

A Review on Robust Digital Watermarking based on Different Methods and its Applications

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Abstract— Digital Watermarking is the process of embedding data called watermark or signature or label or tag into a multimedia object (image or audio or video) so that the watermark can be extracted for ownership verification or authentication. A visible watermark is a secondary translucent image overlaid into the primary image and appears visible to a viewer on a careful inspection. The invisible watermark is embedded in such a way that the modification made to the pixel value is perceptually not noticed and it can be recovered only with an appropriate decoding mechanism. Digital watermarking is used to hide the information inside a signal, which cannot be easily extracted by the third party. Its widely used application is copyright protection of digital information. It is different from the encryption in the sense that it allows the user to access, view and interpret the signal but protect the ownership of the content. One of the current research areas is to protect digital watermark inside the information so that ownership of the information cannot be claimed by third party.

Key words: 2DWT, 2DCT, Spatial Domain, PSNR, MSE

I. INTRODUCTION

Robust digital watermarking is private such technology that has been made to defend digital images from illegal manipulations [15]. It is an idea closely related to steganography, in that both hide a message inside a digital signal. Digital watermarking tries to cover a message related to the real content of the digital signal and it is used as an envelope to hide its existence. Watermarking is used for providing a kind of security for various types of data (it may be image, audio, video, etc.). Watermarking is the process of embedding a message on the host signal. Watermarking is different to steganography, has the extra requirement of robustness against possible attacks. A watermark can either be visible or invisible. Using digital watermarking copyright information implemented in the multimedia data. This is implemented by using some algorithms. Information such as number, images or text with special implication can be embedded. The purpose of this information for copyright protection, covert communication, authenticity distinguish of data file, etc. [2].

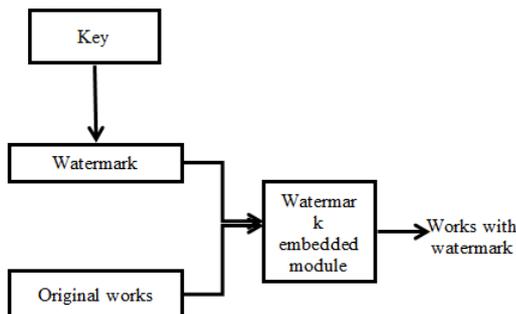


Fig. 1. Embedding Process

II. PROPERTIES OF WATERMARKING

There are three main Properties of digital watermarking technique:

A. Fidelity:

Watermarking should not initiate visible distortions, because if such alterations are introduced it decreases the profitable value of the image.

B. Robustness:

Watermarks could be detached on purpose or unintentionally with the use of simple image processing operations like contrast enhancement, gamma correction etc. Hence watermarks could be robust against variety of such attacks.

C. Capacity or Data Payload:

This property defines how much data should be surrounded as a watermark to successfully detect through extraction. The watermark should be able to carry enough information to describe the distinctiveness of the image. [1]

III. DIGITAL WATERMARKING ALGORITHM

Discrete Cosine Transform (DCT) [3] method is used to convert the time domain signal into frequency domain signal. Using DCT, an image is easily split into pseudo frequency bands and in this work watermark is inserted into middle band frequencies because as we discussed in all frequency domain watermarking schemes, there is a conflict between robustness and transparency.

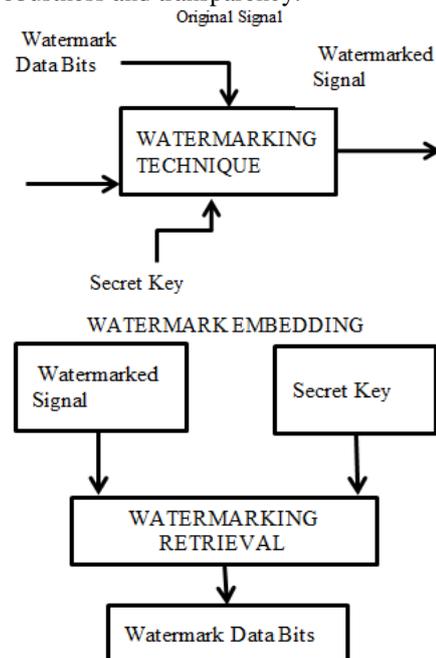


Fig. 3: Digital watermarking process

Wavelet transform has been widely studied in signal processing general and image compression in particular. Here 2-DWT (Two dimensional Discrete Wavelet Transform) method is used to decompose the image into four sub bands namely LL, LH, HL & HH. LL-Low frequency band LH-Horizontal high frequency band HL-Vertical high frequency band HH-Diagonal high frequency band Wavelet coding schemes are especially suitable for applications where scalability and tolerable degradation are important.

LL	LH
HL	HH

Table 2: Single Level Decomposition using DWT

A. Spatial Domain Technique:

In this technique, the watermark is inserted in the cover image changing pixels or image characteristics. The algorithm should carefully weigh the number of changed bits. In the pixels against the possibility of the watermark becoming visible. In a robust manner, this method has the ability to check the alteration of a single bit in every consecutive 8-bits length as it is parity enhanced.

B. Frequency Domain Technique:

Compared to spatial domain techniques, frequency Domain techniques are more applied. The target of this technique is to insert the watermarks in the spectral coefficients of the image. The most well-known used transforms are the Discrete Cosine Transform (DCT), Discrete Fourier Transform (DFT), and Discrete Wavelet Transform (DWT). The discrete wavelet transforms (DWT) and the discrete cosine transforms (DCT) are implemented very effectively in numerous digital images watermarking scheme.

IV. APPLICATIONS OF WATERMARKING

A. Copyright Protection & Owner Identification:

To protect its intellectual property, the data owner can embed a watermark representing copyright information of his data. This application can be a very really helpful tool in settling copyright disputes in court. It is probably the most widely spread use of digital images watermarking and it is also the application we have worked on in the present project.

B. Broadcast Monitoring:

In order to help the automated identification of broadcasted programs, original watermarks can be easily inserted in any type of data to be widely broadcasted on a network. It could assure that advertisers received the airtime they have paid for or make certain that musicians' property is not rebroadcast by pirate stations (or at least, if so, that it can be detected).

C. Copy Protection:

The watermarked information can directly control digital recording device. The embedded key can represent a copy-permission bit stream that is detected by the recording device which then decide if the copying procedure should go on (allowed) or not (prohibited).

D. Data Authentication:

Fragile watermarks are used to detect/display any corruption of an image or any other type of data. If the watermark is

detected, the data is genuine, if not, the data has been corrupted and cannot be considered as genuine.

E. Data Hiding (Covert Communications):

The transmission of private data probably is one of the earliest applications of watermarking. As one would have probably already understood, it comprises of implanting a strategic message into an innocuous one in a way that would prevent any unauthorized person to find it.

F. Medical Safety:

Embedding the date and patient's name in medical images could be increase the confidentiality of medical informations as well as the securities.[4]

V. RELATED WORK

Guorui Sheng (2013)-Color image watermarking has become essential and important copyright protection or authentication scheme. Firstly, the Y luminance of host image is divided into 8×8 sub-blocks and the DC coefficients of each block are directly calculated in the spatial domain without DCT transform. Secondly, according to the watermark information and the quantization step, the DC coefficients are calculated and their increments are further utilized to modify directly the values of all pixels in the spatial domain instead of the DCT domain to embed watermark. When watermark extraction, only the watermarked image and the quantization step are needed in the spatial domain. Experimental results show that the proposed method not only can resist both traditional signal processing attacks and geometric attacks, but also has more efficient in computational complexity. Comparisons also demonstrate the advantages of the method.[6]

Dong Zheng (2014)- In this study, it present a quality estimation process based on the novel semi-fragile and adaptive watermarking scheme. In this scheme, it used the embedded watermark to calculate the degradation of cover image under various distortions. The watermarking process is processed in a DWT domain of the cover images. And the correlated DWT coefficients are across the DWT sub-bands and they are considered into the Set Partitioning in Hierarchical Trees (SPIHT). These SPHIT trees are further decayed into a set of bit planes. The watermark is embedded into the selected bit planes of the selected DWT coefficient of the selected tree without causing important fidelity loss to the cover image. [7]

Qingtang Su (2012) –A novel double color image watermarking technique based on two-level DCT has been proposed in this paper. The color watermark image is embedded into a color host image by modifying the AC coefficients of two-level DCT. In the proposed scheme, the watermark embedding and extracting processes are very simple with the technology of coefficients quantification. Without the original data, the embedded watermark can be successfully extracted from the watermarked image. Experimental results show that the proposed scheme out performs the earlier works and has better robustness and invisibility of watermark. Therefore, we can conclude that the new proposed technique is more suitable for using color image information to protect the copyright of color images that will be transmitted on the Internet.[8]

Sang-WoongLee (2013)-This paper is use to present multimedia authentication and restoration scheme with the security of AES-128 ciphered watermarking and correlated watermarking. An encrypted or ciphered images embedding are done by modified version of Closest Point Transform (CPT) in a digital photograph. It performed several security attacks example such as noise attack, compression attack, and cropping attack on multiple watermarked photographs and it evaluated system robustness. Using Image Authentication, it was locating the tempered areas and restoration which was performed by correlated watermark in the tempered region of watermarked photograph. The PSNR values are uses to check and evaluate the proposed watermarking technique. [9]

YasunoriIshikawa (2014)-This paper describe a new aspect to evaluate the robustness of the optical watermarking technique, this is an unique technology with the help of that add watermarked information to an object image data taken by digital camera`s without adding any specific extra hardware architecture. However, since this technology uses light with embedded watermarked information, which is irradiated onto the object images, the condition of taking a picture with digital camera`s may affect the accuracy with which embedded watermarked data can be detected. Images taken by digital cameras are usually defocused, which occurs under the non-optimal conditions. We evaluated the defocusing in images against the accuracy with which optical watermarking will be detected. Defocusing in images can be expressed with convolution with a specified line-spread function. [10]

Nidaa A. Abbas (2014)-The quad tree is a hierarchical data structure for the presentation of a spatial information`s, which is based on the principle of recursive decomposition, is used in digital image processing and computer graphics. This paper demonstrates the detection of invisible watermarked images generated by popular watermarking techniques, including CDMA, DCT, DWT and Least significant Bit (LSB) are using quad tree. Results corresponding to typical (512 · 512) pixel images show differences between these methods when they are used. Every time we will use the same Images, the original images and invisible watermarked images to test the four methods in conjunction with quad tree decomposition. In addition to subjective method represented by quad tree, many objective evaluations such as Pearson correlation, mean square error (MSE), Structural Similarity Index (SSIM) and false positive and false negative were used to give the comparison criteria between the original and watermarked images. In results, the quad tree decomposition considered a promise to give a subjective method to the recognize among these watermark techniques. [11]

Surbhi (2014)- Together with an fast growth in the use of internet and high speed computer networks; the use of digitally formatted data has increased many folds i.e. the data are easily plagiarized, modified or deleted without any need of proper authentication and authorization. This has led to need for effective copyright protection tools. Digital Watermarking promises to address these issues. This paper gives a survey of Digital Image Watermarking which helps general readers have an overview of digital image watermarking including the definitions, system requirements and process involved. In addition, for the future research

directions of digital image watermarking are discussed. In this overview paper, we have reviewed the most important basic concepts in digital watermarking including its foundation, requirements and watermark framework. After that, common frequency domain watermarking techniques are introduced with analysis of pros and cons in terms of imperceptibility and robustness. Our future work will rely on the implementation and evaluation of joint DWT-DCT based image watermarking over HVS based and application based color spaces. [12]

Lianjie Dong (2014) With the rapid development of network communication and broad application of multimedia technology, copyright protection of digital media work is becoming more and more important. Digital watermarking is viewed as an effective tool for copyright protection of multimedia data. At first the principle, research background and status of digital watermark is described. Then, a blind watermarking algorithm based on DWT is proposed. The watermark image is scrambled by a generalized Arnold transform so as to improve the security of the watermark; the watermark is embedded into the middle-frequency sub band which guarantees the robustness of the algorithm; In order to implement the blind extraction, this paper improves an embedding algorithm based on HVS, which enhances the applicability of the algorithm. This paper tests the algorithm by VC++6.0, and quantity of experiment data shows that algorithm has good robustness, and the imperceptibility of watermark can be guaranteed at the same time. [13]

Pawan Singh Shekhawat (2014) Watermarking technology insert ownership information in suitable form inside any media like audio, video, image etc., so that owner of the object will claim his/her ownership when anyone claim his/her false ownership on that object. Proposed work, proposes a new algorithm for watermark insertion and extraction named as “Non Blind DWT Based Multiplicative SVD Watermarking algorithm” which is new version of the algorithm proposed by Bhargava[8] in his paper “Digital Image Authentication System Based on Digital Watermarking”. In this paper he is utilizing additive approach for watermark embedding and extraction algorithm and proposed algorithm utilize the multiplicative approach also he embeds watermark in one sub-band i.e. approximation sub-band and proposed algorithm utilize all four sub-bands for watermark embedding. [14]

Vinita Gupta (2014)-Digital watermarking is done the act of hiding a message related to a digital signal in different forms like an images, songs, videos within the signal itself. In this paper, we present review on Image Watermarking for Good Robustness .In this paper, we discuss the various factors used in watermarking, properties and application area where water making technique need to be used. Also a survey on the some new work is done in image watermarking field. We surveyed the current literature on digital image watermarking. We classified watermarking algorithms based on the transform domain in which the watermark is embedded. Also, study the watermarking properties, applications and techniques used. This paper shows the different techniques and discusses the important technology called QR code which can be used in future work. [15]

Mohan Durvey (2014) This paper include the detail study of Digital watermarking explanation, concept and the main contributions in this field such as categories of watermarking process that tell which watermarking method should be used. It starts with overview, classification, features, framework, techniques, application, challenges, limitations, quality performance and performance metric of watermarking and a capable Analysis of some major watermarking techniques. In the survey our most important apprehension is image only. [16]

Monika Patel (2014)-The ease of reproduction, distribution, and manipulation of digital documents creates problems for authorized parties that wish to prevent illegal use of such document. To this end, digital watermarking has been proposed as a last line of defense. Digital Watermarking is a data hiding technique where an informations or messages are hidden inside a signal. This method is used for providing copyright protection of digital media. Digital representations of the signals have made the job of Watermarking easier and cost effective, and thus this technology is developing very fast in the media industries also. In this paper we introduced Digital watermarking with its classification. Also we have developed DWT based digital watermarking technique for Images. [17]

Jaishri Guru (2014)-One of most significant property of digital information is that it is in principle extremely easy to produce and distribute unlimited number of its copies. The actuality that an unlimited number of perfect copies of text, audio and video data can be illegally produced and distributed requires to study ways embedding copyright information and serial number in audio and video data Now a day's internet is an essential channel for digital assest, but it has been noticed that someone are misusing by building illegal copies and leaking the information which creates a bad environment in the field of software industry. It can be avoided by doing most excellent efforts using digital watermarking. [18]

VI. PROPOSED WORK

We will take 2 images .First is our original colored image and a second image is our secret color image or watermark color image. It will divide secret color image as well as water color image in its all 3 components and on different components it will apply different transforms as our watermarking technology.

Example: For the first R component of the image it will apply 2 DWT transform to embed watermark in R component. For the second G component of the image it will apply DCT transform to embed watermark in G component. For the third B component of the image it will apply 3-DWT transform to embed watermark in B component. The sequence of RGB and the sequence of transform may be different to generate a secret key.

VII. CONCLUSION

The Digital Watermarking technology is becoming important due to the popularity of usages of images on web. In invisible watermarking technique the watermark is embedded in such a way that the modifications made to the pixel value is perceptually not noticed and it can be recovered only with an appropriate decoding

mechanism.Digital watermarking technology represents a data hiding technique that is used to embed useful information in multimedia object or other work. The proposed technique is classified on different criteria mainly on the domain to spatial domain watermarks, frequency domain watermarks and wavelet domain watermarks .the digital watermarks suffer from different types of attacks that is categorized to state of the art attacks or to estimation based attacks. To detect such attacks a digital watermark agency scheme can be used .the digital watermark technology proved its robustness as protection technique used in many applications such as digital copy right protection .the future of this technology is promising.

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