Tow Dimension Multiwavelet Watermarking In Segmented Image Watermark

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Abstract:

The rapid expansion and proliferation of the Internet, development of high capacity storage devices and the advances of data digitization in recent decades all have rapidly increased the availability and exchange of digital data to the public. These facts, combined with faster personal computers and powerful data processing software, required a reliable copyright protection system of multimedia data (e.g. audio, images, video) against unauthorized copy, illegal distribution and forgery. Of the many approaches existent to protect digital data, especially multimedia data, digital watermarking is probably the one that has received the most interest. In this project we describe a transparency and a robust MDWT digital image watermarking algorithm. In the proposed algorithm, a multiple watermark images are embedded into segmented the RGB host image using a Discrete Multiwavelet Transform (DMWT).This algorithm greatly improves the watermarking efficiency, because its realization only requires taking DMWT or inverse DMWT (IDMWT) to the R, G, B elements of the color host image and watermarked image respectively. Our method yields fine image quality. Simulation results show that the watermarking system has good transparency

1.Introduction

In recent years. Digital image watermarking has drawn extensive attention. Watermark technique is an active research field and provides a new idea for digital media protection, secret message transmission, etc. Of all the data transmitted over the Internet, images are the most common means of message transportation. The purpose behind digital watermarking is to embed the information and data in the host digital media (image, video and audio) with the purpose of copyright protection, access control, broadcast monitoring etc. Embedding the information in images is made possible through making slight changes unrecognized by naked eye [3].

Depending on the problem that watermarking is being used to solve, a good watermarking system should satisfy some of the following requirements: transparency, robustness. The transparency means the watermarked image is unable to be differentiated by naked eye in other word the watermark insertion should not perceptually degrade the quality of the host image [1]. Robustness implies that the watermark scheme ought to have the ability of protecting the watermark against various attacks like cropping, translation, scaling or another type of filters.

In our previous work, we have proposed a digital image watermarking [4] in the DWT domain which is obtain transparency and robust against different type of attack and. In this paper, we are going to increase the performance of that system [4] using MDWT. This paper presents multiwavelet transform-based segmented digital image watermarking schemes. The organization of this paper is as follows. Section 2 presents multiwavelet transform, section 3 presents the proposed methodology and describes the watermark embedding. Section 4 describes the Watermarking Detection and Extraction. Experimental results and discussions are given in Section 4 and conclusions are drawn in Section 5.

2.Multiwavelet Transform

Any good transform should possess several important properties: orthogonality, to ensure the decorrelation of sub-band coefficients; symmetry (i.e. linear phase)to process finite-length signals without redundancy and artifacts and finite-length filters for computational efficiency. However, most real scalar wavelet transforms fail to possess these properties simultaneously. To circumvent these limitations, multiwavelets have been proposed where orthogonality and symmetry are allowed to co-exist by relaxing the time-invariant constraint [5].

Multiwavelets may be considered as a generalization of scalar wavelets. However, some important differences exist between these two types of multiresolution transforms. In particular, whereas wavelets have an associated scaling function $\phi(t)$ and wavelet function $\psi(t)$, multiwavelets have two or more scaling and wavelet functions. For notational convenience, the set of scaling functions can be written using the vector notation $\mathbf{\Phi(t)\equiv[\phi_1(t),\ \phi_2(t)\ldots\ \phi_r(t)]^T}$,where $\Phi(t)$ is called the multiscaling function. Likewise, the multiwavelet function is defined by the set of wavelet functions as $\mathbf{\Psi(t)\equiv[\psi_1(t),\ \psi_2(t)\ldots\ \psi_r(t)]^T}$**.** When r=1, $\Psi(t)$ is called a *scalar* wavelet, or simply wavelet. While in principle r can be arbitrarily large. The multiwavelets studied to date are primarily for r=2, [9].The multiwavelet two-scale equations resemble those for scalar wavelets:

$$\Phi(t) = \sqrt{2} \sum_{k=-\infty}^{\infty} H_k \Phi(2t-k) \qquad \text{……….} \ (1)$$

$$\Psi(t) = \sqrt{2} \sum_{k=-\infty}^{\infty} G_k \Phi(2t-k) \qquad \text{…………} \ (2)$$

One famous multiwavelet filter is the GHM filter proposed by Geronimo, Hadrian, and Massopust [9]. The GHM basis offers a combination of orthogonality, symmetry, and compact support, which cannot be achieved by any scalar wavelet basis [9]. According to Eq. (1) and Eq.(2) the GHM two scaling and wavelet functions satisfy the following two-scale dilation equations:

$$\begin{bmatrix} \phi_1(t) \\ \phi_2(t) \end{bmatrix} = \sqrt{2} \sum_k H_k \begin{bmatrix} \phi_1(2t-k) \\ \phi_2(2t-k) \end{bmatrix} \qquad \text{……..} \ (3)$$

$$\begin{bmatrix} \psi_1(t) \\ \psi_2(t) \end{bmatrix} = \sqrt{2} \sum_k G_k \begin{bmatrix} \phi_1(2t-k) \\ \phi_2(2t-k) \end{bmatrix} \qquad \text{……….} \ (4)$$

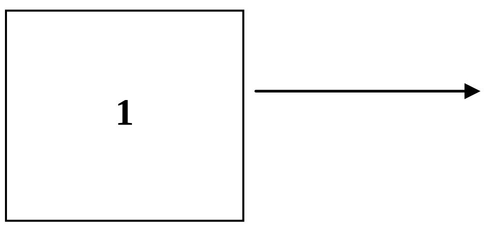
3.1 Decompose and Segmentation Image

In the proposed method the color image (host image) is decomposed into three components R, G and B. watermark logo image will be embedded in the B. The blue channel is chosen to embed the watermark because it is less sensitive to human eyes [4, 5]. Before the embedding process, blue channel segmented to four segments each one of segment is transform into MDWT domain Figure 1.additional segment the watermark image to four image too Figure 2.

Figure (2) segmented watermark image.

3.2 The Embedding Algorithm:

In the first enter each segment from the host image separately in 1-level 2-DMWT to get sixteen sub-block (L_1L_1 ,L_1L_2,L_2L_1,L_2L_2- L1H1, HL1 and HH1……ect) for each block as shown in figure 3,4. The high frequency information of the image suffers from the damage of attack technology like compression, which results in poor robustness; while the low frequency information has plenty of image characteristics, and can be perceived by visual organ easily [7].Therefore, according to the amount of the energy, in all L_1H_2, L_2H_1, $H_1L_2$and H_2L_1 block positions are in the intermediate frequency of the image. Four of the eight positions with middle energy can be selected for digital watermark embedding to keep balance of Transparency.



L_1L_1	L_1L_2	L_1H_1	L_1H_2
L_2L_1	L_2L_2	L_2H_1	L_2H_2
H_1L_1	H_1L_2	H_1H_1	H_1H_2
H_2L_1	H_2L_2	H_2H_1	H_2H_2

Figure (3) One Level 2D-Mul

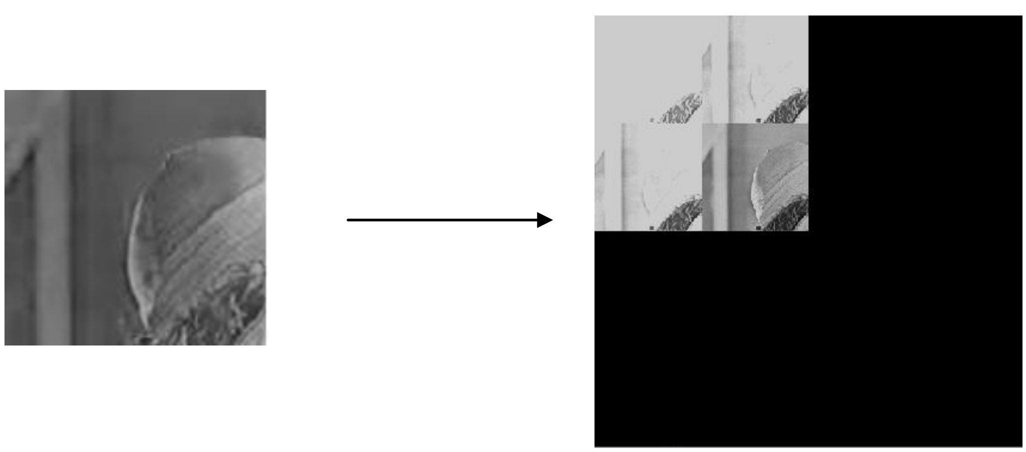


Figure (4) Segment (1) of Lena image decomposed by 2D-MWT.

The embedding algorithm can be achieve by enter the four segmented MU logo in that has size 128 in L_1H_2, L_2H_1, $H_1L_2$and H_2L_1 for each block in the host image to produce the B’ by using the equation 1. In other word enter sixteen segments from Mu logo in four segments from the host image.

$$W_i' = W_i + \alpha Y_i \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

4. Watermark detection and extraction.

The objective of the extraction process is to acquire a credible estimate of the original watermark. To extract the watermark from the watermarked image, perhaps distorted image, the extraction process must be an inverted procedure of the embedding process. In order to extract the

watermark, the original image is required. Hence, the proposed scheme is a non-blind. The extracted watermark is comparable with original watermark and the comparability is able between original image (host image) and watermarked image as long as visually recognizable pattern as watermark has been used. Beside visual judgment for the watermark fidelity, objective measure of similarity between the original watermark and the extracted watermark has been defined.

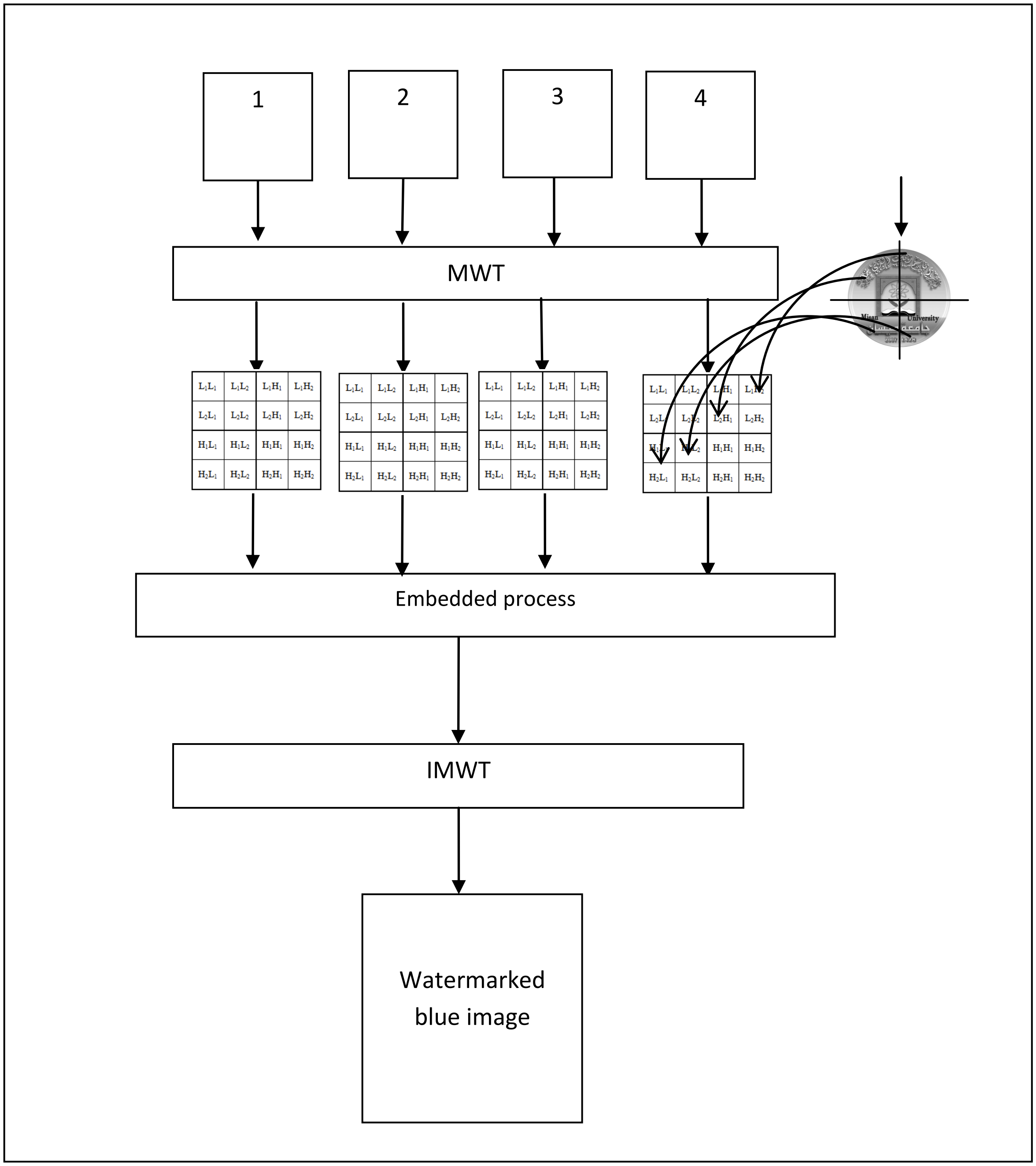


Figure (5) Embedding process.

5. Experimental result

This algorithm is examined using color images, Lena, flower, lion and blue flower images as a host image of size 512x 512. MU logo of size 128 x 128 is used as watermark. Two evaluation techniques are used in our experiments, transparency and robustness. The two Techniques are described below:

Transparency of images and robustness of abstracting digital watermark are still important criterion of judging digital watermarking algorithm. The embed multiple digital watermarking in segmented image using multiwavelet transforms to obtain optimal effect. Experiments show the new algorithm we proposed ensures the quality of watermarking-embed image. In table 1 can see the result Comparison between multiwavelet method and our previous method [4].

Table1: Comparison between proposed method and other different methods

Type of images	Multiwavelet transform 512*512	[4] wavelet transform 1024*1024	Wavelet transform 512*512
Lena	42.75	38.92	33.45
Flower	43.23	39.77	34.78
Lion	38.22	35.12	30.34
Blue flower	38.4	35.59	31.23

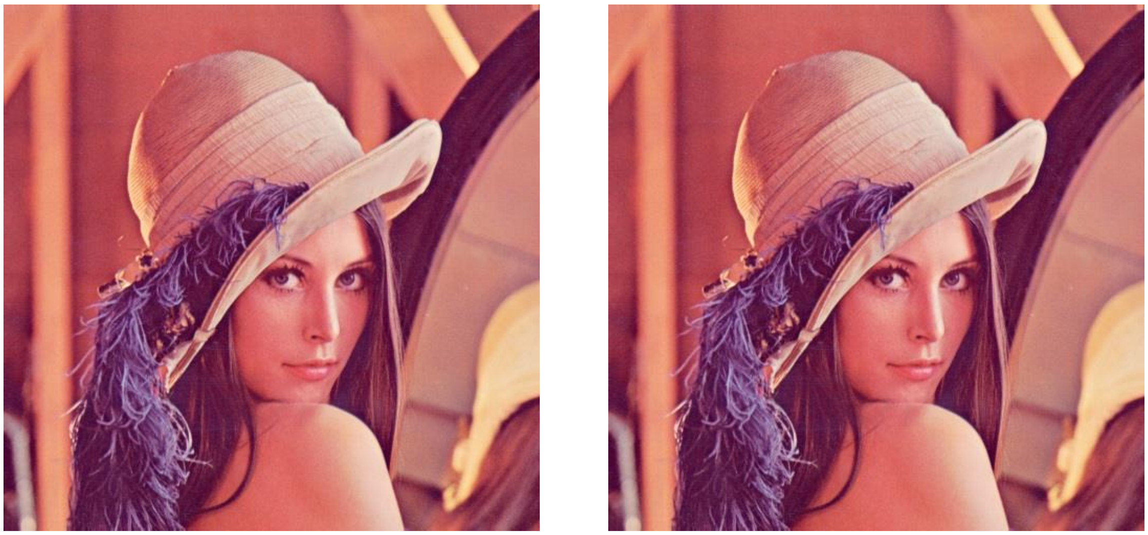


Figure 6 a. Host Lena Image b. Watermarked Lena image PSNR (42.35) db.

(a) (b)

Figure (7) a. Host flower Image b. Watermarked Flower image PSNR (43.23) db.

Figure (8) a. Host lion Image b. Watermarked lion image PSNR (38.22) db

(a)

(b) (b)

Figure (9) a. Host flower Image b. Watermarked blue flower image PSNR (38.4) db.

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