

A Review on Evaluation of Digital Image Watermarking Techniques

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ABSTRACT:-

An efficient strategy that solves many problems within a digitization is Watermarking. By embedding Intellectual Property data like the creator, licence model, creation date or another copyright information within the digital object, the digitiser can reveal they are the creator and spread this information with each copy, even when the digital object has been uploaded to a third party site. This can also be utilized to decide if a required work has been tampered with or copied. This paper describes methods to establish if an application need watermarking strategies and criteria for selecting for the most suitable type. This paper concentrates on evaluating the responsibility of the SVD, DCT and DWT dependent image watermarking for protected transmission

KEYWORDS:- Watermarking, DCT, DWT

1. INTRODUCTION

The digital watermarking is latest and most popular technique for copyright protection. Digital watermarking hides the copyright information into the digital data through certain algorithm. To trace illegal copies, a unique watermark is required based on the location or identity of the recipient in the multimedia network. The sort of information hidden in the item when using watermarking is usually a signature to signify origin or ownership for the purpose of copyright protection. The application of watermarking is copyright control, in which an image owner seeks to avoid illegal copying of the image. Robust watermarks are well matched for copyright protection, because they reside intact with the image under various manipulations.

A watermarking system is divided into three distinct steps, embedding, attack and detection. In embedding an algorithm accepts the host and the data to be embedded,

and produces a watermarked signal. The output of the watermarking scheme is the watermarked image. A VLSI architecture is also used that can put in noticeable watermarks in images.

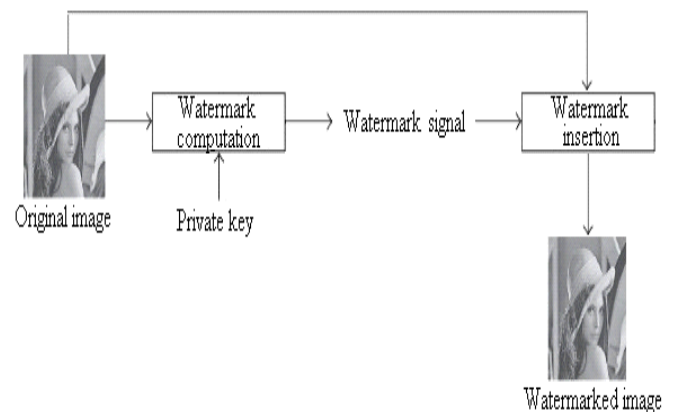


Fig 1: Watermarking Insertion

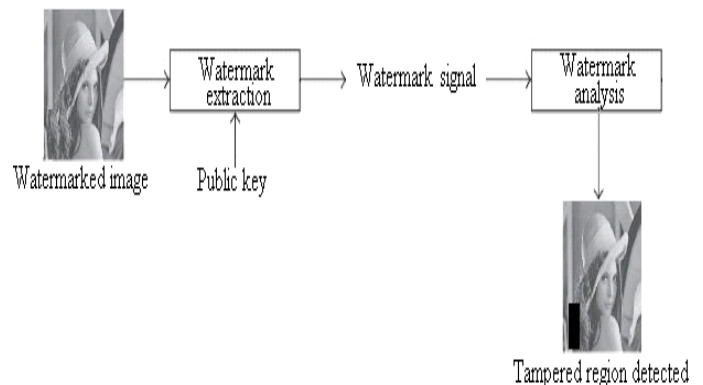


Fig 2: Watermarking Analysis

2. WATERMARKING TECHNIQUES

Numerous watermarking techniques are available. But, the following techniques are frequently used in image watermarking.

2.1 Discrete Cosine Transform

Discrete Cosine Transformation (DCT) transforms a signal from the spatial into the frequency domain by using the cosine waveform. DCT divide the information energy in the bands with low frequency and DCT popularity in data compression techniques such as JPEG and MPEG. The DCT allows an image to be broken up into different frequency bands, making it much easier to insert watermarking information into the middle frequency bands of the image. DCT represents data in terms of frequency space. DCT based watermarking techniques are robust as compared to spatial domain techniques. DCT domain watermarking can be classified into Global DCT watermarking and Block based DCT watermarking.

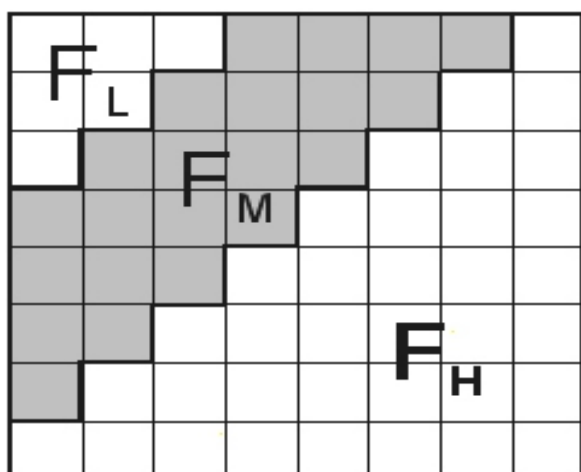


Fig.3. Discrete Cosine Transform regions

Two-dimensional discrete cosine transformation and its inverse transform are defined as [13]:

$$C(u,v)=\alpha(u)\alpha(v)$$

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

$$f(x,y)=$$

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

where, $u,v = 0,1,2,\dots,N-1$

$x,y = 0,1,2,\dots,N-1$

$\alpha(u)$ is defined as follows:

$$\alpha(u) = \sqrt{1/N} \quad u=0;$$

$$\alpha(u) = \sqrt{2/N} \quad u=1,2,\dots,N-1$$

The major benefits of DCT include its high energy compaction properties and availability of fast algorithms for the computation of transform. The energy compaction property of the DCT results in transform coefficients with only few coefficients having values, thus making it well suited for watermarking. Embedding rules in DCT domain are more robust to JPEG/MPEG.

2.2 Discrete Wavelet Transform

DWT is presently used in a broad range of signal processing applications, such as in audio and video compression, elimination of noise in audio, and the simulation of wireless antenna distribution. Wavelets have their energy concentrated in time and are perfectly suited for the analysis of transient time varying signals. DWT is preferred, because it provides both a simultaneous spatial localization and a frequency spread of the watermark within the host image. The hierarchical property of the DWT offers the opportunity of analyzing a signal at different resolutions and orientations.

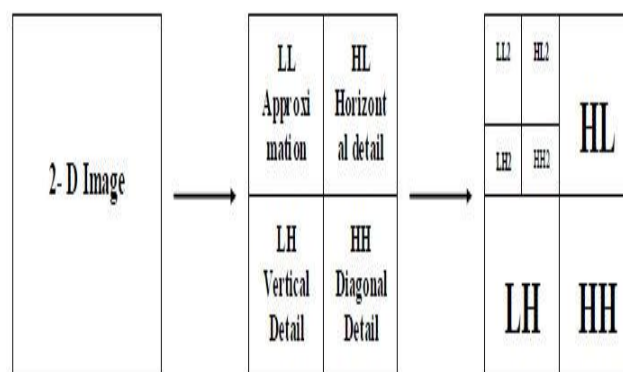


Fig. 4: Wavelet Based Transform

The wavelet transform is given by equation 1. In the wavelet Domain where W_i denotes the coefficient of the transformed image. X_i denotes the bit of the watermark to be embedded. Here α is a scaling factor. And (u, v) represents basic transformed functions [2].

$$I W_{u,v} = W_i + \alpha |W_i| X_i \quad \text{where } u, v \in \{HL, LH\} \quad (1)$$

2.3 Singular Value Decomposition

SVD is a linear algebra technique used to resolve many mathematical problems. It is a robust watermarking scheme for audio signals. SVD has been engaged for different image applications. Such as compression, hash extraction and image watermarking. In image watermarking applications, the singular values of the host image are adapted in order to embed the watermark. SVD is able to profitably represent the algebraic properties of an image. SVD techniques can be applied to any type of images. If it is a gray scale image the matrix values are measured as intensity values and it could be modified directly or changes could be done after transforming images into frequency domain.

Let A be a general real (complex) matrix of order $m \times n$. The singular value decomposition is the following factorization [14]

$$A = U \times S \times V^T \quad (2)$$

Where, U and V are orthogonal (unitary) and $S = \text{diag}(\sigma_1, \sigma_2, \dots, \sigma_r)$, where σ_i , $i = 1, \dots, r$ are the singular values of the matrix A with $r = \min(m, n)$ and satisfying:

$$\sigma_1 \geq \sigma_2 \geq \dots \geq \sigma_r \quad (3)$$

Use of SVD in digital image processing has some advantages which are listed as follows:

1. The size of the matrices from SVD transformation should not necessarily square and can be a rectangle.
2. Singular values in a digital image are less affected if general image processing is performed. It means that for a small perturbation added to an image, its SVs do not change fast.
3. Singular values contain intrinsic algebraic image properties, where singular values correspond to the brightness of the image and singular vectors reflect geometry characteristics of the image.

SVD can effectively reveal essential property of image matrices, so it has been used in a variety of image processing applications such as noise estimation and digital watermarking.

3. LITERATURE SURVEY

Zebbiche et al. (2014) [1] has discussed a robust wavelet-based fingerprint image watermarking scheme using an efficient just perceptual weighting (JPW) model. In this, JPW model three human visual system characteristics has been defined, namely: spatial frequency sensitivity, local brightness masking and texture masking, to calculate a weight for each wavelet coefficient, which is then used to manage the amplitude of the inserted watermark. Fingerprint images perceptually differ from natural images and a JPW model adapted to such images has been enhancing the robustness of watermarking scheme. Mainly this technique has shown a transparent superiority over a number of associated state-of-the-art masking techniques. Yong Zhu et al. (2013) [2] has described the digital watermarking is an important means of copyright protection, that decomposes RGB for the color image and embeds the algorithm of multiple watermarks in the grayscale image of R, G . The algorithm has increases the amount of watermark embedded and solves the interference problem of embedding multiple watermarks. This algorithm has good robustness to resist

Shearing attack, Gaussian noise attack and JPEG compression attack. Ketas Raval et al. (2013) [3] has explained the problems related to security and authenticity of digital data in digital communication. In multimedia communication, digital images and videos have many applications. Although, watermarking algorithms are used for copyright protection and security. But, most of the watermarking algorithms transform the host image and embedding of the watermark information is done in robust way. Also, the uncompressed digital image transmission needs more storage space and bandwidth. So image compression is needed for efficient image transmission. For doing secure image transmission it proposes transform algorithm for digital watermarking based on DCT-DWT watermarking. Nidhi Divecha et al. (2013) [4] has described digital image watermarking is a technology that has been developed to secure digital content from illegal use. Author proposed the implementation and performance analysis of two different watermarking schemes based on DCT-DWT-SVD. These techniques have been used to check the effectiveness for imperceptibility and robustness in which peak signal noise ratio and normalized cross-correlation parameters are used. Hamid Shojanazeri et al. (2013) [5] has described the state of the art in video watermarking techniques. With the growth of Internet services and various storage technologies made video piracy as an increasing problem. Thus, research in copyright protection mechanisms and content authentication, where one of which includes digital watermarking has been receiving an increasing interest from scientists especially in designing a seamless algorithm for effective implementation. Basically digital watermarking involves embedding secret symbols known as watermarks within video data which can be used later for copyright detection and authentication verification purposes. It provides a critical review on various available techniques. In addition, it addresses the main key performance indicators which include robustness, speed, capacity, fidelity, imperceptibility and computational complexity. Yang Qianli et al. (2012) [6] has introduced a digital watermarking algorithm with gray image based on two dimensions which are discrete wavelet and cosine transform for protecting digital media copyright efficiently. In which, the image is transformed into discrete wavelet domain three times, then split the image into sub-blocks, which is lower in horizontal direction and high in vertical direction, and then transform every block into discrete cosine domain, and are embedded into cover image. At last, the secret image is obtained by reverse transform of wavelet and cosine domain. Finally, in this the watermarking is robust to the common signal processing techniques, like JPEG compressing and noise. Hailiang Shi et al. (2012) [7] has described an RST invariant watermarking scheme using DWT-SVD and logistic map in which the watermark is a visually meaningful grayscale logo. In which, the embedding is done by modifying the singular values of the approximation subband of the host image with logistic map encrypted watermark, and then the watermark image is

reconstituted. The results demonstrate that this scheme is able to withstand a variety of geometric attacks and some common signal process additive noise. Mangaiyarkarasi, P. et al. (2011) [8] has presented a new digital image watermarking based on Ridgelet Transform (RT) and extraction using Independent Component Analysis (ICA). RT is a multi resolution transform and it is good for describing the signals with high dimensional singularities. Also, high robustness and good imperceptibility is obtained using ridgelets. The embedded watermark is extracted using ICA, and the advantage of this extraction technique is that it extracts the watermark in spatial domain itself and does not require any transformation process and does not require the original image. So, performance of ridgelet is better than wavelets in digital image watermarking applications. Al-Gindy, A. et al (2011) [9] has introduced a new copyright protection technique using colour watermarks. In which, the watermark is a RGB colour image where each pixel is represented by 24 bits. Then, the RGB colour watermark is preprocessed by converting it into binary sequence. The preprocessed colour watermark is embedded multi-times into the green channel of the RGB host image by modifying the low frequency coefficients of the DCT transformation. This new technique can defend classical attacks such as JPEG compression, low pass filtering, median filtering, cropping, and scaling attacks. In this, the recovery method is blind. Since, it does not need the original host image for extraction. Prasad. R.M. et al (2010) [10] has discussed a robust invisible watermarking scheme for embedding and extracting a digital watermark in an image to protect it from copyrights. The invisible insertion of the watermark image into the original image is performed in wavelet domain using Haar wavelet transform. In this, the authors create a mask matrix using the original image with the aid of MD5 algorithm and random matrix. The mask matrix has been utilized in embedding and extraction processes. For extracting watermark, the relationship degree between the mask matrix and the watermark embedded wavelet coefficients is evaluated. Ghost.S et al. (2009) [11] has introduced watermarking technique spread spectrum modulation based method which has greater robustness. As watermarking applications, demand development of low cost watermark algorithms in order to implement in real-time environment. For this, a block based multiple bit spatial domain spread spectrum image watermarking scheme has been represented where a gray scale watermark image is shown by less number of binary digits using novel channel coding and spatial biphas modulation principle. This algorithm can also be applied for authentication as well as secured communication in real time environment. Dorairangaswamy et al. (2009) [12] has explained a hidden and blind watermarking scheme for copyright protection of digital images with the aim of shielding against digital piracy. In this watermarking scheme, a binary watermark image has been invisibly embedded into the host image for achieving copyright protection. In this watermarking scheme, the process of watermark extraction

needs only the watermarked image and it does not require the original image or any of its characteristics, and hence it is blind.

4. CONCLUSION AND FUTURE SCOPE

In this paper, a review of some well-known image watermarking techniques has been done. Digital watermarking is a strategy which basically concerns a lot of conflicting requirements and trade-offs. Thus succeeding in many real-world as well as technical tasks. Digital watermarking utilizing SVD is a quickly emergent arena with heaps of potential in future novel applications, also its present applications in the data security, manufacturing and data hiding areas. In the context of multimedia communication, digital images and videos have a lot of applications in entertainment world such as TV channel broadcasting. The fast evolution of digital technology makes the growth of reliable and robust schemes for defending digital images, audio, text and video from piracy. On communication channel watermarked may be ruined by noise. A encoding and decoding techniques should eliminate random noise take place over a communication channel. So, watermarking systems are systems in which the hidden message is correlated to the host signal. A watermark is a identifiable image or pattern in paper that look to be as various shades of lightness. Adding together a visible watermark is a simple way of recognizing images and defending them from illegal use online.

In near future we will recommend a modified SVD dependent watermarking to enhance the results further. And also we will utilize embedding plus plus to improve the security. On the other hand, additional enhancement will also be done by implementing the enhanced algorithm in real time environment. Also some further attack will be considered to estimate the performance of the proposed algorithm further.

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