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Digital Watermarking - Classification

Shilpa ann andrews

PG student RIT pampady,kottayam 686502 ,India

A B S T R A C T

2.5 quintillion bytes of data are produced by humans every day. This data are stored and transmitted in a digital format and can easily be copied without loss of quality and efficiently distributed. That's why protection has become increasingly important. Digital image watermarking is a technique in which watermark data is embedded into a multimedia product and, later, is extracted from or detected in the watermarked product. This technology often protects copyright of multimedia data, and protects databases and text files. This paper discusses different classifications on digital watermarking.

Keywords: *Digital watermarking,classification,*

1. Introduction

Here introduce the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 9.5 pt. Here follows further instructions for authors. The term "Digital Watermark" was coined by Andrew Tirkel and Charles Osborne in December 1992. The first successful embedding and extraction of a steganographic spread spectrum watermark was demonstrated in 1993 by Andrew Tirkel, Charles Osborne and Gerard Rankin.Watermarks are identification marks produced during the paper making process. The first watermarks appeared in Italy during the 13th century, but their use rapidly spread across Europe. They were used as a means to identify the paper maker or the trade guild that manufactured the paper. The marks often were created by a wire sewn onto the paper mold. Watermarks continue to be used today as manufacturer's marks and to prevent forgery.

2. Classification

Blind and non blind watermarking

In blind digital watermarking, none of the knowledge of the host is employed in extracting the embedded watermark, while in nonblind digital watermarking some host information is employed.

Blind watermarking via DWT and DCT

Ali Benoraira , Khier Benmahammed and Noureddine Boucenna proposed a paper on blind image watermarking which is based on differential embedding in DWT and DCT domains. It is a simple watermarking scheme based on the combination of DWT and DCT domains. In the embedding process, a differential technique is performed on two transformed sub-vectors so that the extraction of the watermark is achieved using only the difference of the corresponding watermarked sub-vectors.

* *Corresponding author*
E-mail address: *shilpaannandrews@gmail.com*

2.1 Non Blind watermarking via dual –tree complex discrete wavelet transform

T. Minamoto and R. Ohura presented a new non-blind digital image watermarking method for embedding a binary logo in an image, based on the dual-tree complex discrete wavelet transform (DT-CDWT) and interval arithmetic. Translation invariance property of the DT-CDWT helps to extract the watermark from a rotated watermarked image. Blind methods are more useful than non-blind ones because the original image may not be available in actual applications. However, non-blind methods are appropriate for some watermarking applications. For example, if an owner needs to prove ownership of an image, the watermark detector or extractor can be used to compare the original image with the watermarked one.

Perceptible and imperceptible watermarking

Perceptible watermark is visible to the human. Thus these type of watermarked images can be easy to created. Whereas imperceptible watermark can be embedded only by using sophisticated algorithms.

Perceptible via Fast Fourier Transform

A perceptible removable watermark can be used to add copyright owner's identification to media or lower the value of the digital contents. The application scenario for perceptible watermarks is to give the protected contents available freely for download as a preview. For a fee, the watermark can be removed to restore the media quality to the original level. M. Loytynoja, N. Cvejic and T. Seppanen, present a scheme to protect the audio data by embedding high capacity robust watermark to it. The watermark can be removed using a secret watermarking key with only minimal remaining distortion. The protection watermark embedding and detection is done in the spectral domain. The watermark is embedded into selected Fast Fourier Transform coefficients' magnitudes of the cover audio using frequency hopping method.

Perceptible via Adaptive modulation scheme

C. Chen, W. Huang, B. Zhou, C. Liu, and W. H. proposed a new picture-embedding 2D barcode, called PiCode. Adaptive modulation scheme which adapts modulation energy to the local image intensity, is introduced. This system is capable of providing a beautiful perceptual view to the traditional QR code thus making it a perfect example of perceptible watermarking.

Imperceptible via Discrete Cosine Transform

Discrete Cosine Transform (DCT) can be used to create an imperceptible watermark. In DCT first of all image is segmented into non overlapping blocks of 8x8.Then forward DCT is applied to every of those blocks. then some block selection criteria is applied then coefficient selection criteria is applied. Then watermark is embedded by modifying the chosen coefficients and within the end inverse DCT transform is applied on each 8x8 block. The first efficient watermarking scheme was introduced by Koch et al. In their method, the image is first divided into square blocks of size 8x8 for DCT computation. A pair of mid-frequency coefficients is chosen for modification from 12 predetermined pairs. Bors and Pitas developed a way that modifies DCT coefficients satisfying a block site selection constraint. After dividing the image into blocks of size 8x8, certain blocks are selected supported a Gaussian network classifier decision. the center range frequency DCT coefficients are then modified, using either a linear DCT constraint or a circular DCT detection region. A DCT domain watermarking technique supported the frequency masking of DCT blocks was introduced by Swanson. Cox developed the primary frequency-domain watermarking scheme. then tons of watermarking algorithms in frequency domain are proposed.

Imperceptible via Discrete wavelets transform

Discrete wavelets transform is also another imperceptible water marking method. It is more frequently used due to its time/frequency characteristics. Here an image is passed through series of low pass and high pass filters which decompose the image into sub bands of different resolutions. Image is decomposed into four parts, one part is a low frequency of original image, the one bottom left is vertical details of the original image, the top right contains horizontal detail of the image , the bottom right block contains high frequency of original image. This technique uses wavelet filters to transform the image.

A discrete wavelet transform (DWT) is any wavelet transform for which the wavelets are discretely sampled . It is useful for processing of non-stationary signals. In transform small waves which are called wavelets of varying frequency and limited duration are used as mother wavelet .. Wavelets are created by translations and dilations of a fixed function called mother wavelet. Wavelet transform provides both frequency and spatial description of an image DWT is the multi resolution description of an image the decoding can be processed sequentially from a low resolution to the higher resolution . The DWT splits the signal into high and low frequency parts. The high frequency part contains information about the edge components, while the low frequency part is split again into high and low frequency parts. The high frequency components are usually used for watermarking since the human eye is less sensitive to changes in edges .

Imperceptible via Discrete Fourier transform

Discrete Fourier transform (DFT) transforms a continuous function into its frequency components. Discrete Fourier transform is scaling, rotation and translation. So DFT can be used to recover from various geometric attacks such as cropping.This method also makes invisible watermarks. The results obtained by the computational simulation which was conducted by M. Cedillo Hernández, M. Nakano Miyatake, H. M. Pérez Meana show that the DFT method satisfies perceptual invisibility and it is sufficiently robust, due to that the embedded watermark survived over the different type of attacks, such as JPEG compression, filtering, noise addition, scaling, translation, cropping, and rotation.

Imperceptible via Discrete Fourier transform and singular value decomposition

P. K. Dhar and T. Shimamura proposed an audio watermarking scheme using discrete Fourier transformation (DFT) and singular value decomposition (SVD) for copyright protection of sound contents. The original audio is segmented into non-overlapping frames. Spectrum of *each frame is computed by DFT. Prominent spectral peaks are detected from the frequency spectrum of every frame employing a peak detection algorithm. SVD is applied to the chosen prominent peaks of every frame represented during a matrix form. Watermark is then embedded into the very best singular*

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