3rd Level Image Hiding Technique Using Alpha Blending Method

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Abstract: We have implemented a robust watermarking technique for the copyright protection based on 3rd level DWT. In this technique a multi bit watermark is inserted into the low frequency sub bands of a cover image by using modified alpha blending technique. The insertion and extraction of the watermark in the gray scale cover image is found to be simpler than other transform technique. The proposed method is compared with statically parameters such as PSNR & MSE. The experimental results demonstrate that the watermarks generated with the proposed algorithm are imperceptible and the inferiority of watermarked image and the recovered image are enhanced.

Key words: Image watermarking, 3rd level DWT, MSE, PSNR

I. INTRODUCTION

At the presence time, the capacity in observation of accessing as well as sharing images has becomes increasingly facial with the internet allowing people to procure information remotely from anywhere in the entire world. Moreover, there has been also development with regard to the number of the digital images over the internet for the sake of the fact that a vast number of millions of people are capturing digital photos. This mentioned fact could bring forth the requirement their own images for people to protect their own images or intellectual properties. Digital watermarking technology has been referred to as fit for acceptance as a form of copyright protection and a preventing those who have such an ambition in order to get a hold of such multimedia data either image disproportionately.

In digital watermarking method to be valuable it should imperceptible and robust to common image manipulation like filtering, compression, cropping, scaling, rotation, collusion attacks among many others digital signal processing operation. Current watermarking technique are mainly grouped into two major classes : spatial domain and frequency domain watermarking.

When comparing spatial domain technique frequency domain watermarking technique proved to more effective with respect to achieving the imperceptibility and robustness requirement of digital watermarking algorithm. Commonly used frequency domain transform includes DWT, DCT, and DFT. However DWT has been used in digital image watermarking more commonly due to its superiority spatial localization and multi resolution characteristics which are similar to the theoretical model of the human visual system. Further performance improvements in DWT based digital image watermarking algorithms could be obtained by increasing the level of DWT.

II. LITRETURE REVIEW

Here in this section we will study the review of digital watermarking used for image. It describes the earlier work which has been done on digital image watermarking by using DWT and other techniques as well as the analysis of a variety of watermarking schemes and their results.

A.H.Taherinia[2] proposed a discrete cosine based watermarking scheme based on spread spectrum communications. He computes the DCT of non overlapping 8*8 blocks of host image than using DC coefficients of each block of host image and constructs a low resolution approximation image. They apply block based DCT on this approximation image and a PN sequence is added into a high frequency for detection. They extract the approximation image from the watermark image then same PN sequence is generated and its correlation is computed with high frequency of the watermarking approximation image the simulation results show by this technique has good robustness for some common image processing operations.

Darshna Mistry[3] introduced digital watermarking methods in spatial domain and transform domain methods. The spatial domain is the normal image space in which a change in position in image directly projects to a change in position in space. Exp: Least Significant Bit (LSB) method. Transform domain method produced high quality watermarking image by first transforming the original image into frequency domain by the use of Fourier transform DCT or DWT . Author found that watermarking is comparatively much better than spatial domain encoding.

M.S.S.BABU [4] introduced the algorithm of discrete wavelet transform and hackle transformed combine is develop to achieve the integrity authentication of colour image contents through embedding watermarking. Firstly, a new watermarking image is generated with the XOR between the original binary watermarking and the image which is processed with Henkel transformed .when the watermark is embedded, the original image colour is converted first and the brightness component is decomposed into its three discrete wavelet. Then, the low frequency approximation sub image of third level is extracted and its least significant bit is 0. Finally new watermark is embedded into its least significant bit. Through comparing the pixels of original watermarking image with that of the extracted watermarking image, it can be determine whether the watermarking

image has been tamper, and the tamper area of the original colour image is located. This algorithm has strong capabilities of detection and location and its keep the original image quality well.

Ali Al Haj [5] introduced combined discrete cosine transform and discrete wavelet transform watermarking algorithm. They first used discrete wavelet transform and wavelet transform and after that he done with the combination. When he used combined DCT and DWT algorithm at that time he gated good results.

Mei Jiansheng [6] introduced a dwt algorithm based on human vision character by using the block technology. Watermarking signal is embedded into high frequency band of wavelet transform domain and before embedding this watermark image has been DCT in order to improve its robustness. He got that robustness against many common images processing operation of filter, sharp enhancing, adding salt noise, image compression, image cutting and so on. This algorithm has strong capabilities of embedding signal and attacks.

Surya Pratap Singh[9] introduced a robust watermarking technique for colour and gray scale image. In the proposed technique the watermark is embedded in 3rd level of DWT and before embedding the watermark image is passed through chaotic encryption process for its security, other important thing is that in the proposed method watermark is embedded in the form of DCT with special coefficient shifting algorithm to minimize the impact on main image. The simulation result shows that the proposed method gives very good results and the watermark is resilient to many types of attack.

Chiou-Ting Hsu[10] introduced an image authentication technique by embedding digital watermark into image is proposed. He embed the watermark with visually recognizable patterns into the images by selectively modifying the middle-frequency parts of image. Several variations of the proposed method will be addressed. The proposed technique successfully survives image processing operation.

Nikita kashyap[1] proposed method based on DWT and alpha blending technique. They implemented the digital watermarking technique by using DWT and by comparing results of statically parameter they got the better result

III. DISCRETE WAVELET TRANSFORM

Wavelet transform is a time domain restricted analysis method with the window's size fixed and forms convertible. There is quite good time differentiated rate in high frequency part of signals DWT transformed. Also there is quite good frequency differentiated rate in its low frequency part. It can refine the information from signal [7].

The fundamental proposal of discrete wavelet transform (DWT) in image process is to multi-differentiated decompose the image into sub-image of different spatial domain and self-determining frequency bands. Then transform the coefficient of sub-image. After the original image has been DWT transformed, it is decomposed into 4 frequency bands which is one low-frequency band(LL) and three high-frequency band(LH,HL,HH). If the information of low-frequency band is DWT transformed, the sub-level frequency band information will be obtained. A 2D image after 3-times DWT decomposed can be shown as figure.1. Where, L represents low-pass filter, H represents high-pass filter. An original image can be decomposed of frequency band of HL1, LH1, and HH1. The low-frequency band information also can be decomposed into sub-level frequency band information of LL2, HL2, LH2 and HH2. By doing this the original image can be decomposed for n level wavelet transformation [8]

The information of low frequency band is an image close to the original image. Most signal information of original image is in this frequency band. The frequency band of LH, HL and HH respectively (Figure 1) represent the level detail, the vertical detail and the diagonal detail of the original image.

According to the nature of HVS, human eyes are sensitive to the change of smooth band of image, but not sensitive to the insignificant change of periphery, profile and line. Therefore, it's tough to aware that putting the watermarking signal into the large amplitude coefficient of high-frequency band of the image DWT transformed. Then it can carry more watermarking signal and has good concealing effect [7].

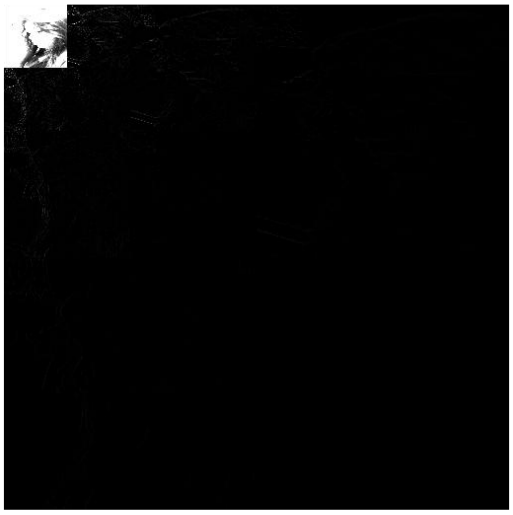


Figure 1. Two-dimensional image after three-times DWT decomposed

IV. PRAPOSED WATERMARKING TECHNIQUE

Based on DWT technique, we recommend a new watermarking method for inaccessible multimodal biometric verification system. The planned method is divided into two parts, watermark insertion and watermark extraction.

A. Watermark Insertion Process

In this process first of all the gray scale cover image is occupied and 2-Dimentional, 3-level DWT (Discrete Wavelet Transform) is apply to the image which decompose image into low frequency and high frequency apparatus. In the same approach 2-Dimentional, 3-level DWT is also apply to the watermark image which is to be inserted in the cover image. The wavelet used here is the wavelets of haar family. The method used here for inserting the watermark is alpha blending [1,9]. In this method the decomposed apparatus of the cover image and the watermark are multiplied by a scaling factor and are added. Since the watermark inserted in the low frequency approximation component of the cover image. According to the formula of the alpha blending the watermarked image is given by bands LL3, LH3, HL3, and HH3.

$$WMI = q * (LL3) + k* (WM3) \quad (1)$$

Where WMI = low frequency component of watermark image, LL3 = low frequency component of the cover image obtained by 3-level DWT, WM3 = low frequency component of Watermark image, and q, k = Scaling factors for the cover image and watermark respectively. After inserting the cover image with watermark image,

3-level Inverse discrete wavelet transform is applied to the watermarked image coefficient to produce the final protected watermarked image. Figure 2 shows watermark insertion process.

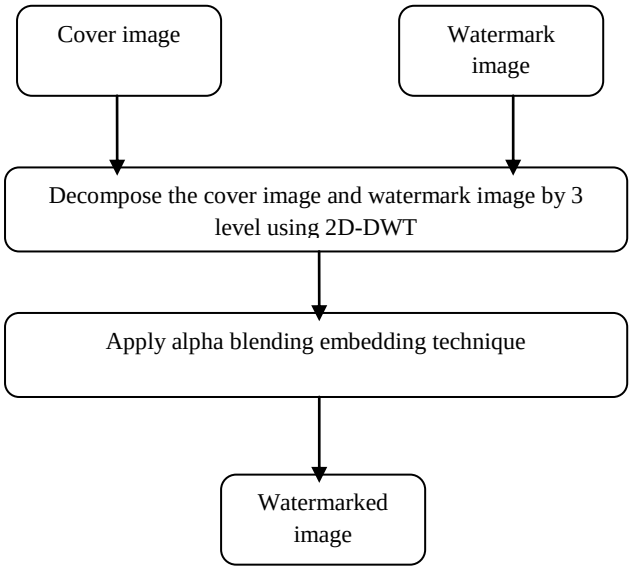


Figure 2 watermark insertion process

B. Watermark Extraction

In this process first of all 3-level DWT is applied to watermarked image and cover image which decomposed the image in sub-bands.

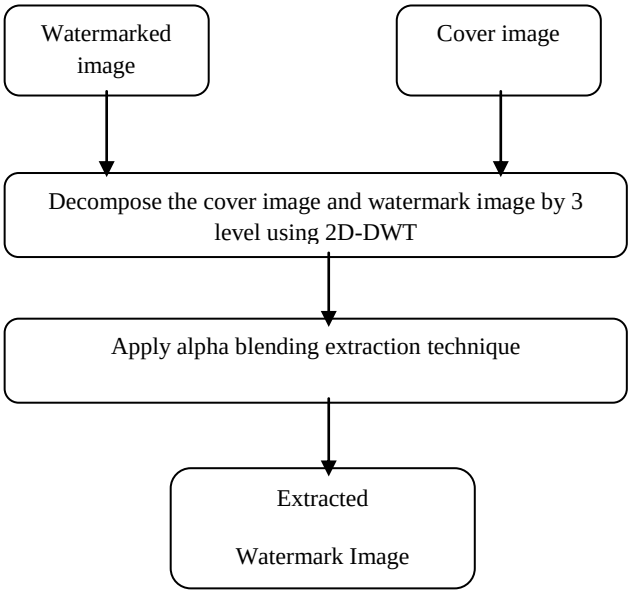


Figure 3 watermark extraction technique

After that the watermark is extract from the watermarked image by using the equation (2) of the alpha blending [1]. According to the equation (2) of the alpha blending the extracted image is given by

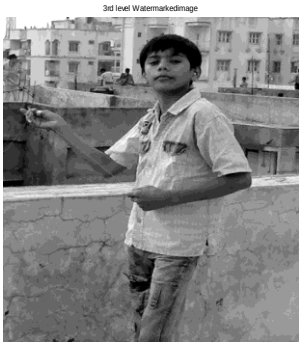
$$EW = (WMI - q * LL3) \quad (2)$$

Where EW= Low frequency approximation of extracted watermark, LL3= Low frequency approximation of the cover image, and WMI= Low frequency approximation of watermarked image. After extraction process, 3-level Inverse discrete wavelet transform is applied to the watermark image coefficient to produce the final extracted watermark image. Figure 3 shows the watermark extraction process.

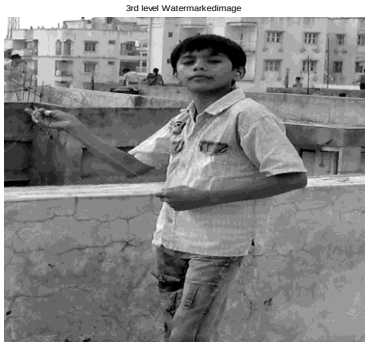
V. EXPERIMENTAL RESULTS

We have taken cover image and watermark image which we have shown in figure 4.

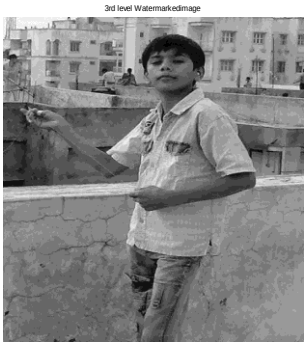
Figure 4. cover and watermark image



(a) For q=0.0001 & k=1.2



(b)For q=0.0001 & k=0.97



(b)For q=0.0002 & k=0.7

Figure 5. Watermarked image by applying 3-level DWT for various values of scaling factor

(a) For q=0.0001 & k=1.2

(b)For q=0.0001 & k=0.97

(c) For q=0.0002 & k=0.70

Figure 6. Extracted image by applying 3-level DWT for various values of scaling factor

Here we have taken cover image and the watermark image for the simulation. We have taken both the greyscale image and both the images are same size of 512*512.figure 4 shows the cover image and watermark image.
For insertion of watermark in the cover image the value of scaling factor k is varied from 2 to 0.1by keeping q constant and best results is obtained for k=0.97 and q=0.0001.

As the value of k is decreased further to 0.1 the watermark image becomes dark and finally invisible. Figure 5 shows the watermark image by applying 3-level discrete wavelet transform for different value of scaling factor.
For the process of extracting the watermark from the watermarked image the value of k constant and q is varies from 2 to 0.1.for the higher values of q the watermark becomes almost imperceptible and as the value of q is decrease best result is obtained, and if q is further decrease the recovered watermark becomes darker and PSNR decreases. Figure 6 shows the recovered images using 3-level DWT for various values of scaling factor. The values of MSE (Mean square error) PSNR (Peak Signal To Noise Ratio) are calculated for the different values of the scaling factors k and q which are shown below in the table 1.

Best results for watermarked image is obtained at k=0.97 and q=0.0001 and best result for recovered image is obtained at k=0.0001 and q=0.97.which is shown in figure 5 & 6

From the table 1 we can observed that the value for PSNR and MSE on 3-level DWT it gives better results as shown in table 2.

q	k	MSE	PSNR	Observation
0.0001	2	4.6180	41.4862	
0.0001	1.4	0.7966	49.1185	
0.0001	1.2	0.2249	54.6110	
0.0001	0.97	0.0015	76.5090	Best Result
0.0001	0.70	0.1347	52.9250	
0.0001	0.50	0.9886	48.18.6	
0.0001	0.40	1.4488	46.5208	
0.0001	0.20	2.6324	46.5208	

Table.1 watermarked image in terms of MSE and PSNR

k	q	MSE	PSNR	Observation
0.0001	2	4.2675e+005	8.1710	
0.0001	1.4	6.8281e+004	1.0771	
0.0001	1.2	1.7070e+004	5.8084	
0.0001	0.97	384.0779	28.2866	Best Result
0.0001	0.70	3.8408e+004	2.2866	
0.0001	0.50	1.0669e+500	2.1504	
0.0001	0.40	1.5363e+005	3.7340	
0.0001	0.20	2.7312e+005	6.2328	

Table.2 Extracted watermark image in terms of MSE and PSNR

VI. CONCLUSION

In this paper an image watermarking technique is used which is based on 3-level discrete wavelet transform has been planned. This technique can be inserted the imperceptible watermark into prominent quality of the image using alpha blending technique. Experimental results show that the eminence of watermarked image and the extracted watermark are depending on the scaling factor k and q and also provide improved performance.

REFERENCES

1. Nikita kashyap and G.R. Shinha., Image watermarking using 2-level DWT",Advances in Computational Research ,ISSN: 0975-3273 & E-ISSN: 0975-9085, Volume 4, Issue 1, 2012, pp.-42-45

2. A.H. Taherinia and M. Jamzad, Two Level DCT Based Digital Watermarking, International Conference on Systems, Signals and Image Processing (IWSSIP'06) September 21-23, 2006. Budapest, Hungary

3. Darshana Mistry, Comparison of Digital Water Marking methods, (IJCSE) International Journal on Computer Science and Engineering, Vol. 02, No. 09, 2010, 2905-2909

4. M.V.S.S.BABU, a robust watermarking algorithm for image authentication,2012 international conference on information and network technology(ISINT 2012) IPCSIT vol.37(2012),Singapore.

5. Ali Al-Haj, Combined DWT-DCT Digital Image Watermarking, Journal of Computer Science 3 (9): 740-746, 2007 ISSN 1549-3636© 2007 Science Publications

6. Mei Jiansheng1, Li Sukang1 and Tan Xiaomei2, A Digital Watermarking Algorithm Based On DCT and DWT, ISBN 978-952-5726-00-8 (Print), 978-952-5726-01-5 (CD-ROM)Proceedings of the 2009 International Symposium on Web Information Systems and Applications (WISA'09)Nanchang, P. R. China, May 22-24, 2009, pp. 104-107

7. Suthar A.C. , Patel C.B. and Kulkarni G.R. ,Implementation Of Image Security Issues Using Mixed Frequency Domain Scheme, International Transactions on Electrical, Electronics and Communication Engineering, Vol. 1, No.5, 2011

8. V.S.Vora, A.C.Suthar, Y.N.Makwana, S.J.Dawda, "Analysis of Compressed Image Quality Assessments" in An International Journal of Advanced Engineering & Applications (IJAEA), ISSN: 0975-7783, January '10, Volume 2, pp.225-229.

9. Surya Pratap Singh1, Paresh Rawat2, Sudhir Agrawal, A Robust Watermarking Approach using DCT-DWT, International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, Volume 2, Issue 8, August 2012)

10. Chiou-Ting Hsu and Ja-Ling Wu, Hidden Digital Watermarks in Images, IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 8, NO. 1, JANUARY 1999

11. Akhil Pratap Shing, Agya Mishra, Wavelet BasedWatermarking on Digital Image, Indian Journal of computer Science and Engineering, 2011.

12. Nilanjan Dey, Anamitra Bardhan Roy, SayantanDey, A novel approach of color image hiding using RGB color planes and DWT, International Journal of Computer Applications, 2011.