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Study and Analysis of Domain Based Digital Image Water Marking Techniques: Survey

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Abstract

Due to the modern steps forward in internet technology and evolution of very high-speed networks operating everywhere, security of digital content is must. So, it has become a hard job to protect copyright of an individual's creation. Digital image watermarking (DIW) is usually utilized for copyright protection of virtual facts. The effectiveness of a digital watermarking (DW) approach is indicated by using the robustness of embedded watermarks (EW) against the quantity of assaults. In the present paper, a survey on DW procedure, applications, concept and its offerings in various fields are introduced. There are lots of strategies for watermarking like, discrete wavelet transforms (DWT), and discrete cosine transform (DCT). The ordinary performance aspect of these strategy's peak signal to noise ratio (PSNR), imply rectangular errors (MSE).

Keywords: *Digital wartermaring, digital watermarking techniques, DWT, DCT etc.*

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INTRODUCTION

In most accepted works, in the field of information security is data hiding (DH). DH is normally implemented to solve or protect two issues, proof of copyright protection (CP) and ownership [1]. DIW is effective and best approach which is capable to protect our assets from various kinds of attacks. It covers some secret data in digital images (DI) that is unobserved by the human visual system (HVS). It hides records through slightly modifying their pixels and offers lots of security in host image (HI) like, finger printing CP, possession safety and temper detection (TD). DIW is implemented in two steps:

1. Embedding process, and
2. Extraction process.

Embedding Process

First of all, appropriate picture is selected as a cover image. In the same way, a watermark is also selected. After this, that watermark is embedded in this cover image with the help of a suitable watermark embedding (WE) algorithm. We have discussed about various (WE) embedding algorithms below in this paper. After applying an algorithm, we get the watermarked image (WI) as an output (Figure 1).

Extraction Process

The reason of watermark extraction (WE) process is to extract the watermark from the WI. For attaining the WE algorithm is applied in the reverse order to split the watermark from WI. The extracted watermark can be varying from the unique watermark (Figure 2).

DIGITAL WATERMARKS TYPES

Watermarking strategies are classified into the following:

- On the basis of document that has to be watermarked, LSB watermarking techniques are divided into the four types:
  - Text Watermarking;
  - Image Watermarking;
  - Audio Watermarking; and
  - Video Watermarking.
- In other way, DWs techniques are divided as follows:

Visible Watermark

It is basically a secondary picture that is imposed on original image for protection of that picture. In this, changes that are made to original image are visible. For example Figure 3(a) and (b) shows the original and visible WI.

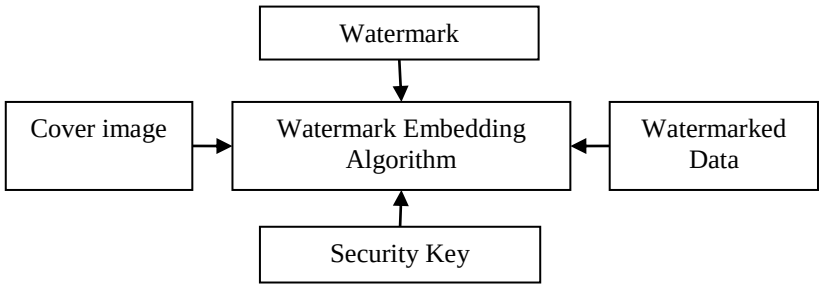

Fig. 1: *Embedding Process.*

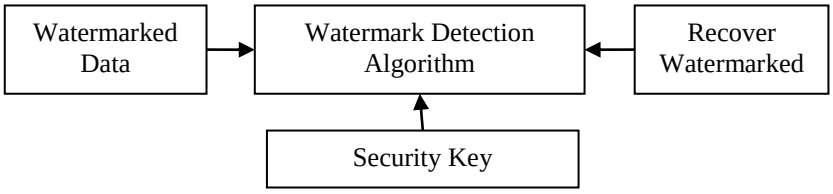

Fig. 2: *Extraction Process.*

Fig. 3: (a) *Original Image;* ***(b)*** *Watermarked Image.*

Invisible-Robust Watermark

In this type of watermarking technique, the changes that are made to original image in the form of a watermark are unnoticeable and the changes made are easily recovered later with the help of suitable decoding algorithm.

Invisible-Fragile Watermark

It is added in digital content and if the added watermark is found to be degraded or altered (Figure 3), it indicates tampering with content or alteration of picture [2].

CLASSIFICATION OF DIGITAL WATERMARKING

Classification of DW to hide the name of the game information, for which many algorithms are being used; these algorithms can be labeled into domains referred to as:

1. Spatial domain (SD) and
2. Frequency domain (FD).

SD watermarking minor implement the pixels of randomly decided on subsets of a picture one or two. On the other hand, the picture is first transformed into the FD by the utilization of any transformation method in FD techniques such as FT, DCT or DWT (Figure 4). Now the info is added to the values of its transform coefficients. After making use of the inverse remodel, marked the coefficients form the embedded picture [3].

Spatial Domain

Least Significant Bit (LSB)

Two kinds of LSB procedure are proposed. Pseudo-noise (PN) sequence can be cast-off to replace LSB of a picture in the first mechanism whereas in the second mechanism a PN sequence was added to the LSB [4].

Patchwork Technique

n pairs of picture points, (a, b), had been arbitrarily chosen in patchwork. The picture

records have been lightened in a while, and darkened in b. Many types of attacks are provided in this method against high level of robustness but here in this technique, very small amount of information can be hidden.

Predictive Coding Scheme

In this approach, a PN sample say, W(x, y) is delivered to cover image (CI). It will increase the robustness of watermark by means of growing the benefit aspect. But due to high increment in gain factor, image quality may decrease.

Frequency Domain

Discrete Cosine Transforms (DCT)

First of all, picture is segmented into non overlapping blocks of 8×8. Then, to each of these blocks, forward DCT is applied. After that, some block selection criteria is applied and then coefficient selection criteria is applied. Then watermark is embedded by modifying the chosen coefficients and ultimately on every 8×8 block, inverse DCT remodel is applied.

$$y(j,k) = \sqrt{\frac{2}{M}}\sqrt{\frac{2}{N}}\alpha_j\alpha_k \sum_{x=0}^{M-1}\sum_{y=0}^{N-1}\{x(m,n) * \cos\frac{(2m+1)j\pi}{2M}\cos\frac{(2n+1)k\pi}{2N}\}$$

$$\alpha_j = \begin{cases}\frac{1}{\sqrt{2}} j = 0 \\ 1 \end{cases} or j = 1,2,\ldots\ldots,N-1$$

$$\alpha_k = \begin{cases}\frac{1}{\sqrt{2}} k = 0 \\ 1 \end{cases} or k = 1,2,\ldots\ldots,N-1$$

Discrete Wavelets Transform (DWT)

It is more commonly used owing to its frequency/time characteristics. In this approach, a picture is handed through a series of low skip and high bypass filters which break up the picture into sub-bands of different resolutions. Picture is split into four parts, one part of original image is a low frequency (LF), the one bottom left is vertical details of the original image, the top right contains horizontal detail of the picture, the lowest proper block incorporates high frequency (HF) of unique picture (Figure 5). This method uses wavelet filters to convert the picture.

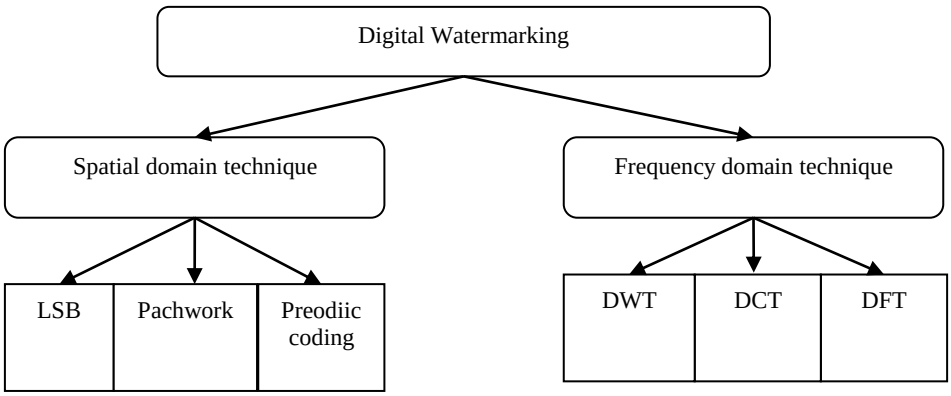

Fig. 4: *Classification of Digital Watermarking.*

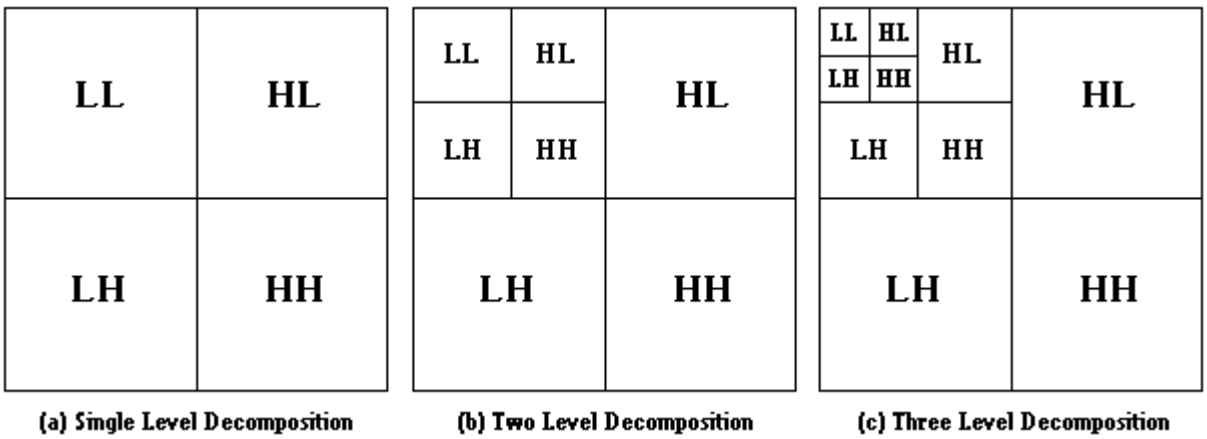

Fig. 5: *Levels of Decompositions.*

Discrete Fourier Transform (DFT)

In this method, a continuous function in time domain is transformed into FD. DFT is invariant, translation rotation and scaling while the spatial domain DCT and DWT does not follow this. So DFT can be utilized to recover the original image from various geometric attacks (GA) such as cropping [5].

$$x(k) = \sum_{n=0}^{N-1} x(n) e^{-i2\pi knn/N}$$

Singular Value Decomposition (SVD)

It takes a square matrix of gene expression records defined as A, where A is an×p matrix wherein the n rows represent the genes, and the p columns represent the experimental conditions.

$An \times p = U_{nxn} S_{nxp} V^T p \times p$

Where,

$U^T U = I_{nxn}$

$V^T V = I_{pxp}$ (i.e. U and V are orthogonal)

Columns U are the left singular vectors or we can say gene coefficient vectors. S denotes singular values (SV), V^T has rows that are the right singular vectors or we can say expression level vectors. An enlargement of the genuine information in a coordinate system where the covariance matrix is diagonal, is described or represented by way of SVD [6].

LITERATURE SURVEY

Raquib *et al*. proposed a singular adaptive DIW model primarily based on changed fuzzy C-method (FCM) clustering [7]. For watermark embedding manner, we used DWT. A segmentation method XieBeni XFCM is used to discover the segments of original image to expose suitable places for embedding watermark. The aim is to cognizance on right segmentation of the picture so that the embedded watermark can face up to not unusual photo processing (IP) assaults and provide protection to DI. Several attacks were performed on the WIs and original watermark was extracted.

According to Kumar *et al*., DW enables us to protect ownership rights on digital multimedia, such as audio, image and video data [8]. DW is digital signal carrying information of the creator or distributor of the media. DW is inserted into digital media in such a way that it is imperceptible to the human eye, but it is visible to a computer. A watermarking assault is any processing which can impair watermark detection. There are one of a kind styles of attacks which can affect the WI which consist of cropping, noise (salt & pepper, Gaussian), rotation etc.

According to Basu *et al.*, digital domain is today's most preferred area for data processing and transmission [9]. In case of data augmentation or authorized replication, copyright protection has become an exigent challenge. Here a SD image watermarking (IW) scheme is developed through a pixel based saliency map where the inadequate nature of human visual system is utilized. The experimental results and a brief assessment with some existing frameworks confirm that this proposed scheme not only makes the information transparent into the cover object but also provides superior robustness and hiding capacity.

Kumaran *et al*. proposed advantages and the working functionalities [10]. This algorithm is verified on different WIs, and it is providing robust and secure results. To measure the effectiveness of this algorithm is to provide embedding and extracting images. PSNR and MSE also calculated the EW pictures. In this, DWT watermarking embedding result images provide the good, secure and robust results. This paper proposed how to process LSB technique.

Furqan *et al*. presented a sturdy and blind DIW technique to obtain CP [11]. In order to guard copyright material from unlawful duplication, diverse technologies were evolved, like key-based cryptographic approach, DW and so on. In DW, a signature or copyright message is secretly embedded in the picture by making use of an algorithm. In our paper, we implement that algorithm of DW by combining both DWT and SVD techniques.

Zong *et al.*, in their paper recommended a novel IW system to take care of these attacks, as good as different customary attacks [12]. In the embedding approach, we first preprocess the HI by way of a Gaussian low-move filter. Then, a secret key is used to randomly decide

on a quantity of grey levels and the histogram of the filtered picture with recognition to these chosen grey levels is built. After that, a histogram-form-associated index is introduced to decide on the pixel agencies with the best number of pixels and a trustworthy band is constructed among the selected and not chosen pixel organizations. A watermark-embedding scheme is proposed to insert watermarks into the chosen pixel organizations. The usage of the histogram-form-associated index and riskless band results in good robustness.

According to Anita *et al.*, at present globally, DW is widely used for picture protection [13]. Among them, IW strategies DWT have extensive variety of capability. Here this paper explains concept of developing new IW. It makes use of the DWT after which develops a DWT SVD procedure. Even DWT has wide range of functionality but when SVD is combined with it, it will enhance the robustness of extracted image.

According to Shoaib *et al.*, the procedure of DW embeds the information called watermark in digital media like picture, video, audio file and so forth, so that it may be claimed for rights [14]. The paper represents the entire software implementation of three-level DWT algorithms and to have more relaxed information, a covert secret is used. The key secret is given to WI for the period of embedding procedure and even as extracting the WI, the equal secret is used. To examine effectiveness of the watermark video, MSE and PSNR parameters are used.

Rajput *et al.* proposed a novel manner for RGB digital watermarking situated on 2-DCT with DWT algorithm [15]. For this use of images, first one is CI and second one is secret picture. For offering higher safety, we worked on RGB factors. In this, we performed on two algorithms first one is 2-DWT and secondly 2-DCT applied on RGB elements. Experimental results show that PSNR, NE value, and PSNR reach up to 56%.

In the paper by Raju *et al.*, a hybrid watermarking manner has been furnished which mixes DCT and DWT to provide the WI [16]. The proposed approach allows us to get noticeable as good as the invisible WI by altering the worth of the scaling factor. Right here in this paper, the perceptibility is measured making use of statistical parameters comparable to PSNR and MSE on distinct values of the scaling aspect. Also, the effectiveness of this process is measured for specific types of attacks on the groundwork of BCR.

COMPARATIVE ANALYSIS

Title	Author	Feature	Result
[1] Lsb Based DIW For Gray Scale Image	Deepshikha Chopra, Preeti Gupta, Gaur Sanjay BC, Anil Gupta	LSB algorithm	PSNR 14.3467
[2] Grayscale Image DW Technology Based on Wavelet Analysis	Qing Liu, Jun Ying	DWT applied up to 3 layers Use blind watermarking approach	PSNR 10.077 MSE 0.2134
[3] A DIW Algorithm Based on Chaos and Fresnel Transform	Zhaoshan Wang, Shanxiang Lv, Yan Shna	Based on Chaos and Fresnel Transform	PSNR 38.17 MSE 39.96
[4] A hybrid SVD DCT Watermarking Technique Based on LPSNR	Fangjun Huang, Zhi-Hong Guan	Achieve high robustness without losing transparency	PSNR 23.97 MSE 0.1385
[5] Blind IW Scheme Based on Wavelet Tree Quantization Robust to GAs	Enping Li, Huaqing Liang, Xinxin Niu.	Bind watermarking robust to common IPorations and GAs such as rotation, scaling. Cropping.	PSNR 12.736 MSE 1.3524
[7] A Rotation Resistant IW Algorithm via Circle	Tan Yuxi, Gao Zhinian, Tang Lei, Sun Peng, Li Yu in	Has a good resistance to against rotation and compression attack	PSNR b19.8363 MSE 3.9827

CONCLUSION

The goal of digital image watermarking (DIW) is to offer better security of host image. Both, the discrete wavelet transform (DWT) and the discrete cosine transform (DCT) methods have been demonstrated to enhance the fidelity of watermarked images and the ability of the watermarked image to oppose attacks, commonly referred to as robustness. The performance of the DIW techniques will be evaluated after testing against different attacks such as Gaussian noise, compression, image processing, and filtering attacks.

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