A NEW APPROACH FOR DIGITAL WATERMARKING IN RGB IMAGES

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Abstract— **The goal of proposed work is to improve the robustness of watermarked image. The watermark is embedded into original image. The original image and watermarked image is required for extraction of digital watermark. The method of digital watermarking in frequency domain is analyzed and verified on RGB images. Also a comparison is performed between PSNR values of watermarked image in frequency domain.**

Keywords— **Digital watermarking, frequency domain, SWT.**

I. INTRODUCTION

Today, in the era of networking and technology we need transmission of data. For providing information security during transmission various techniques like cryptography, steganography, digital watermarking is used. In cryptographic techniques significant information is encrypted so that only the key holder has access to that information. On decryption of information, the security is lost. Steganography is the art and science of hiding the data within some cover media like image file, audio file, video file etc. Both hide a message inside a digital signal. In Steganography, the digital signal has no relation to the message, and it is used as a cover to hide its existence, while Watermarking tries to hide a message related to the actual content of the digital signal. Since digital signal or pattern is present in each unaltered copy of the original image. The digital watermark may serve as a digital signature for the copies.

According to Singh (2011), digital watermarking methods can be divided into two groups according to the domain of application of watermarking. In spatial domain methods, the pixel values in the image channel(s) are changed. In frequency domain methods, a watermark signal is added to the host image in a transform domain such as the SWT domain. A popular application of watermarking is to give a proof of correctness of digital data by embedding copyright statements.

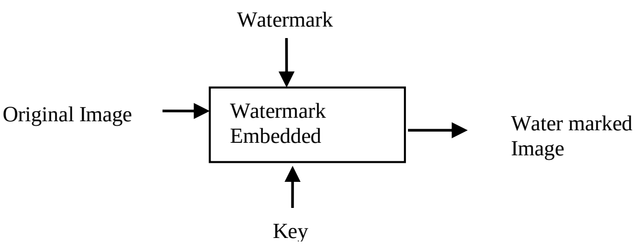

Fig.1 Watermark Embedding

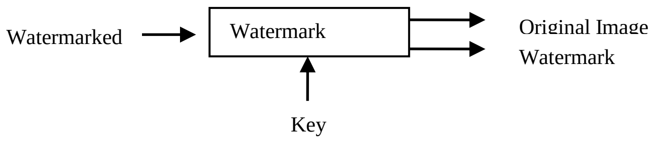

Fig.2 Watermark Extraction

In our work, we proposed a new method of digital watermarking in frequency domain. First generate the pseudorandom sequence and perform SWT transformation on original and watermark image and then XOR the pseudorandom sequence with transformed watermark and then embed the resultant image into transformed original image.

The rest of this paper is organized as follows: Section 2 gives applications of watermarking and Section 3 properties of watermarking. Section 4 consist our proposed method i.e. Discrete Stationary Wavelet Transformation (SWT) method. In section 5, experimental results and analysis is shown. At the last of this paper, Section6 concludes our work and gives some emphasis on future work also.

II. APPLICATIONS & SIGNIFICANCE OF DIGITAL WATERMARKING

Applications and significance of Digital watermarking are:

A. Copyright protection

Digital watermarking is used to identify and protect copyright ownership.

B. Software Piracy and Copy protection

Digital content can be watermarked to indicate that the content is illegally replicated. The devices capable of replication can detect such watermarks and prevent unauthorized replication of the content.

C. Tracking

Digital watermarks can be used to track usage of digital content. Each copy of digital content can be uniquely watermarked with metadata specifying the authorized users of the content. The watermarking techniques used for tracking is fingerprinting.

D. Broadcast monitoring

Advertising companies use systems that can detect the broadcast of advertisements for billing purposes by identifying the watermarks broadcast along with the content.

E. Tamper proofing

Digital content can be embedded with fragile watermarks that get destroyed when any sort of modification is made to the content. Such watermarks can be used to authenticate the content.

F. Concealed communication

Digital Watermarking is a special steganography that depends on contents can be used for concealed communication also.

III. PROPERTIES OF DIGITAL WATERMARKING

According to yadav et al (2011), various properties of digital watermarking are:

A. Imperceptibility

The embedded watermarks should not affect the quality of cover signal both perceptually as well as statistically.

B. Robustness

Watermark signal should not be removed or eliminated by unauthorized distributors.

C. Inseparability

Digital Separation of watermark signal to retrieve the cover signal is not possible.

D. Security

Watermarking keys ensure that only authorized users are able to detect/modify the watermark.

E. Embedding Effectiveness

The effectiveness of a watermarking system is the probability that the output of embedder will be watermarked. The percentage of cover signal that result in positive detection will be the probability of the effectiveness.

F. Fidelity

In general, the fidelity of a watermark system refers to the perceptual similarity between original and watermarked version of the cover signal.

G. Data Payload

Digital Data payload refers to number of bits a watermark embeds in unit of time or works.

IV. PROPOSED TECHNIQUE

The Stationary wavelet transform (SWT) is a wavelet transform algorithm designed to overcome the lack of translation-invariance of the discrete wavelet transform (DWT). Translation-invariance is achieved by removing the down samplers and up samplers in the DWT and up sampling the filter coefficients by a factor of 2^{j-1} in the j^{th} level of the algorithm. The output of each level of SWT contains the same number of samples as the input – so for a decomposition of N levels there is a redundancy of N in the wavelet coefficients

The proposed technique is divided into two steps: watermark insertion and watermark extraction. The goal of proposed work is to improve the robustness of watermarked image. After this a comparison is performed between PSNR values of watermarked image in frequency domain.

A. Algorithm Description

Watermark Embedding

1. The Read original image and watermark image.
2. Generate a pseudorandom sequence.
3. Perform SWT2 transformation on original image and watermark image, we get a coefficient matrix.
4. XOR the pseudorandom sequence with watermark image and the resultant image is modified watermarked image.
5. Watermark embedding can be done as :

$$O \leftarrow swtc \times mwi \quad \text{Eqn. (1)}$$

O=output coefficient matrix

swtc = transformed coefficient matrix

mwi =modified watermark image

6. Apply inverse discrete stationary wavelet transformation to get watermarked image.

Watermark Extraction

1. Read the watermarked image and original image.
2. Perform SWT2 transformation on original image and watermarked image, we get coefficient matrix.
3. Watermark extraction can be done as :

$$W \leftarrow swtc/oi \quad \text{Eqn. (2)}$$

oi=original image

swtc = transformed coefficient matrix

W = watermark coefficient matrix

4. XOR the above pseudo random sequence with extracted watermark image.
5. Apply inverse discrete stationary wavelet transformation to get original watermark image.

B. *Performance Evaluation*

According to Sharma and Rajni (2012), PSNR and MSE can be defined as:

PSNR: The visual quality of watermarked and attacked images is measured using the Peak Signal to Noise Ratio. It is given by equation 3

$$\text{PSNR}=10\times\log[\frac{R^2}{MSE}] \quad \text{Eqn. (3)}$$

Where R represents maximum fluctuation or value in the image, its value is 255 for 8 bit unsigned number.

Here **MSE=** Mean Squared Error between Original and Distorted Images. It is given by equation4

$$\text{MSE} = \sum_{i=0}^{M-1}\sum_{j=0}^{N-1}\left(\frac{[OI(i,j)-DI(i,j)]^2}{M\times N}\right) \quad \text{Eqn. (4)}$$

NORMALISED CORRELATION (NC): According to Shieh et al (2003), the NC between the W(i,j) embedded watermark, and the W'(i,j) extracted watermark, is defined by

$$\text{NC} = \frac{\sum_{i=1}^{Mw}\sum_{j=1}^{Nw}[W(i,j)*W'(i,j)]}{\sum_{i=1}^{Mw}\sum_{j=1}^{Nw}[W(i,j)]^2} \quad \text{Eqn. (5)}$$

Where Mw and Nw are the size of original watermark and extracted watermark. The correlation normalized by the energy of the watermark to give unity as the peak correlation.

V. Result Analysis

Fig. 3 Watermark Embedding of Vinca.jpeg into lena.jpeg

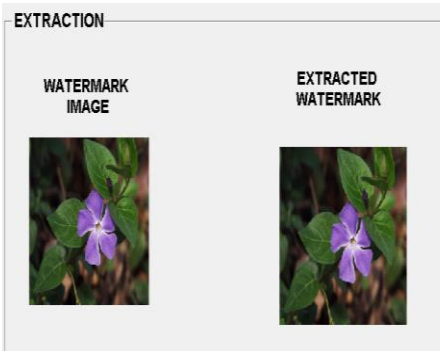

Fig. 4 Watermark Extraction

Fig. 5 Watermark Embedding of Waterfall.jpeg into lena.jpeg

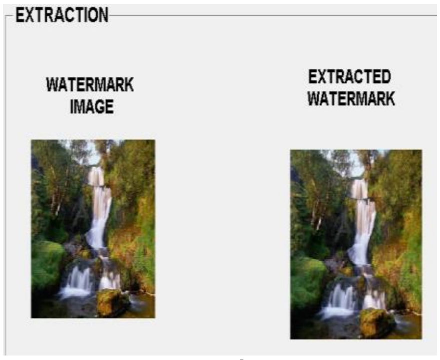

Fig. 6 Watermark Extraction

Fig. 7 Watermark Embedding of GatewayofIndia.jpeg into lena.jpeg

Fig. 10 Watermark Extraction

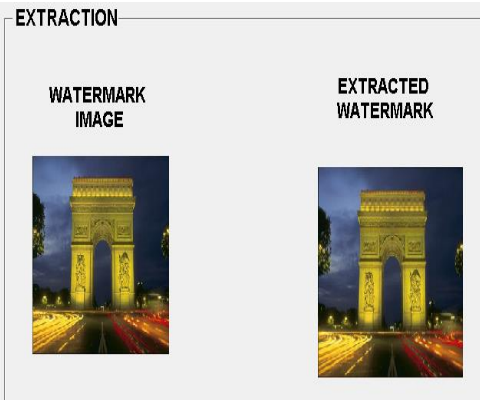

Fig. 8 Watermark Extraction

Fig. 11 Watermark Embedding of Vinca.jpeg into capcium.jpeg

Fig. 9 Watermark Embedding of logo.jpeg into lena.jpeg

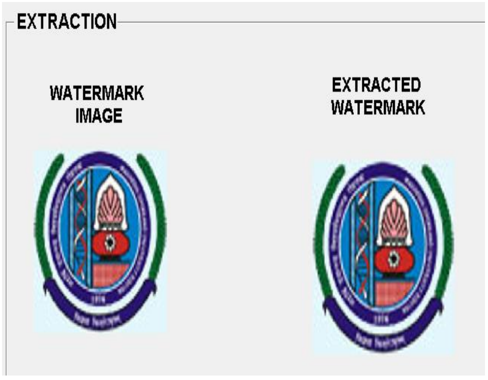

Fig. 12 Watermark Extraction

TABLE I
MSE, PSNR & CORRELATION OF EXTRACTED WATERMARK

Original Image	Watermark	MSE	PSNR	Correlation
Lena	Vinca	0.5603	50.6463	0.9985
Lena	Waterfall	0.6504	49.9977	0.9959
Lena	Gateway of India	0.3221	53.0508	0.9962
Lena	Logo	0.0509	61.0632	1.0000
Capcium	Logo	0.0550	60.7271	1.0000

VI. CONCLUSIONS

The With the advancement in technology improvements are done on digital watermarking techniques. In this paper we proposed a technique using discrete stationary wavelet transformation on the color images. To improve the robustness we use XOR operation on the watermark image before embedding. MSE and PSNR, Correlation of the extracted watermark are calculated. Our future work is to introduce a new approach that works on frequency domain using 3-dimension images.

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