Implementation Of Image Security Issues Using Mixed Frequency Domain Scheme

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Abstract

This paper presents a comparative study of watermarking schemes. For that, we implemented two make over techniques in the direction of implant a watermark or significance in a wrap picture. In this paper we encompass united Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT) algorithm. According to the characteristics of human visualization, the information of digital watermarking which has been discrete cosine Transformed, is put into the high frequency band of the image which has been wavelet transformed. Image authentication hides the secret or private information in digital images. The projected picture validation scheme imperceptibly embeds an authenticated image into the wrap image and also increases robustness & concealing properties of an image. It is very valuable aligned with geometric attacks that are applied on image for development. The authentication drawing out procedure necessitates not only the watermarked image but also the original image and its characteristics.

Keywords*: digital image watermarking, discrete cosine transform, discrete wavelength transform*

1. Introduction

Digital watermarking technology is to utilize for multimedia components like acoustic and video so, the digital embedding method to put out of sight the watermarking information for any digital products. The watermarking signal being implanted into transporter is as a delicate signal to insert into a well-built environment [1]. For digital images digital watermarking can be performed in two domains: Spatial and frequency. One of the simplest methods of spatial domain is to revolutionize the Least Significant Bit of the original image as a result of the watermark bits to acquire the watermarked image. Such transform is not at each and every one perceptible by the human eyes. Excluding the drawback is, if the LSB of the image is deliberately misrepresented with all 0's or all 1's subsequently the whole information of watermark is vanished and not at all be retrieved. Consequently the supplementary spatial domain watermarking technique is transforming the intensity altitude of the original image depending on the watermark data. However, this method is not robust at all.

This paper introduces an algorithm of digital watermarking based on Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT) which increases robustness and concealing of a watermarked image. By the side of first the watermarking image utilized using the discrete cosine transformed. Because of the discrete cosine transformed modulus has only the low frequency component information of watermarking image, as long as this information do not misplace then the watermarking image can be rehabilitated fine. This enhances the robustness and concealment. The original image It is decomposed by the use of the discrete wavelet transform and prefer the appreciate wavelet modulus in the high frequency level. The watermarking information is embedding into the related position. Composed the whole image IDWT transformed and get the watermarked image. The watermarking is uncontaminated but it reasonably in the diverse way. Even though momentous advancement has been prepared in watermarking of digital images, many exigent problems still remain in practical applications. In the middle of these problems is the flexibility of watermarking to elimination attacks. Such attacks are easy to put into practice; nevertheless it can make a lot of the obtainable watermarking algorithms unproductive.

2. Frequency domain transforms

2.1 Discrete cosine transform

Various types of transforms are available for image processing, the character of discrete Fourier transform (DFT), and discrete cosine transform (DCT) turn over the image edge to make the image transformed into the form of even function. It's one of the most common linear transformations in digital signal process technology.

DCT coefficient in row *u* and column *v* of the DCT matrix.

$$C(u,v)=\alpha_u\alpha_v\sum_{x=0}^{M-1}\sum_{y=0}^{N-1}I(x,y)\cos\frac{\pi(2x+1)u}{2M}\cos\frac{\pi(2y+1)v}{2N},$$

for $0\le u\le M-1$, $0\le v\le N-1$ and

$$\alpha_u=\begin{cases}1/\sqrt{M}, & u=0\\ \sqrt{2/M}, & 1\le u\le M-1\end{cases}, \quad \alpha_v=\begin{cases}1/\sqrt{N}, & v=0\\ \sqrt{2/N}, & 1\le v\le N-1\end{cases}$$

$$x(m,n)=\sqrt{2/M}\sqrt{2/N}\sum_{u=0}^{M-1}\sum_{v=0}^{N-1}\alpha u\alpha v y(u,v)$$

The image is reconstructed by applying inverse DCT operation according to equation shown below:

$$f(x,y)=\sum_{u=0}^{M-1}\sum_{v=0}^{N-1}\alpha_u\alpha_v C(u,v)\cos\frac{\pi(2x+1)u}{2M}\cos\frac{\pi(2y+1)v}{2N},$$

for $0\le x\le M-1$, $0\le y\le N-1$ and α_u , α_v as defined above.

The main information of 2D-DCT can not only concentrate of original image into the smallest low-frequency coefficient, but also it can cause the image blocking effect being the smallest, which can realize the good compromise between the information centralizing and the computing complication. So it obtains the wide spreading application in the compression coding.

2.2 Discrete wavelet transform

Wavelet transform is a time domain localized 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 distill the information from signal.

The basic idea of discrete wavelet transform (DWT) in image process is to multi-differentiated decompose the image into sub-image of different spatial domain and independent frequency district. Then transform the coefficient of sub-image. After the original image has been DWT transformed, it is decomposed into 4 frequency districts which is one low-frequency district(LL) and three high-frequency districts(LH,HL,HH). If the information of low-frequency district is DWT transformed, the sub-level frequency district information will be obtained. A two-dimensional image after three-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 districts of HL1, LH1, and HH1. The low-frequency district information also can be decomposed into sub-level frequency district information of LL2, HL2, LH2 and HH2. By doing this the original image can be decomposed for *n* level wavelet transformation [3].

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

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According to the character of HVS, human eyes are sensitive to the change of smooth district of image, but not sensitive to the tiny change of edge, profile and streak. Therefore, it's hard to conscious that putting the watermarking signal into the big amplitude coefficient of high-frequency band of the image DWT transformed. Then it can carry more watermarking signal and has good concealing effect.

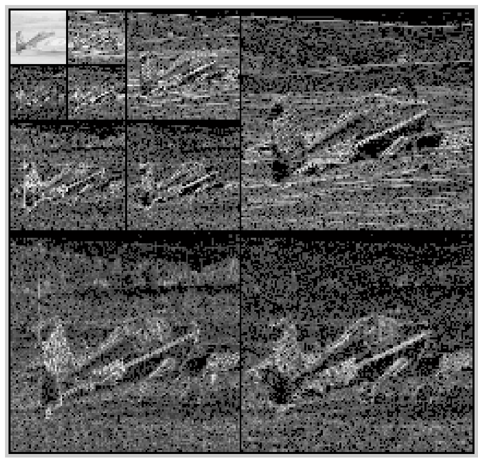


Figure 1. Two-dimensional image after three-times DWT decomposed

3. Proposed algorithm

We represent our proposed algorithms in execution flow. Figure 2 is use for watermark embedding and figure 3 is use for watermark distilling.

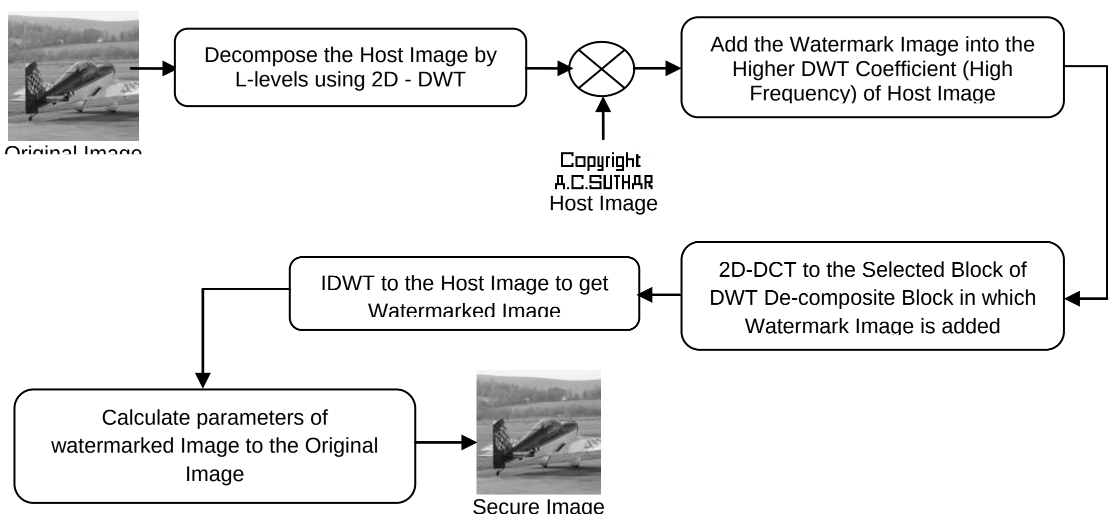


Figure 2. Execution flow of embedding method

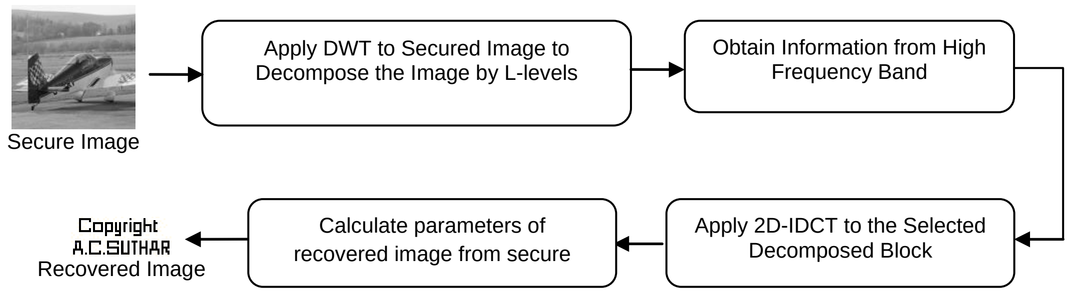
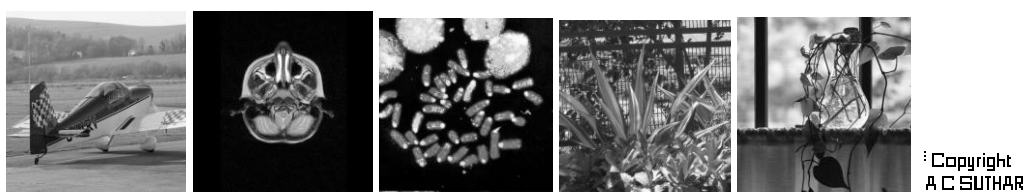


Figure 3. Execution flow of distilling method

4. Experimental results

A 256x256 gray scale images is taken as the cover image and watermark of size 64x64 is embedded into the cover image using the three methods DCT, DWT and proposed algorithm. In the experiment Figure (4-a), Figure (4-b), Figure (4-b), Figure (4-d) and Figure (4-e) are used as cover images and Figure. (4-f) is used as the watermark.

Different security issues applied on the various images and obtain the Peak Signal to Noise Ratio as a matrix for comparison.



(a) (b) (c) (d) (e) (f)

Figure 4. Useful figures for simulations

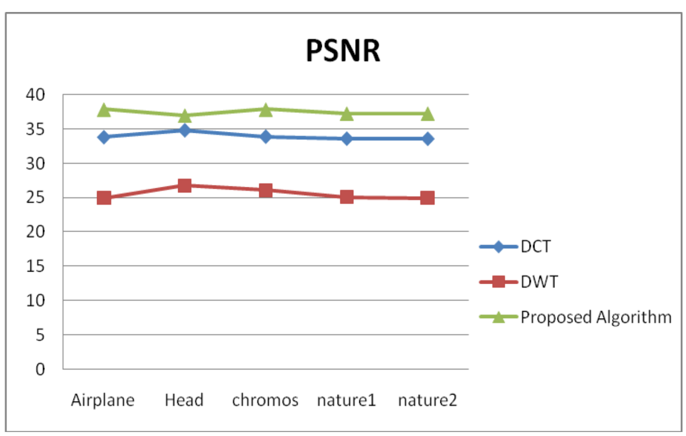


Figure 5. Comparative Analysis of PSNR of proposed algorithm with DCT and DWT

Figure 5 represents value of PSNR different 5 images such as airplane; head, chrome, nature1 and nature2 without any attack apply. In that we notice in all image propose algorithm shows superior performance. But this result is not enough for prove superior in attack case. So, we apply Salt and pepper, Gaussian, Blurring, Unsharpening, High Pass Filter, and Low Pass filter, Compression, Median Filter, Cutting and Jitter are applied on the watermarked images attack.

Table1. Simulation results of peak signal to noise ration of various security issues

Security issues /Attacks	***Discrete cosine transform (PSNR dB)***	***Discrete wavelet transform (PSNR dB)***	***Proposed Algorithm (PSNR dB)***
Without Attack	33.825	24.994	37.877
Salt and pepper	24.923	22.255	25.208
Gaussian	24.763	22.195	25.075
Blurring	28.853	28.478	29.016
Unsharpening	20.537	12.433	22.882
High Pass Filter	26.512	18.295	29.001
Low Pass Filter	31.160	30.369	32.078
Compression	31.451	30.638	31.939
Wiener Filter	34.769	32.254	35.682
Median Filter	33.262	30.363	34.262
Cutting	15.365	15.009	16.398
Jitter	4.823	4.823	4.823

Experiment result mention in tabular and chart form for analysis. Table 1 represents the value of PSNR of proposed algorithm with DCT and DWT with airplane image and Figure 6 represents in chat form of table 1 data.

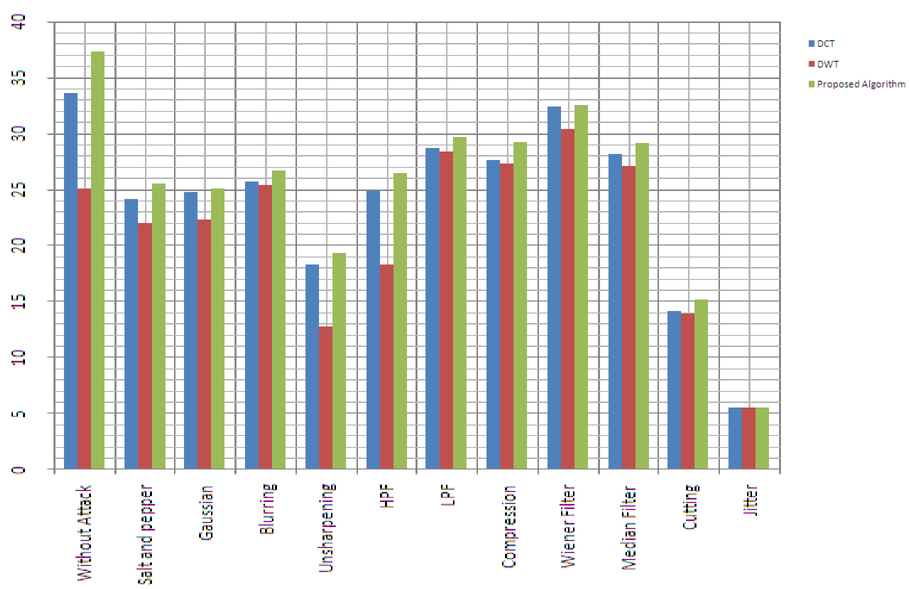


Figure 6. Comparative Analysis of PSNR of proposed algorithm with DCT and DWT with airplane image

5. Conclusion

The robustness of the watermarking schemes are verified by applying different attacks like adding Salt and pepper, Gaussian , Blurring, Unsharpening, High Pass Filter, Low Pass filter, Compression , Median Filter , Cutting and Jitter. Peak Signal to Noise Ratio (PSNR) is used as a measure for comparing the original image and watermarked image, original watermark and extracted watermark. If the PSNR value is high then the algorithm is robust.

After applying the attacks to the watermarked image, the watermark is extracted from the watermarked image with attack. It is observed that the PSNR values calculated for watermark extraction after applying attacks is high for proposed algorithm in all attack case for natural image and plane image. The watermarking scheme is robust to all the attacks shows proposed algorithm is more efficient then DWT and DCT.

6. References

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