

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 9, September 2017

A Secure Image Watermarking Technique Based On DWT-DCT

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ABSTRACT: A digital watermark is a digital data embedded into a digital document for example text, graphics or multimedia and keeps data unique to the copyright holder, the maker of the document or the certified consumer. The major applications of the Digital Image watermarking are mostly for authentication, recognition and copyright safety. The Digital watermarking is a method of inserting one signal hooked on another signal. The implementation is completed by using both the spatial and frequency domain for the mission of information hiding. The algorithms use the concept of Least Significant Bit (LSB) substitution, Discrete Wavelet Transform (DWT), Discrete cosine transform (DCT) etc. Certain Parameters like Peak Signal-to-Noise Ratio (PSNR), Mean Square Error (MSE) and Signal-to Noise Ratio (SNR) are the performance parameters used for the study and judgment among the techniques. The capability of every algorithm is too noted and the outcomes are obtained by using software as Matlab. With this paper, we have presented a Digital Image Watermarking, which is based on DWT-DCT Methodology. With the help of this technique, we can do safe image transmission.

KEYWORDS: Digital Watermarking, Peak Signal to Noise Ratio, Discrete Wavelet Transform, Discrete Cosine Transform, Mean Square Error.

I. INTRODUCTION

At the current time, the ability in contemplation of accessing and sharing the images has turned out to be increasingly simplistic with the Internet that allows people to obtain the data remotely from any place in the whole world. Furthermore, there has been also the development with regard to the number of the motionless digital pictures over the internet for the sake of the actuality that the huge number of people are capturing digital pictures. This mentioned fact could carry forth the necessity for people to protect their personal images or intellectual property. As given the motivation to defend intellectual property, Digital Watermarking technique has been taken to be fit for receiving as a type of copyright protection and to prevent those that has such a goal in order to obtain a hold of such type of multimedia info or data either picture disproportionately [1].

Basically, the process or practice of digital watermarking can be described as the technique for inserting information into a different signal (a digital signal). The watermark technology protect the ownership of the multimedia entity [2]. In case of digital images, the inserted or embedded info can be either visible or invisible from the user. The major purpose of digital watermark is to give copyright protection for intellectual property i.e. in the digital format. Typical usage scenarios for the process of watermarking are copyright protection and data validation.

II. RELATED WORK

Image watermarking is an efficient technique for the purpose of hiding the data into the image. It is the safe technique for the trustworthy communication. This paper is basically based on image watermarking technique for rising the safety

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of the data. Numerous different image watermarking technique have been projected to improve the safety of the images.

In the year 2009 **Ben Wang, Jinkou Ding, Qiaoyan Wen, Xin Liao, Cuixiang Liu** [3] contributed their efforts in the field of Image Watermarking using DWT DCT and SVD. Based on the dissimilar algorithm like DWT, DCT and SVD, they suggested a new and innovative watermarking technique for digital image. Their experimental outcome shows that this algorithm combines the benefits of these three algorithm. It can assure the imperceptibility and toughness very well. Besides this, the algorithm is strong to the ordinary image procedure such as JPEG compression, noise etc. Thus, the proposed technique compared with the SVD and the DCT+SVD algorithms, in which their algorithm has stronger robustness and quicker speed in embedding and extracting process.

In the year 2010, **Munesh Chandra, Sikha Pandey** [4] introduced a combined algorithm of DFT-DWT for Invisible Blind Watermarking Techniques. Through their proposed method, they proposed a frequency based invisible blind watermarking method that make use of DFT and DWT transform for copyright security of digital images. The suggestion of applying two transform is fully based on the fact that combined transforms could pay costs for the drawbacks and demerits of each other, resulting in efficient watermarking.

Yanyan Han and Wencai He [5] in 2013 explains the dual watermarking algorithm that is based on the technique of DWT and VCS. This dual watermarking technique takes the benefit of the characteristics of the VCS method and DWT algorithm to enhance the safety and robustness of the watermarks.

Jobenjit Singh [6] in 2013 presented review paper that describes the procedure of the image watermarking, its applications as well as its properties .This paper basically reviewed the research work that has been done on the Digital Image Watermarking. It also presented the fundamental model for embedding and extraction of watermark. After that, it mentioned the attribute of the watermarking scheme. Then after it listed a number of the applications of Digital Image Watermarking. Lastly, the possible attacks on Digital Image Watermarking has been described.

At last, In the year of 2016 [7] **Maruturi Hari Babu Ch. Hima Bindu, K.Veera Swamy** proposed a technique that is "A secure and Invisible Image Watermarking Scheme Based on Wavelet Transform in HSI Color Space". The proposed method has confirmed with a variety of resolutional images. Experimental outcome has shown an improvement over existing and previous methods in terms of Peak Signal to Noise Ratio (PSNR) and Mean square error (MSE).

III. BASIC MODEL OF DIGITAL IMAGE WATERMARKING

Digital Image Watermarking can be defined as a pattern of bits embedded into a digital image that helps us to recognize the file's copyright info (the author, and the rights, etc.).The basic model of Digital Image Watermarking comprises of two parts: the first one is the Watermark Embedding Procedure as shown in Fig 1 and the second part consists of the Watermark Extraction Procedure [6] as shown in Figure 2 below.

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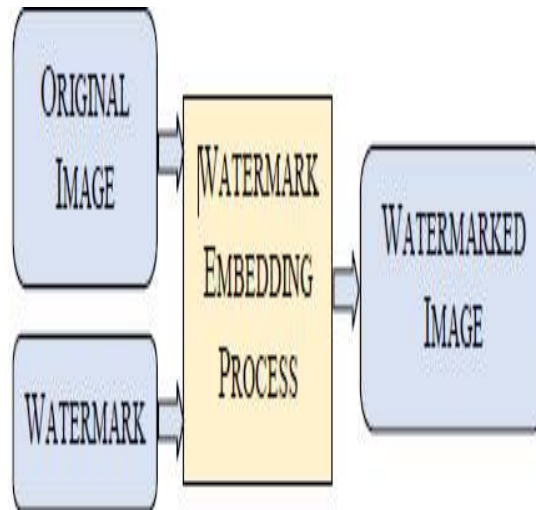


Fig.1:Watermark Embedding procedure [6]

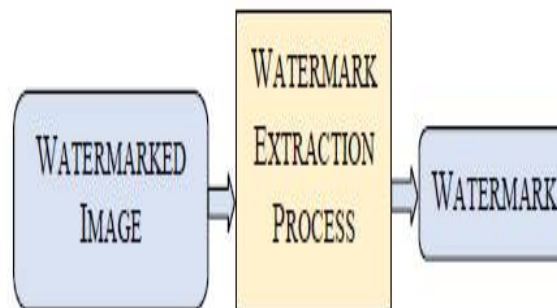


Fig.2: Watermark Extraction procedure [6]

Watermark Embedding Method shown in Fig 1 above is a process of embedding watermark into host image. The outcome is the Watermarked image. The whole process is carried out at sender's area. In Fig 2 at receiver side, the Watermark Extraction Procedure detect the watermark from the Watermarked image.

IV. PROPOSED METHODOLOGY

Now the next is discussion on the methodology (DWT-DCT technique) that is used in this paper and it is as follows:

❖ DWT-DCT Technique

In this work, the methodology that has been applied is an original image is taken as a sample input data (512*512) and 256*256 gray scale image as a secret data has been embedded into a color reference image. As we all know that a normal color image consists of the RGB color space and therefore to use them for watermarking technique they have to be split out and would be processed independently.

In this methodology, a Reference image is taken and DWT has been applied on host image and DCT has been performed on 256*256 gray scale secret image to get watermarked image.

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(a) Watermark Embedding:

Step I: The first step starts with is to call the inputs that is the Reference Image.

Step II: The next step of this will be to make sure about the dimensions of the Reference image and it should be resized into 512X512.

Step III: After that, process the image will be divided based on the RED, GREEN and BLUE component and will be processed independently but under the same procedure.

Step IV: Now the technique consists of the DWT-DCT approach where the Red, green and blue channel is first exposed to the DWT equation that decompose the image into four sub bands which is LL1,LH1,HL1,HH1

Step V: Then apply second level of decomposition on LL1 of red, green and blue channels, which give again four sub bands, that is LL2, LH2, HL2and HH2.

Step VI: Select Secret Image and resize it into 256 X 256.Then,if the image is colored, convert it into Gray scale image.

Step VII: After that procedure, the DCT technique is applied on secret image, which is 256*256 grayscale image.

Step VIII: Separate it into 8 sub parts , and embedding algorithm is applied.

Step IX: Apply IDWT to obtain a Level 1 Low -low frequency band.

Step X:Again, apply IDWT to obtain reconstructed image.

Step XI: Obtain the three constructed layer and concatenate all the layers to obtain the RGB original image with watermark behind it.

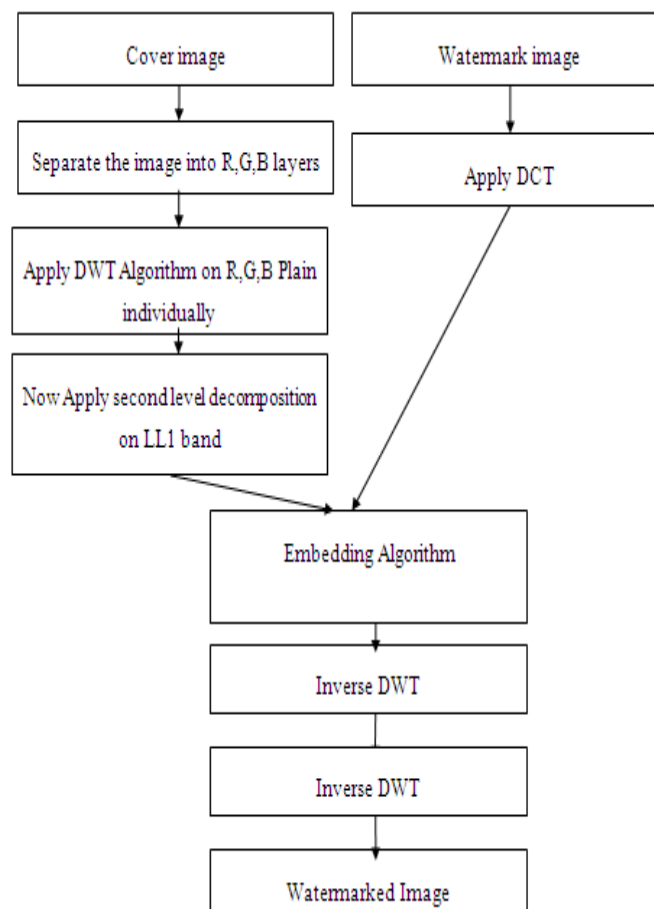


Fig.3 Flowchart of Embedding process

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(b) Watermark Extraction:

Step I: Take the watermarked image as input.

Step II: Now the image will be divided based on the RED, GREEN and BLUE component and will be processed independently but under the same procedure.

Step III: Now, Apply DWT on Red, Green and Blue channel of watermarked image that decompose the image into four sub bands which is LL1, LH1, HL1, HH1

Step IV: Then apply second level of decomposition on LL1 of Red, Green and Blue plane, which give again four sub bands, which are LL2, LH2, HL2 and HH2.

Step V: Recall embedding process in reverse order.

Step VI: Reshape matrix to its original form, which is 256 * 256.

Step VII: Apply Inverse DCT on image to get extracted image.

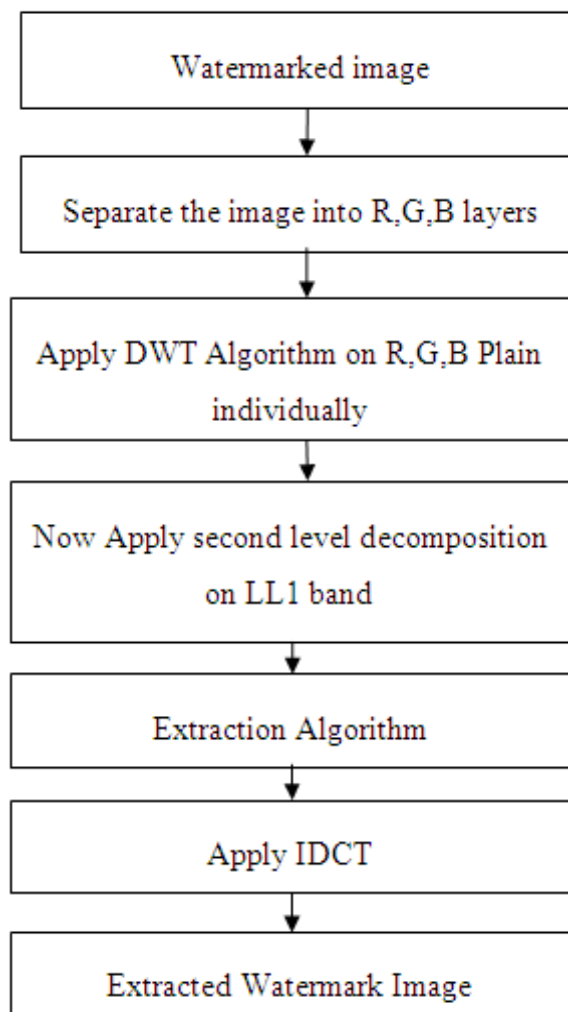


Fig.4 Flowchart of Extraction process

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The above flowchart is showing the entire process of embedding and extraction process using DWT-DCT techniques used in our research work. The figure 3 shows how to embed cameraman.jpg grayscale image into Lena.jpg image. Figure 4 describe how to obtain cameraman image again from watermarked image.

V. RESULTS AND DISCUSSION

For testing performance of this DWT-DCT proposed algorithm the experiments result is simulated with the help of software MATLAB(R2017a).In the following experiments, color images as "lena.jpg" and "pepper.jpg" is used as host image and "cameraman.jpg" which is 256 X 256 grayscale image is taken as secret image for embedding purpose.



Fig.5: (a)-(b) original image ;(c) watermark image; (d)-(e) watermarked images; (f)-(g) are the watermark extracted image,

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(h)- (m) Red, Green and Blue component of Watermarked image of Lena and pepper

Above pictures includes original image, watermark image, watermarked image, its extracted image and R,G,B component of watermarked image. First two picture are Lena and Pepper which has been used as reference image whose size is 512 *512. Third image is taken as grayscale cameraman image whose size is 256*256. Forth and Fifth are the final watermarked image for Lena and Pepper. Next two images are extracted image of cameraman from Lena and Pepper. And at last images from (h) to (m) are the Red, Green and Blue component of watermarked images in which first three are for Lena and last three are for Pepper.

TABLE 1:
REPRESENTATION OF RESULTS OBTAINED FROM IMPLEMENTED ALGORITHM (DWT-DCT)

Performance Parameter of Proposed Methodology(DWT-DCT)									
Images	PSNR	MSE	FSIM	SNR	IQI	SSIM	MAE	PCC	Robustness
Lena	97.8140	1.0757e-05	0.9709	-4.6222e-04	0.9998	0.9802	6.9232	7.8145e+05	0.9981
Greens	75.7500	0.0017	0.9441	-0.0846	0.9923	0.8908	20.5468	7.6196e+05	0.9864
Pepper	116.5815	1.4287e-07	0.9870	-0.0026	0.9926	0.9963	3.3328	7.8567e+05	0.9995
Trees	87.1082	1.2655e-04	0.9606	-0.0240	0.9974	0.9569	11.1416	7.8158e+05	0.9977
Fabric	80.3584	5.9874e-04	0.9383	-0.0064	0.9980	0.9459	17.5825	7.6598e+05	0.9928

The above Table no 1 shows the performance parameter of proposed methodology i.e. DWT-DCT technique. The accompanying Table 1 shows the different quality measures for various pictures. Here, MSE is Mean Square Error; PSNR is Peak Signal to Noise Ratio; FSIM is feature similarity index; PCC is Pearson correlation coefficient; IQI is Image Quality Index, MAE is Mean Absolute Error; SNR is Signal to Noise Ratio; SSIM is Measure of Structural Similarity Index. The table no 2 below shows the Comparison between Previous [7] and proposed methodology in terms of PSNR and MSE.

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TABLE 2:
COMPARISON OF PSNR AND MSE BETWEEN EXISTING METHOD [7] AND PROPOSED METHOD

Images	Existing Method [7]		Proposed Method (DWT-DCT)	
	MSE	PSNR	MSE	PSNR
Lena	0.0409	59.4482	1.0757e-05	97.8140
Pepper	0.0694	57.4758	1.4287e-07	116.5815

VI. CONCLUSION

Experiment results obtained shows that the proposed methodology, which is DWT-DCT transform, enhanced the performance of the watermarking technique. From the Observation Table, we can see that proposed algorithm achieved the acceptable range of PSNR for watermarked images. Previous Method [7] gave less PSNR performance compared to our proposed methodology.

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