A Survey Of Digital Watermarking Techniques

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Abstract: Digital watermarking has become a promising research area to face the challenges created by the rapid growth in distribution of digital content over the internet. To prevent misuse of this data Digital watermarking techniques are very useful in which a secret message called as a watermarks which can be a logo or label is embedded into multimedia data imperceptibly which would be then used for various applications like copyright protection, authentication, and tamper detection etc. Based on the requirement of the application the watermark is extracted or detected by detection algorithm to test condition of the data. 

Keywords: Digital Watermarking, Copyright, Authentication.

1. Introduction

The rapid growth in internet has changed many aspects of our lives. The use of internet in day to day life by common people is continuously rising around the world. This is rapidly increasing because it seems natural use internet to provide real time coverage of stories, publishing newspapers, magazines, music, still images would yield commercial benefits by providing a fast and inexpensive way to distribute their work. It becomes very easy to search and develop any digital content on the internet. But there is a serious problem faced about unauthorized and illegal access and manipulation of multimedia files over internet. Everybody can obtain copies of copyrighted multimedia openly at low cost and with no loss of information, while this good for sharing but using them for the commercial profit would be unethical. So problem comes how to share data with protecting owner’s rights.

The protection and enforcement of intellectual property rights for digital media has become an important issue. Digital watermarking to provides way to protect the Intellectual property rights of publishers, artists, distributors and photographers. Watermarking is used for providing a kind of security for various type of data it may be image, audio, video, etc.[2].

The remainder of this paper is organized as follows. Section III provides overview of Digital Watermarking, which Section IV describes the Image Watermarking Techniques. Section V describes Comparative Analysis which contains eighteen types of analysis. Finally section VI concludes this paper.

2. Literature Review

Digital watermarking can be seen as a process to insert a secret message or logo into the original media source by using signal processing method. It provides a high level of security; as the location of embedded information is secret, and the watermark algorithm is also not public. Digital watermarks should be difficult to remove or change without damaging the host signal. Watermarking is used for various applications viz. copyright protection, broadcast monitoring, authentication, fingerprinting.

Watermarking techniques can be classified in various ways. Whether there is the need of the original image for watermark extraction or detection, watermarking is classified to blind, semi-blind and non-blind watermarking techniques. It can be classified on the basis of visibility of watermark, whether visible or invisible. On the basis of how the watermark be embedded in the image; either by changing the pixels i.e. spatial or by transformation domain. Which will be explained below in the paper [1][2][3].

3. Digital Watermarking Overview

3.1 Watermarking Background

Image Watermarking is the technique of embedding of owner copyright identification with the host image...at first it is used in paper mills as paper mark of company. Then it is common in practice up to 20th century. After that watermark also used in the postage stamp and currency notes of any country to ensure there authenticity.

3.2 Basic Model of Digital Image Watermarking

The basic model of digital image watermarking can be divide into two parts; the first part is the watermark embedding process and the second part is the watermark detection process which shown in Figures below.[4]
The original image is transformed by using the concept of Fresnel diffraction plane by distance parameter, and watermark image is embedded after scrambled by chaotic sequence. The watermark image can be retrieved without original image, and there is little changes on the original image after embedding. Chaotic scrambling can encrypt watermark information

Fangjun Huang, Zhi-Hong Guan [11] “A hybrid SVD DCT watermarking method based on LPSNR”. proposed, a watermarking method which combines the singular value decomposition (SVD) and the discrete cosine transform (DCT). In which only the singular values (SVs) of the watermark need to be embedded into the original image for more transparency that can easily be obtained. They proposed method would be quite robust., the local peak signal-to-noise ratio (LPSNR) is adopted in our method to achieve the highest possible robustness without losing the transparency.

Enping Li, Huaqing Liang, Xinxin Niu[12]. “Blind Image Watermarking Scheme Based on Wavelet Tree Quantization Robust to Geometric Attacks”, paper proposes an improved blind image watermarking scheme based on wavelet tree quantization. The wavelet coefficients of the original image are grouped into wavelet super trees. Each watermark bit is embedded using two wavelet super trees. The watermark is extracted according to the statistical difference between two wavelet super trees the proposed algorithm is robust to both common image processing operations and geometric attacks such as rotation, scaling, cropping.

Wang H. et al.[13] proposed a chaotic watermarking scheme for authentication of JPEG images. The quantized DCT coefficients after entropy decoding are mapped to the initial values of the chaotic system, and then the generated watermark information by chaotic iteration is embedded into JPEG compressed domain. Re-quantization operation does not invalidate tamper detection due to direct modification of DCT coefficient after quantization. Extraction is also performed in the compression domain. Extraction is fast and complexity of method is claimed to be low.

Tan Yuxi, Gao Zhirin, Yang Xiaoyuan, Tang Lei, Sun Peng, Li Yu[14] in “A Rotation Resistant Image Watermarking Algorithm via Circle” has proposed A rotation resistant image watermarking algorithm to solve digital image watermarking extracting when rotated with any angle. The algorithm firstly do watermarking with binary serialization, and then divide the source image into several circle area with the center point of the image, segment the circle area according to length of the binary watermarking sequences with certain rules, the binary watermarking sequences embedded in segmentation of circle with modulus algorithm. When watermarking is extracted, corresponding inverse operation of embedded, firstly extracting the binary watermarking sequences from every segmentation of circle, then combined it into binary watermarking, recover the embedded watermarking image. Experimental results show that the algorithm has a good resistance against rotation and compression attack.

Mohamed M. Ibrahim1, Neamat S. Abdel Kader 2, M. Zorkany3, [15] in “A Robust Image Watermarking Technique Based On Image Interlacing” proposed a effective non-blind image watermarking for this problem of overhead of original.

4. Image Watermarking Techniques

Deepshikha Chopra, Preeti Gupta, Gaur Sanjay B.C., Anil Gupta[8] in “Lsb Based Digital Image Watermarking For Gray Scale Image” proposed an invisible watermarking technique (least significant bit) and a visible watermarking technique using LSB algorithm which replaces the least significant bits of pixels selected to hide the information. They applied various attacks on the watermarked image and their impact on quality of images are measured using MSE and PSNR

Qing Liu,Jun Ying(2012) [9],has proposed “Grayscale Image Digital Watermarking Technology Based on Wavelet Analysis” In this paper, firstly, original image is transformed by using the DWT (Discrete wavelet transform) upto the 3-layers, means apply 3 times ,so that image is divided into the different sub band(LL, LH, HL and HH) and watermarked image is embedded into the intermediate frequency sub band. Spread spectrum technology is also used in this paper and blind watermarking technique is used to extract the watermark. Spread spectrum technology provides Secure communications because signal is “hidden” like noise but it increases bandwidth of signal and increases the complexity and also used blind detection technique to extract the watermark is used.

Zhaoshan Wang, Shanxiang Lv,Yan Shna [10] in “A Digital Image Watermarking Algorithm Based on Chaos and Fresnel Transform has proposed, a digital image watermarking algorithm based on chaos and Fresnel transform is proposed.
image interfacing as a new way in the watermarking systems. The performance of this method is compared with the ordinary non-blind watermarking technique over a wide range of images. Simulation results show the effectiveness of the proposed method and robustness against different attacks.

Dr. Mohamed Sathik and S. S. Sukatha [16] has proposed in “An Improved Invisible Watermarking Technique for Image Authentication”, a blind watermarking scheme. According to which, the low frequency subband of wavelet domain and the rescaled version of original image are utilized in the watermark construction process. A scrambled version of watermark is obtained with the help of Arnold Transform. The operation of embedding and extraction of watermark is done in high frequency domain of Discrete Wavelet Transform since small modifications in this domain are not perceived by human eyes.

Keta Raval, Sameena Zafar [17], “Digital Watermarking with Copyright Authentication for Image Communication”, Most watermarking algorithms transform the host image and embedding of the watermark information by robust way. Uncompressed digital images need a lot of storage capacity and bandwidth so efficient image transmission need image compression. The solution is becoming more complex with the growth of data. They propose Digital Watermarking by proposed transform Algorithm based on DCT-DWT watermarking for secure image transmission.

Neeraj Bhargava, M.M. Sharma, Abhimanu Singh Garhwal and Manish Mathuria [18], “Digital Image Authentication System Based on “Digital Watermarking” This research paper introduces a prototype for Digital Image Authentication System (DIAS). This system can perform visible and invisible watermarking on image, which is applicable for color and gray images. The complete system consists of two functions, one for hiding information inside image and other for detecting information from image. In this approach, digital watermarking performed using Discrete Wavelet Transform (DWT) and analyzed its results.

Dr. M. A. Dorairangaswamy [19], “Protecting Digital-Image Copyrights: A Robust and Blind Watermarking Scheme” proposed a The Digital Rights Management (DRM) the proposed scheme is a robust and blind watermarking scheme which can be used to protect the copyrights of digital images. By copyrights of the image by invisibly embedding a binary watermark image into the host image. The proposed scheme embeds binary watermark pixels into host image pixels to construct the watermarked image. As the proposed watermarking scheme is blind, we do not require the original image or any of its characteristics for watermark extraction.

Mei Jiansheng, Li Sukang and Tan Xiaomei [20], “A Digital Watermarking Algorithm Based on DCT and DWT” in this paper proposed an algorithm of digital watermarking based on Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT). According to the characters of human vision, in this algorithm, the information of digital watermarking which has been discrete Cosine transformed, is put into the high frequency band of the image which has been wavelet transformed. Then refine the digital watermarking with the help of the original image and the watermarking image. The simulation results show that this algorithm is invisible and has good robustness for some common image processing operations.

Navnidhi Chaturvedi, Dr. S. J. Basha [21] “Comparison of Digital Image watermarking Methods DWT & DWT-DCT on the Basis of PSNR”, In this paper they have compared watermarking using DWT & DWT-DCT methods performance analysis on basis of PSNR, Similarity factor of watermark and recovered watermark.

Yang, Xiuguang Li and Xiaoyuan [22], in “A blind watermarking algorithm resisting to geometric transforms based on SVD” proposed a watermarking algorithm to resist the geometric transformation based on singular value decomposition (SVD) logrithm polar coordinate is proposed. The log-polar mapping (LPM) is used to resist rotation and scaling attacks, and the odd-even quantization algorithm is used to embed watermark. The algorithm show good resistant to geometric attack and better robustness.

Mingli Zhang, Qiang Zhang, and Changjun Zhou [23] In “Robust Digital Image Watermarking in DWT-SVD”. Proposed a novel robust image watermarking scheme based on discrete wavelet transform (DWT), singular value decomposition (SVD). In which singular values of the encrypt watermark are embedded on the singular values of the important inscribed circle domain of normalized cover image’s DWT sub-bands. The experimental result of the proposed method is good in imperceptibility, and the significant improvement in robustness under geometrical attacks.

Chen Li, Cheng Yang, Wei Li [24] in “Wavelet Bases and Decomposition Series in the Digital Image Watermarking” analyzes and compares the performance of different wavelet bases in the digital image watermarking and the effect of different wavelet decomposition series for the digital image watermarking embedding based on the application of wavelet in the digital image watermarking. The experiments proved the digital image watermarking embedding based on bi-orthogonal wavelet better than others.

Xiong Shunqing, Zhou Weihong, and Zhao Yong [25] in” A New Digital Watermarking Algorithm Based on NSCT and SVD” proposed an new algorithm of digital watermarking based on combining the Non Sub Sampled Contourlet Transform and SVD, they first applied the NSCT to the image and extract the low-frequency sub-band of image, and then decompose the low-frequency sub-band of image by SVD, finally embed the watermarking in the decomposed singular value. The experiment results show that the new algorithm has good ability in standing up to geometric attacking, especially rotation attacks.

5. Comparative Analysis

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6. Conclusion

In this paper we studied the overview of digital watermarking process. In this paper we studied various approaches used and identified features of each of them, by this survey we can say that the different approach is suitable for different uses. We also noticed the that each approaches can designed to robust against specific types of attacks. In the end we presented the table of some paper used for comparison and identified their features.

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