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BCH Encoded DWT Based Watermarking Scheme Based on Singular Value Decomposition for Higher PSNR Ratio

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***Abstract* – In this era of digital media, digital information suffers from copyright and integrity violations. In case of any dispute like rights violation and ownership of content creator, digital watermark play a vital role to protect the property rights of the original owner of digital information. Numerous of watermarking has been proposed recently but image quality ie imperceptibility and robustness of host image at receiving is need to be improved. Where the PSNR value indicate the visual quality of the image where higher PSNR value lead better image quality. So main research gap need to developed a watermarking scheme which prevent authentication of digital information with maintain higher PSNR ratio also. The embedding algorithm is robust against common image processing operations. It is concluded that the embedding and extraction of the proposed algorithm is well optimized, robust and show an improvement over other similar reported methods..Towards higher degree of robustness, transparency and blindness this paper proposed encoded hybrid digital watermarking Scheme (EHDWS) which is based discrete wavelet transform (DWT) and singular value decomposition (SVD). In EHDWS watermark singular bits are encoded by BCH code followed by DWT and SVD. In proposed hybrid digital image watermarking using of BCH based Singular Value Decomposition and Discrete wavelet Transformation algorithm is best .by using of this hybrid digital watermarking possible to harmless our image from many type of attack and higher PSNR value.**

***Keywords* – Digital Watermark, DWT, Haar Transform, SVD , BCH Code**

I. INTRODUCTION

The rapid development of digital technologies has improved access to information resources. These new technologies allow us to store, transfer and manage digital content with less time, less complexity and efficiency. However, the analysis also brings disadvantages, such as illegal copying and distribution of digital content. Internet plays an important role in the movement of unauthorized and illegal digital content. [1] This increases the risk of violating the owner of the copyright and prevent the authenticity of digital content. One way to protect digital content from illegal copying and distribution is to include additional information called watermark on it.

Digital watermarking is injected to prevent the digital authentication information. Digital watermarking is integrated permanently in the care sector as an identification code or image that is visible or invisible and tends to discourage unauthorized copying. [2]

If an intrusion attempt to harm or temper the water marked numerical data, Watermark help capture the action taken by the intruders based on the protection of copyright. Watermark with many features such as invisibility, transparency, security and robust protection of copyright servers, video authentication and fingerprint and copy control [3].

Tattoo work scenario can be divided in the spatial domain or frequency based on the human perception watermark can be visible or invisible. Watermark should be applied to the source and destination application. Watermark joins change the coefficient frequency image host using a common method such as the discrete Fourier transform (DFT), discrete cosine transform (DCT), Discrete Wavelet Transform (DWT), etc. [1].

In this paper the proposed technique will use the DWT transformation scheme for the digital watermarking. Which decomposes the input image in four components, namely, LL, HL, LH and HH, where the first letter corresponds with frequency offset of the row either low or high and second latter refer to filter applied to the columns. The lowest resolution level LL refer to approximate part of the host image [4] whereas rest three refer to detail parts and give the vertical high (LH), horizontal high (HL) and high (HH) frequencies. In the proposed algorithm, watermark is embedded into the host image by modifying the high frequency coefficients band i.e. HH sub band .

The method of error correction coding used in this article is the BCH (Bose Chaudhuri Hocquenghem-) code (Lin and Costello, 1983). The algorithm is commonly applied to CCIR 584-1. This is a type of cyclic code that is capable of correcting random errors. BCH codes method used in this document each of the four data bits of a data flow of 7 bits. Therefore, we can call BCH (7, 4). It is assumed that the authentication data using encoding a BCH C (7, 4). When c is 1 error little can be converted back to an original. When AC 2-bit error can not be restored but can detect the existence of error. This method provides a method that is not only capable of authentication, but can also restore the authentication data manipulated to its original form. A cyclic code has good mathematical structure that includes a mechanism for automatic synchronization. This mechanism is provided by a shift register with linear feedback. If the data is not

correct when decoding, you can quickly return to an error state to regulate decoding. This property is robust enough to extract data from a data stream containing errors. We can achieve the goal of authentication images with this advantage.

II. RECENT WORK

DWT is most appropriate to achieve robust and invisible watermarking scheme that leads to good visual image quality signed. In recent years, the singular value decomposition (SVD) is used as a new method of watermark. An overview of the functionality on changes in an image and its structural information which play an important role in predicting the image quality is presented. Changes singular vectors associated with singular values representing primarily the luminance of the image. We use hybrid DWT-SVD transformed in this paper that the watermark integration will.

Liu and Liu [5] presented algorithm SVD based watermark. In this algorithm, compute singular values of the host image, and transform incorporating the watermark and apply SVD transform once again in a row matrix to find the unique modified values. These singular values combine to extract watermark image watermark, the reverse process is applied to extract the watermark. Watermarks based on SVD has been proposed by several investigators.

Li Yuan Zong and [6] introduced a hybrid system of watermark DWT-SVD have human visual system. Hybrid DWT-SVD decomposes the host image into four sub-bands and integrates applied SVD singular values of the watermark in these sub-bands. Chandra [7] illustrates a watermarking process by adding buffer the singular values of the singular values of the entire image. Initially, the singular values of the host and watermark image are calculated, and then amplified singular values of the watermark is added to the host image.

Raval and Rege [8] introduced several watermarking schemes based on DWT transform. Image host range is divided into two different bands LL, HH and watermark embedded in it. The regime has a very big difference against attacks such as compression, more noise, histogram equalization, but unable to resist the attacks of rotation, scale printing and scanning.

Naghsh-Nilchí Kasmani and [9] enters a processing system that serves both hybrid DCT and DWT to integrate the digital watermark. Initially DCT hybrid approach used to integrate the watermark followed by three levels of DWT decomposition. Hybrid system with a good recovery from attacks, but suffer from the problem of time complexity.

III. PROPOSED WATERMARKING SCHEME

In this work, a hybrid plan digital water mark encoded (EHDWS) was proposed. EHDWS is based on Haar DWT transform with upper band singular value decomposition. Initially proposed DWT EHDWS break the image into four frequency bands namely LL, HL, LH and HH with the help of turn harr.

The technical proposals using the DWT processing system for digital watermarking. That the input image is decomposed into four components, namely, LL, HL, LH and HH, where the first letter corresponds to a change of the line is high or low back and the second to the last filter applied to the columns frequency.

HH group EHDWS used to integrate the watermark, since haves fi ner details of the energy of the image. Thus embedded watermark will not affect the fidelity coverage perceptual image.

The proposed watermark scheme is integrated by replacing the singular values of the image band HH host BCH code with singular values of the watermark. Selecting the watermark image is such that its singular values are within the given range and power of singular values of watermark will be approximately equal to the energy of the singular values of the HH band. And replacement of the singular values will not affect the image quality and energy content of HH group perceived.

BCH code authentication first transform data entry in the error correction code by an encoding rule. And every bit of the code is integrated into a pair execution of an image. In the authentication process, the extracted data is checked whether it meets the standards corresponding correction or no coding errors. Failure to comply with the rules, the pair of execution will be treated as a disturbed area.

IV. WATERMARK EMBEDDING ALGORITHM

Step 1:- Apply SVD over Watermark Image (W)

$$\text{Watermark}_{\text{image}} = U_W * S_W * V_W^T \quad \ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where S_W Singular value co-efficient are rounded to the nearest integer and represented by 7 bits, including sign

Step 2:- Decompose the host image into four sub-bands with different wavelength by using DWT Haar wavelet transformation

$$\text{Host}_{\text{image}} = LL, HL, LH, HH \quad \ldots\ldots\ldots\ldots\ldots\ldots 2$$

Step 3:- Apply SVD over HH band of Host image.

$$\text{Host}_{\text{image}}^{HH} = U_{HH} * S_{HH} * V_{HH}^T \quad \ldots\ldots\ldots\ldots\ldots 3$$

Step 4:- Apply BCH (7, 4) code generation over $\text{Watermark}_{\text{image}}^{Sw}$ for generating error detection code where n represents codeword length, k represents message length.

$$S_w^{BCH} = BCH(S_W, 4) \quad \ldots\ldots\ldots\ldots\ldots\ldots 4$$

Step 5:- Replace the singular values of the HH band with the encoded singular values of the watermark.

$$\text{Water Marked Host}_{\text{image}}^{HH} = U_{HH} * S_w^{BCH} * V_{HH}^T \quad \ldots\ldots 5$$

Step 6:- Apply inverse DWT to produce the watermarked cover image.

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WATERMARK EXTRACTION ALGORITHM

Step 1:- Apply SVD over Watermark Image (W)

$\text{Watermark}_{\text{image}} = U_W * S_W * V_W^T$ ……6

Where S_W Singular value co-efficient are rounded to the nearest integer and represented by 7 bits, including sign

Step 2:- Decompose the Water marked image into four sub-bands with different wavelength by using DWT Haar wavelet transformation

$\text{Water Marked}_{\text{image}} = \text{LL, HL, LH, HH}$ ……7

Step 3:- Apply SVD over HH band of Water Marked image.

$\text{Water Marked}\ {}^{\text{HH}}_{\text{image}} = U_{HH} * S_{HH} * V_{HH}^T$ ……8

Step 4:- Apply BCH (7, 4) code generation over Watermark ${}^{\text{Sw}}_{\text{image}}$ for generating error detection code where n represents codeword length, k represents message length.

$S_w^{BCH} = BCH(S_W, 4)$ ……9

Step 5:- Compare S_w^{BCH} value evaluated in equation 9 and S_{HH} evaluated in equation 8 if same the host watermarked image not suffered from any noise and attack

Step 6:- Replace the encoded singular values of the watermarked image with singular values of the HH band ie singular matrix .

$\text{Host}\ {}^{\text{HH}}_{\text{image}} = U_{HH} * S_{HH} * V_{HH}^T$ ……10

Step 7:- Apply inverse DWT to produce the original Host image.

V. RESULT ANALYSIS

The proposed works has tested on the different images of size 512x512. All These images are colored. Here the images are used called LENA and pepper. The watermark image has also the same size as the host image. To simulate the proposed work the implementation has done in MATLAB. The execution has been done on the i3 processor with 4 GB RAM and 500 GB HDD.

Table 1: Comparison between PSNR ration of various approach

Data Set	Approach	PSNR (dB)
Lena	Proposed Approach	78%
	Robust	31%
Peppers	Proposed Approach	67%
	Robust	52%

The term peak ratio of signal to noise, often abbreviated PSNR, which represents the ratio of the maximum possible power of a signal and noise power corrupting affects loyalty. PSNR can be described in terms of PSNR logarithmic scale higher indicate low fidelity and vice versa. This can happen because we want to minimize the MSE (mean square error) between images with respect to the maximum value of the image signal. The mean square error for our practical purposes allows us to compare the values of the "real" our original pixel our degraded image. Now from the given table, it can be easily said that the proposed algorithm works best with DWT-SVD algorithm.

The table shows the results with different authors gave in recent years. PSNR factor is an image used to determine the quality of the image or image. It is calculated using average error MSE squire means square error (MSE), which for two m × n monochrome images I and K whereone noisy images is considered another approach is defined as:. PSNR calculate the original image and the resulting image. These two parameters are calculated using the following formulas.

$$PSNR = 10 \log_{10} \left(\frac{MAX^2}{MSE}\right) \text{……1}$$

$$MSE = \frac{\sum_{M,N}[I_1(m,n) - I_2(m,n)]^2}{M*N} \text{……..2}$$

Experimental results show that in Table 1 show that PSNR range between 48 db to 53 db of all existing technology. Technical Base FA DWT-SVD is about 52-55 db PSNR compared in both individual and multi-scale, which is the largest among all the existing approach say loukhaoukha [10] with 47,718 PSNR db for Lena and approximate 48,097 Peppers PSNR db, Ishtiaq [12] with approximately 48,105 db PSNR and Xianghong [13] db PSNR with 49,075 DWT then proposed scheme SVD-based authentication BCH code tattoo approximate PSNR 73.78 dB and 65.46 dB for Lena Peppers PSNR. Demonstrate that the proposed algorithm provides performance mass compared to previous approaches. The results are Lena and paste peppers that were also used by previous authors.

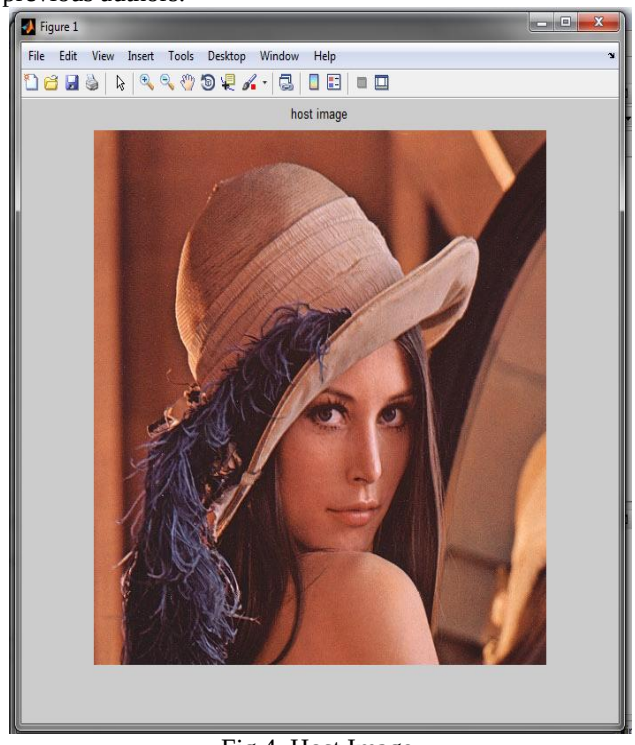

Fig.4. Host Image

This figure shows the host image on which the watermark image will be embed. In this work there are

different images has been use. Here only the outputs of lena image has shown.

In this manner there is also need of any watermark. In this scenario the image of fruits is woks a water mark image. Both images will take as a input using the MATLAB code.

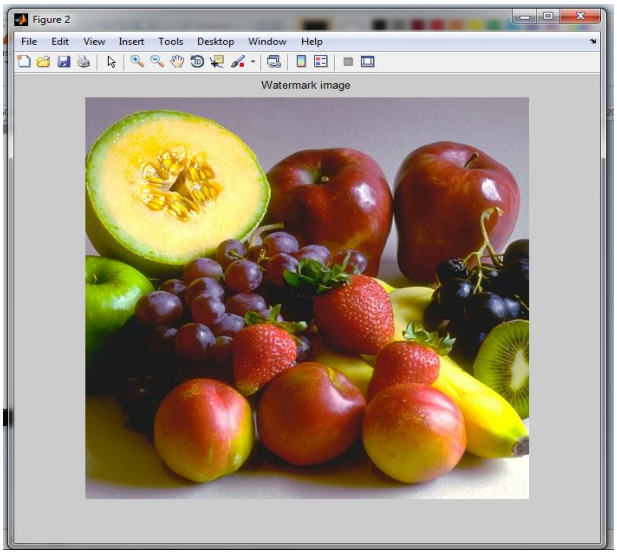

Fig.5. Watermark Image

Here we need to apply the bch code on watermark image. The output has shown below in the form of figure.

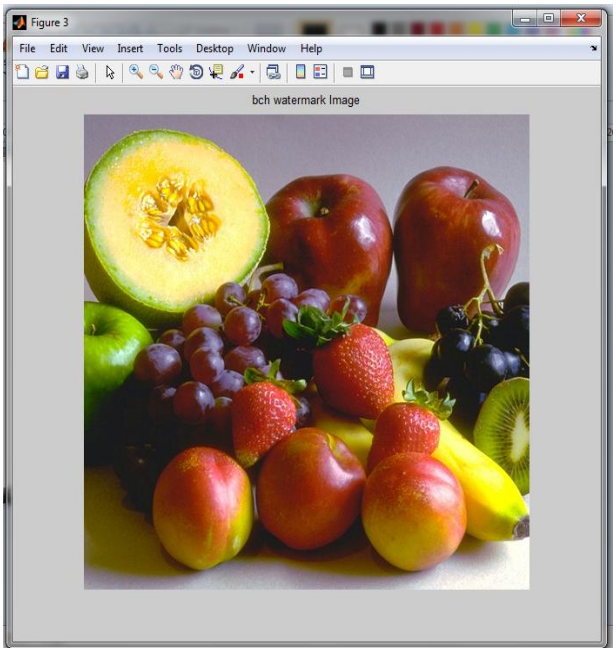

Fig.6. BCH watermarked

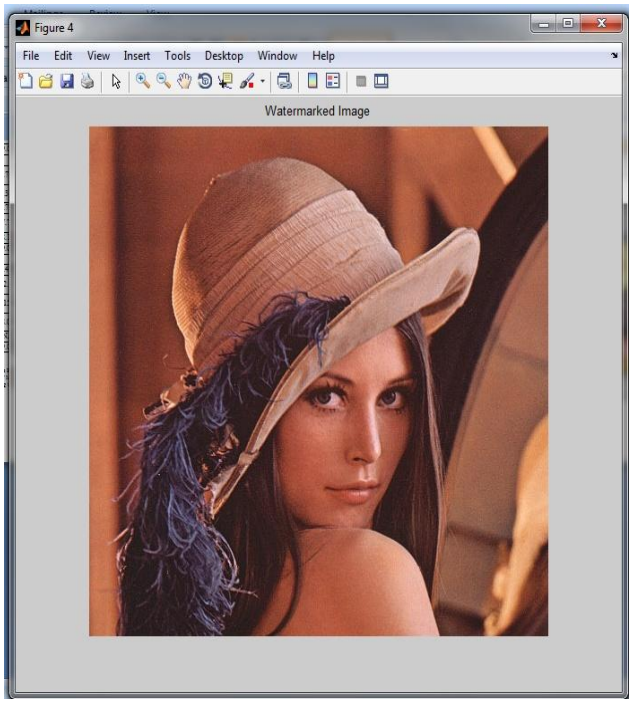

Fig.7. Watermarked Image

This figure is our final output. This output conations the watermark which can transfer one end to another end.

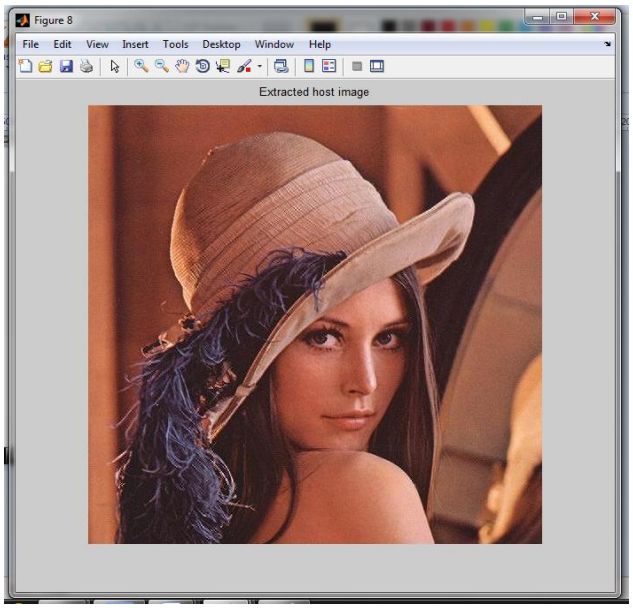

Fig.8. Extracted Host Image.

There is need to remove the watermark from the host image. Above figure is a extracted host image from final output.

VI. Conclusion and Future Work

Watermark should be robust and recoverable even if some of the content has been changed for one or more attacks such as compression, filtering, geometric distortion, resizing, etc. Our hybrid project scheme coded

digital watermarking (EHDWS) has a high degree of robustness that is validated by retrieving the watermark and the attack printing scanning is one of the strongest attacks .In this work propose a water marks blind scheme based discrete wavelet transform (DWT) and singular value decomposition (SVD). Singular values are used at high frequency (HH) band (OAS) to optimize perceptual transparency and robustness limitations. While most diets based on SVD be robust, has paid little attention to security aspects. Many of the existing DWT and SVD-based approaches do not handle the issue of authentication and security. The proposed method relates to the incorporation of this authentication mechanism based fl aw in BCH. Thus, the resulting method is both robust and safe time. Experimental results show that the proposed scheme provides higher PSNR values, indicating that the visual quality of the signed and attacked images is good and robust performance embedding scheme against various image processing operations. The proposal to use this algorithm for image tattoo art, but this work does not extend to video of two types - compressed and uncompressed. In the future, we will try to accomplish this with real-time constraints must also be considered. To this end, the complexity of calculation time for integration and extraction must be considered and applied.

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