite Domain," Proceedings of the 2013 International Conference on Pattern Recognition, Informatics and Mobile Engineering (PRIME) February 21-22.

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[8] C.N. Sujatha & P. Satyanarayana, "High Capacity Video Watermarking based on DWT-DCT-SVD"International Journal of Science, Engineering and Technology Research (IJSETR), Volume 4, Issue 2, February 2015.
[9] Chuhong Fei, Deepa Kundur & Raymond H. Kwong, "Analysis and Design of Secure Watermark-Based Authentication Systems" IEEE Transactions On Information Forensics And Security, Vol. 1, No. 1, March 2006.
[10] Nebu John Mathai, "Hardware implementation perspective of digital video watermarking algorithm" IEEE Trans on signal processing vol. 51, No.4, April 2003.
[11] Satyen Biswas "An adaptive compressed MPEG-2 video Watermarking scheme" IEEE Trans on Instrumentation and measurement, vol. 54, No.5, October 2005.
[12] Zhe-Ming lu "Multipurpose image watermarking algorithm based on multistage vector quantization" IEEE Trans on Image processing vol. 14, No.6, June 2005.
[13] Alessandro piva, "managing copyrights in open network" IEEE Trans Internet Comput vol.6, No.3, pp.18-26, May-June 2002.
[14] M. Maes ,"Digital Watermarking for DVD video copy protection", IEEE Signal Process. Mag., vol.17, No.5, PP.47-57, Sep.2000.
[15] K. Tamilvanan, "FPGA Implementation of Digital Watermarking System", IJCSMC, Vol.3,Issue.4, April 2014, pg.1321-1327.
[16] Mr. Ashish S. Bhaisare, "Significance Research Review on Real Tome Digital Video Wartermarking System For Video Authentication",Proc. Of the second intl. Conf. on Advances in computer, Electronic and electrical Engineering –CEEE2013.
[17] T. Pun, "Optimal adaptive diversity watermarking with channel state estimation," Proc. SPIE, Security Watermarking Multimedia Contents III, vol. 4314, Jan. 2001.
[18] P. Duhamel, "Unified Approach of Asymmetric Watermarking Schemes," Security and Watermarking of Multimedia Contents III, P.W. Wong and E. Delp, eds., Proc. SPIE, vol. 4314, 2001, pp. 269 279.
[19] R. Lagendijk, "Watermarking digital image and video data: A state-of-the-art overview," *IEEE Signal Process. Mag.*, vol. 17, no. 5, pp. 20–46, Sep. 2000.
[20] D. Kundur and D. Hatzinakos, "Diversity and attack characterization for improved robustwatermarking," *IEEE Trans. Signal Processing*, vol. 49, pp. 2383–2396, Oct. 2001.
[21] M. Ramkumar and A. N. Akansu, "Theoretical capacity measures for data hiding in compressed images," *Proc. SPIE, Voice, Video Data Commun.*, vol. 3528, pp. 482–492, Nov. 1998.
[22] R. B.Wolfgang, C. I. Podilchuk, and E. J. Delp, "The effect of matching watermark and compression transforms in compressed color images," in *Proc. IEEE Int. Conf. Image Process.*, vol. 1, Oct. 1998.
[23] C. Fei, D. Kundur, and R. Kwong, "Transform-based hybrid data hiding for improved robustness in the presence of perceptual coding," *Proc. SPIE, Math. Data/Image Coding, Compression Encryption IV*, vol. 4475, July 2001.
[24] S. Baudry, J. F. Delaigle, B. Sankur, B. Macq, and H. Maitre, "Analyzes of error correction strategies for typical communication channels in watermarking," *Signal Process.*, vol. 81, pp. 1239–1250, June 2001.
[25] F. Hartung and B. Girod, "Watermarking of uncompressed and compressed video," *Signal Process.* vol. 66, no. 3, pp. 283–301, 1998.

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