

Review on Image Watermarking Techniques

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Abstract

In this world of internet the multimedia data can be easily copied and transmitted. Watermarking provides us solution to copyright the multimedia data. It is the technique to hide image within other image. In this paper, we have discussed various methods of watermarking and compare it. From this survey we try to find the more secure and robust watermarking techniques.

Keywords: Watermarking, DCT, DFT, DWT

1. Introduction

A Digital image watermarking systems is efficient method for copyright protection and authentication of digital image. Watermarking techniques hide a message that cannot guess by anyone, watermarking is used to provide a kind of security for various types of data. Digital watermarking is of three types, visible watermarking, invisible watermarking and dual watermarking. In visible watermarking the image is partially visible in other image. Visible watermarks are generally used for the copyright protection. Invisible watermarks cannot be seen, but can be detected with some algorithm. Dual watermark is a combination of a visible and an invisible watermark. An undetectable watermark can be used as a backup for the visible watermark. It is used to verify ownership.

There are two methods to embed the watermark, Spatial Domain and Transform Domain. In spatial domain, the least significant bits of original contents is modified. With this method Successful recovery of watermark image is possible but it offers less security.

If cover image is

01001010 11010010 00110010...

Secret image is

1001011...

Watermark image is

0100101**1** 1101001**0** 0011001**0**...

In Frequency domain first the host or main data is transformed and then modifications are applied to transformed coefficients. Watermark is embedded

transform coefficients. Hence it is more secure than spatial domain watermarking.

2. Transform domain watermarking

Watermarking in the transform domain is done with discrete Fourier, discrete cosine, and wavelet transform of the host image. The host image is decomposed by these transforms and then secret image is embedded in it. Inverse transform is applied to get the host image back.

2.1 Discrete Cosine Transform (DCT)

DCT watermarking is more robust as compared to spatial domain watermarking. But they are difficult to implement and computationally more costly.

2.1 Discrete Fourier Transform (DFT)

In DFT, low frequency coefficients modification can cause visible artifacts in the spatial domain, so low frequency coefficients should be avoided. High frequency coefficients are removed during JPEG compression. The best way to avoid the both lower and higher frequencies weakness is to embed the watermark in the mid level frequency.

2.3 Discrete Wavelet Transform (DWT)

The transform is based on waves, called wavelets, of varying frequency and limited duration. It provides both frequency and spatial description of an image. The wavelet transform decomposes the image into three spatial directions, i.e. vertical, horizontal and diagonal.

It decomposes the image into different frequency ranges such as low frequency, middle frequency and high frequency. Magnitude of DWT coefficients is high in the lowest bands (LL) at each level of decomposition and is least for other high bands .

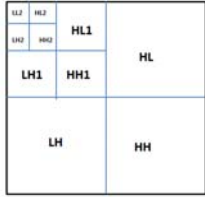


Fig.1 DWT three level decomposition

4. General method of watermarking

The process of image embedding and image extraction is given as follows:

4.1 Image Embedding

- The cover image is decomposed into different sub images.
- The cover image can be decomposed with any of the transform such as DCT, DFT, DWT
- Select one sub image for secret image embedding
- Secret image(watermark) is now embedded within the sub image with some algorithm
- Apply inverse transform, to get cover image

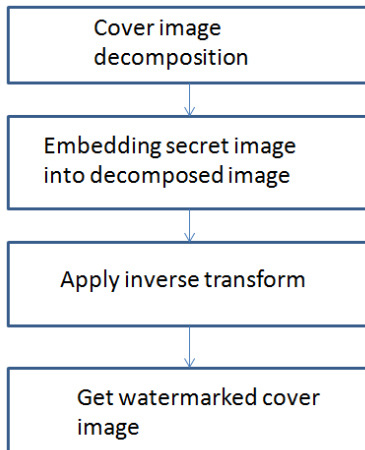


Fig.2 watermark embedding flowchart

4.2 Image Extraction

- Watermarked cover image is decomposed into sub images
- Extract secret image with reverse algorithm that is used for combining secret image

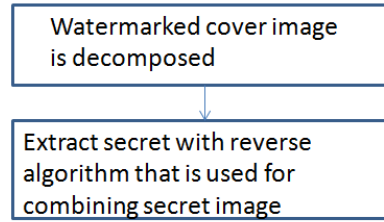


Fig.3 watermark extraction flowchart

5. Related work

The comparison between DFT and DWT is explained in paper [1], the result shows that DWT is efficient than the DFT. For DFT the PSNR is found to be 47 and NC is 0.1696, while for DWT, PSNR=67 and NC=0.9807. Hence it is concluded that for the better result both the technique should be combined.

In research paper [2], both DCT and DWT are used. In This DCT is applied to the watermark and DWT is applied to cover image, combine both the image and perform IDWT to get cover image. Reverse process is used to extract the watermark. But for the extraction process original cover image is required, so it is less secure.

Paper [3] represents a method in which watermark is split into two shares, one share is embedded into a cover image and other share is the key to extract the watermark. Hence it can be easily hacked.

It uses (N,N) secret sharing scheme. The proposed method embeds the copyright image into original image and is to be shared among n participants. Then the copyright image could be recovered using simple XOR operations without any loss.

For embedding:

Secret image $A=[]$
 Random matrices as $B1=[]$ $B2=[]$
 1) $A1=B1 \oplus A$
 2) $A2=B1 \oplus B2$
 3) $A3=B2 \oplus A$

For extraction:

$A1 \oplus A2 \oplus A3 = A$

Hence all N shares are required for the extraction.

6. Overview of literature Survey

The overall methods comparison is given in the following table. The comparison is done on the basis of their PSNR (Peak Signal to Noise Ratio) value.

Research paper	Method used	Features/PSNR
Namita Chandrakar, Jaspal Bagga [5]	i) LSB embedding algorithm for spatial domain ii) DCT and DWT	i) In spatial domain the watermark can be successfully and easily recovered ii) more security but successful recovery cannot be possible
Suppat Rungraungsilp, Mahasak Ketcham, Tanee [1]	i) Low band DFT ii) Haar wavelet transform in DWT	DFT PSNR=47 NC=0.1696 DWT PSNR=67 NC=0.9807
Mei Jiansheng, Li Sukang and Tan Xiaomei [2]	First apply DCT to watermarking image DWT to host image	PSNR=50.02 NC=0.9782
Nagaraj Dharwadkar, B. Amberker [3]	watermark is split into two One share is embedded into a cover image and other share is the key to extract the watermark	PSNR=57.71 Less security
Sushma Yalamanchili, M.Kameswara Rao [4]	Encode the embedded image into n shadows	PSNR=32.67 Less security

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7. Conclusion

In this review paper we have focused on the watermarking concept and different techniques. The transform domain technique is efficient over the spatial domain. Among all the transforms DWT gives best result. From this Literature review it is concluded that we need to increase the security of watermarking processes with new methods by using DWT more effectively i.e. high level DWT, and secret image can be encrypted with some technique before embedding within cover image. This will increase its security.