A Review on Digital Watermarking Techniques

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Abstract - Digital watermarking plays very important role in multimedia for several applications such as copyright protection, ownership protection and identification, data authentication, broadcast monitoring etc. The aim of every application is to provide security to the digital information. Digital watermarking is a method of embedding some information with original image in the form of text, image etc. Digital watermarking is a very developing field and widely used in various applications. This paper presents a review on different digital watermarking techniques. The watermarking techniques is mainly two type e.g. spatial domain or frequency domain or on the basis of wavelets.

Keywords - *Digital watermarking, Frequency domain, Discrete cosine Transform (DCT), Discrete Wavelet Transform (DWT).*

I. INTRODUCTION

Digital watermarking is a method of embedding digital data called watermark into a multimedia object in such a way that watermark can be easily detected to make a decision about the objects. It may be classified as visible or non-visible. Example of visible watermarking is the text visible in the background of any document. On the other hand, non-visible watermark is hidden in the object, which can be detected by an authorized person. Such watermarks can use for authentication and preventing unauthorized copying. The digital image watermarking is the best method for multimedia copyright protection problems [1, 2]. Digital watermarking will have a number of useful applications such as digital cameras, medical imaging, image databases, and video on demand systems, and many others. Recently, lot of digital watermarking methods have been proposed, which is based on spatial domain technique and frequency domain technique. These techniques are used in watermark embedding algorithm and watermark extracting algorithm [3].

II. LITERATURE REVIEW

This section presents the methods currently available in the field of digital watermarking. It presents a review of some important work in the field of digital watermarking technique. A survey of the current research is presented as well as an analysis of the current techniques and methods available for digital image watermarking are also presented. In 2009, J. Mei et al. [4] proposed a DWT digital watermarking algorithm based on human vision characters. In this technique, all watermark images is transformed by using DCT transformation. Then this watermark image is inserting into the HF band of wavelet transformation domain. In 2010, C. C. Lai et al. [5] introduce a technique in which the watermark is not inserted directly on the wavelet coefficients but it is on the elements of singular values of the cover image's DWT. In 2012, N. Chaturvedi et al. [8] have compared watermarking using DWT & DWT-DCT method's performance analysis on basis of PSNR.

III. WATERMARKING TECHNIQUES

Digital watermarking techniques may classified in spatial domain-based watermarking, frequency domain based watermarking and feature-based watermarking. In this paper spatial domain-based watermarking and frequency domain based watermarking has described.

A. Spatial domain based technique

In spatial domain based technique watermarking system directly change the main data elements, for example pixels in an image. Most widely used method for this purpose is LSB technique[3].

The image is as a matrix MxN where M and N are the dimensions of the image and the value of the pixel in the position (i,j) is a binary number. This binary number can be divided into a most significant bit (MSB) which contains lot of information and a least significant bit (LSB) which contains very less information. In LSB technique LSB of Original image pixels are replaced by MSB of watermark image pixels.

Following steps are used to perform LSB technique.

1. Select the original image and watermark image.

2. Select number of bits of original image so that it can maintain the quality of the image. Image quality depends on number of bits. If more number of bits are selected then it will diminish the quality of the image.

3. Insert the MSB of watermark image in LSB of original image. For example

(1111 1111 1010)

When a number 101 is embedded into the least significant bits of this part of the image, the resulting grid is as follows:

(1111 1110 1011)

Spatial domain techniques such as LSB are easier to implement, but they are limited in robustness, which is not expected in any watermarking applications. It can applied in simple operation such as cropping or addition of noise.

B. *Frequency domain based Techniques*

Frequency transform domain watermarking technique apply the different transformations on an image like DFT, DCT, DWT etc. and embed the watermark into coefficients by changing coefficients values. Thus techniques in this domain embeds watermark into coefficients rather than in pixel values. Techniques in frequency transform domain are as follows:

Discrete Cosine Transformation (DCT) based image watermarking [9] is a kind of transform whose kernel is in cosine function. It works for complex numbers. It converts an image from spatial domain to transform domain and vice versa. When an image is transformed using DCT it divides given image into 8*8 blocks. Then it finds low and high frequency components by zigzag scanning. And then embeds watermark in low frequency components. This method provides high robustness against JPEG compression. DCT methods lack resistance to strong geometric attacks.

Discrete Wavelet Transformation (DWT) based image watermarking [10] is a decomposition technique that decomposes given image into set of basic wavelets. It provides spatial and transform representation of an image. DWT is suitable technique to identify the area in the image that contains secret image. DWT decompose given image into low and high frequency components and finds high frequency components and embeds an image into high frequency components. In DWT based method frequency resolution depends on frequency so when frequency is corrupted it decreases robustness. DWT multiresolution technique decomposes given image into four sub bands –LL(High scale low frequency components), LH (Vertical low scale high frequency components), HL (Horizontal low scale high frequency components), HH (Diagonal low scale high frequency components) [10]. It embeds watermark into LH and HL bands. This method does not provide strong robustness against different types of geometric and image processing attacks. Discrete Wavelet Transform-Discrete Cosine Transform based hybrid watermarking (DWT-DCT) is hybrid watermarking technique is used that combines DWT and DCT. In this method first DWT is applied on the host image up to different levels followed by DCT and then applies different types of attacks. As the number of level increases size of watermark decreases and PSNR increases [10].In this method mark image is multiplied with deviation of host image so quality degrades very slowly. This method provides high PSNR and can extract high quality and large marks. It does not change the view of host image. This method satisfies the requirements of robustness. Combined Discrete Wavelet Transform (DWT)-Discrete Cosine Transform (DCT)-Singular Value Decomposition (SVD) based watermarking [9] is a combined technique of DWT, DCT and SVD. It combined in a zigzag way to satisfy the requirement of robustness. First DWT is applied on host image which decomposes the given image into four bands. And then DCT is applied on HH band and map the DCT coefficient using zigzag scanning and then applies SVD to get singular value coefficients. Same procedure is then applied on watermark image. Extraction is same as embedding but works in reverse manner. This method provides good robustness. But complexity increases as process of application of DWT, DCT, SVD and IDWT, IDCT, and inverse SVD.

IV.   CONCLUSION

Watermark embedding and extraction algorithms are required for providing copyright protection and ownership identification and other security purpose. This paper presents a brief survey on various digital watermarking techniques in different domains and their requirements. In this paper, different watermarking techniques are classified with their requirements, benefits and limitations. It has been concluded that to minimize distortions and to increase capability, techniques in frequency or transform domain must be combined with other techniques.

V.   REFERENCES

[1]. P. Mahajan and A. Kohl, "CEET: A Compressed Encrypted & Embedded Technique for Digital Image Steganography", IOSR Journal Of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661,p-ISSN:22788727 vol. 16, no. 2, Ver. X (2014) March-April.

[2]. Moniruzzaman et al. "An Image Fragile Watermarking Scheme Based on Chaotic System for Image Tamper Detection", 3rd International Conference on Informatics, Electronics & Vision (2014).

[3]. G. V. Mane and G. G. Chiddarwar, "Review Paper on Video Watermarking Techniques", International Journal of Scientific and Research Publications, vol. 3, no. 4, (2013) April, 1 ISSN 2250-3153.

[4]. J. Mei, S. Li and X. Tan, "A Digital Watermarking Algorithm Based on DCT and DWT", IOSN 978-9525726-00-8, Proceedings of the 2009 International Symposium on Web Information Systems And Applications (WISA'09)Nanchang , P.R. China , (2009), May 22-24, pp. 104-107.

[5]. C.C. Lai and C.C. Tsai, "Digital Image Watermarking Using Discrete Wavelet Transform and Singular Value Decomposition", IEEE Transactions on Instrumentation and Measurement, vol. 59, no. 11, (2010) November.

[6]. G. S. Chandel and P. Patel, "A Review: Image Encryption with RSA and RGB Randomized Histograms", International Journal of Advanced Research In Computer And Communication Engineering, vol. 2, no. 11, (2013), November.

[7]. M. Narang and S. Vashisth, "Digital Watermarking using Discrete Wavelet Transform", International Journal of Computer Applications (0975 – 8887) vol. 74, no. 20, (2013) July.

[8]. N. Chaturvedi and S. J. Basha, "Comparison of Digital Image Watermarking methods DWT & DWTDCT on the basis of PSNR", International Journal Of Innovative Research in Science, Engineering and Technology, vol. 1, no. 2, (2012), December.

[9]. S. S. M. Ziabari, R. E. Atani, K. Keyghobad and A. Riazi, "Digital Image watermarking using Edge Detection and Genetic Algorithm", International Journal of Scientific Engineering and Technology vol. 3, no. 1.

[10]. U. Yadav, J. P. Sharma, D. Sharma and P. K Sharma, "Different Watermarking Techniques And Its Applications: A Review", International Journal Of Scientific And Engineering Research, vol. 5, no. 4, (2014) April.

[11]. Sanju Saini, Arvind kumar, "Speed control of separately excited d.c. motor using self tuned ANFIS techniques", International journal of computer science & technology", Vol. 3, Issue 1, pp. 500-504, March 2012.

[12]. Bipasha Bhatia, Sanju Saini & Narender kumar, " Automatic generation control of multi-area power systems using ANN controller", International journal of Engineering Science and Technology, Vol. 4, No. 7, pp. 3329-3334, July 2012.

[13]. Sanju Saini and J.S. Saini , "Chaotic queue-based genetic algorithm for design of a self-tuning fuzzy logic controller," 6th Global Conference on Power Control & Optimization, 6-8 August 2012, Las-Vegas, U.S.A.

[14]. Vijay Rohilla, Sanju Saini et. al., "Identification of suitable LFC structure optimized by GA with SMES in deregulated environment", International journal of applied engineering research, Vol. 7, No. 11, 2012.

[15]. Megha Tiwari, Sanju Saini et. al., "Multisim Implementation & application of Chua's circuit in secure communication", National conference on contemporary techniques & technologies in Electronics Engineering, D.C.R.U.S.T, Murthal, Sonepat, 13-14 March, 2013.

[16]. Pawan, Sanju Saini, " Matlab Simulation of Chaotic System and its Application in Secure Communication with AWGN Channel", International Journal of Electrical, Electronics and Data Communication, vol. 1, Issue 4,pp. 56-59, ISSN:2320-2084, 2013.

[17]. Snehlata, Mrs.Sanju Saini, "Chaotic Search Based Genetic Algorithm for Economic Load Dispatch Problem", Proc. of Int. Conf. on Emerging Trends in Engineering and Technology, DOI: 03.AETS.2013.3.142_34© Association of Computer Electronics and Electrical Engineers, 2013.

[18]. Rajbala, Mrs. Sanju Saini, " MATLAB Implementation of Memristor based Chua's Circuit and its Chaos Control", Proc. of Int. Conf. on Emerging Trends in Engineering and Technology, DOI: 03.AETS.2013.3.279 © Association of Computer Electronics and Electrical Engineers, 2013.

[19]. Sanju Saini, Dr. J.S.Saini "GA Optimized Time Delayed Feedback Control of Chaos in a Memristor Based Chaotic Circuit", Proceedings of IEEE Symposium on Computational Intelligence for Engineering solutions 2014 , Orlando, Florida, U.S.A, 9-12 Dec. 2014, pp. 74-80.

[20]. Sanju Saini, Dr. J.S.Saini, "Secure Communication Using Memristor based Chaotic Circuit", Proceedings of IEEE International Conference on Parallel, Distributed and Grid Computing, Waknaghat, Solan, H. P., India, December 11-13, 2014, pp.159-163.

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