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Video Watermarking Based On Wavelet Packet Analysis for Various Attack

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Abstract— As the world has moved to the digital era, whole content the living being has been uploaded to the server over internet. People are now very much familiar with the internet and are using for every need. The transition from the old era to the existing one has made people to have internet for various need and to fulfil the requirement of information. As the people are getting educated for the use of internet many kind of misuse of the private content has also been seen. Hence there is a requirement of securing the data which is uploaded to the internet irrespective of the necessity. There has been various method proposed in recent past by many researchers. Some of them are security of image or video using PCA, DCT, and DWT etc. Some also proposed methods utilizing the Stenographic or Cryptographic techniques of security. One way of providing security is the method of watermarking. Recently the use of Discrete Packet Transform technique has been evolved as a new technique for signal analysis. The use of this method for image and video watermarking has been seen in recent years. Here the paper analyses the use of Discrete Wavelet Packet Transform for digital watermarking and attack analysis. The attack analysis is done by the introduction of various types of noise in the embedded video and then extracting the copyright image from the noisy image after demonising. The results obtained for video watermarking and as per the extracted watermark image it can be concluded that this method of watermarking proves to the most robust and economical in terms of SSIM and UIQI which is the measure of quality of the image.
Keywords— include at least 5 keywords or phrases

I. INTRODUCTION

The swift increase of multimedia data over internet demands sophisticated procedure for protecting and proficient access to information. Rising exercise and sharing of multimedia records, through the internet have extensively used communication system, & media are raising numerous tricky aspects concerning defence. Currently, it is extremely simple to create an unrestricted number of copies of digital information & their distribution or allocation does not require complex action. In addition, to this sociable software editing tool allows simply altering the content of multimedia data. Thus, it is essential to build up technique which able to defend sensitive information from unauthorized exercise. There are some techniques associated with the security of data content; some of them are Steganography, Cryptography and Watermarking. Cryptography is defined as the art of science of secret writing. Cryptography is about defending the content of the message. It hides the content of the message from an attacker, but not the existence of the message, whereas Steganography is the art of science of writing hidden messages in such a way that no one apart from the sender & intended recipient suspect of the existence of the message. Steganography even hides the existence of the message in the data. Therefore cryptography protects the content of a message. Steganography is said to protect both messages & communicating parties. Digital watermarking embeds information into digital data (the carrier) in a secret and ordinary way. The embedded information is denoted as a digital watermark [2]. The digital watermark shall be robust against distortions that do not significantly degrade the receiver's perception of the carrier signal. For authentication also digital watermarking is used. Authentication is the recognition of whether the content of the digital data has altered. Robustness is the additional requirement for watermarking. Even if the existence of watermark is acknowledged by the intruder, it should be ideally unfeasible to remove the embedded watermark without rendering the cover object. Video watermarking can be considered as a superset of usual image watermark. Actually, some image watermarking method can be extended to watermarking videos, but in actuality video watermarking methods necessity to meet supplementary challenges than that in the image [4].Thus, the security of video content is one of the most crucial factors. Till now the image watermarking procedure has been flourished. Now the times come to nurture video watermark. Video watermarking is not a separate technology. It can be linked with different application to achieve a complicated method. Here fig.1.1 shows the watermarking technique in which original information is embedded into the cover image. One of the most common applications of digital watermarking is copyright protection, especially in image watermarking and it is to add copyright information into digital object without loss of quality. Some of the video characteristics that impact watermarking comprises of:

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A. Maximum correlation between consecutive frames. If independent watermarks are embedded on each frame, attackers could do frame averaging to take out a major segment of the embedded watermark.
B. Some applications like broadcast monitoring need real time processing and as a result have low complexity.
C. Watermarked video sequences are very much susceptible to pirate attacks such as frame averaging, frame swapping, and lossy compression

II. LITERATURE OUTCOMES

Outcomes of Literatures that has been surveyed which motivated for the implementation of the work, are as follows: as presented by Mohan A Chimanna et al. (2013), Algorithm implemented using DWT-PCA is robust against common video processing attacks. The method used in watermarking the highest frequencies (HH) is more robust against another group of attacks (Salt and pepper, Gaussian, cropping, rotation). Jagannath Sethi et al. (2011) suggested WPT is better than WT both subjectively as well as objectively. The paper describes the best tree on the basis of Shannon entropy. The new approach checks the entropy of decomposed nodes (child nodes) with entropy of node, which has been decomposed (parent node) and takes the decision of decomposition of a node. Matis et. al (2010) proposed a video watermarking technique in transforming domain using discrete wavelet transform. In this experiment author uses a six video sequence with special dynamic properties. These properties are dynamic D, mezzo- dynamic-MD & lightly dynamic-LD. In 10 second of the period a video is cut & frame rate is 25fps. In this α (alpha), which is a power of embedded watermark which is attuned with required robustness. In α factor is adjusted to values 5,7,10 and 15. In this watermarking embedding is performed into all frames of the original video sequence & also on each color component R, G, B of all frames and extraction is performed from random frames with every component of the frames. From the result, it can be concluded that this approach is used to increase robustness of the system against such attacks like frame averaging, frame dropping & frame swapping. And the disadvantages of the proposed method are computing time & the requirement of the original video in the extraction process

III. METHODOLOGY

Literature that had been surveyed provided the needed information on video watermarking. The study of their individual advantages and disadvantages has encouraged the necessity of the work presented in the paper. Presented work uses wavelet packet and encrypt the watermark image to the original image. Decomposition is done by “Haar” wavelet transform, which is simple, symmetric and orthogonal wavelet. The wavelet packet analyses the signal at different frequency bands by means of different resolutions by decomposing the signal into a coarse approximation and detail information. Wavelet packet employs two sets of functions, called scaling and wavelet functions, which are associated with low pass and high-pass filters, respectively [13]. The decomposition of the signal into different frequency bands is basically obtained by successive high-pass and low-pass filtering of the time domain signal. The original 1D dimensional signal x[n] is calculated by passing it through a series of filter. Fig. 4.1 shows the block diagram of filter analysis where the signal is decomposed into two parts a detailed part (high frequency part) and an approximation (low frequency part). The sample x[n] are passed through a low pass filter with the impulse response ‘g’ resulting in the convolution of the two signals. The signal is also decomposed simultaneously by a high pass filter with the impulse response ‘h’. The output is shown in the fig 1.2 [8]. The HL (high-low or horizontal detail) sub band is created by high pass filtering along the rows and low pass filtering along the columns, hence capturing the vertical edge. The HH (high-high or diagonal details) sub band is created by high pass filtering along the rows and columns, accordingly capturing the diagonal edges [8].

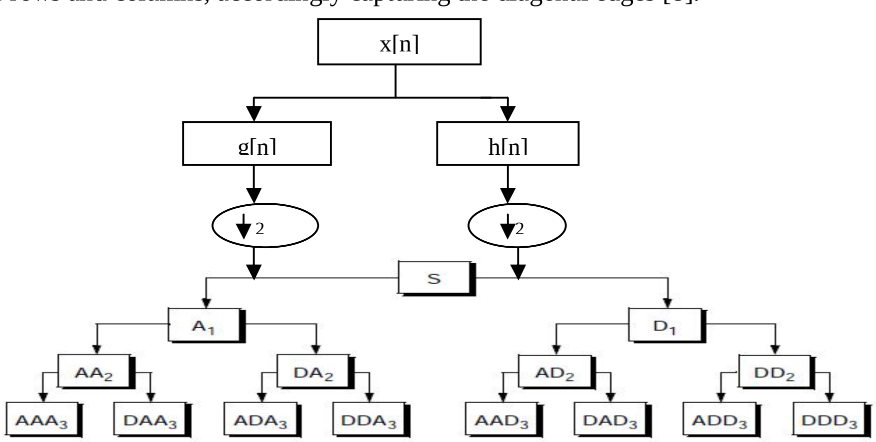

Fig. 1.1: (a) Basic Decomposition Steps for Image in Wavelet Packet, (b) Block Diagram of Filter Analysis

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In wavelet packet frame of work, the ideas of de-noising and compression are exactly same as that of those developed in the wavelet frame of work. The difference is only that the wavelet packets offer a more flexible and complex analysis, as in wavelet packet frame of analysis, the approximations as well as the details are spitted.

De-noising and compression are interesting applications of Wavelet Packet analysis. The Wavelet Packet compression or de-noising procedure involves four steps: Decomposition, Computation of the best tree, Thresholding of wavelet packet coefficients & Reconstruction.

Wavelet packet based embedding of copyright image is an approach in which the coefficient of the input frame is fused with the coefficient of the copyright frame. The reverse is true while extraction. The Embedding and Extraction flow chart is shown in the figure below.

A. Embedding and Extraction Algorithm

Wavelet packet based embedding of copyright image is an approach in which the coefficient of the input frame is fused with the coefficient of the copyright frame. The reverse is true while extraction. The Embedding and Extraction flow chart is shown in the figure below.

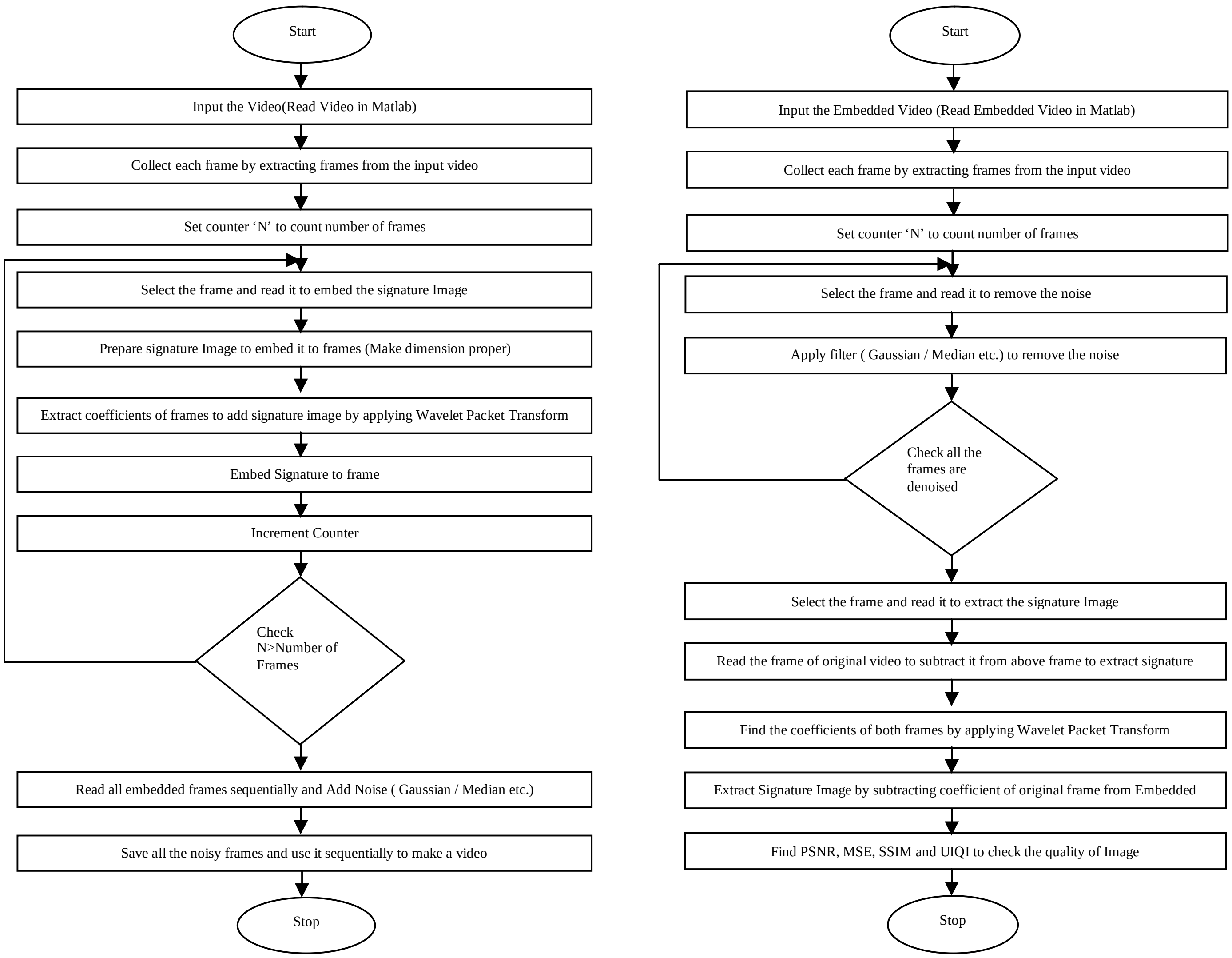

Fig. 1.2: Flow Chart of presented work

In this paper embedding and extraction of copyright image has been shown which is implemented by Wavelet Packet Method and the analysis of effect of various noise in the video has been done. Six raw video sequences (Akiyo, foreman, coast guard, tennis and

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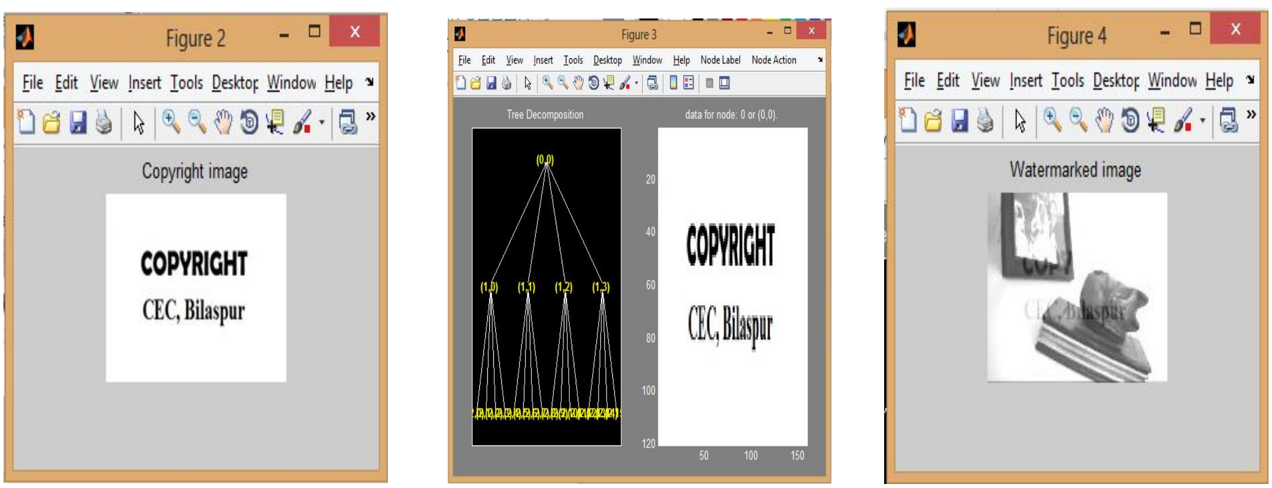
two real video) are used as test sequences. The size of these video sequences is 262 x 262 with a frame rate of 15 frames/ second and watermark image is of size 262 x 262. Video data is taken as input, divide this video into number of frames, then frames are selected for applying the proposed method, then Wavelet Packet Method is applied for embedding the watermark in the coefficients of original Image. Then noise of various types like Gaussian, Salt & Pepper and Speckle noise has been added to the embedded video. Various denoising schemes has been used for removal of noise prior to the extraction of the watermark image. Proper extraction of watermark is achieved by applying Wavelet Packet Reconstruction function to reconstruct the frames and get the denoised watermarked frames which is just reverse of the embedding process to get the extracted watermark.

IV. RESULTS

The MATLAB based simulation result is shown which demonstrate watermarking of copyrighted image of the video frames by the proposed algorithm. The design system will be tested using the following parameters: Peak Signal to noise ratio (PSNR), Mean Square Error (MSE), Normalized Coefficient (NC), Structural Similarity Index (SSIM) and Universal Image Quality Index (UIQI). By the use of MATLAB R2014a, the efficiency of watermarking technique has been demonstrated by the experimental results. Following figure shows the results obtained while processing.



(a) (b) (c)

Fig. 1.3: (a) Initial Copyright Image, (b) Wavelet Coefficient of Copyright Image, (c) One of Watermarked Frame

(a) (b)

Fig. 1.4: Noisy and Denoised Frame

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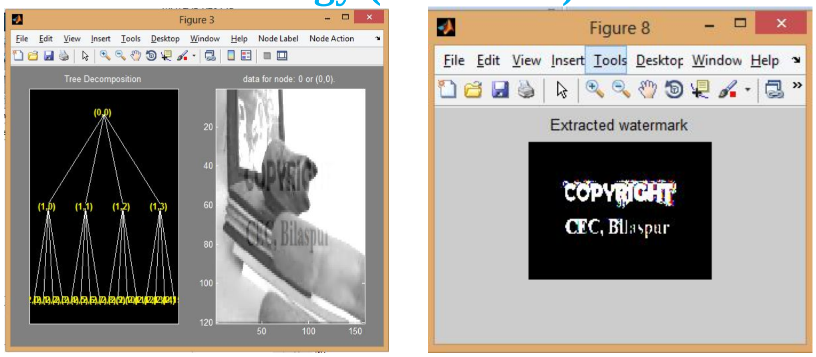
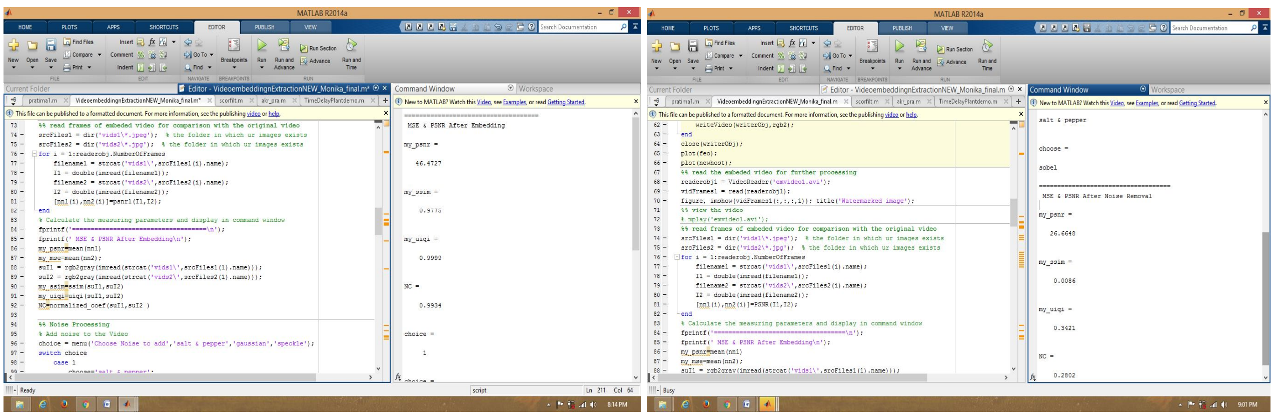


(a) (b)

Fig. 1.5: (a) Wavelet Coefficient of Watermarked Frame, (b) Extracted Copyright Image from watermarked frame

The Frames are analyzed and the performance parameter had been obtained once after embedding and before noise processing and other after noise processing and the simulation results are shown below:



(a) (b)

Fig. 1.6: (a) Simulation Results after Embedding (b)Simulation Results after Noise Processing

TABLE I
ATTACK ANALYSIS

(Obtained PSNR for cat_video.avi)

Attacks/ Filters	Salt & Pepper Noise	Gaussian Noise	Speckle Noise
Gaussian Filter	30.2040	30.1816	30.5488
Sobel Filter	26.6648	26.5816	27.0875
Averaging Filter	30.3322	30.2606	30.5920
Laplacian Filter	26.3168	26.3968	26.8842
Disk Filter	30.5589	30.5559	30.9037
Log Filter	26.4578	26.5709	27.0443
Motion Filter	30.4297	30.3504	30.6863
Prewitt Filter	26.5306	26.4010	26.8771

(Obtained SSIM for cat_video.avi)

Attacks/ Filters	Salt & Pepper Noise	Gaussian Noise	Speckle Noise
Gaussian Filter	0.8354	0.8800	0.8329
Sobel Filter	0.0086	0.0130	0.0193
Averaging Filter	0.4842	0.5689	0.4975
Laplacian Filter	-0.1941	-0.1875	-0.2072
Disk Filter	0.2391	0.3251	0.2255
Log Filter	-0.2321	-0.2241	-0.2587
Motion Filter	0.4093	0.4976	0.4067
Prewitt Filter	0.0110	0.0141	0.0211

(Obtained PSNR for cat_video.avi)

Attacks/ Filters	Salt & Pepper Noise	Gaussian Noise	Speckle Noise
Gaussian Filter	0.9999	0.9999	1.0000
Sobel Filter	0.3421	0.3161	0.3360
Averaging Filter	0.9997	0.9997	0.9997
Laplacian Filter	0.1948	0.2015	0.1975
Disk Filter	0.9942	0.9935	0.9939
Log Filter	0.3032	0.3213	0.3623
Motion Filter	0.9973	0.9970	0.9972
Prewitt Filter	0.2601	0.2449	0.2463

(Obtained SSIM for cat_video.avi)

Attacks/ Filters	Salt & Pepper Noise	Gaussian Noise	Speckle Noise
Gaussian Filter	0.9704	0.9816	0.9793
Sobel Filter	0.2802	0.2099	0.2763
Averaging Filter	0.9467	0.9600	0.9561
Laplacian Filter	0.0701	0.0530	0.2272
Disk Filter	0.9043	0.9194	0.9143
Log Filter	0.0890	0.1042	0.2921
Motion Filter	0.9317	0.9433	0.9389
Prewitt Filter	0.2514	0.1908	0.2065

V. CONCLUSION

With reference to the table discussed above it can be concluded that the higher values of the PSNR, SSIM, UIQI and NC can be obtained after attacking and denoing. In present work Discrete Wavelet Packet Transform based image processing using fusion technique has been discussed first and then the attack analysis has been done on the embedded videos. In the proposed method, PSNR, SSIM, UIQI and NC of the watermarked frames are extracted and based on that it can be concluded that due to any type of attack on the video the similarity and the quality has been largely preserved by the Gaussian filter. The PSNR value is much varying and Disk filter in all the cases proves to provide good PSNR value. The algorithm and attack has been experimentally evaluated.

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