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Image Security of Water Marking Digital Image Based on based on SVD and DWT with Haar Transform

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Abstract- This paper proposed a novel watermarking based on SVD and DWT with Haar transform, the embedding; the lowest frequency components of the source image which were transformed into DWT were divided into sub-blocks in order to improve capacity. of watermarking. Then the watermark is embedded in the singular values of sub-blocks. Hence in this proposed method, depending on the embedding stage and extraction stag that presented in but our scheme embeds the logo bits inside the low frequency domain because DWT gives optimal results with LL domain, while used middle frequency domain with DCT. Our improvement by using an image encryption using the encoding along with the image watermarking hence this provide more accuracy in the security and also less in data loss, when compared with the other methodologies. This method also focused on the objective of improving the quality after embedding stage and the recovered watermark after extraction stage. After experiments, it was found that our proposed method provides security and high performance with low computational complexity and good objective quality. Our scheme evaluate the performance for the watermarked image after embedding stage by using Peak signal to Noise Ratio (PSNR), while the recovered watermark evaluated by some types of the performance metrics such as Mean Square Error (MSE).

Keywords- HAAR, DWT, SVD Image Enecryption, Watermarking.

I. INTRODUCTION

In current years, dynamic chaotic organization has been widely used to propose cryptographic primitives with confused behavior or similar accidental assets. In his groundbreaking work, Shannon barbed out exceptional opportunity for dynamic chaotic graphs in communication.

He recognized 2 essential attributes that a good data encryption system should have, namely to avoid (resist) numerical attacks: proliferation or confusion. Distribution can propagate changes to the entire encrypted data, while fabrication can hide connection among original data or encrypted data.

In recent years, dynamic chaotic arrangement has been widely used to design cryptographic primitives with chaotic behavior and randomness. Like attributes. In his groundbreaking work, Shannon pointed out exceptional opportunity for dynamic chaotic graphs in communication. He identified 2 basic attributes that a good data encryption system should have, namely to avoid (resist) statistical attacks: proliferation or uncertainty. Diffusion can propagate changes to the entire encrypted data, while fabrication can hide connection among original data or encrypted data.

1. Motivation:
Recent developments in digital technology and the Internet have made it easy for people around the world to access digital resources. This exposes digital resources to the threat of downloading and then illegal editing to create the threat of counterfeiting. Unauthorized users sometimes assign the modified content as their own resources for personal benefit. In addition to the possible loss of revenue, these issues often lead to misuse of content against the original intentions of the original owner.

Digital watermarking is intended as a potential tool to control unauthorized use of digital resources by implementing a mechanism that protects ownership against unauthorized use. In addition, as ownership protection is always an extremely important consideration for content owners, digital watermarks are now widely used in electronic publications, online newspapers, digital libraries and social networking sites. [4][6]Although significant progress has been made in digital image watermarking, many challenges.

II. METHODOLOGY

In this proposed method one-level Haar wavelet transform to decompose the host image into one approximation coefficient matrix *LL*, and three detail coefficient matrices *LH*, *HL* and *HH* respectively in the horizontal,

vertical and diagonal directions. Because the embedding strength of the watermark is dependent on signal energy and most of the energy of a nature image is concentrated in the low-frequency region, we therefore embed the watermark into the *LL* subband to resist possible digital.

In DWT, the distribution is divided into two parts: frequency and time

- The most common part is the edge element of the sign.
- The lower part is usually divided into two parts, the lower and the lower frequency.
- This process can be performed on a regular basis and is often put into practice on hand.

1. **Singular Value Decomposition:**
Singular value decomposition (SVD) describes a general and popular method which has different applications from solving most linear least-squares problems, multivariate analysis to computing pseudo inverse of a matrix. Images are in fact a matrix with nonnegative scalar entries.

Consider an image with the size m×m; the SVD for this image can be achieved by =

$$\mathbf{A = USV^T}$$

$$\mathbf{S= diag\ (\lambda_i)}$$

$$\mathbf{I=1,\ldots\ldots n}$$

Where S is a diagonal matrix of singular values λi which are arranged in decreasing order and U and V describes the orthogonal matrices.

The columns of V are the right singular vectors whereas the columns of U are the left singular vectors of the input image A.

By using the SVD technique for image watermarking, it finds the SVD of each block or the cover image of the cover image, and then it develops the singular values to embed the watermark. Image watermark embedding first, one-level Haar DWT is utilized for decomposing the cover image A into four sub-bands (i.e., LL, LH, HL, and HH).

After that, SVD technique is applied to the LH and HL sub-bands as follows:

$$\mathbf{A^K = U^K S^K V^{KT}}$$

Where k =1,2 describes the sub-bonds. Afterwards, the watermark is divided into two sections, i.e.

$$\mathbf{W= W^1+W^2}$$

Where W^K describes the half of the watermark image. Here, using 1 W^1 and W^2 , the singular values of HL and LH get modified and then SVD is applied to them as follows:

$$\mathbf{S^K + a\ W^K = U^K\ S^K\ V^{KT}}$$

Where α describes the scale factor. The scale factor can be employed for controlling the watermark strength to be inserted. In the following, the modified DWT coefficients are obtained by:

$$\mathbf{S^K + a\ W^K = U^K\ S^K\ V^{KT}}$$

$$\mathbf{A^{*K} = U^K\ S_W^K\ V^{KT}}$$

And finally, the watermarked image can be achieved by applying the inverse DWT with the modified DWT coefficients and non-modified DWT coefficients.

2. Performance Estimation:

2.1 PSNR: PSNR is easily defined by square error (MSE). If I am given a monochrome m × n image without noise and the average K value of the noise is defined as:

$$\mathbf{PSNR=10.log_{10}}\left(\frac{MAX_I^2}{MSE}\right)$$

$$\mathbf{PSNR=10.log_{10}}\left(\frac{MAX_I}{\sqrt{MSE}}\right)$$

$$\mathbf{20.log_{10}}(MAX_I)\mathbf{-10.log_{10}(MSE)}$$

2.2 MSE: The MSE evaluates quality of a predictor (i.e., a function that maps a random input to a example of the value of a accidental variable) or an estimator (i.e., a mathematical purpose that maps a sample of data to an approximation of population parameter, from which data samples).

The meaning of MSE varies depending on whether it describes a prediction variable or an estimated variable. If a prediction vector is produce from a example of n data points on all variables, or prediction vector is a vector of experiential principles of envisage inconsistent and is a predicted value (for example, according to least squares fit), then in predictable variable Sample MSE calculated as

$$\mathrm{MSE} = \frac{1}{n}\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2.$$

MSE can also be calculated on q data point that are not used to estimate model, which may be because they are retained for this principle or because the data is recently attain. In this procedure called cross-validation, MSE is usually called mean square mistake.

III. IMPLEMENTATION WORK

1. Input Image:
Images are a kind of rectangular response (pixels). Each pixel represents a specific character measurement of the measured dimension. This property may have many, but we usually measure the average size (one value) or the brightness (three values) of the image filtered through red, green, and blue filters. These values are usually replaced by eight integers that give a maximum resolution of 256.

2. Preprocessing:
The purpose of preprocessing is to recover image data to prevent unnecessary manipulation or to improve certain functions related to further processing and analysis. Image processing can manage image redundancy. The adjacent pixels that correspond to the real one have the same note of the same brightness. If the deformed pixel can be retrieved from the image, the adjacent pixels can be restored to a moderate value. Depending on the size of the pixel barrier used to calculate the brightness of the new pixel.

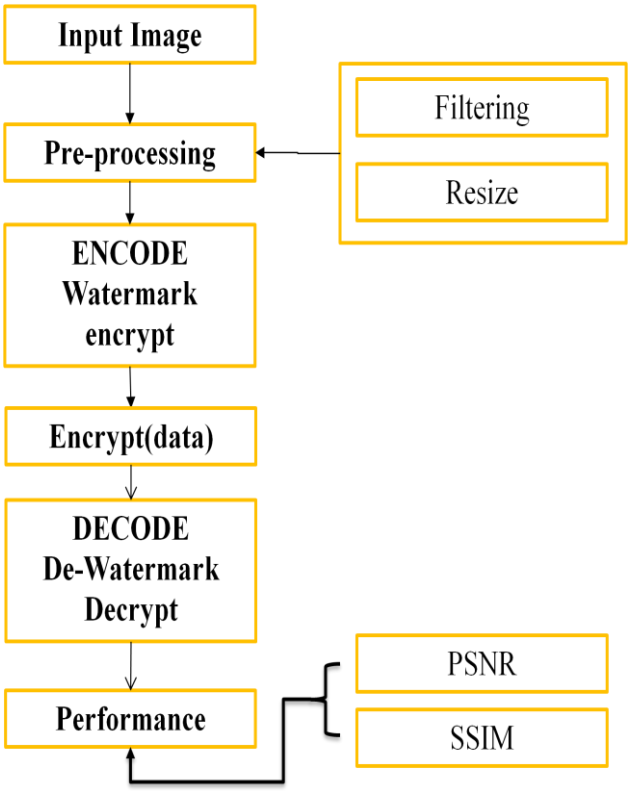

Fig 1. Proposed flow chart.

3. Encode/Decode:
In the last few years, digital watermarking of multimedia contented has become a very active field of research. Watermarking is a very important area with copyright for various electronic documents and media. With the widespread use of images on the Internet, it may sometimes be necessary to use a watermark.

Digital watermarking is procedure of processing combined information into digital signals. A watermark is an auxiliary image that overlaps the main image or provides a way to protect the image. It acts as a digital signature that gives the image ownership or realism. Digital watermarking technology is very inspiring in terms of image authentication or attack security. This paper suggests multiple and reversible data hidden in an encrypted image.

In planned scheme, an encryption key is used to encrypt original image, and a data slider key is used to integrate other data into the encrypted image.

For encrypted images that contain additional data, recipient can still extract the additional data, even if the recipient does not know the contents of image if recipient has only one hiding key. If the recipient has only one encryption key, he can decrypt received data to attain an image corresponding to innovative image, but cannot extract other embedded data. When both encryption and data slider keys are used at same time, by utilizing the spatial connection in the natural image, other entrenched data can be productively extract or original image can be restored entirely.

IV. SIMULATION RESULTS

The MATLAB replication is conceded out in MATLAB 2015 with help of MATLAB image dispensation tool. Figure 1 shows input image with key or remove watermark as output. The images are removed from MATLAB software.

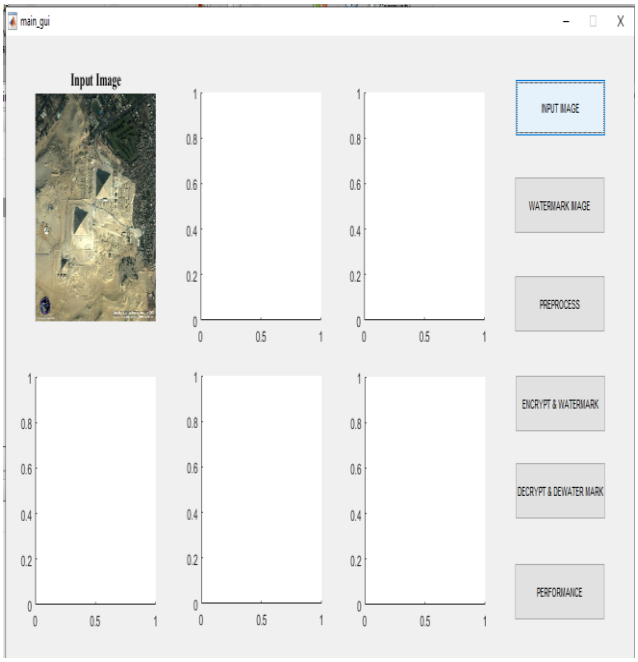

Fig 2. GUI window for input image.

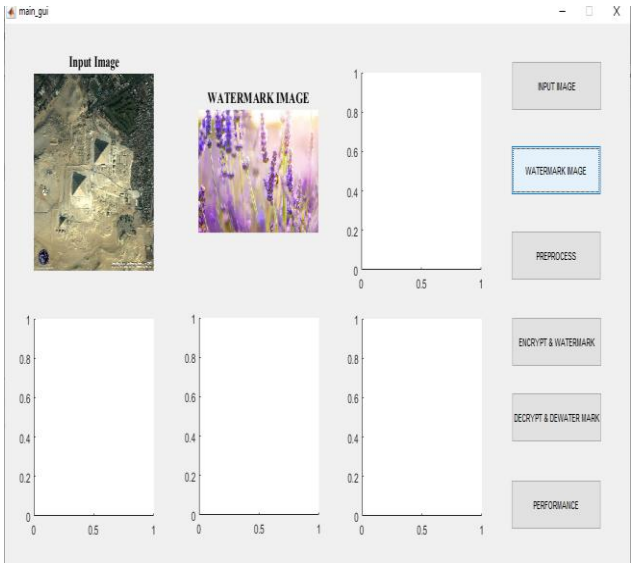

Fig 3. GUI windows for water marking image.

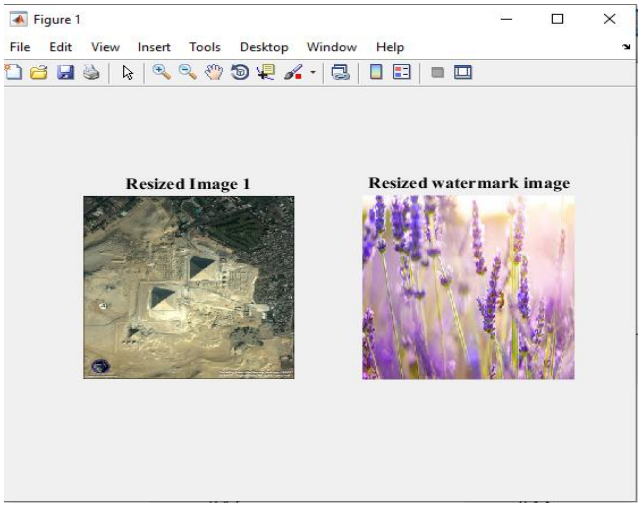

Fig 4. GUI window for resize and water marking resize image.

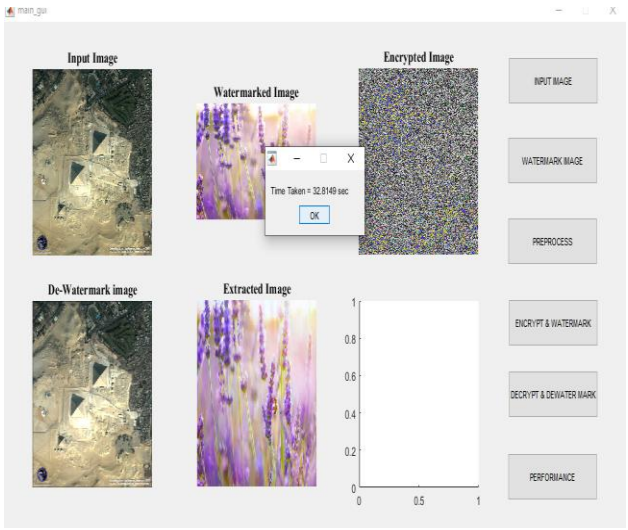

Fig 5. GUI window for resize and water marking resize image encrypted image.

In the original message, watermarks are used to protect the data, and these marks are taken at the end of the reception. Therefore, use the code with confidential information to protect them.

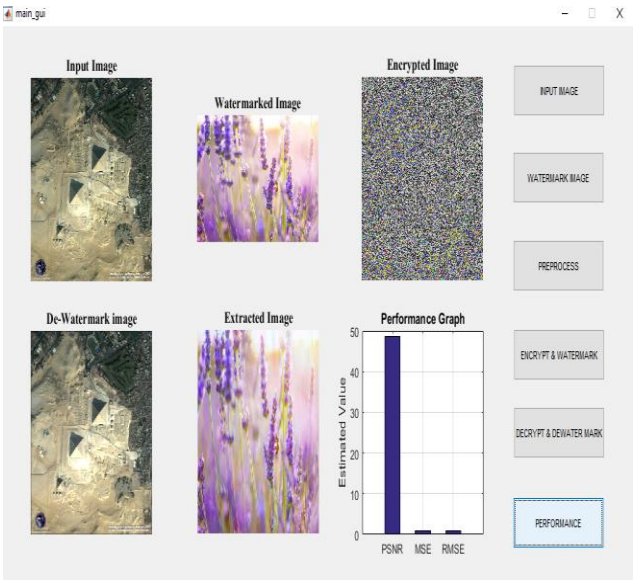

Fig 6. GUI window for resize and water marking resize image de encrypted image.

Table 1. Result Comparison with Existing Work.

	Watermarking Techniques	PSNR	MSE
Existing work [1]	DWT-DCT	51.01	0.52
Proposed work	DWT-DCT With Haar Transform and SVD	52.88	0.41

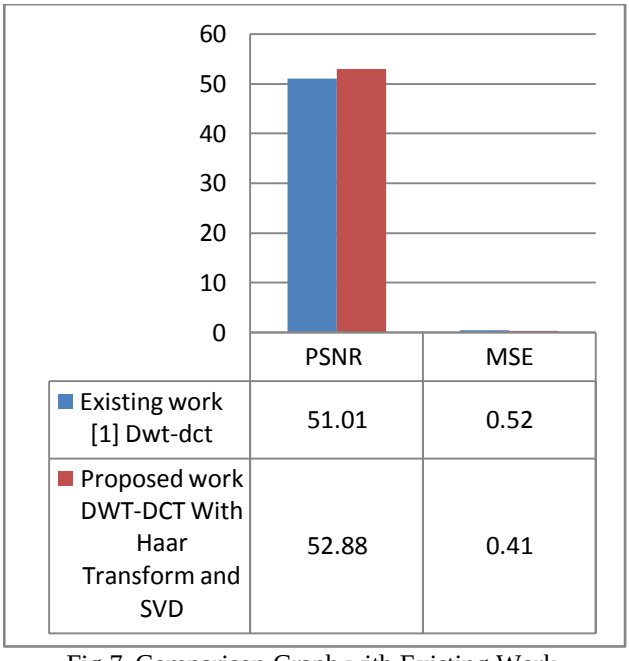

Fig 7. Comparison Graph with Existing Work.

V. CONCLUSION

A singular value decomposition) based wavelet image approach was implemented in this paper. This can be used to fuse two low clarity input images to increase the clarity of the output image and to increase the visual perception. This method is implemented by the proposed approach by performing the wavelet decomposition of input images and taking approximation coefficient alone.

Then SVD is applied to approximation coefficient &choosing certain components of SVD (U, Σ and V) of the input images based on a singular value. The two most common digital watermarks for transformation domain are based on discrete wavelet transformation (DWT) and digital watermark the merits of DWT, SVD, and DCT to achieve efficient blind image watermarking.

While the DWT offers multiresolution analysis in time and frequency, the SVD conserves the algebraic invariance of the image. Henceforth the proposed scheme applies the SVD to the matrix blocks in the *LL* subband of one-level 2-D DWT, and then applies the DCT to the left- and right-singular vectors associated with the largest singular value. The performance compares with other existing technique the proposed technique showing the better performance as compare to existing technique.

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