Techniques of Digital Watermarking

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Abstract

Digital watermarking is the newfangled idea in digital media. As the replication and modification of digital media content is done frequently and without any significant obstruction, secrecy and authenticity become vulnerable to attacks. The technique of digital watermarking is one of the valid methods for copyright protection. This paper gives a summary of different innovative techniques in this emerging area. Now a day's worldwide research activities and the industrial interest in digital watermarking methods are growing tremendously. In the Requirements for image watermarking include imperceptibility, robustness to common signal processing operation, attacks and capacity. In this serve as the concrete foundation and the advances in this technology in recent years.

Keywords

Digital Watermarking, watermarking, techniques of watermarking

I. Introduction

Digital watermarking is the process of embedding information into a digital contains. The purpose of digital watermarks is to provide copyright protection for intellectual property that is in digital format. A watermark is a translucent design impressed on paper during manufacture and visible when the paper is held to the light. Its purpose is to stop limitation, by making the Watermark near impossible to reproduce. The concept of Digital watermarking considers this process in the digital domain from the cryptography and Steganography. The purpose of a digital watermark is to hide within an image or audio file some data specifically relating to that file. The base requirement of a watermarking technique is that adding a mark to a sound file should not degrade its quality. Several watermarking techniques have been proposed. Some methods embed the watermark in the spatial domain of the image [1]. Other watermarking techniques use transform methods, such as the FFT, DCT, and Wavelet transform to embed the watermark. Recent developments have also seen the use of the Human Visual System to improve watermark performance [2].

II. Techniques used for watermarking

A. Embedding and Extraction of watermark

The information embedded as a watermark can be almost anything. It can be a bit string representing copyright message, serial number, plain text, etc. However, sometimes it can be more useful to embed a visual watermark (e.g. corporate logo) instead of a bit string as a watermark. The watermark is then embedded in DWT coefficients. In this case any modification to an image and changes in discrete wavelet coefficients and after apply Inverse discrete wavelet transform is taken to get watermarked image. Fig. 1 shows embedding of watermarks. Watermarks of extraction are generally used blind and non blind the requirement of original image. Watermark Extraction at lower resolutions is computationally effective because at each successive resolution level, smaller frequency bands are involved. Fig 2 show Extraction of watermarks.[3].

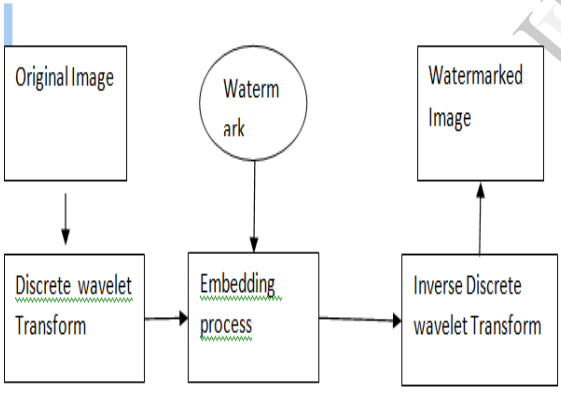


Fig.[1]. Embedding of watermarks

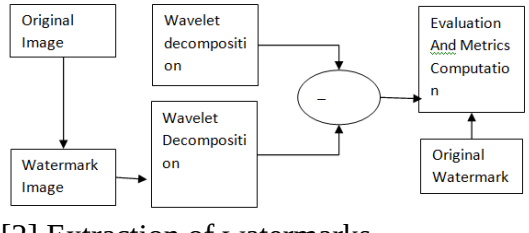


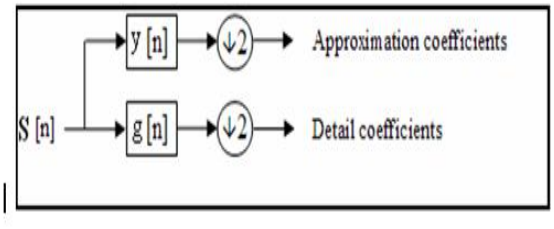
Fig.[2].Extraction of watermarks

B. DCT-based watermarking

DCT domain watermarking can be classified into mainly two types- (i) Global DCT watermarking (ii) Block based DCT watermarking. In the DCT Block Based Watermarking Algorithm are: Segment the image into non-overlapping blocks of 8x8, And forward DCT to each of these blocks, And some block selection criteria (e.g. HVS). In the two-dimensional DCT is usually used in digital image processing .while coefficients at high frequencies are very small. and DCT applied an image's energy at low frequencies.[4].

C. DWT-based watermarking

In this transform the signal is decomposed into a set of basic wavelets followed by the altering of lower frequencies at various resolutions. because it can be used as a computationally efficient version of the frequency models for the HVS .In this human eye is less sensitive to noise in high resolution DWT bands and DWT image and video coding, such as embedded zero-tree wavelet (EZW) coding, are included in the upcoming image and video compression standards, such as JPEG2000 .The details coefficients ***D*** (high frequencies) are produced by passing the signal ***S*** through a low pass filter. In this figure shown [3].one level DWT decomposition



This forms wavelet decomposition is approximation of original image and three

detail signals (horizontal, vertical and diagonal [5].

D. Dual based watermarking techniques

The dual based watermarking techniques are mainly two types; visible watermarking and invisible watermarking.
Visible watermarks are an extension of the concept of logos. Such watermarks are applicable to images only. These logos are inlaid into the image but they are transparent. Such watermarks cannot be removed by cropping the centre part of the image. Further, such watermarks are protected against attacks such as statistical analysis. Visible watermark is a secondary translucent overlaid into the primary image. The watermark appears visible to a casual viewer on a careful inspection.[6]
The invisible-robust watermark is embedding in such a way that alternations made to the pixel value are perceptually not noticed and it can be recovered only with appropriate decoding mechanism. The invisible-fragile watermark is embedded in such a way that any manipulation or modification of the image would alter or destroy the watermark. Dual watermark is a combination of a visible and an invisible watermark. In this type of watermark an invisible watermark is used as a backup for the visible watermark. An invisible robust private watermarking scheme requires the original or reference image for watermark detection. An invisible robust public watermarking scheme does not require the original or reference image for watermark detection [7].

E .Optimization techniques

In these optimization techniques -This includes singular value decomposition, independent component analysis, artificial neural network, optimization algorithms.

E.1 Singular Value Decomposition (SVD)

Singular value decomposition is one of the most powerful numerical analysis tool used to analyze matrices. In SVD transformation, a matrix can be decomposed into three matrices that are of the same size as original matrix. SVD transformation preserves both one-way and non-symmetric properties, usually not obtainable in DCT and DFT transformations. [8] Using SVD in digital image processing has advantages like the size of the matrices from SVD transformation is not fixed and can be a square or a rectangle; singular values in a digital image are less affected if general image processing is performed and singular values contain intrinsic algebraic image properties. The singular values of the host image are modified to embed the watermark image by employing multiple singular functions. Watermark is embedded and extracted by adjusting value between selected coefficients and actual output trained by support vector regression. SVD factorization is done on different non-overlapping blocks by taking wavelet transform. Watermarks are generated by singular value of different block [9].

E.2 Independent Component Analysis (ICA)

Independent component analysis is recently developed technique for image watermarking.

ICA is applied to compute statistically independent transform coefficients where watermark is embedded. The main advantage of this approach is that on one hand, each user can define its own ICA-based transformation. These transformations behave as private-key. An orthogonal watermark is developed to blindly detect it with a simple matched filter. ICA consists of projecting a set of components onto another statistically independent set. This approach assumes multiple-input multiple- output model and has been successfully applied to image watermarking. ICA presumes watermarked image as a mixture of original image and watermark. The mixture image can be separated to estimate this watermark. Although ICA is utilized to detect and extract the watermark, they are still vulnerable to geometric distortion attack. [10].
watermarks are embedded into middle frequency at LH and HL sub-bands. An intelligent ICA-based detection is proposed which directly extracts watermarks in spatial domain. A novel characteristic of this detection is that it does not require the transformation process to extract the watermarks [11].

E.3 Artificial Neural Network (ANN)

An artificial neural network (ANN) is a mathematical model or computational model that is inspired by the structure and functional aspects of biological neural networks. A neural network consists of an interconnected group of artificial neurons, and Most attacks do not degrade the quality of detected watermark image as FCNN has storage and fault tolerance. [12].

E.4 Support Vector Machine (SVM)

In recent years, SVM has been used for digital watermarking. SVMs are easier and better to than use traditional neural network models. The idea of SVM is to construct a mapping model from input data to output data which are also defined as features for input data and targets for output data. There are two data sets in classification, i.e., training data and testing data. Each training data contains several features and one target. After SVM learns using the training data, SVM can produce a model to predict the corresponding target of the test data. [13]

E.5 Genetic Algorithm (GA)

In case of watermarking, the singular values (SVs) of the host image are modified by multiple scaling factors to embed the watermark image. Modifications are optimized using GA to obtain the highest possible robustness without losing the transparency [14].

III . Conclusion

In this papers, we discussed about watermarking techniques, First we identified the many of the techniques proposed for watermarking. This paper gives a base to understand the recent advances in digital watermarking which may have happened after the review works described in this paper.

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