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An Enhanced Video Watermarking Approach for Robustness And Security Using Pixel And Transform Domain in An Uncompressed Video

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Abstract: It has been observed that many numbers of researches has been done in field of digital video watermarking using transformation technique. Digital media protection and security is major concern in today's world because of explosion of data exchange on the Internet and the extensive use of digital media. In this paper, a comprehensive approach for managing robustness and security of video watermarking is introduced. We propose a digital video watermarking scheme based on combination transformation and pixel domain technique. For any reliable water marking Robustness and Fidelity are the major requirements. In pervious work, a robustness scene-based watermarking scheme is proposed. We focus on improving the fidelity at higher extent of scheme in this paper. The fidelity of the scheme is enhanced by applying using combination of our proposed and DWT watermarking algorithm, which optimizes the quality of the watermarked video. We have performed a series of experiments for effectiveness of this scheme.

Keywords: Image watermarking, video frames Extraction, Audio Extraction, copyrights, Authentication, DWT.

1. INTRODUCTION

High speed computer networks, the Internet and the World Wide Web have revolutionized the way in which digital data is distributed. The widespread and easy accesses to multimedia contents and possibility to make unlimited copy without loss of considerable fidelity have motivated the need for digital rights management. Digital watermarking is a technology that can serve this purpose. A large number of watermarking schemes have been proposed to hide copyright marks and other information in digital images, video, audio and other multimedia objects [1, and references there in].

A watermark is a digital data embedded in multimedia objects such that the watermark can be detected or extracted at later times in order to make an assertion about the object. The main purpose of digital watermarking is to embed information imperceptibly and robustly in the host data. Typically the watermark contains information about the origin, ownership, destination, copy control, transaction etc. Potential applications of digital watermarking include transaction tracking, copy control, authentication. legacy system enhancement and database linking etc. [2].Growing popularity of video based applications such as Internet multimedia, wireless video, personal video recorders, video-on-demand, set-top box, videophone and video conferencing have a demand for much higher compression to meet bandwidth criteria and best video quality as possible. Different video Encoder Decoders (CODECs) have evolved to meet the current requirements of video application based products. Among various available standards H.264 / Advanced Video Codec (AVC) is be coming an important alternative regarding reduced band width, better image quality in terms of peak-signal-to-noise-ratio (PSNR)and network friendliness [26], but it requires higher computational complexity.

2. LITERATURE SURVEY

Apparently any image watermarking technique can be

Extended to watermark videos, but in reality video watermarking techniques need to meet other challenges than that in image watermarking schemes such as large volume of inherently redundant data between frames, the unbalance between the motion and motionless regions, real-time requirements in the video broadcasting etc. Watermarked video

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sequences are very much susceptible to pirate attacks such as frame averaging, frame swapping, statistical analysis, digital-analog (AD/DA) conversion, and lossy compressions.

Video watermarking applications can be grouped as security related like Copy control [18], fingerprinting, ownership identification, authentication, taper resistance etc. or value added applications like legacy system enhancement, database linking [1], video tagging, digital video broadcast monitoring[19], Media Bridge [20] etc.

Apart from robustness, reliability, imperceptibility, practicality, and video watermarking algorithms should also address issues such as localized detection, real time algorithm complexity, synchronization recovery, effects of floating point representation, power dissipation etc [17]. According to the working domain, video watermarking techniques are classified in pixel domain and transform domain techniques. In pixel domain the watermark is embedded in the source video by simple addition or bit replacement of selected pixel positions. The main advantages of using pixel domain techniques are that they are conceptually simple to understand and the time complexity of these techniques are low which favor real time implementations. But these techniques generally lacks in providing adequate robustness and imperceptibility requirements. In transform domain methods, the host signal is transformed into a different domain and watermark is embedded in selective coefficients. Commonly used transform methodologies are discrete cosine transformation (DCT) and discrete wavelet transformation (DWT). Detection is generally performed by transforming the received signal into appropriate domain and searching for the watermarking patterns or attributes.

The main advantage of the transformed domain watermarking is the easy applicability of special transformed domain properties. For example, working in the frequency domain enables us to apply more advanced properties of the human visual system (HVS) to ensure better robustness and imperceptibility criteria.

➢ *Frequency Domain Watermarking:* Most of watermarking techniques [6-8], the watermark will be embedded into the frequency domain instead of the spatial domain for the robustness of the watermarking mechanism. Discrete Cosine Transformation (DCT), Discrete Fourier Transformation (DFT) and Discrete Wavelet Transformation (DWT) are the three main methods of data transformation in this domain. The main strength offered by transforming domain techniques is that they can take advantage of special properties of alternate domains to address the limitations of pixel-based methods or to support additional features. Generally, transform domain methods require higher computational time.

➢ As DCT is a linear transformation and watermark is independent of the picture, the watermark can be added in the DCT domain. The 1D watermark vector is rearranged into frame structure and by transforming it to88× DCT domain; the watermark can be added directly to a partially decoded video stream. Since the size and transfer rate of water marked video should be identical to the original video, DCT coefficients of watermark and video frame are combined only if the resulting VLC code is of same length of the original one. Again drift compensation is required to cancel out watermark components from P and B frames, as motion compensated prediction or interpolation from other frames are added by the decoder to construct the P and B frames.

➢ *Discrete Fourier Transform:* This approach first extracts the brightness of the to-be-marked frame, computing its full-frame DFT and then taking the magnitude of the coefficients. The watermark is composed of two alphanumerical strings. The DFT coefficient is altered, then IDFT [23]. Only the first frame of each GOP is watermarked, which was composed of twelve frames, leaving the other ones uncorrupted. It is good robustness to the usual image processing as linear/non-linear filtering, sharpening, JPEG compression and resist to geometric transformations as scaling, rotation and cropping.

➢ *Least Significant Bit Modification [15]* In this technique, the Least Significant Bit of each pixel is used to embed the watermark or the copyright information. In this technique cover image is used to store the watermark, in which we can embed a smaller object multiple times. The pixels are identified where embedding will be done using a pseudo-random number generator based on a given key.
LSB modification is suitable tool for stegnography as it is a simple and powerful tool for it.But it can not preserves robustness which is required in watermarking applications.

➢ *The DWT transform:* Multiresolution property of DWT

helps in decomposition of images. The image is passed

through various orthonormal filters like Daubechies, QMFs etc. so that the image gets divided into four nonoverlapping multiresolution sub-bands. These subbands are LL, LH, HL, HH i.e. approximation, horizontal details, vertical details and diagonal details. This is called first level wavelet decomposition of an image. DWT provides excellent spatio-frequency localization. Most of the image energy is concentrated in the lower frequency sub-bands (LL) while details like sharpness, edges etc. of the images are present in high frequency subbands (LH, HL, and HH). Therefore watermark is embedded in high frequency subbands to avoid degradation of the host video and make it invisible. But embedding watermark in high frequency subbands may reduce robustness. To get best tradeoff between performance and robustness, watermark is embedded into LH and HL subbands. In the proposed algorithm, a second level DWT decomposition is applied and then blockwise DCT is applied on the LH and HL planes before embedding the watermark. The watermark is embedded in the LH2 and HL2 subbands of LH and HL subbands of the first level decomposition. It improves the robustness of the algorithm and it helps in increased capacity of embedding data.

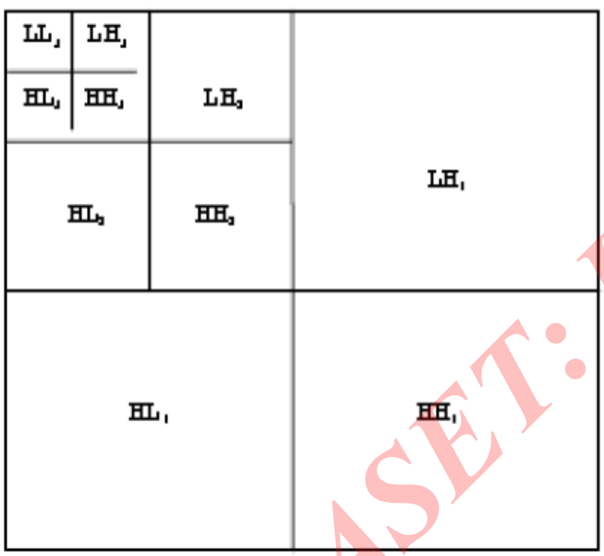

Figure 2.1 The Model of DWT Decomposition

3. PROPOSED METHODOLOGY

Algorithm

(1)Select video

(2)Input uncompressed AVI Format video.

(3)Separate Frames and audio.

(4)Insert Watermark Image using Transform method on Each Frames of Extracted Video (Invisible Watermarking).

(5)Create video from all watermarked frames.

(6)Select newly created video and Insert Watermark Image using bit method on Each Frames of Extracted Video (Visible Watermarking).

(7)Create video from all watermarked frames.

(8)Insert an Audio into newly created video.

(9)Analyze PSNR graph.

(10)Analyze resultant video

(11)Go to top

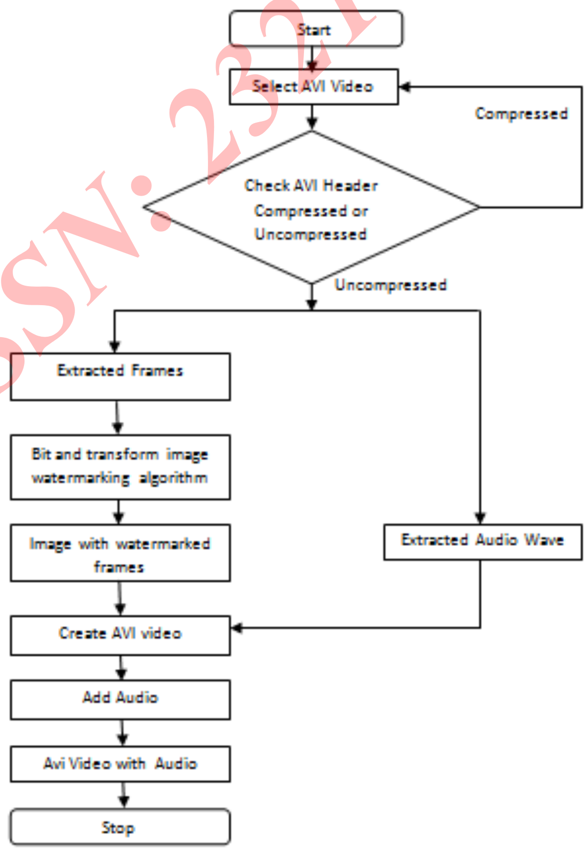

Figure 3.1 Proposed data Flow diagram

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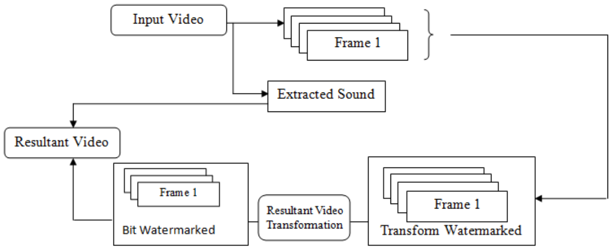


Figure 3.2 System Flow

Step 1: Select An AVI uncompressed video.

Step 2: Split Video into Frames and audio as per system flow diagram, split frames and an audio. In video file each object if identified by its header. By continuous check of a header of frames and sound, it could simple to separate it.

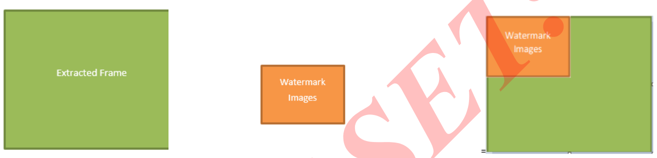
Thus an avi video is represented with an equation

$$\mathrm{vi} = \int_{i=1}^{n} \int (\mathrm{fi} + \mathrm{Si}) + (\mathrm{fi} + 1 + \mathrm{Si} + 1) + \cdots (\mathrm{fn} + \mathrm{sn})$$

Where vi=Avi video

F=Frame.

S=Sound Sample



Frame *Watermark Image(pixel and Transformation)* *Watermarked Frame*

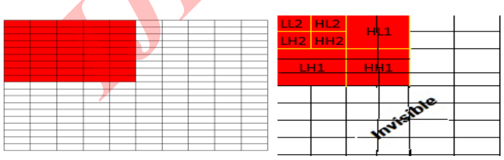


Figure 3.4 Red Color Shown with Watermark Image Transformation (step 1) and Pixel (step 2).

Let an Input image is of size 100 X 100 and watermark image is 10 X 10 Size. It means numbers of pixels watermark in resultant frame is

$$Rf = \frac{100 * Si}{Im}$$

Where

Rf=Resultant Image Pixels

Si=Watermark Image Pixels

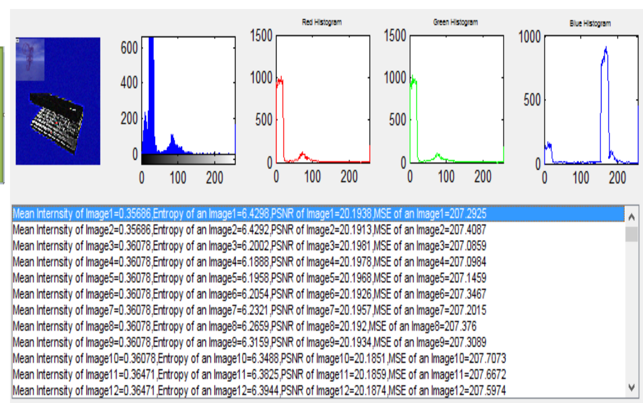
Im=Input Image Pixels

Step 3: Insert watermark Image by using transform method (frequency domain) into Extracted frames. This inserted watermark is invisible.

Step 4: Create a video from all the extracted frames along with inserted watermark.

Step 5: Select the newly created video with invisible watermarking and insert watermark image by using bit method (spatial domain) into extracted frames with already have invisible watermarking.

1. PSNR ANALYSIS



The Mean Square Error (MSE) and the Peak Signal to Noise Ratio (PSNR) are the two error metrics used to compare image compression quality. This ratio is often used as a quality measurement between the original and a watermarked image. If one of the signals is an original signal of acceptable (or perhaps pristine) quality, and the other is a distorted version of it whose

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quality is being evaluated, then the MSE may also be regarded as a measure of signal quality.

In psnr analysis we show frame intensity as shown in fig 4.2 also show psnr and mse for every frame separated from input video using red histogram, green histogram and blue histogram.

CONCLUSION

Digital watermarking provides more options and promises for multimedia security management. The solutions are more likely to remain application dependent and trade-offs between the conflicting requirements of low distortion, high capacity complexity, and robustness still have to be made. Before trustworthiness can be evaluated, possible attacks for specific applications have to be studied at the implementation stage. This paper proposes a new video watermarking scheme based on Pixel in spatial domain and Transformation method in a frequency domain. This technique is tested on uncompressed (taken from AVI high quality film) and uncompressed (taken by digital camera) video movies. The watermark which is embedded into the regions between frames (HL, LH bands). Experimental results show that the proposed new scheme has a higher degree of invisibility and visibility against the attack of frame dropping, adaptive quantization, and frame filtering than the previous developed scheme in spatial domain. The involved parameters are tuned in order to evaluate the performance of the algorithm by using the performance parameters (quality measure and similarity). The future work will be the implementation of our scheme in different compressed video codec standards like (MPEG2, MPEG4). It can also be used for audio layer in video codec standards.

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