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A Survey on Various Watermarking Techniques for Video Data Copyrighting

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Abstract: ***As the last few years have witnessed blistering excrescence in video coding technology, one of the prevailing fields of interest is to expound an establishment with authentication and copyright protection methodology embedded within an efficient video codec. In this paper, we put through a scrutiny on available and accessible video watermarking techniques. In later past, there has been a discernible quickening in information substitution over the web and the broad utilization of computerized media. The mounting interest with reference to digital watermarking throughout the last decade is undeniably due to the boost in the need of copyright protection which has facilitated an enormous ascent in the applications of video watermarking in copy control, broadcast monitoring, finger printing, video authentication, copyright protection etc. The main aspects of such techniques are information hiding, capacity, security and robustness. Robustness is an essential element when it comes to Video Watermarking Techniques as in its presence, is not possible to eliminate the watermark without rigorous degradation of the cover content. In this paper, we introduce and institute the sundries of Video Watermarking and attributes necessitated to design a robust watermarked video for valuable application and focus on various domains of video watermarking techniques.***

Keywords: Attacks, SVD, Security, Wavelet, Watermarking techniques.

1. Introduction

As discussed earlier, with the galloping neoplasm of the Internet and multimedia systems in distributed milieus, it has become facile for digital data owners to transmit multimedia documents athwart the Internet. Consequently, there is an increase in concern over copyright protection of digital contents [10]. Conventionally, encryption and control access techniques were employed to protect the ownership of media. These techniques, however, do not protect against unauthorized copying after the media have been successfully transmitted and decrypted. To overcome such weaknesses, in this paper we focus on engaging the digital watermarking techniques to protect digital multimedia intellectual copyright, and propose a new algorithm specifically for video watermarking purpose.

2. Digital Security Background

Multimedia and network security issues were ritually handled through cryptography; on the other hand, cryptography ensures secrecy, credibility and respectability just when a message is transmitted through an open channel, for example, an open system. It doesn't ensure against unapproved duplicating after the message has been effectively transmitted. In actuality, Digital watermarking is a solid approach to ensure copyright of media information much after its transmission. Watermarking is an idea of implanting an extraordinary example known as a watermark, into an interactive media record so that a given bit of copyright data is perpetually fixed to the information which can later demonstrate the possession, distinguish an abusing individual, follow the denoted archive's spread through the system, or basically advise clients about the Rights-holder or the allowed utilization of the information [6].

3. Video Watermarking Techniques

3.1 Discrete Wavelet Transform

Discrete wavelet transform is a multi-resolution decomposition of a signal. Considering an image, 1 level DWT involves applying a low pass and a high pass filters along the columns and then the rows, respectively [1]. In two dimensional applications, for each level of decomposition, first DWT is performed in the vertical direction, followed by the DWT in the horizontal direction. After the first level of decomposition, there are 4 sub-bands: LL1, LH1, HL1 and HH1. For each successive level of decomposition, the LL sub-band of the previous level is used as the input. Each tile component undergoes three levels of decomposition. This results in 10 sub-bands per component. LH1, HL1, and HH1 contain the highest frequency bands present in the image tile, while LL3 contains the lowest frequency band.

3.2 Wavelet Packet Transform-Based Robust Video Watermarking Technique

In this section, we discuss some motivating factors in the design of our approach to video watermarking scheme. WPT is used for developing the algorithm. Let us consider V is the host video and W is the binary watermark image. The host video is a colour video of size M × N × 3 × n. We save the positions of robust sub-bands for extraction process. The watermark W is a binary watermark of size Mw × Nw .The wavelet packet transform generalizes the wavelet transform and provides a more flexible tool for the time-scale analysis of the data. All advantages of the wavelet transform are retained because the wavelet bases are in the repertoire of bases available with the wavelet packet transform. Given this, the WPT may eventually become a standard tool in signal and image processing. Using a pair of low and high-pass filters to split a space corresponds to splitting the frequency content of a signal into roughly low and high-frequency components. In wavelet decomposition, we leave the high-frequency part alone and keep splitting the low-frequency part. Also in wavelet packet decomposition, we split the high-frequency part into low and high-frequency parts. So, in general, wavelet packet decomposition divides the frequency space into various parts and allows better frequency localization of signals. Present research on watermarking mainly concentrates on the still images. In this paper, a new robust video watermarking scheme is presented and employed in wavelet packet transform domain. The watermark is a meaningful binary logo instead of randomly generated Gaussian sequence. Watermark is embedded not only in higher, but also in lower frequency without any degradation in the video. Experiments show better robustness against different attacks, especially against frame dropping and MPEG coding. The proposed algorithm is simple, efficient and with less complexity. In the present work, we already considered small rotations and the problem with large rotations can be addressed in the future.

3.3 Discrete Cosine Transform

Discrete cosine transformation [2],[3],[4] (DCT) transforms a signal from the spatial into the frequency domain by using the cosine waveform. DCT concentrates the information energy in the bands with low frequency, and therefore shows its popularity in digital watermarking techniques. The DCT allows a frame to be broken up into different frequency bands, making it much easier to embed watermarking information into the middle frequency bands of a frame. The middle frequency bands are chosen such that they have minimized to avoid the most visual important parts of the frame (low frequencies) without over-exposing themselves to removal through compression and noise attacks (high frequencies).For the same block size and constant value the first method gives better results at the receiver end compared to the second. As the value of the constant increases, the watermark recovery is better at the cost of perceptibility of the watermarked video in both methods.

3.4 A Wavelet-Based Digital Watermarking For Video

This technique propounds a new blind watermarking scheme based on 3D wavelet transform and video scene segmentation [5],[6]. First of all, By still image decomposition technique a grey- scale watermark image is decomposed into a series of biplanes which are correlative with each other and pre-processed with a random location matrix. After that the pre-processed biplanes are adaptively spread spectrum and added in 3D wavelet coefficients of the video shot. As the 1-D multi-resolution temporal representation of the video is only for the temporal axis of the video, each frame along spatial axis is decomposed into 2D discrete wavelet multi-resolution representations for watermarking the spatial detail of the frame as well as the motion and motionless regions of the video. Experimental results show that the proposed techniques are robust enough against frame dropping, averaging and MPEG lossy compression. It proposes an innovative blind video watermarking scheme in the 3D wavelet transform using a gray scale image as a watermark. The process of this video watermarking scheme, including watermark pre-processing, video pre-processing, watermark embedding, and watermark detection, is described in detail. Experiments are performed to demonstrate that our scheme is robust against attacks by frame dropping, frame averaging, and lossy compression.

3.5 Digital Watermarking For Video Piracy Detection

In the proposed system the video file is watermarked with the copyright information. The copyright information includes data about the vendor, buyer, a serial number and other information. When it is detected that the video is a pirated, it is possible to dewater mark the file to retrieve the copyright information. With this information we can trace back to the source of piracy. In the proposed system the watermark is made invisible. The watermark is spread throughout the image, so its location cannot be traced easily. The spreading of the watermark also prevents data loss from manipulations like compression etc. Apart from these advantages, the digital watermark in the proposed system can’t be erased or overwritten. It is also robust and completely unaffected by common audio or video processing operations. It combines enormous versatility with ease of installation, integration; and operation. It offers wide range of applications, including copyright control and broadcast monitoring.

3.6 Scene-Based Video Watermarking Scheme

The new watermarking scheme we propose is based on scene changes in [7]. In our scheme, a video is taken as the input, and then a watermark is decomposed into different parts which are embedded in corresponding frames of different scenes in the original video. As applying a fixed image watermark to each frame in the video leads to the problem of maintaining statistical and perceptual invisibility [8], our scheme employs independent watermarks for successive but different scenes. However, applying independent watermarks to each frame also presents a problem if regions in each video frame remain little or no motion frame after frame. These motionless regions may be statistically compared or averaged to remove the independent watermarks [9],[10]. Consequently, we use an identical watermark within each motionless scene. With these mechanisms, the proposed method is robust against the attacks of frame dropping, averaging, swapping, and statistical analysis. This newly proposed scheme consists of four parts, including: watermark pre-process, video pre-process, watermark embedding, and watermark detection.

3.7 DWT-SVD Combined Full Band Robust Watermarking Technique For Color Images In YUV Color Space

In this algorithm the multi-resolution capability of wavelet transformation technique is combined with singular value decomposition technique to make it robust. Since the watermark is hidden in full band of YUV channel algorithm is highly robust against common attacks such as addition of noise, histogram equalization and cropping, which are considered as one of the serious attacks. The quality of the extracted watermark shows that the new proposed algorithm is robust and also the quality of cover image is not degraded. The performance of algorithm is analysed through the results which are obtained by embedding large sized watermark in all the three channels of cover image in YUV space. The quality of the watermarked image can be measured either subjectively or objectively and it is observed that both subjective and objective quality of watermarked image is good. The PSNR is the objective criteria used to measure the quality of the watermarked image. Similarly the quality of the extracted watermark is measured by comparing it with the original watermark and is called similarity measure. The robustness of algorithm is tested against various attacks such as addition of salt and pepper noise, Gaussian noise, and cropping and histogram equalization. Image of size 512 X 512 is taken as cover image and watermark is hidden in full band of Y, U and V channels of cover data. The quality of the watermarked image is measured through PSNR The watermarked image quality is not degraded and also the watermark is imperceptible, so the proposed algorithm is characterized as imperceptible algorithm. The proposed algorithm is tested in YUV channels. In future, algorithm can be extended for streaming data as well to be tested against other possible attacks.

4. Performance Analysis

Performance of the different video watermarking schemes can be analyzed by the different Properties or the parameters of the watermarking scheme which are as explained below:

4.1 Performance Parameters

Imperceptibility: The watermark should not noticeably distort or degrade the host data in order to preserve the quality of the marked document.

Robustness: To measure robustness the watermark must be reliably detectable against signal processing schemes including data compression.

Fragility: These kinds of watermark are embedded in host data in such a way that they do not survive in the case of any modification even copying.

Tamper-resistance: The tamper-resistance property is focused on the intentional attacks in contrast to robustness.

False positive rate: The Probability of identifying an unwatermarked piece of data as containing a watermark by a detector is called the false positive rate.

Data payload: The amount of information present in watermarked media is called data payload.

Normalized correlation : The key component of the images detection is the normalized correlation.

PSNR: peak signal to noise ratio. It should be as high as possible.

5. CONCLUSION

The watermark recovery is better at the cost of perceptibility of the watermarked video in different methods. DWT with SVD algorithm can be extended for streaming data as well to be tested against other possible attacks. The various schemes discussed are robust against attacks by frame dropping, frame averaging, and lossy compression. Commonly these methods are computationally excessive and erratic. Moreover, The proposed scheme satisfies the requirement of imperceptibility and robustness for a feasible watermarking scheme

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