Discrete Wavelet Transform Sub-bands Based Digital Video Watermarking

Rachana Mittal
M.tech student, CSE Branch
Poornima College of Engineering
Jaipur, India
mittalrachana04@gmail.com

Dr. Ajay Khunteta
Professor, department of CSE
Poornima College of Engineering
Jaipur, India
khuntetaajay@poornima.org

***Abstract*— Fame of digital video foundation is accompanied by the necessity for copyright safeguard to preclude illicit copying and distribution of digital video. . As a procedure of copyright security, digital video watermarking has recently emerged as a enormous area of curiosity and an extraordinarily energetic subject of study. In this article, the targeted semi-visible watermarking is approached using Daubechies Wavelet functions and Principal component analysis (PCA) based approach, the watermark or message embedded into cover image, prior to it. The embedding is carried out in independent components of PCA domain, by the virtue of alpha, the secret key. Experimental setup reveals that embedding a watermark can be performed more faster and more robust.**

Keywords*— *digital watermarking, haar, Discrete Wavelet Transform, matlab, component analysis

I. INTRODUCTION

Digital representation offers many advantages for processing as well as distributing image and other types of information world-wide. First, digital software programs offer unprecedented flexibility in presenting, creating manipulating and editing the digital information. The digital image's proliferations are encouraged into many more applications by improving the compression technology[1]. Second, digital data is allowed to be distributed and disseminated on a wide scale through digital communication network like internet. Lastly digital information can be processed, and in particular, copied without introducing loss, degradation, or noise. The field digital watermarking in various forms is thus a branch of the digital technological era. Content owners and creators are concerned more about the consequences of the illegal copying and distribution on the cumbrous rate. Although the issue is not only idealized as illegal copying and distribution of copyrighted materials has given an arise to the economic damage which is estimated to be in the billions of dollars. This technological advancement in peer-to-peer systems will actualize ample challenges for copyright applications[3]. Thus, there is a great desire for methods which can preserve the economic value of digital image and protect the rights of content owners. The most appropriate mechanism, to serve this target is none other than digital watermarking. Further the article is organized as follows:

Review on different watermarking techniques including spatial domain and transform domain are discussed and is presented in Section 2 'Literature Survey' with a literature review. Watermarking and its essential ingredients, classification of different watermarking attacks and applications regarding watermarking have been discussed in Section 3 'Digital Watermarking'. Hybrid based watermarking technique has been discussed in Section 4 'Discrete Wavelet Transform'. Experimental Tool & methodology are detailed in Section 5. Section 6 and 7 carried experimental results and future scope.

II. LITRATURE SURVEY

In the current scenario, digital interactive media technology has shown a remarkable growth. Various advantages includes during the transmission of data as well as simple annotating or tampering in any unit of the digital interactive media, thus enable to imitate a digital information without any damage to the quality of the information and intelligence operations have made the digital interactive media technology of great importance to the analog supplement[7]. Watermarking techniques can be differentiated into the following four categories: Image Watermarking, Video Watermarking, Audio Watermarking, and Text Watermarking. Invisible and visible are the two elementary types of digital image watermarking, and the digital watermark extracted can be treated as either visible or invisible[4]. The spatial domain includes inserting watermark by altering the minimal significant bit of the image content with a bit provided by the watermark content [8]. Generally Discrete versions of Cosine Transform (DCT), Fourier Transform (DFT) and Wavelet Transform (DWT) [10] are deployed as variant methods for data hiding. The important objective provided by transform domain techniques is that they can achievepros of general characteristic of other domains to provide the disadvantages of pixel-based process [6,7].

In paper 'Digital Watermarking: A Tutorial Review' [1], Saraju P Mohanty discussed about the history and techniques of information hiding i.e. image, test, video and compared this technique with steganography and cryptography.

'Techniques For Data Hiding' by W. Bender, D. Gruhl, N. Morimoto and A. Lu proposes several data hiding technique for embedding data in host text, image as well as audio signals with an aim of achieving indemnity of huge embedded data with respect to intentional attempts [2].

One more approach 'A Novel Image Zero Watermarking Scheme Based on DWT-SVD' by Zhou, Jin has been taken into account which inevitably leads to some quality degradation to embed a watermark [3,5].

III. DIGITAL WATERMARKING

Digital image watermarks are fragments of information inserted to digital content like video frames, sound or still images which can be later extracted to get an assertion about the content. This expertise could also be textual data of some random creator. Its copyright or it can be a captured image or multimedia itself. Most of the time, a digital picture watermark can also be inserted into all types of interactive media. Transforming the watermarked image is called as a predetermined attack, even if the purpose of such transformation might be malicious or non-malicious. A digital image watermarking is a way where owner clandestinely inserted noise-tolerant image content[8].

A. Essential Ingredients of Watermarking

Numerous defining properties characterize the watermarking system that includes:

i) Fidelity: An ideal component of watermarking system is that it requires fidelity. A watermarking system is useless if it has a distorted cover image or a distracted useless image.

ii) Robustness: The ideal watermark needs to be entirely resistant to distortion and should be robust when introduced during either normal use.

iii) Blind Detection: Blind detection basically points out to the power to trace the image watermark without permission to the original content.

B. Applications of Digital Watermarking

- Copyright Protection - for the protection of the intellectual property, the content owner can insert a watermark that represents copyright content in the image.
- Source Tracking (different recipients have different watermarked content)
- Fingerprinting: to trace the source of illegal copies, the owner can use the fingerprinting technique.
- Data authentication: the so called fragile watermarks can be used to know the authenticity and integrity of content.

IV. DISCRETE WAVELET TRANSFROM

Discrete wavelet transforms which offers excellent space frequency localization and security along with an insight into principal component analysis used for orthogonal transformation. The discrete wavelet transform serves as an authentic opportunity to the cosine transform that is pre-owned by standard JPEG image extensions. The discrete wavelet transform domain is more appropriate for image watermarking than the discrete wavelet transform on various background:

- The DWT provides fascinating space-frequency localization of pertinent image characteristic like textures and edges.
- The discrete wavelet transform stipulates great form of the human visual system.
- The DWT is flexile as there are infinite wavelet filter banks.

Some examples of DWT are: Haar Wavelets, The dual tree complex wavelet transform, Daubechies Wavelets etc.

V. EXPERIMENTAL TOOL & METHODOLOGY

A. Matlab

For technical computing, MATLAB is a high-performance language. The specific usages are: Algorithm development, Math and computation, Data analysis, exploration, and visualization etc.

B. Methodology

The methodology adopted for digital video watermarking is depicted in fig.1. Image are processed through DWT and PCA domains, where embedding is performed by mathematical addition.

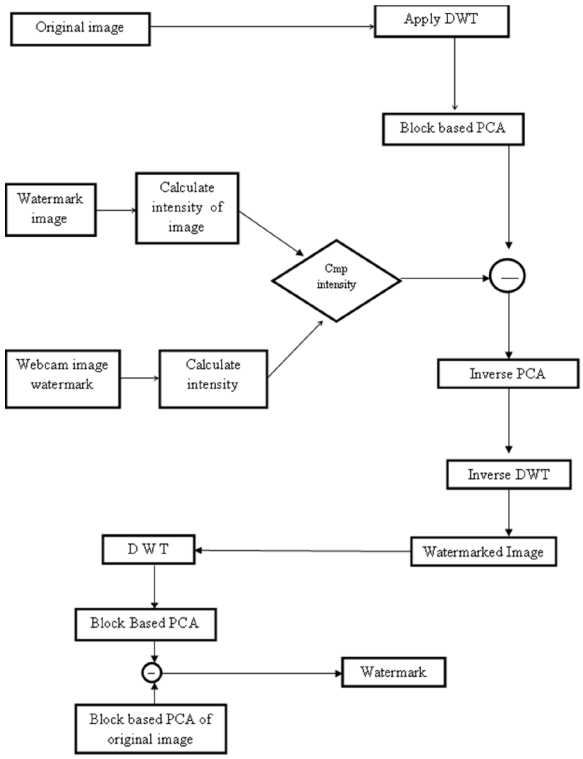


Fig.1:- Block diagram representation of watermarking

For the sake of extraction of hided watermark, a reversible process is deployed so as to reach PCA domain as shown by fig.1 and an invertible mathetical operation is carried out to extract the hidden message.

C. Result verification

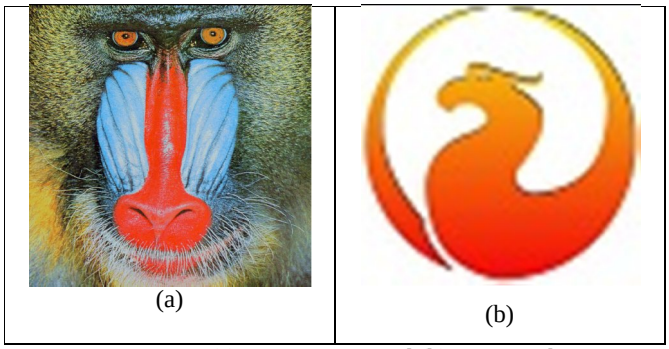
The NC (Normalized Coefficients) and MSE(Means Square Error) values are obtained for the image watermarking process. MSE denotes the equality index of original cover image with comparability to watermarked image. While NC represents the index that shows the detritions of extricated image watermark when confront to original image watermark which has been used for concealing in the earlier stage. More resemblance more is watermarking by using this approach in an efficient way.

PSNR=10Log10(2552/MSE)

$$NC = \frac{\sum W_{i,j} * \sum W'_{i,j}}{\sqrt{\sum (W_{i,j})^2 * \sum (W'_{i,j})^2}}$$

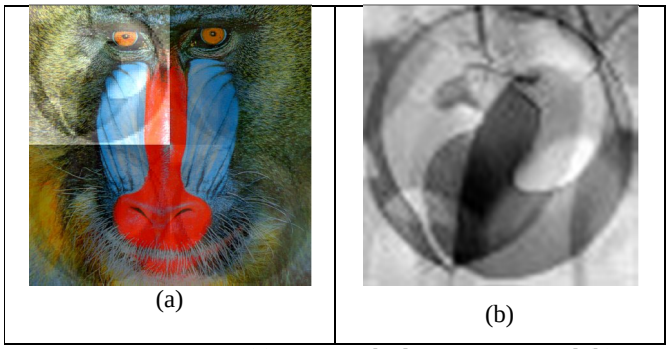
VI. EXPERIMENTAL RESULTS

This proposed work is applied to an image 'image1.tif' using a watermark logo 'image2.tif' shown in figure 2. depending on the intensities of watermark. The RGB watermark is converted to gray before embedding. Figure 3 shows watermarked cover image and extracted watermark respectively.



(a) (b)

Fig.2:- Depicts (a) Cover image and (b) watermark message image



(a) (b)

Fig.3:- Depicts (a)Watermarked cover image and (b) extracted watermark message

VII. CONCLUSION

Digital image watermarking technology is a rising field in information technology, cryptology, engineering science and signal process and communications. In this article we have proposed a novel watermarking scheme for colored digital frames of a video session. The retrieved results gives the PSNR and NC values as 105dB and 0.95 respectively. It proves that this novel approach can be utilized to achieve better watermarking performance as compared to standard state of arts.

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