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SECURE DATA HIDING IN TRANSFORM DOMAIN FOR DIGITAL VIDEO SEQUENCES

[1]S.JanardhanaRao, [2]Dr O.NagaRaju

[1] Research Scholar, ANU, Guntur, AP, India,

[2] Head, Computer Science Department Government College, Macherla, Guntur, AP, India

***Abstract**: Video data hiding presents a challenging task in the current research area. In this a novel invisible data hiding scheme is proposed in the wavelet the domain using Secure zone (SZ) concept. This mechanism is robust against different attacks that can be applied on video sequences. Selective embedding mechanism is introduced for data hiding with the help of SZ concept. Experimental analysis in terms of decoding error were calculated and acquired good results which is a indication for better secret data hiding scheme for videos .*

Index Terms - Data hiding, Secure zone, selective embedding, wavelet transform

I.INTRODUCTION

Data hiding refers to techniques for embedding data in host media. Most of the previous research has focused on still image watermarking; video watermarking has more potential for commercial applications, less research has been conducted on high capacity data hiding in video streams. Ancillary data embedded in a video stream can carry information about the content itself, low-level descriptors for video indexing, retrieval and segmentation. Other applications include annotation, subtitling, multi-lingual services, tele-text, etc. Due to the data intensive nature of video, in most applications it is required to hide data in the transformed domain. Compared with still images, video watermarking presents a much higher capacity or bandwidth. At the same time the computational complexity in video watermarking is higher due to the amount of data that need to be processed. Since a video is formed from a sequence of frames, it presents the data hider with the possibility to embed and send a large amount of data[1].

Data hiding in video sequences is performed in two ways, bit stream level and data level. In the bit stream level the redundancies in the current compression standards are exploited. This type of method is totally dependent on the bit stream structure and it can be easily exploited. Hence this type data hiding is suitable for authentication. Despite of these limitations bit stream level based data hiding schemes are attractive for robust invisible data hiding. In this paper one such algorithm in the wavelet transform domain is proposed This paper is organized as follows ,section I describes about the need and importance of data hiding, section II explains the secure zone selection ,section explains about the proposed scheme for selective data embedding ending with section IV & V with results and conclusions.

II. SECURE ZONE BASED SELECTIVE DATA HIDING

This method depends on the secure zone concept which means that no alteration is been allowed in this region for data hiding process. Let s be the host signal in R and mϵ {0,1} be the data to be hidden [3]. Then the marked signal is obtained as

$$\hat{s} = \begin{cases} s, s \in FZ \\ Mm(s), s \in AZ \end{cases} \quad (1)$$

Where FZ is the forbidden zone and AZ is the allowed zone and $M_m(s)$ is the mapping function which can be expressed as

$$M_m(s) = \{s + e_m(1 - \frac{r}{||e_m||}) \quad (2)$$

The FZ can be knows from

$$FZ_m = \{s||e_m|| \leq r\}$$
$$AZ_m = \{s||e_m|| > r\} \quad (3)$$

During the extraction process minimum distance approach has been considered

$$\hat{m} = argmin\, d(y, y_m) \quad (4)$$

Where y is the received signal and y_m is equal to the FZ obtained.

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III.NON SUBSAMPLED CONTOURLET TRANSFORM

The NSCT is completely shift invariant, multi-scale and multi direction expansion that has better directional frequency localization and fast implementation where it helps to achieve the similar sub band decomposition as that of contourlet but without the down samplers and up samplers in it [8]. The NSCT construction can be divided into two parts where one part demonstrates the non sub-sampled pyramid structure, which splits the input into a low pass sub band and a high pass sub band .The other is non sub-sampled directional filter bank structure, which decomposes the high pass sub band into several directional sub bands as shown in Fig.1. This process is iterated repeatedly on the low pass sub band outputs of non sub-sampled pyramids. Here, non sub-sampled pyramids provide multiscale decomposition and non sub-sampled directional filter banks provide directional decomposition

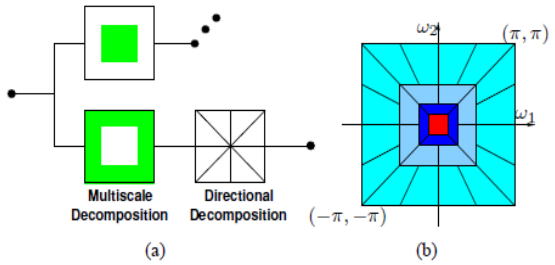

Figure 1: Illustration of Non-sub-sampled Contourlet Transform (a) Block diagram (b) Resulting frequency division

IV. PROPOSED METHODOLOGY

The below figure shows the generalized block diagram for the proposed mechanism

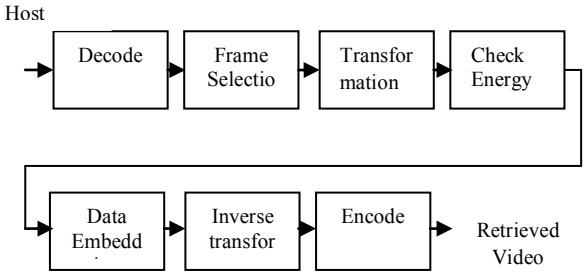

Figure 2: block diagram of the proposed mechanism

a)Embedding Procedure

1. *For the embedding Y-channel is been utilized*
2. *Apply the transformation (NSCT/DWT) and partition the low frequency components into 8x8 non overlapping blocks*
3. *In the selective embedding procedure the data will be hidden only in certain block of the certain frames. So firstly we are supposed to select the blocks and the frames.*

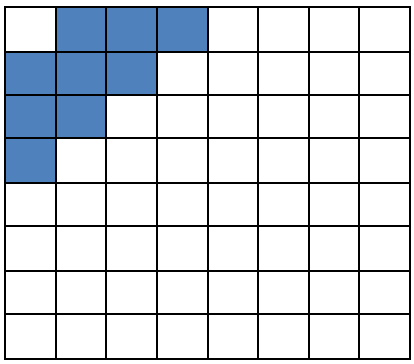

Figure 3: Mask for considering frequency band

4. *Block selection: Energy of the mask region is calculated for a given block if this energy is above certain threshold (T1) then the block is processed or else left unchanged.*
5. *Frame selection: Selected number of blocks in the whole frame is counted .If the ration of the selected blocks to the all bocks is above certain threshold (T0) the frame is processed or else it is left unchanged*
6. *Coefficient selection: Energy of each coefficient in the selected block region is compared against a certain threshold T2.If the energy is above the threshold then it is used for data hiding or else left unchanged*

b) Extraction Procedure

The given marked video sequence will be undergoing the first three steps in the embedding procedure

1. *At each frame, frame synchronization markers are decoded first. Message decoding is*

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performed once the end of the group of frames is detected.

2. *Two frame indexes are stored current f_{cur} and previous f_{pre} to decode the message u*

3. *If f_{cur} >t then skip this frame*
4. *If f_{cur}=f_{pre} then skip this frame*
5. *If both the cases are not met then process the current frame. Put o_m values in the corresponding place of data structure .Non selected blocks re left as erasures*

V EXPERIMENTAL RESULTS

The experiment was conducted with two different transformations like DCT (Discrete cosine transform) and DWT(Discrete wavelet transform) in which a block size 8x8 was considered for block partitioning .A selective number of coefficients were considered as shown in figure 2 from the low frequency bands. In the case of DWT; LL components were considered with the same block size. The input video sequences were collected from [2] of CIF format whose resolution is 352x288 in 4:0:0 YUV encoded stream .The experiments were conducted with T0=0.3, T1=0.3 and T2=0.8 thresholds.

(a) (b)

Figure 3: (a) Original 2nd Frame of flower sequence (b) Marked frame with DCT, PSNR=28.10

(a) (b)

Figure 4: (a) Original 2nd Frame of flower sequence (b) Marked frame with DWT, PSNR=28.25

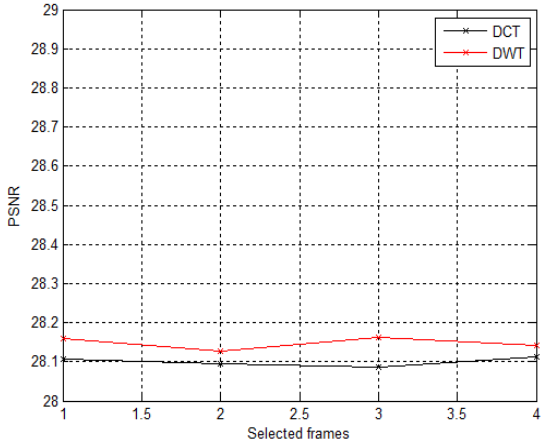

Figure 5: Performance analysis of the proposed scheme with respect to different selected frames and PSNR

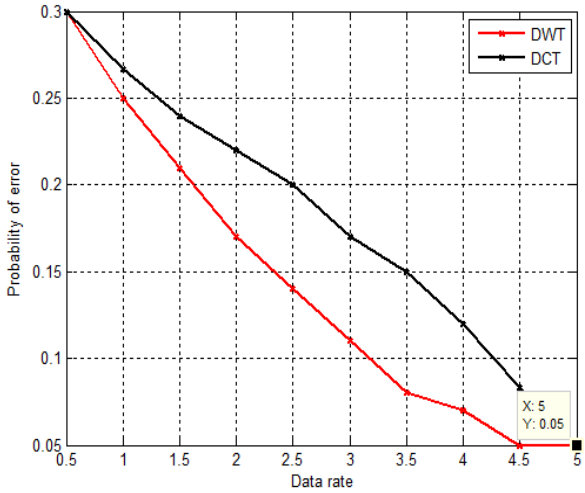

Figure 6: Performance analysis of the proposed scheme with respect to different data rates and the probability of error

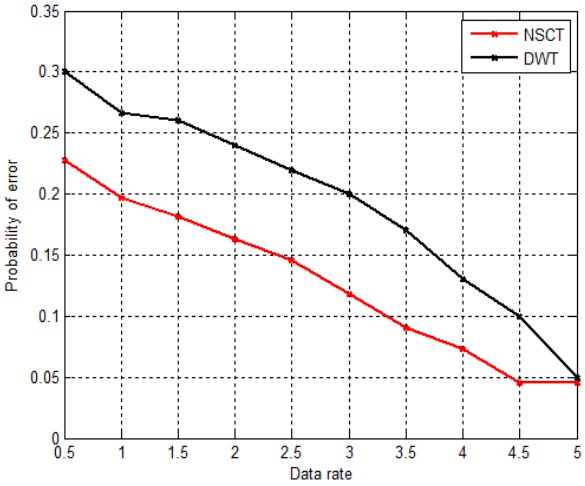

Figure 7: Performance analysis of the proposed scheme with respect to different data rates and the probability of error

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V.CONCLUSION

Secure zone based selective data embedding scheme is proposed in wavelet domain .The method out performs than the existing DCT based approach with and increment of about 0.2dB of PSNR on average with a probability of error 0.05 decrement. It is here by concluded that the current scheme may be utilized for better selective approach. This work can be further extended with spreading codes and higher multi resolution analysis transformations.

REFERENCES

[1] Solanki, K.; Jacobsen, N.; Madhow, U.; Manjunath, B.S.; Chandrasekaran, S., "Robust image-adaptive data hiding using erasure and error correction," Image Processing, IEEE Transactions on , vol.13, no.12, pp.1627,1639, Dec. 2004
[2] http://trace.eas.asu.edu/
[3] E. Esen and A. A. Alatan, "Forbidden zone data hiding," in Proc. IEEE Int. Conf. Image Process., Oct. 2006, pp. 1393–1396.
[4] M. Wu, H. Yu, and B. Liu, "Data hiding in image and video: II. Designs and applications," IEEE Trans. Image Process., vol. 12, no. 6, pp. 696– 705, Jun. 2003.
[5] Z. Wei and K. N. Ngan, "Spatio-temporal just noticeable distortion profile for grey scale image/video in DCT domain," IEEE Trans. Circuits Syst. Video Technol., vol. 19, no. 3, pp. 337–346, Mar. 2009.
[6] M. Maes, T. Kalker, J. Haitsma, and G. Depovere, "Exploiting shift invariance to obtain a high payload in digital image watermarking," in Proc. IEEE ICMCS, vol. 1. Jul. 1999, pp. 7–12.
[7] T. Kalker, G. Depovere, J. Haitsma, and M. J. Maes, "Video watermarking system for broadcast monitoring," in Proc. SPIE Security Watermarking Multimedia Contents Conf., vol. 3657. 1999, pp. 103– 112.
[8] M. Maes, T. Kalker, J.-P. M. G. Linnartz, J. Talstra, F. G. Depovere, and J. Haitsma, "Digital watermarking for DVD video copy protection," IEEE Signal Process. Mag., vol. 17, no. 5, pp. 47–57, Sep.2000.
[9] K. Wong, K. Tanaka, K. Takagi, and Y. Nakajima, "Complete video quality-preserving data hiding," IEEE Trans. Circuits Syst. Video Technol., vol. 19, no. 10, pp. 1499–1512, Oct. 2009.
[10] A. Sarkar, U. Madhow, S. Chandrasekaran, and B. S. Manjunath, "Adaptive MPEG-2 video data hiding scheme," in Proc. 9th SPIE Security Steganography Watermarking Multimedia Contents, 2007, pp. 373–376.

BRIEF PROFILE OF AUTHORS:

[2]Dr.O NagaRaju. received Ph.D. in the department of Computer Science Engineering, Acharya Nagarjuna University, Guntur, Andhra Pradesh, India. He has a satisfactory consistent academic track of record. He is currently working as a Head, Computer Science Department Government College, Macherla, Guntur (Dt). He has occupied various academic responsibilities like practical examiner, project adjudicator in Andhra Pradesh. His current research is focused on Software Engineering, Image Processing & Database Management System. He has published several papers in National & International Journals.

[1]Syamalapalli Janardhan Rao graduated his AMIE from Kolkata, India, Masters Degree in ECE from Jawaharlal Nehru Technological University (JNTU), Anantapur, A.P, India, in 2010. He got another Master Degree in CSE from IETE Delhi, India in 2009. He is currently being Fellow of IETE, New Delhi, and workinkg as an Associate Professor in the Department of electronics and telecommunication Annasaheb Dange college of engineering& Technology, ashta, India. He has served for 20 years in Indian Air force on different RADAR Systems. His main research fields include and Digital Water Marking, Network security.

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