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Dual watermarking for video using discrete cosine transform

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ABSTRACT

Digital watermarking technique is becoming popular for copyright information. The watermark embedded in the digital video may be incorrectly detected and extracted due to lack of appropriate algorithm, so the main concern is to implement the algorithm which is more resistant to different types of attacks. We proposed a video watermark technique has been introduced where Pseudo Random Sequence for Frame Section and Discrete cosine Transform fusion Technique, for adding more security, is used. PSNR, MSE and NC values are analyzed on the basis of different noises and attacks. Hybrid technique is robust against high stream, low stream, frame drop, frame trim attacks. Software used MATLAB

Index terms: Watermarking, Discrete cosine transform, Pseudo random process, Robustness.

INTRODUCTION

Now a days the protection of digital data has become an important issue due to the rapid development and deployment of multimedia technology due to the increasing usage of internet. The copyright protection and authentication is a very challenging task of multimedia content. The term “content” generally refers to any digital information, like digital audio, video, graphics, animation, images, text, etc [1]. Unlike earlier analogue media, this content can be easily shared and copied without losing its quality. However, these advantages of digital media formats over analogue may get translated into disadvantages with respect to copyright management, because there exists a possibility of unlimited copying without a loss of quality which has led to a considerable financial loss for copyright holders. Furthermore, recording medium and distribution networks for analogue multimedia are more costly. Due to this ease of content modification and duplication, protection of intellectual property and prevention of unauthorized tampering becomes important and research in this technological area has grown by leaps and bounds. Before the invention of Steganography and cryptography, it was a challenge to transfer secure information from one place to another and thus, to achieve secure communication environment. Normally an application is developed by a person or a small group of people and used by many. Hackers are those people who tend to change the original Some of the applications of watermarking include ownership protection, proof for authentication, air traffic monitoring, medical applications etc. This technique of watermarking has extensive use in Music Industry. A watermark is a unique electronic identifier embedded in image/audio/video data, typically used to identify ownership of copyright. Watermarking is the process of embedding information into a signal (e.g. audio, video or image) in a way that is difficult to remove. If the signal is copied, then the information is also carried in the copy. Watermarking has become very important to enable copyright protection and ownership verification and save the

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Intellectual Property from any unauthorised person/persons.

Hence, protecting an application should have the highest priority. Protection techniques have to be efficient, robust and strong to restrict such malicious users. This lead to the development of the new but related technology called "Watermarking".

REVIEW STAGE

Different algorithms are available in the spatial and transform domains for digital watermarking. The techniques in the spatial domain still have relatively low-bit capacity and are not resistant enough to compression and other data processing. For instance, a simple noise in the data may eliminate the watermark data. On the other hand, frequency domain-based techniques can embed more bits for watermark and are more robust to attack. Some transforms such as Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT) are used for watermarking in the frequency domain. Most of the DCT-based techniques work with 8 × 8 blocks. These transforms are being used in several multimedia standards such as MEPG-2, MPEG-4, and JPEG2000 [8]. In addition, different watermark algorithms have been proposed using Least Significant Bit (LSB), DCT and DWT. In considering the attacks on watermarks, the robustness and perceptual transparency feature of an algorithm becomes very important. In this regard, the classification of a watermark method as robust if the watermark data embedded by that algorithm in an image/audio or any other data cannot be damaged or removed without destroying or damaging the data itself. Therefore, an attack is successful only if it can eliminate the watermark without damaging the original data itself. The question is which transform watermark algorithms are stronger and have more robustness to different attacks compared to other techniques? A comparative study has been performed on different watermark algorithms for their robustness. In fact the robustness of the algorithms is dependent on the frequency at which the watermark data is added. We have also proposed algorithms for image and audio watermarking along with encryption algorithm.

Final stage

This thesis deals with the watermarking of images and audios for copyright protection. The watermarking information that will be used includes text message, copyright symbol, handwritten signatures and mobile phone numbers. The reason for this is they are more informative compared to pseudo random sequences. The watermarking information will be encoded before inserting it in the images and audios. Arnold transform will be used for this purpose. The use of the Arnold Transform will increase the security of the system. The embedding of the coded watermark information will be performed in the frequency domain rather than the spatial domain. The combination of DCT and DWT will be used for this purpose. The watermarks should be invisible and cause minimal distortion to the host images. The objective of this research is to develop new algorithms that can embed and extract the watermarking data and satisfy the above requirements. The performance of the developed algorithms will be assessed by testing them using a variety of images and audio files.

The aim of this research is to develop powerful watermarking techniques that preserve the intellectual property of images and audio files. The new techniques utilised Arnold Transform to meet the watermarking requirements. Arnold Transform is used to improve the robustness of the watermarking algorithms. The algorithms embed the Arnold Transformed watermarks in the low frequency coefficients of the DCT and DWT blocks. Furthermore, the shuffle process is used in the watermarking algorithms to increase the robustness against the cropping, noise and scaling attacks.

The new techniques have unique features:

- The watermarking algorithms are blind since they do not require the original image during the extraction process.
- They are robust against major attacks.
- The watermarks are invisible and cause minimal distortion to the cover image.
- The novelty of this research can be summarized as follows:
- The Arnold Transform is combined with the DCT and DWT.

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- The proposed algorithms was successfully implemented and validated using a variety of images and audio files.
- The use of benchmarks such as Peak signal to Noise Ratio (PSNR), Mean Square Error (MSE) and Similarity Factor (SF) for evaluating the quality of the original data and watermark data.

LITERATURE SURVEY

In the area of digital watermarking, image watermarking predominantly has engrossed a lot of interest in the research community. The majority of the research work is devoted to image watermarking as compared to audio and video. Some of the reasons are described below. The test images are readily available. Images carry sufficient redundant information so that watermarks can be embedded easily. It may be assumed that any successful image watermarking algorithm may be upgraded for the video also. Images are represented in spatial domain as well as in frequency domain. The image in the transform domain is represented in terms of its frequency coefficients and in spatial domain it is represented by pixels. Simply, transform domain means the image in the form of multiple frequency bands. To represent an image in the transform domain, reversible transforms like Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT) or Discrete Fourier Transform (DFT) can be used. Each of these transforms has its own features and represents the image in its own ways. Watermarks can be imposed within images by changing the transform domain frequency coefficients. In case of the spatial domain, simple watermarks could be imposed in the images by modifying the pixel values or the Least Significant Bit (LSB) values. However, more robust watermarks could be imposed in the transform domain of images by changing frequency coefficients. Cox and Miller in 1997, proposed a paper titled Secure Spread Spectrum Watermarking for Multimedia and after that most of the research work is carried out based on this work. Even though the spatial domain based approaches cannot sustain most of the common attacks like compression, high pass or low pass filtering, etc., many spatial domain based schemes have been presented. After that, transform domain watermarking schemes has emerged and now it is Reversible Watermarking. This chapter presents an overview of Literatures in digital image watermarking technology.

Pseudo random sequence

A random number is a number generated by a process, whose outcome is unpredictable, and which cannot be sub sequentially reliably reproduced. This definition works _ne provided that one has some kind of a black box - such a black box is usually called a random number generator - that fulfills this task. Random numbers and lots of applications in gambling, statistical sampling, computer simulation, cryptography, completely randomized design, and other areas where producing an unpredictable result is desirable. Generally, in applications having unpredictability as the paramount, such as in security applications, hardware generators are generally preferred

Properties of pseudo-random numbers

1. Uncorrelated Sequences - The sequences of random numbers should be serially uncorrelated.
2. Long Period - The generator should be of long period. Ideally, the generator should not repeat; practically, the repetition should occur only after the generation of a very large set of random numbers.
3. Uniformity - The sequence of random numbers should be uniform, and unbiased. That is, equal fractions of random numbers should fall into equal \areas" in space. Eg. if random numbers on [0,1) are to be generated, it would be poor practice were more than half to fall into [0, 0.1), presuming the sample size is sufficiently large.
4. Efficiency - The generator should be efficient. There should be low overhead for massively parallel computations.

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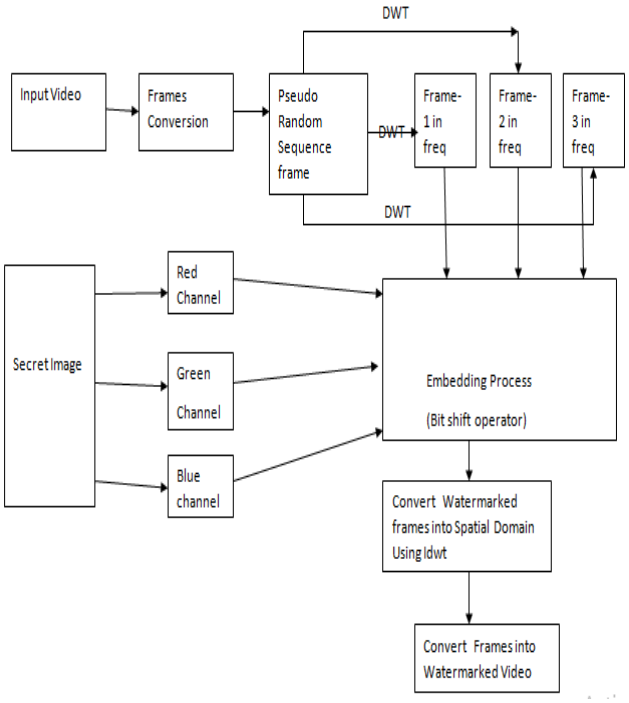
PROPOSED METHOD

Watermarked block diagram



DCT based Proposed Watermarking Technique

This chapter presents technical details and sparsity property of Discrete Cosine Transform (DCT). The DCT based proposed watermarking technique for biometric image protection in a multibiometric system is explained in this chapter. This chapter is also present the effect of this proposed technique on the performance of a multibiometric system. The comparison of proposed watermarking technique with existing watermarking techniques is also explained in this chapter.

Discrete cosine transform (DCT)

The discrete cosine transform is used for converting the image into its frequency coefficients. The advantage of cosine transform has decomposed the image into the same size into the frequency domain. In many video and image. Compression algorithms, the DCT is applied to the image for converting into its frequency domain and then perform quantization on these coefficients for data compression (Shih, 2008).If i (x, y) is a representation of the image in pixel domain and I (u, v) is a representation of the image in the frequency domain, the general equation for a 2D DCT is (Jain, 1999):

$$I(u,v)=\alpha(u).\alpha(v)\sum_{x=0}^{M-1}\sum_{y=0}^{N-1} i(x,y)\cos\left[\frac{(2x+1)u\pi}{2M}\right]COS\left[\frac{(2Y+1)v\pi}{2N}\right]$$

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Dct based proposed watermarking technique

$$\alpha(u) = \sqrt{\frac{1}{M}}\, for, u = 0$$

$$\alpha(u) = \sqrt{\frac{2}{M}}\, for, u = 1,2,3,..., M-1$$

where,

$$\alpha(v) = \sqrt{\frac{1}{N}}\, for, v = 0$$

$$\alpha(v) = \sqrt{\frac{2}{N}}\, for, v = 1,2,3,...., N-1$$

The inverse DCT is calculated using below equation:

$$i(x,y) = \sum_{u=0}^{M-1} \sum_{v=0}^{N-1} \alpha(u).\alpha(v).\cos\left[\frac{(2x+1)u\pi}{2M}\right]\cos\left[\frac{(2y+1)v\pi}{2N}\right]$$

Where ,X=0,1,2,…,M-1;Y=0,1,2,…,N-1.

The most convenient method for expressing the 2D DCT is given by matrix production as I=AiAT, and its inverse DCT isi=ATIA, where I and i are image data matrices and A is the DCT basis matrix (Shih, 2008). These DCT coefficients are indicated the correlation between the original data and its corresponding DCT basis value. These coefficients are indicated amplitudes of all cosine waves which are used for reconstruction of the original image in the inverse procedure. The 2D DCT decomposition of any image in different frequency coefficients is shown in Figure 6.1. In Figure, the black portion is shown high AC frequency DCT coefficients and the white portion is shown lowest DC frequency DCT coefficients. The DC coefficients have lower band frequency coefficients which are perfect for watermark embedding but create a problem of perception and vice versa are true for high-frequency AC DCT coefficients. The DCT can apply to any image using two procedures such as, without block procedure and with the block procedure and which is shown in Figure.

Dct based proposed watermarking technique

(a) **(b)**

(a) DCT Coefficients without Block Process
(b) DCT Coefficients with Block Process

The important properties of DCT are given below. The DCT can use for generation of sparse measurements of any image (Jain, 1999).

1. The discrete cosine transform is real and orthogonal.
2. The discrete cosine transform is fast transform.

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3. The discrete cosine transform has an excellent energy compaction for highly correlated data.

When discrete cosine transform (DCT) basis matrix is multiplied with any image, then the image is converted into its sparse domain. The basic DCT basis matrix is shown in Figure 6.2. This DCT basis matrix is used to generate sparse coefficients of a watermark biometric image in the curvelet based proposed watermarking technique. The more information about how to generate a DCT basis matrix is given in Appendix B.

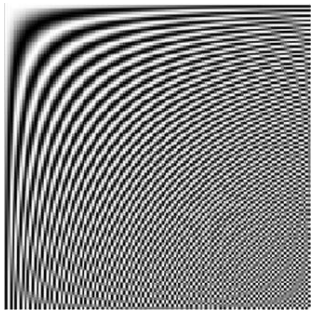

Fig. 6.2 Sparsity Property of Discrete Cosine Transform (DCT)

- For the watermarking purpose, all DCT coefficients of a host biometric image are
- For the watermarking purpose, all DCT coefficients of a host biometric image are modified according to gain factor and values of sparse information of the watermark biometric image in this proposed technique.

Dct based proposed watermarking technique

The image are laid in the low-frequency DCT coefficients which are easily corrupted by any manipulation. When compression is applied to an image which is removed high frequency DCT coefficients of the image. So these two DCT coefficients are easily corrupted by any manipulation. This is the reason behind choosing all DCT coefficients for the watermarking purpose. In this proposed watermarking technique, the sparsity property of Discrete Wavelet Transform (DWT) is explored. The DWT is used for generation of sparse measurements of the watermark biometric image. In this technique, wavelet basis matrix is generated using the wavelet matrix method instead of detail wavelet coefficients (Yan, 2009; Vidakovic, 1999). This DWT basis matrix is multiplied with the watermark biometric image to convert into its sparse coefficients.

This sparse information of a watermark biometric image is embedded into all DCT coefficients of a host biometric image. This proposed technique is nonblind technique because the original host biometric image is required at extraction side. This proposed watermarking is divided into two procedures such as watermark preparation & embedding and watermark extraction & reconstruction. The proposed block diagram of watermark preparation & embedding and watermark extraction & reconstruction is shown in Figure 6.3 (a) and 6.3 (b), respectively.

CONCLUSION

The rapid growth of digital media and communication network has highlighted the need for Intellectual Property Rights (IPR) protection technology for computer software.

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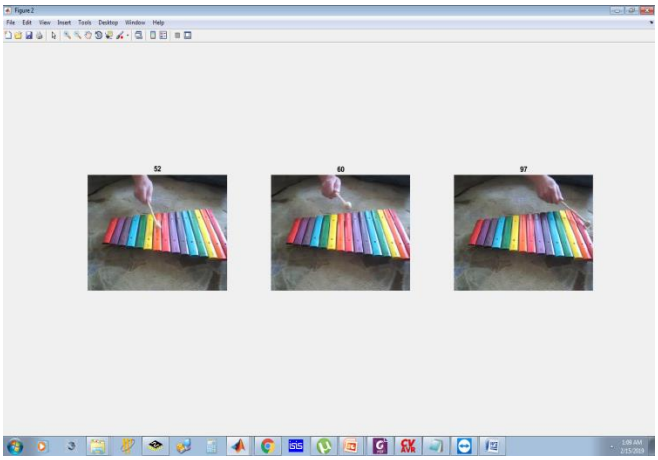
Output



Watermarking of software and databases have become a hotspot for research in recent years. Watermarking can be used to identify the owners, license information, or other information related to the ownership carrying the watermark. Watermarks can provide the mechanism for determining if a particular work has been tampered with or copied illegally.

In this thesis, study of watermarking, software watermarking and security issues for business softwares, browser based applications and relational databases has been done. After that reviewed the current security issues in the various software and detailed survey of software watermarking to describe aims, problems and techniques was performed. The main objective of this thesis is formalized in two important concepts (embedding and extraction) for business and application software, image, web based online applications and relational database.

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