A Robust DWT Digital Image Watermarking Technique Basis On Scaling Factor

Heena Shaikh,Mohd.Imran Khan, Yashovardhan Kelkar

Department of Information Technology, MIT, Ujjain
heenushaikh@gmail.com , imran.khan@mitmandsaur.info,
yasho028@rediffmail.com

Abstract:

At the present time, the aptitude in contemplation of accessing as well as sharing images has become progressively facile with the Internet allowing people to procure information remotely from anywhere in the entire world. Moreover, there has been also an expansion with regard to the number of the still digital images over the internet for the sake of the fact that a vast number of millions of people are capturing digital photos. Fundamentally, the procedure of digital watermarking can be delineated as a method for embedding information into another signal (a digital signal). In case of digital images, the embedded information can be either visible or hidden from the user. In this project, we will concentrate on imperceptible watermarks. The principal intention of digital watermarks is to provide copyright protection for intellectual property that is in digital format. Typical usage scenarios for watermarking are such as copyright protection and data authentication. In this paper, we describe an imperceptible and a robust DWT digital Image Watermarking algorithm.The algorithm watermarks a given digital image using a Discrete Wavelet Transform.

Keywords:

Digital watermarking, Discrete Wavelet Transform(DWT), Peak Signal to Noise Ratio, Scaling Factor, Gaussian Noise, Salt and Pepper.

I. Introduction

The DWT transform, Wavelets are special functions which, in a form analogous to sines and cosines in Fourier analysis, are used as basal functions for representing signals. For 2-D images, applying DWT corresponds to processing the image by 2-D filters in each dimension. The filters divide the input image into four non-overlapping multi-resolution sub-bands (LL_1), (LH_1), (HL_1) and (HH_1). The sub-band (LL_1) represents the coarse-scale DWT coefficients while the sub-bands (LH_1), (HL_1) and (HH_1) represent the fine scale of DWT coefficients[1]. To obtain the next coarser scale of wavelet coefficients, the sub-band (LL_1) is further processed until some final scale "$_N$" is reached. When "$_N$" is reached we will have 3N+1 sub-bands consisting of the multi-resolution sub-bands (LL_N) and (LH_X),(HLx) and (HHx) where "X" ranges from 1 until "N "[1][2].Due to its excellent spatio-frequencylocalization properties, the FDWT is very suitable to identify the areas in the host image. where a watermark can be embedded effectively. In particular, this property allows the exploitation of the masking effect of the human visual system such that if a DWT coefficient is modified, only the region corresponding to that coefficient will be modified. In general most of the image energy is concentrated at the lower frequency sub-bands (LL_X) and therefore embedding watermarks in these sub bands may degrade the image significantly[3].

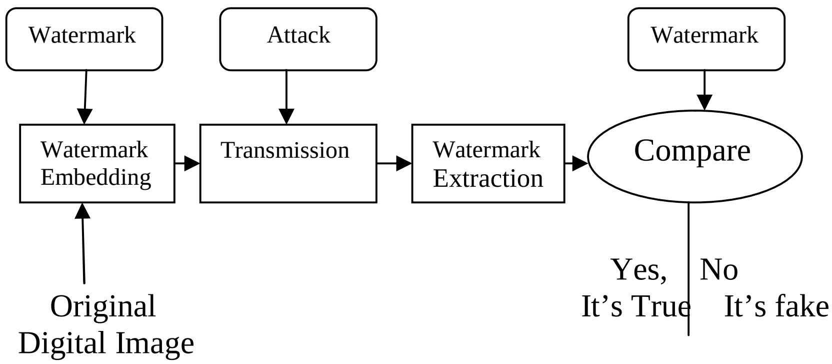


Fig. I Digital image Watermarking

The embedding and detecting procedure for watermarking technique based on DWT transform.[4]Computing PSNR function (peak single-to-noise ratio)based on scaling factor of the resultant watermarked images from the techniques DWT for the purpose of measuring the distinctive distortion between the cover image and the watermarked image.[5]Applying the checkmark software by means of MSE function for the original watermarks and extracted watermarks from the DWT technique.[5]

II. Proposed Watermarking Scheme

In the case of one dimensional signal, the signal itself is to be divided into two groups of frequency components as low frequency components and high frequency components which are mainly determined as the 1st pass of the low-pass and high-pass frequencies, While the high-band frequency group would remain unchanged, the low-band frequency group will be then divided up into two other inner groups of frequencies causing the 2nd pass of the low-pass and high-pass frequencies. The same process is to be continued in such an arbitrary number of times making the next passes by dividing the low-band frequency blocks. The decomposition process can be simply constructed by applying the previous technique into the one-dimensional signal X(N)[6].

However, the original signal *X(N)* can be also reconstructed by using the same frequency coefficients which have been used through the decomposition process of the DWT. The reconstruction process is determined as the inverse DWT (IDWT).[6][7]

The function of the DWT transform domain is based on the watermarking technology is composed of two major parts which are the encoding and decoding procedures. Those two procedures are plainly the key for implementing the embedding as well as the extracting system by way of the DWT transform.[7].

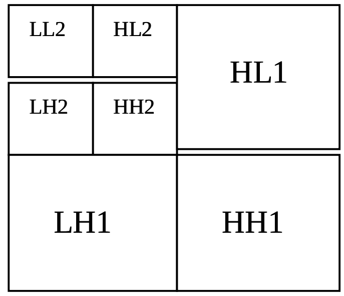


Fig. II Sketch Map of Image DWT Decomposed

II.I Embedding Technique for DWT

This technique will decompose the cover image of the two dimensional DWT into four frequency bands through the first pass as (LL_1), (LH_1), (HL_1) and (HH_1) frequency coefficients. The frequency bands where it has the lowest resolution of the 1st pass (LL1) can be also decomposed into a 2nd level (pass). [6] Secondly, we are to apply the Gaussian Noise and can insert the watermark signature into the reset of the available frequency bands which include the high frequency coefficients without dealing with (*LL*) regions from all over the passes (levels). We must add the signal of the bands where the large frequency components to the signal of the Gaussian Noise and modifying them without

moderating the original signal which resides in the (*LL*) band; thereafter, the watermarked image would be performed appropriately.[5]

Cover Image

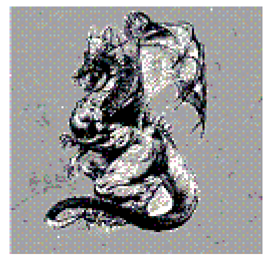
Test Image

Watermarked Image

Fig. III Embedding Technique for DWT

II. Extraction Technique for DWT

In contemplation of achieving this procedure, we should have the cover image and the watermarked image readily applicable. Consequently, the DWT decoding technique will decompose those two images into four frequency bands through the 1st pass as described previously. Afterward, we are to select for instance one of those bands where the large frequencies reside through one of the levels (passes) in the decomposed cover image and the decomposed watermark. Let's suppose the selected band from both decomposed images is (HH1), we have then to compare the difference of the frequency coefficients in those bands of the decomposed images and examine their cross correlation. Subsequently, if the cross correlation has detected a peak, then the watermark signature will be extracted; if not, then the same operation will continue on comparing the rest of the other bands consist the high frequency components from both of the decomposed images and investigate their cross correlation until the peak is detected; correspondingly, the watermark signature will be latterly recovered.[4]

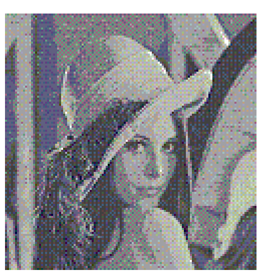



Watermarked Image Retrieved Image

(No Attack)


Watermarked Image Retrieved Image

(Gaussian Noise)




Watermarked Image Retrieved Image

(Salt and Pepper)

Fig. IV Extraction Technique for DWT

III. Performance Evaluation

For testing the performance of this algorithm, the experiments is simulated with the software MATLAB. In the following experiments, the gray-level image with size of 384*384 "Lena" is used as host image to embed watermark. Another binary image with size of 196*210 "key" is as the watermark. In order to test the performance, the watermarked image suffers some different signal attacks, which includes filer, sharp enhancing, adding salt noise, image compression, image cutting and rotation. The simulation results, including the watermarked image and distilled watermark under different kinds of signal attack [9], The exact PSNR values of the processings are shown in Tab. I. Simulation results suggest that this watermark algorithm can be robust against many common different types of attacks such as adding salt and pepper noise, image compression, Gaussian noise.

(a) (b)

(c) (d)

(a) Original Image

(b), (c), (d) Watermarked Image with different Scaling Factor

Fig. V Attack-Gaussian Noise


(e)


(f)


(g)


(h)

(e)Original Image

(f), (g) ,(h) Watermarked Images With Different Scaling Factor

Fig.VI Attack-Salt and Pepper

Table I
The parameter values of attacked watermark image

Scaling Factor	Gaussian Noise (PSNR)	Scaling Factor	Salt & Pepper (PSNR)
(0,0.025)	8.0196	(0.02)	8.6481
(0.05,0.030)	8.3254	(0.05)	8.6499
(0.10,0.035)	8.5441	(0.08)	8.3312
(0.15,0.040)	8.6451	(0.11)	8.1735
(0.20,0.045)	8.6613	(0.14)	8.0176

IV. Conclusion

In this paper, we proposed a watermarking scheme based on discrete wavelet transform that based on scaling factor. By using the block technology, watermarking signal is embedded into the high frequency band of wavelet transformation domain. The simulation results suggest that this watermarking system not only can keep the image quality well, but also can be robust against many common image processing operations of compression , salt and pepper noise,gaussion noise and so on. This algorithm has strong capability of embedding singal and anti-attack.

V.References

[1] Jacquin, “A Image Coding Based on a Fractal Theroy of Iterated Contractive Image Transformation”, IEEE Trans. J,I(I), pp.18-30, Image Processing, 1992.

[2] ChangHong Dong, “The use of MATLAB for imagery processing and applies” , Beijing: The publishing of defence industry, 2004, pp. 33-37.

[3] Yen JC, “Watermark Embedded in Electronic Letters”,Xi’an:XiDian University Press, 2000, pp. 80-81.

[4] Nikolaidis, “Copyright Protection of Images using Robust Digital Signatures”, ICIP, Conf, pp. 2168-2171, 1999.

[5] GhoutiL, BouridaneA and Ibrahim MK, “Digital image watermarking using balanced multiwavelets” , IEEE Transactions on Signal Processing, 54(4), pp. 1519-1536, 2006.

[6] Reddy AA, Chatterji BN, “A new wavelet based logowatermarking scheme” , Conf. Pattern Recognition letters,26(7), pp. 1019-1027, 2005.

[7] J Jiang, A Armstrong, “Data hiding apporoach for efficient image indexing”, Electronics letters. 7th, 38(23), pp. 1424-1425, 2002.

[8] I. J. Cox, M. L. Miller, J. A. Bloom, "Digital Watermarking", Morgan Kaufmann Publishers, 2002.

[9] YiCheng, MingSheng Zhang, “Auto-adapter image watermark algorithm of DCT” , ShangHai: Computer Engineering and Applications, 2005.

[10] Ejima, M. and A. Myazaki, 2001." On the evaluation of performance of digital watermarking In the frequency domain,” in Proc.of IEEE int.conf.on Image processing,2 :546-549.

[11] Shital Gupta, Dr Sanjeev Jain A Robust Algorithm of Digital Image Watermarking Based on Discrete Wavelet Transform. Published in Special Issue of IJCCT Vol.1 Issue 2, 3, 4; 2010 for International Conference [ACCTA-2010], 3-5 August 2010.

[12] P. Bao and X. Ma, \Image adaptive watermarking using wavelet domain singular value decomposition," IEEE Transactions on Circuits and Systems for Video Technology, pp. 96{102, 2005.