IJournals: International Journal of Software & Hardware Research in Engineering
ISSN-2347-4890
Volume 3 Issue 11 November, 2015

EFFECTIVE WATERMARKING ALGORITHM TO PROTECT ELECTRONIC PATIENT RECORD USING DCT

Author: G.Pradeepkumar[1]; V.Chandra Prasad [2]; G.Rathanasabhapathy[3]

Affiliation: *Assistant Professor,ECE* [1]; *Assistant Professor,ECE* [2]; *Assistant Professor,ECE* [3]

Nandha Engineering College [1]; *KPR Institute of Engineering and Technology* [2]; *Nandha Engineering College* [3]

E-mail: pradeep17ece@gmail.com[1]*;chandraprasad90@gmail.com* [2]*;rathanamgrs@gmail.com*[3]

ABSTRACT

Due to development of latest technologies in the areas of communication and networking, the present businesses are moving to the digital world for effectiveness, convenience and security. Medical images require special safety and confidentiality because critical judgment is done on the information provided by medical images. Digital watermarking is an emerging technology to protect multimedia data for security purpose. This project suggests a comparative performance of digital image watermarking scheme using Discrete Cosine Transform (DCT) and their performance has been measured by using metrics like PSNR, Quality Index and Elapsed time. Initially, the Medical image is decomposed using image transforms like DCT . Subsequently, the watermark embedding and extraction process are to be performed in frequency domain transform along with LSB substitution algorithm which is of spatial domain. The performance of the proposed watermarking method is explained with the aid of experimental results.

Keywords: Discrete Cosine Transform (DCT), Elapsed time, Least Significant Bit (LSB), Medical image, Quality Index, Peak Signal to Noise Ratio (PSNR).

1. INTRODUCTION

In the recent days, there is a rapid development of the Internet and multimedia systems in distributed environments and the transfer of multimedia and medical documents across the Internet by the digital data owners has become simple. Thus, there is a raise in concern over copyright protection of digital contents [2], [3]. Protection of digital images has gained remarkable significance with the presence of internet. From the last two decades use of internet is rapidly increased in business and medical field towards achievement of effectiveness, easy accessing and security by introducing the digitization in their work. The introduction of image processing tools has increased the susceptibility for illegal copying, alteration, and dispersion of digital images. Against this background, the data hiding technologies for digital data like digital watermarking have attracted enormous attention recently [4].

Digital Watermarking is an important tool in securing images, audio, video signals. Various types of Digital Watermarking techniques are used for several applications. Watermarking is the process of embedding a message data (watermark) such as a secret image, audio or video into another data (Cover object) which is visible to the public [6]. In case of Blind Watermarking technique the secret message image is invisible. If robustness is increased, then computational complexity is also increases. At the mean time it has a capability to embed the bulky data with high imperceptibility and also to produce very high robustness. Watermarking techniques are classified into two types: Spatial domain techniques [7][8] and Transform domain techniques [9][10][11].

In spatial domain technique the MSB of watermark message is embedded directly into the LSB of Cover image i.e., watermark information is embedded directly into images pixels [8]. Considering the Images, Watermarking in the frequency domain methods are the most successful ones [10]. The frequency domain approaches are highly beneficial for Image Watermarking. In Transform domain technique the original cover image is transformed into transform coefficients by using various transforms like DCT, DFT and DWT etc [12].

In this proposed method, watermarking is to be done by using Discrete Cosine Transform (DCT) along with LSB substitution algorithm separately for various medical images and their performance

has to be analyzed by using various parameters like PSNR, Quality Index and Elapsed time.

2. OVERVIEW OF TRANSFORMS

The performance of the proposed scheme has to be been analyzed by using various parameters like PSNR, Quality Index and Elapsed time. Quality index is an metrics which resembles the quality of an image, an algorithm has to be developed in such a way that it is to be maintained both the PSNR and Quality index in a good rate. The Mean Square Error (MSE) and the Peak Signal to Noise Ratio (PSNR) are the two error metrics used to compare image compression quality. The MSE means the cumulative squared error between the compressed and the original image, whereas PSNR denotes a measure of the peak error.

$$MSE=\frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j)-K(i,j)]^2$$

The PSNR is defined as:

$$PSNR = 10.\log_{10}\left(\frac{MAX_I^2}{MSE}\right)$$
$$= 20.\log_{10}\left(\frac{MAX_I}{MSE}\right)$$
$$= 20.\log_{10}(MAX_I) - 10.\log_{10}(MSE)$$

Here, MAXI is the maximum possible pixel values for the image and the pixels are represented by using 8 bits per sample i.e., 255.

Elapsed time is the time difference between CPU time and start time. The elapsed time is given by

Elapsed time = CPU time – Start time

3. PROPOSED METHOD

In the proposed digital image watermarking scheme the watermark is embedded using discrete cosine transform. The algorithm is composed of two processes. They are watermark embedding process and watermark extraction process.

3.1.Embedding Process for DCT

The original image (medical image) is taken and is then resized into 1024x1024 pixels. Similarly, the watermark (EPR Data) is resized into 128x128 pixels. Then, the original resized image is block-processed into 8x8 blocks so as to completely embed the 128x128 watermark on 1024x1024 images. After this, 2D- Discrete Cosine Transform is applied on these 8x8 sub-blocks individually to convert it from time domain to frequency domain. The watermark image is embedded on the 8x8 blocks in the middle frequency band. For embedding watermark, the value of frequency coefficient is changed in-accordance to watermark data. Reversed 2D-DCT is performed afterward on the watermark embedded image to convert from frequency domain to time domain. The final image which is obtained is the watermarked image. This process is shown in the Fig.1.

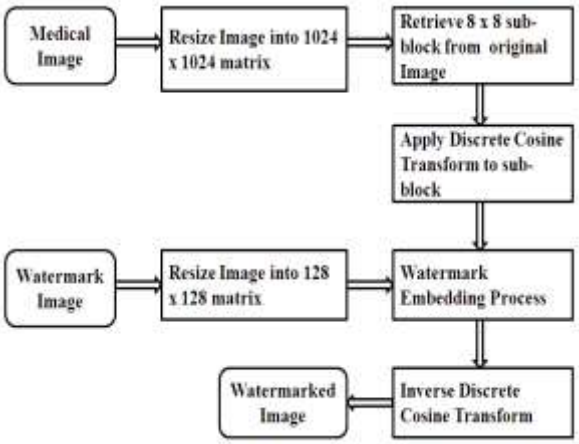

Fig. 1 DCT Watermark Embedding Process

3.2.Extraction Process for DCT

The watermarked image is resized into 1024x1024 pixels if needed. Then watermarked image is again block processed into 8x8 pixels. Then Forward 2D-DCT is applied on the block processed image to have frequency separation. After this, Extraction process is done in the same way as embedding was done in embedding process. Depending upon the comparison done with particular pixels on which watermark data was embedded, decision is make which is stored in again 128x128 empty arrays. Then this matrix is the extracted image which was original watermark image. The watermark extraction process is shown in the Fig. 2.

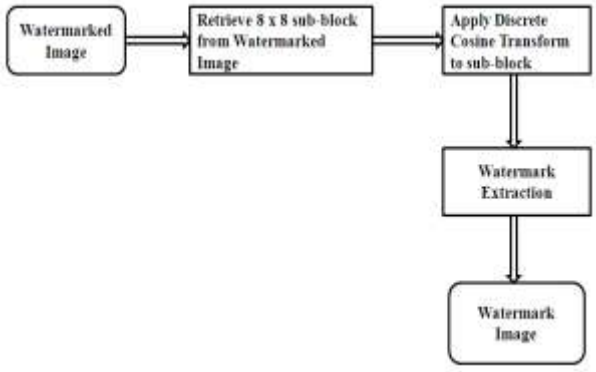

Fig. 2 DCT Watermark Extraction Process

The efficiency of the Discrete Cosine Transform (DCT) and Discrete Wavelet Transforms are applied to various medical images and compares the performance by measuring the various parameters like PSNR, Quality Index and Elapsed time.

4. RESULTS AND DISCUSSIONS

Experiment is performed on various medical images to check the proposed method for imperceptibility and security.

4.1. DCT Transform (Embedding and Extraction)

The watermark embedding and extraction process for DCT using Matlab for various medical images are analyzed. In the embedding process, EPR data is embedded into medical image and then obtained the watermarked image. In the extraction process, the required EPR data is extracted from the medical image. Fig. 3 shows the extraction of EPR data from medical image.

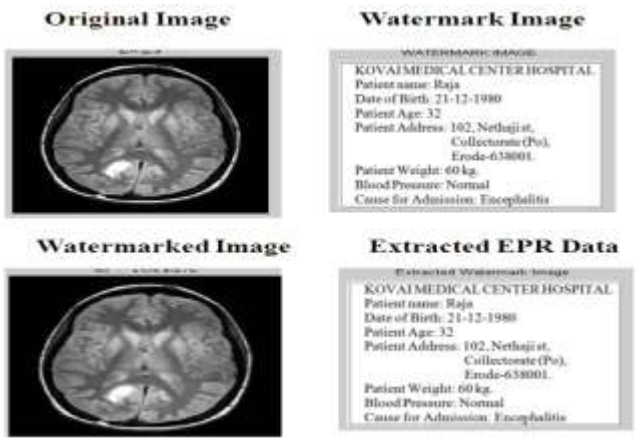

Fig. 3 DCT based Embedded and Extraction for medical image

Table 1.Quality Index for different medical images using DCT

S. No	Medical Image	QUALITY INDEX for Recovered Image	
		EPR Data	Medical Image
1	Image 1	0.862	0.869
2	Image 2	0.846	0.854
3	Image 3	0.834	0.849
4	Image 4	0.859	0.865
5	Image 5	0.849	0.862

Table 2.PSNR Values for different medical images using DCT

S. No	Medical Image	PSNR (dB)	
		Watermarked image	Recovered Image
1	Image 1	55.28	54.29
2	Image 2	54.94	54.62
3	Image 3	56.54	55.32
4	Image 4	55.58	55.16
5	Image 5	55.94	55.34

5. CONCLUSION

The proposed method, watermark data is embedded into medical image in the middle frequency band and then extract watermark (EPR) data from the medical image using DCT transform. From the table, it is has been understand that PSNR value for embedded and extracted image using DCT approaches 55 dB.As Quality Index is concerned, the above table shows that DCT is more effective. Thus, the proposed DCT watermarking method is proven to be effective by providing better PSNR value without degrading the quality of the image. In future, the proposed method is subjected to noises to analyze their robustness.

6. REFERENCES

[1] A.Umaamaheshvari and Dr.K.Thanushkodi," An Effective Watermarking Scheme for Medical Images Using HybridTransform (DCT- DWT) vol.5 no(1-4). 2011 in IJCSES

[2] A. Piva, F. Bartolini, and M. Barni, "Managing copyright in open networks," IEEE Transactions on Internet Computing, Vol. 6, No. 3, pp. 18–26, May–Jun. 2002.

[3] C. Lu, H. Yuan, and M. Liao, "Multipurpose watermarking for image authentication and protection," IEEE Transactions on Image Processing, Vol. 10, No.10, pp. 1579–1592, Oct. 2001.

[4] Tosihiro Akiyama, Fumiaki Motoyoshi, Osamu Uchida and Shohachiro Nakanishi, "Hybrid Digital Watermarking For Color Images Based On Wavelet Transform", 2006.

[5] Memon, N. and Wong, P., "Protecting Digital Media Content" In: Communications of ACM, Vol. 41, No.

7, pp. 35-43, July 1998.

[6] G. Voyatzis and I. Pitas, "The use of watermarks in the protection of digital multimedia products," IEEE Proceedings, Vol. 87, No. 7, pp 1197-1207, July 1999.

[7] Mohsen Ashourian, "A new mixed spatial domain watermarking of three dimensional triangle mesh", Proceedings of the 4th international conference on Computer graphics and interactive techniques in Australasia and Southeast Asia, pp: 251 - 255, 2006.

[8] Ahmad, S., Zhe-Ming Lu, "Intelligent Watermark Recovery Using Spatial Domain Extension", in Proceedings of the International Conference on Intelligent Information Hiding and Multimedia Signal Processing, IIHMSP '08, pp: 735-739, 2008.

[9] Xinghao Jiang, Tanfeng Sun and Jianhua Li, "A Novel Original Streaming Video Wavelet Domain Watermarking Algorithm in Copyright Protection ", Lecture Notes in Computer Science, Springer Berlin, Vol : 5353, pp: 891-893, 2008.

[10] Srdjan Stankovic, Irena Orovic, and Nikola Zaric, "Robust Speech Watermarking Procedure in the Time-Frequency Domain", Journal on Advances in Signal Processing, pages: 9, 2008.

[11] G.S.El-Taweel, H.M. Onsi, M.Samy, M.G. Darwish, "Secure and Non-Blind Watermarking Scheme for Color Images Based on DWT", GVIP Special Issue on Watermarking, 2007.

[12] Coatrieux, G., Maitre, H., Sankur, B., Rolland,Y., Collorec, R., "Relevance of watermarking in medical imaging", in Proceedings of the IEEE EMBS International Conference on Information Technology Applications in Biomedicine 2000, pp. 250–255, 2000.

[13] Trichili, H., Boublel, M., Derbel, N., Kamoun, L., "A new medical image watermarking scheme for a better tele-diagnosis", in Proceedings of the IEEE International Conference on Systems, Man and Cybernetics, Vol.1, pp. 556–559, 2002.

[14] Xiang-Yang Wang and Hong Zhao, "A Novel Synchronization Invariant Audio Watermarking Scheme Based on DWT and DCT", IEEE Transactions On Signal Processing, Vol. 54, No. 12, December 2006.

[15] Sunita V Dhavale, and Suresh N Mali "High Capacity Robust Medical Image Data Hiding using CDCS with Integrity Checking", International Journal of Recent Trends in Engineering and Technology, Vol. 3, No. 2, 2010

[16] Mustafa Ulutas, Guzin Ulutas, Vasif Nabiyev V, "Medical Image Security and EPR hiding using Shamir's secret sharing scheme", Journel of Systems and Software, Vol.3, pp.935-938, 2011.

[17] Hossein Rahmani, Reza Mortezaei and Mohsen Ebrahimi Moghaam,"A New Robust Watermarking Scheme to Increase Image Security", EURASIP journel on Advances in signal processing, Article Id 428183, 2010.