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Review Paper of Digital Image Watermarking using Discrete Wavelet Transform

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ABSTRACT: In this paper a digital image watermarking based on 2-D discrete wavelet transform (DWT) is presented. In this technique a multi-bit watermark is embedded into the low frequency sub-band of a cover image by using alpha blending technique. During embedding, watermark image is dispersed within the original image depending upon the scaling factor of alpha blending technique. Extraction of the watermark image is done by using same scaling factor as for embedding. Performance of method for different value of scaling factor is analyses & compare with 2-D DWT method by using statistical parameters such as peak signal-to-noise-ratio (PSNR) and mean square error (MSE).

KEYWORDS: Discrete Wavelet Transform, Haar wavelet, JPEG Image Encoding, Peak Signal to Noise Ratio,

I. INTRODUCTION

Due to the advancement of digital multimedia tools the storage and distribution of multimedia content is become very easy. Issues on security have emerged and there is a vital need for protecting the digital content against counterfeiting, piracy and malicious maniple. Watermark--A visible or invisible signature embedded inside an image to show authenticity or proof of ownership. The hidden watermark should be inseparable from the host image, robust enough to resist any manipulations while preserving the image quality. Thus through watermarking, intellectual properties remains accessible while being permanently marked. This digital signature approaches use in authenticating ownership claims and protecting proprietary hidden information, discourage unauthorized copying and distribution of images over the internet and ensure a digital picture has not been altered.

This particular application area is known as fingerprinting and thus has numerous financial implications. The most serious attack for fingerprinting is the “collusion attack”. If attacker has access to more than one copy of watermarked image, he/she can predict/ remove the watermark data by colluding them. Researchers working on “fingerprinting” primarily focus on the “collusion attack”.

So, while designing a watermark scheme, we decided that our proposed schemes must be designed in such a way that schemes are inherently collusion attack resistant. Therefore this thesis presents a new term “ICAR (Inherently Collusion Attack Resistant)” as a requirement for a watermarking system. The other 3 issues are taken into account while developing the watermarking schemes.

Then various application areas of watermarking are represented and what may the key requirements of a successful watermarking system are discussed. Since watermarking can be classified on various parameters, the various types of watermarking are represented based on different classifications.

ISSUE 1: Till now there is no “Generic” nature in the watermarking algorithms available. More precisely, if certain approach is applicable for a gray level image, the same approach does not work for the other formats of an image.

ISSUE 2: Even if gray color image watermarking algorithms are extended for RGB color images, the maximum work has been done for BLUE color channel only because human eyes are less sensitive to detect the changes in BLUE color channel. No attack impact analysis, i.e., which color channel may be affected by a particular attack, has been carried out.

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Therefore, apart from choosing digital Image Watermarking as a major problem, we have chosen to identify the suitability of a color channel with respect to attack (if any) for multicolor channel images (True color windows BMP, uncompressed JPEG). We also decided to explore the ways such that attack impacts may be minimized before the watermark embedding process**.**

ISSUE 3: In most of the research papers, once the watermarking scheme is finalized, it is applied to all test images. Since each image is different and has certain characteristics and after embedding the watermark data by a particular watermarking scheme, its performance against a particular attack may not be similar with other image. No study is conducted to make the embedding scheme based on some image characteristics.

II. LITERATURE REVIEW

N. Senthil Kumaran et al. [1], Image security is a relatively very young and fast growing. Security of data or information is very important now a day in this world. In this paper proposed to advantages and that working functionalities. This algorithm is verified on different watermarking images. And it's providing robust and secure results. To measure the effectiveness of this algorithm is provide embedding and extracting images. PSNR and MSE also calculated the embedding watermarking images. In this DWT watermarking embedding result images provide the good, secure and robust. In this paper proposed to how to process LSB technique.

Aase et al. [2] briefly discussed the issue of watermarking digital images as part of a general survey on cryptography and digital television. The authors provided a description of a procedure to insert a watermark into the least significant bits of pixels located in the vicinity of image contours. Since it relies on modifications of the least significant bits, the watermark is easily destroyed. Further, their method is restricted to images, in that it seeks to insert the watermark into image regions that lie on the edge of contours.

Ahmed et al. [3] described a method that adds or subtracts small random quantities from each pixel. Addition or subtraction is determined by comparing a binary mask of bits with the LSB of each pixel. If the LSB is equal to the corresponding mask bit, then the random quantity is added, otherwise it is subtracted. The watermark is subtracted by first computing the difference between the original and watermarked images and then by examining the sign of the difference, pixel by pixel, to determine if it corresponds to the original sequence of additions and subtractions. This method does not make use of perceptual relevance, but it is proposed that the high frequency noise be pre-filtered to provide some robustness to low-pass filtering. This scheme does not consider the problem of collusion attacks.

Akhaee et al. [4], digital watermarking has been investigated deeply for its technical and commercial feasibility in all media types like, digital photographic image, printed materials or document images and video. It is a proven method for reducing content piracy and improving the ability to identify, tract and manage digital media. It is widely used in applications like rights management, remote triggering, filtering/classification and e-commerce. It is a technique that is used to balance the need for content security with best possible consumer experience to enable media and entertainment industries to adapt the advanced facilities of the modern digital revolution while reducing the threat of content theft.

Ali et al. [5], proposed two schemes where the first was fragile watermarking and was used to authenticate the digital content, while the second was used to reconstruct the region where the integrity verification fails.
The watermark embedding procedure even though efficient reduced the quality of the reconstructed image when the strength of attack was increased. Different decomposition levels grant the tamper detection within the image in localized spatial and frequency domain. The aim is to present an authentication technique that hides watermark into some wavelet sub-bands of the to-be-authenticated image. This scheme is capable of detecting malicious and incidental manipulations. Furthermore, security is of particular concern that is often overlooked. It is extremely difficult for an attacker to create a faked image that appears to be authentic.

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III. DIGITAL WATERMARKING

The information to be embedded in a signal is called a digital watermark, although in some contexts the phrase digital watermark means the difference between the watermarked signal and the cover signal. The signal where the watermark is to be embedded is called the *host* signal. A watermarking system is usually divided into three distinct steps, embedding, attack, and detection. In embedding, an algorithm accepts the host and the data to be embedded, and produces a watermarked signal.

Then the watermarked digital signal is transmitted or stored, usually transmitted to another person. If this person makes a modification, this is called an attack. While the modification may not be malicious, the term attack arises from copyright protection application, where third parties may attempt to remove the digital watermark through modification. There are many possible modifications, for example, lossy compression of the data (in which resolution is diminished), cropping an image or video or intentionally adding noise.

Detection (often called extraction) is an algorithm which is applied to the attacked signal to attempt to extract the watermark from it. If the signal was unmodified during transmission, then the watermark still is present and it may be extracted. In robust digital watermarking applications, the extraction algorithm should be able to produce the watermark correctly, even if the modifications were strong. In fragile digital watermarking, the extraction algorithm should fail if any change is made to the signal.

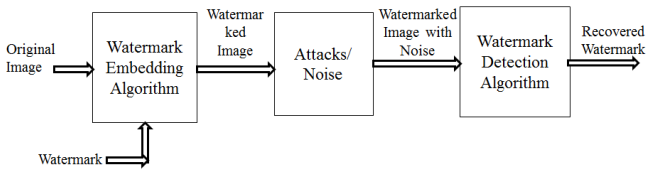

Figure 1: General digital watermark life-cycle phases with embedding-, attacking-, and detection and retrieval functions

IV. DISCRETE WAVELET TRANSFORM

The model used in [5] to implement the tree structure of Direct Wavelet Transform (DWT) is based on the filtering process. Figure 1 depicted a complete 2-level Direct WT. In this figure G and H is the high pass and low pass filter respectively.

Computation period is the number of the input cycles for one time produces output samples. In general, the computation period is M= for a j-level DWT. The period of the 2-level computation is 8. Figure 1, The Sub band Coding Algorithm As an example, suppose that the original signal X[n] has N- sample points, spanning a frequency band of zero to π rad/s. At the first decomposition level, the signal passed through the high pass and low pass filters, followed by subsampling by 2. The output of the high pass filter has N/2- sample points (hence half the time resolution) but it only spans the frequencies π/2 to π rad/s (hence double the frequency resolution).

The output of the low-pass filer also has N/2- sample points, but it spans the other half of the frequency band, frequencies from 0 to π/2 rad/s. Again low and high-pass filter output passed through the same low pass and high pass filters for further decomposition. The output of the second low pass filter followed by sub sampling has N/4 samples spanning a frequency band of 0 to π/4 rad/s, and the output of the second high pass filter followed by sub sampling has N/4 samples spanning a frequency band of π/4 to π/2 rad/s. The second high pass filtered signal constitutes the second level of DWT coefficients. This signal has half the time resolution, but twice the frequency resolution of the first level signal. This process continues until two samples are left. For this specific example there would be 2 levels of decomposition, each having half the number of samples of the previous level.

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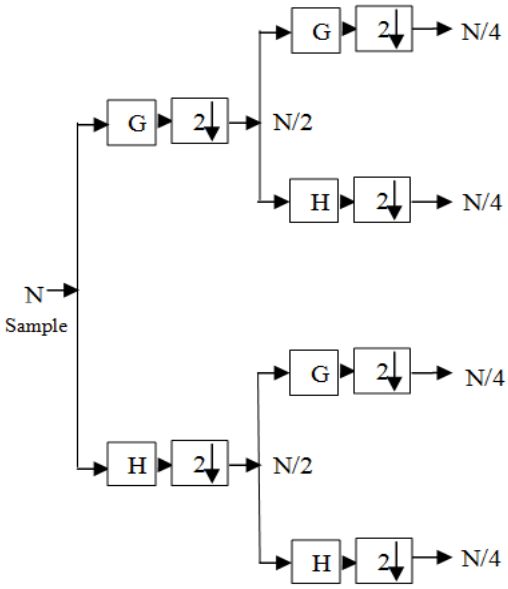

Figure 2: 2- Levels for DWT. Where G, H are the high-pass and low-pass filter coefficient.

Th decomposition (remaining two samples, in this case). The DWT will then have the same number of coefficients as the original signal.

V. METHODOLOGY

A. Watermark Embedding

For this process firstly we apply 2 level DWT on host image decomposes the image into sub-images, 3 details and 1 approximation. The approximation looks just like the original. The same manner 2 level DWT is also applied to the watermark image. For this Haar wavelet is used. Then technique alpha blending [8] is used to insert the watermark in the host image. In this technique the decomposed components of the host image and the watermark are multiplied by a scaling factor and are added. Since the watermark embedded in low frequency approximation Component of the host image so it is perceptible in nature or visible. Alpha blending: formula of the alpha blending the watermarked image is given by

WMI=k*(LL3) +q*(WM3) WM3 = low frequency approximation of Watermark, LL3 = low frequency approximation of the original image, WMI=Watermarked image, k, q-Scaling factors After embedding the watermark Image on cover image Inverse DWT is applied to the watermarked image coefficient to generate the final secure watermarked image.

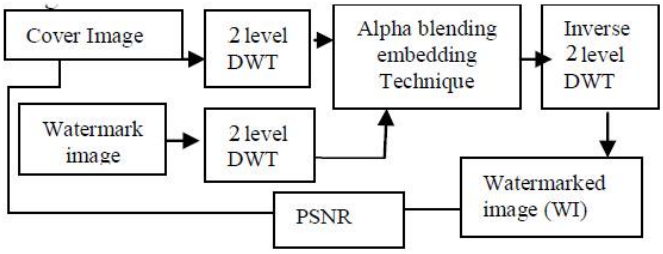

Figure 3: Watermark embedding process by 2 levels DWT.

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B. Watermark Extraction

For this firstly we applied 2 levels DWT to watermarked image and cover image which decomposed the image in sub-bands. After this we apply alpha blending on low frequency components. *Alpha blending***:** Formula of the alpha blending extraction for Recover watermark is given by RW = (WMI - k*LL3) /q RW= Low frequency approximation of Recovered watermark, LL3=Low frequency approximation of the original image, and WMI= Low frequency approximation of watermarked image. After extraction process, Inverse discrete wavelet transform is applied to the watermark image coefficient to generate the final watermark extracted image. Fig. 4 shows the watermark extraction process.

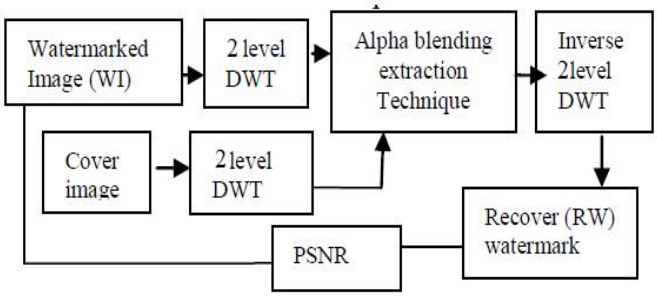

Figure 4: watermark extraction process by 2 levels DWT.

VI. CONCLUSION

A 2 level DWT based image watermarking technique has been implemented. This technique can embed the invisible watermark into the image using alpha blending technique which can be recovered by extraction technique. Experiment results shows that the quality of the watermarked image are dependent only on the scaling factors k and q and the recovered watermark are independent of scaling factor. Results shows that the recovered images and the watermark are better for 2-D discrete wavelet transform then 1 & 2 level discrete wavelet transform.

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