Middle-East Journal of Scientific Research 20 (12): 2305-2309, 2014
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2014.20.12.329

Integration of Digital Image Processing Using Watermarking Algorithm

P. Kavitha

Department of Information Technology,
Bharath University, India

Abstract: The most important and distinguishing features of wavelet-based watermarking schemes. Application scenario, copyright protection is considered and building on the experience that was gained, implemented two distinguishing watermarking schemes. Detailed comparison and obtained results are presented and discussed. Its improved robustness is due to embedding in the low-frequency wavelet coefficients and optimal control of its strength factor from HVS point of view. Maximum-likelihood (ML) decoder is used aided by the channel side information. The performance of the proposed scheme is analytically calculated and verified by simulation. Experimental results confirm the imperceptibility of the proposed method and its higher robustness against attacks compared to alternative watermarking methods in the literature.

Key words: Human visual system (HVS) · Maximum-likelihood decoder · Scaling-based image watermarking · Wavelet transform

INTRODUCTION

A digital watermark is a kind of marker covertly embedded in a noise-tolerant signal such as audio or image data. It is typically used to identify ownership of the copyright of such signal. "Watermarking" is the process of hiding digital information in a carrier signal; the hidden information should [1], but does not need to contain a relation to the carrier signal. Digital watermarks may be used to verify the authenticity or integrity of the carrier signal or to show the identity of its owners. It is prominently used for tracing copyright infringements and for banknote authentication [2]. Like traditional watermarks, digital watermarks are only perceptible under certain conditions, i.e. after using some algorithm and imperceptible anytime else. If a digital watermark distorts the carrier signal in a way that it becomes perceivable, it is of no use [3] Traditional Watermarks may be applied to visible media (like images or video), whereas in digital watermarking, the signal may be audio, pictures, video, texts or 3D models. A signal may carry several different watermarks at the same time. Unlike metadata that is added to the carrier signal, a digital watermark does not change the size of the carrier signal [3].

The development of effective digital image copyright protection methods have recently become an urgent and necessary requirement in the multimedia industry due to the ever-increasing unauthorized manipulation and reproduction of original digital objects. The new technology of digital watermarking has been advocated by many specialists as the best method to such multimedia copyright protection problem [4]. Its expected that digital watermarking will have a wide-span of practical applications such as digital cameras, medical imaging, image databases and video-on-demand systems, among many others [5]. In order for a digital watermarking method to be effective it should be imperceptible and robust to common image manipulations like compression, filtering, rotation, scaling cropping, collusion attacks among many other digital signal processing operations. Current digital image watermarking techniques can be grouped into two major classes: spatial-domain and frequency-domain watermarking techniques[6]. Compared to spatial domain techniques, frequency-main watermarking techniquesproved to be more effective with respect to achieving the imperceptibility and robustness requirements of digital watermarking algorithms. Commonly used frequency-domain transforms include the

Corresponding Author: P. Kavitha, Department of Information Technology, Bharath University, India.

Discrete Wavelet Transform (DWT), the Discrete Cosine Transform (DCT) and Discrete Fourier Transform (DFT) [7]. However, DWT has been used in digital image watermarking more frequently due to its excellent spatial localization and multi-resolution characteristics,which are similar to the theoretical models of the human visual system. Further performance improvements in DWT-based digital image watermarking algorithms could be obtained by combining DWT with DCT. The idea of applying two transform is based on the fact that combined transforms could compensate for the drawbacks of each other, resulting in effective watermarking [8]. In this paper, we will describe a digital image watermarking algorithm based on combining two transforms; DWT and DCT. Watermarking is done by altering the wavelets coefficients of carefully selected DWT sub-bands, followed by the application of the DCT transform on the selected sub-bands.

In this paper, in order to achieve higher robustness against various attacks, a new scaling-based multi-bit watermarking approach in the wavelet transform domain is used [9]. In our imple-mentation, the host image is segmented into small blocks and high entropy blocks are chosen. In each block, low-frequency wavelet coefficients are scaled upward or downward by a constant factor depending on the value of the watermark bits. This constant value, named the strength factor, is optimized both to minimize the impact on the quality of the image and to obtain the best detection performance [9]. For data extraction, similar to the MLdetector is used. However, our decoder profits from the knowledge of certain characteristics of the original image, like variances of image blocks which makes the proposed decoder semi-blind. We model the low frequency wavelet coefficients of image blocks with Gaussian distribution. Under this assumption, the optimum threshold and error probability of the proposed scaling-based watermarking method are analytically calculated [10]. Besides, analytical formulations of performance analysis for this decision-theoretic problem under Gaussian signal and Gaussian noise conditions are presented. The rest of the paper is organized as follows. In Section II, the proposed scaling-based watermarking method using wavelet transform domain and HVS characteristic are introduced [11]. In this section, the optimum threshold in the ML detector is analytically investigated. Performance analysis of the proposed method is also presented in Section III [12]. The multiobjective optimization approach to find the best value for the strength factor is elaborated in Section IV. Section V contains simulation results and discussions about the robustness of the proposed approach against common attacks and the comparison of its performance over other watermarking techniques and finally Section VI concludes the paper [13].

Proposed Algorithm

Watermark Embedding Algorithm: In case of two-dimensional image, after a DWT transform, the image is

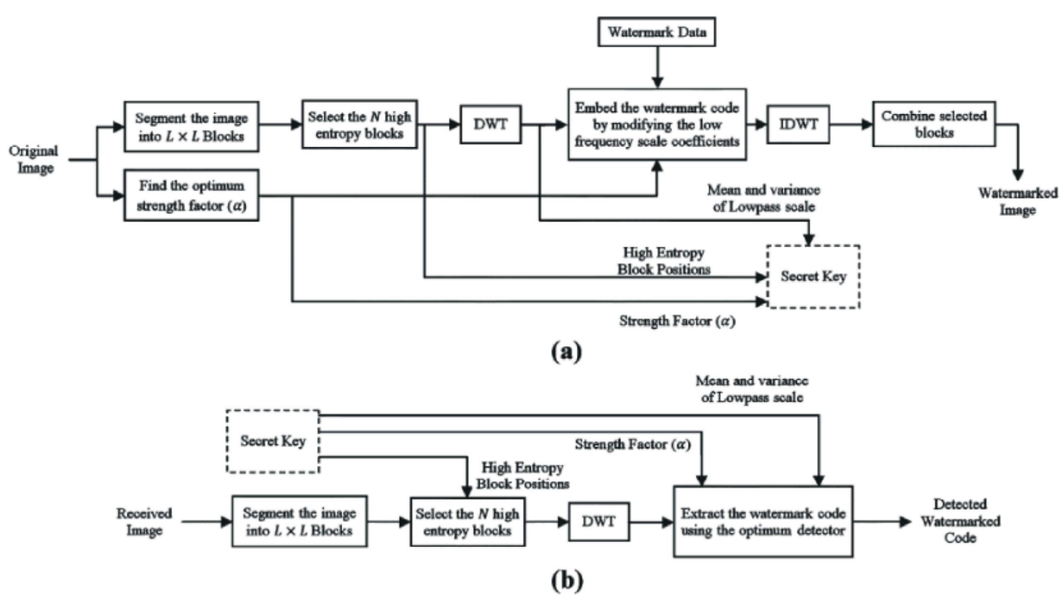

Fig. 1: Block diagram of the proposed watermarking scheme. a) Embedding. b) Decoding

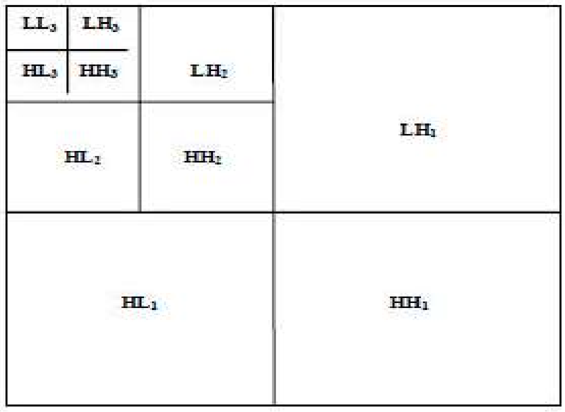

Fig. 1: DWT Decomposition model

divided into four corners, upper left corner of the original image, lower left corner of the vertical details, upper right corner of the horizontal details, lower right corner of the component of the original image detail (high frequency) [14]. You can then continue to the low frequency components of the same upper left corner of the 2nd, 3rd inferior wavelet transform.

On the basis of such considerations, the algorithm uses a different color image multiplied by the weighting coefficients of different ways to solve the visual distortion and by embedding the watermark, wavelet coefficients of many ways, enhance the robustness of the watermark.

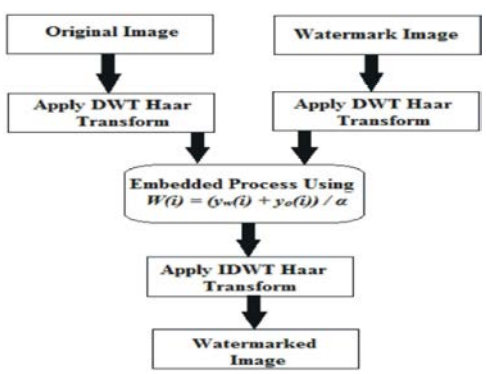

Fig. 2: Watermark embedding algorithm Block Diagram

After that we select the ordered coefficient from 1 to N to get N coefficient. the formulae of watermark embedding are as follows.

$$C_w(i) = Y_o(i) + \alpha_1 w(i) \quad (1)$$

where the parameter α is called embedding intensity and their effect of validity of the algorithm directly is apply after this process, after that apply the inverse wavelet transform to the image for find out watermark image [15].

Watermark Extraction Algorithm: The extraction algorithm process is the inverse of the embedding process. It is assumed that the watermark as well as the see value is available at the receiver end to the authorized users [16].

The operation of channel separation is applied on the watermarked color image to generate its sub images and then 2-level discrete wavelet transform is applied on the sub images to generate the approximate coefficients and detail coefficients.

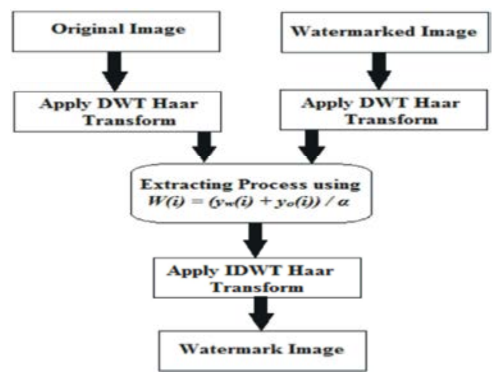

Fig. 3: Watermark Extraction algorithm Block Diagram

For this purpose the following formulae is use-

$$W(i) = (y_w(i) + y_o(i)) / \alpha \quad (2)$$

After this Execution the Inverse 2-level discrete wavelet transform is applied on the watermark data to generate three watermark images extracted.

Experiment and Result: The test set for this evaluation experiment watermark image randomly selected from the internet. Matlab 7.0 software platform is use to perform the experiment. The PC for experiment is equipped with an Intel P4 2.4GHz Personal laptop and 2GB memory [17].

The proposed scheme is tested using ordinarily image processing. From the simulation of the experiment results, we can draw to the conclusion that this method is robust to many kinds of watermark images [18].

Table 1 show the peak signal to noise ratio of performance of our proposed method of watermarked image and original image with various watermark image, where our watermarked images peak signal to noise ratio has a better performance than others [19].

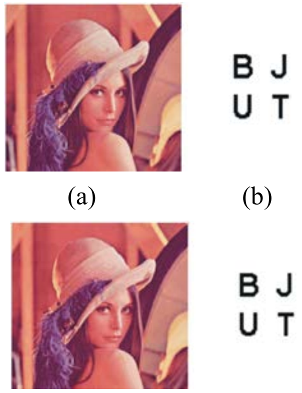

Fig. 4: (a) Original image (b) BJUT watermark Image (c) Watermarked image (d) Recovered watermark Image

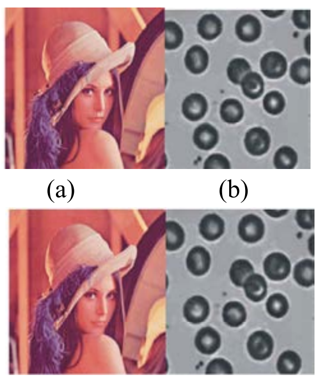

Fig. 5: (a) Original image (b) Bobbol watermark Image (c) Watermarked image (d) Recovered watermark Image

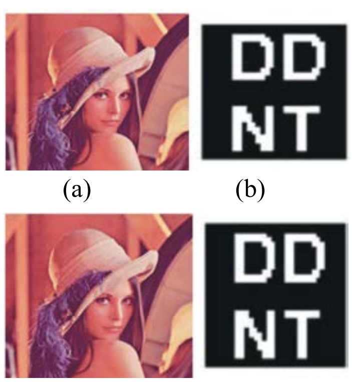

Fig. 4: (a) Original image (b) DDNT watermark Image (c) Watermarked image (d) Recovered watermark Image

Table 1: Experiment Result

	Original Lena Image (PSNR)	Watermarked Lena Image (PSNR)
BJUT Watermark Image	33.1224	41.9946
Bobbol Watermark Image	33.1224	47.5911
DDNT Watermark Image	33.1224	45.8103

CONCLUSION

We have presented a new robust semi-blind scaling-based watermarking technique in the wavelet domain. The method embeds the watermark information in high-entropy blocks under Watson's HVS criterion. For watermark decoding, the maximum-likelihood decoder is optimized for each block and which utilizes side information consisting of block positions and block parameters. Both the embedding in the low-pass wavelet coef?cients and the informed ML decoder contribute to the robustness of the method against JPEG compression and additive noise. The probability of error is analytically investigated and a close form solution is achieved which well agrees with the experimental results. The trade-off of imperceptibility and robustness has been elegantly solved via the multi-objective optimization approach.

Extensive experiments have indicated that the proposed watermarking method resists to a host of attacks signi?cantly better than its competitors in the multiplicative watermark category. Future work may be performed by developing the proposed idea in other transform domains such as contourlets and also extending the ML decoder to correlated coefficients.

REFERENCES

1. Corona, B., M. Nakano and H. Pérez, 2004. Adaptive Watermarking Algorithm for Binary Image Watermarks, Lecture Notes in Computer Science, Springer, pp: 207-215.
2. Reddy, A.A. and B.N. Chatterji, 2005. A new wavelet based logo-watermarking scheme, Pattern Recognition Letters, 26: 1019-1027.
3. Huang, P.S., C.S. Chiang, C.P. Chang and T.M. Tu, 2005. Robust spatial watermarking technique for colour images via direct saturation adjustment, Vision, Image and Signal Processing, IEE Proceedings, 152: 561-574.
4. Gonzalez, F. and J. Hernandez, 1999. A tutorial on Digital Watermarking, In IEEE annual Carnahan conference on security technology, Spain.

5. Kunder, D., 2001. Multi-resolution Digital Watermarking Algorithms and Implications for Multimedia Signals, Ph.D. thesis, university of Toronto, Canada.
6. Eggers, J., J. Su and B. Girod, 2000. Robustness of a Blind Image Watermarking Scheme, Proc. IEEE Int. Conf. on Image Proc., Vancouver.
7. Barni, M., F. Bartolini and A. Piva, 2002. Multichannel watermarking of color images, IEEE Transaction on Circuits and Systems of Video Technology, 12(3): 142-156.
8. Kundur, D. and D. Hatzinakos, 2004. Towards robust logo watermarking using multiresolution image fusion, IEEE Transcations on Multimedia, 6: 185-197.
9. Lu, C.S. and H.Y.M Liao, 2001. Multipurpose watermarking for image authentication and protection, IEEE Transaction on Image Processing, 10: 1579-1592.
10. Ghouti, L., A. Bouridane, M.K. Ibrahim and S. Boussakta, 2006. Digital image watermarking using balanced multiwavelets, IEEE Trans. Signal Process., 54(4): 1519-1536.
11. Tay, P. and J. Havlicek, 2002. Image Watermarking Using Wavelets, in Proceedings of the 2002 IEEE, pp: II.258-II.261.
12. Kumswat, P., Ki. Attakitmongcol and A. Striaew, 2005. A New Approach for Optimization in Image Watermarking by Using Genetic Algorithms, IEEE Transactions on Signal Processing, 53(12): 4707-4719.
13. Daren, H., L. Jifuen, H. Jiwu and L. Hongmei, 2001. A DWT-Based Image Watermarking Algorithm, in Proceedings of the IEEE International Conference on Multimedia and Expo, pp: 429-432.
14. Hsu, C. and J. Wu, 1998. Multi-resolution Watermarking for Digital Images, IEEE Transactions on Circuits and Systems- II, 45(8): 1097-1101.
15. Mehul, R., 2003. Discrete Wavelet Transform Based Multiple Watermarking Scheme, in Proceedings of the 2003 IEEE TENCON, pp: 935-938.
16. Udayakumar, R., V. Khanna, T. Saravanan and G. Saritha, 2013. Retinal Image Analysis Using Curvelet Transform and Multistructure Elements Morphology by Reconstruction, Middle-East Journal of Scientific Res., ISSN: 1990-9233, 16(12): 1798-1800.
17. Udayakumar, R., V. Khanna, T. Saravanan and G. Saritha, 2013. Cross Layer Optimization For Wireless Network (Wimax), Middle-East Journal of ScientificResearch,ISSN:1990-9233,16(12):1786-1789.
18. Thooyamani, K.P., V. Khanaa and R. Udayakumar, 2013. A frame work for modelling task coordination in Multi-agent system, Middle-East Journal of Scientific Research, ISSN:1990-9233, 15(12): 1851-1856.
19. Thooyamani, K.P., V. Khanaa and R. Udayakumar, 2013. An Integrated Agent System for E-mail Coordination using Jade, Indian Journal of Science and Technology, ISSN: 0974-6846, 6(6): 4758-4761.