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Different Types of Noise Attack based DWT-SVD Hybrid Technique for Watermarking

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ABSTRACT
"Watermarking" is the process of hiding digital information in original data, to increases robustness and security using the different technique like Discrete Wavelet Transform (DWT) and Singular Value Decomposition (SVD). The available methods till date result in good security but they are not robust enough against different attacks. The aim of this research work is to develop a robust and secure watermarking scheme against various sorts of attacks. The robustness and security in increased by combining DWT and SVD. Accordingly an efficient scheme is developed here that are having better MSE and PSNR against a wide range of attacks.The simulated experimentation is done in MATLAB and the simulation results of propose method (DWT-SVD) gives improved results than the existing method (DWT).
Keywords: Discrete Wavelet Transform, SVD, PSNR, MSE

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I. INTRODUCTION

Because of the current advancement in web technology, redistribution of computerized substance has turned out to be simple. It prompts to the intense need of sheltered and real condition for the handling of advanced substance. This downside can be overcome by utilizing watermarking technology. Watermarking of images has as of late obtained enormous interest in a scope of applications like, identification of image, copyright protection, verification of image and information stowing away, among others. Duplication and dissemination of sight and sound information have been rendered simple and for all intents and purposes costless because of huge advances in systems administration and high speed processors. Digitized information can without much of a stretch be controlled along these lines losing its inventiveness [1].Thus it makes copyright security of advanced media a stern challenge. In this way the idea of advanced watermarking comes into picture. Advanced watermarking is the handle that implants information called a watermark into a sight and sound protest in a manner that the watermark can be later on recognized or extricated for a question declaration purposes. The sight and sound articles, in which the watermark is inserted, are as a rule called the first, cover flag, have flag or basically the work [2].The watermark ought to be inserted in such a way, to the point that the inventiveness of the host picture ought not be twisted [3].A advanced watermark is a recognizing snippet of data that is appointed to the information to be secured. One imperative necessity by this is the watermark can't be effectively extricated or expelled from the watermarked project. A powerful digital watermarking technique must fulfill the two primary prerequisites of impalpability and robustness to basic images attacks like trimming, revolution, Gaussian clamor, movement obscure, salt and pepper clamor, pressure and numerous more flag preparing operations. Advanced picture watermarking strategies are assembled into spatial and frequency domain.

Spatial Domain

- It is manipulating or changing an image representing an object in space to enhance the image for a given application.
- Techniques are based on direct manipulation of pixels in an image
- Used for filtering fundamentals, smoothing filters, sharpening filters, unsharp masking and laplacian

Frequency Domain

- This technique are based on modifying the spectral transform of an image
- It transforms the image to its frequency representation
- Carry out an image processing
- Figure out inverse transform back to the spatial domain
- High frequencies correspond to pixel values that modify hastily across the image (e.g. text, texture, leaves, etc.)

Strong low frequency components correspond to huge scale features in the image (e.g. a single, homogenous object that dominates the image) the image watermarking processing is shown in fig.1. In this research, we proposed DWT-SVD –HF technique to watermark the images which improve the quality and security of image.

II. DISCRETE WAVELET TRANSFORM

The main deviation between current JPEG and JPEG2000 begin with the implementation of DWT as a replacement of the block based DCT. The DWT basically analyzes a sub block component to divide it into many of sub-bands at dissimilar levels of resolution. The 2-D DWT is implemented by applying the 1-D DWT horizontally and then vertically in each component as shown in Figure 1. In the initial level of decomposition, four sub-bands are produced. The LPF sub-band gives a 2: l subsample in both vertical and horizontal directions, a low-resolution edition of the original component. This is an estimation of the new image in subsampled form. The other sub-bands are characterized by a down sampled residual edition of the new image required for the ideal reformation of the new image. The LL2, HL2, LH2, and HH2 are the higher level of decompositions derived from the LL1 sub-band and this is continued in a same manner. Usually, compression profit cannot attain after five levels of decomposition in natural images.

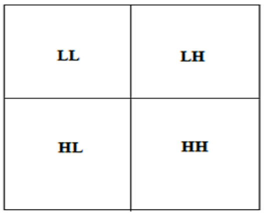

Figure 1: Wavelet Domain

Each and every component is separately analyzed by an appropriate DWT after preprocessing. The DWT basically divided each component into many sub-bands in dissimilar resolution stages. Every sub-band is then separately quantized by reducing precision parameter, if it is lossy compression. The precision reduced sub-bands are then separated into a many smaller code-blocks of same dimension, with the exception of the code-blocks at the corners of every sub band. The dimension of the sub-blocks is 32 × 32 or 64 × 64 in order to improve storage handling capacity and is very apt for VLSI execution with on-chip memory. Every sub block is then entropy encoded alone to make compressed bit streams. The three major jobs of the compression stage are in the upcoming sections.

Singular Value Decomposition

The technique of singular value decomposition, or SVD for short, has a long and somewhat surprising history. It started out in the social sciences with intelligence testing. Early intelligence researchers noted that tests given to measure different aspects of intelligence, such as verbal and spatial were often closely correlated.

Because of this, they hypothesized that there was a general measure of intelligence in common, which they called "g," for "general intelligence," now more commonly known as "I.Q." So they set about teasing out the different factors that made up intelligence so as to pull out the most important one.

SVD is known under many different names. In the early days, as the above passage implies, it was called, "factor analysis." Other terms include principal component (PC) decomposition and empirical orthogonal function (EOF) analysis. All these are mathematically equivalent, although the way they are treated in the literature is often quite different.

Today, singular value decomposition has spread through many branches of science, in particular psychology and sociology, climate and atmospheric science, and astronomy. It is also extremely useful in machine learning and in both descriptive and predictive statistics.

III. PROPOSED METHODOLOGY

DWT involves decomposition of image into frequency channel of constant bandwidth. This causes the similarity of available decomposition at every level. DWT is implemented as multistage transformation. Level wise decomposition is done in multistage transformation.

S is a diagonal matrix of singular values in decreasing order. The basic idea behind SVD technique of watermarking is to find SVD of image and the altering the singular value to embed the watermark. In Digital watermarking schemes, SVD is used due to its main properties:

1) A s mall agitation added in the image, does not cause large variation in its singular values.
2) The singular value represents intrinsic algebraic image properties. [3]

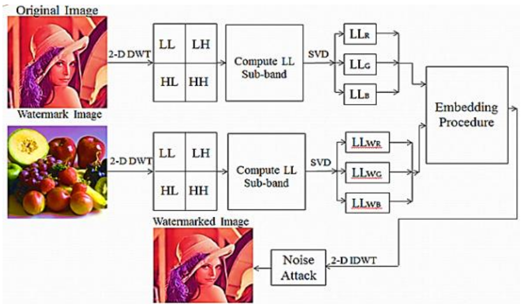

Figure 2: Flow Chart of Proposed Methodology

Algorithm for Watermark Embedding
Step 1: Input Host image
Step 2: Rearrange the host image (RI)
Step 3: Apply 2-D DWT on rearranged image RI to decompose it into four sub-bands LL, HL, LH and HH.
Step 4: Select sub-band LL of RI.
Step 5: Then apply SVD to sub-bands LL to get SH1, SH2 and SH3.
Step 6: Input watermark image Wi. Apply 2-D DWT to decompose it into four sub-bands LL1, HL1, LH1 and HH1.
Step 7: Select sub-bands LL1 of Wi.
Step 8: Then apply SVD to sub-bands LL1 to get SW1, SW2 and SW3.
Step 9: Modify SH1, SH2 and SH3 by using equation
SH1 = SH1+(0.10*SW1);
SH2 = SH2+(0.10*SW2);
SH3 = SH3+(0.10*SW3);
Step 10: Construct modified SVD matrix SH1, SH2 and SH3.
Step 11: Apply inverse DWT and finally get watermarked image WI.

IV. SIMULATION RESULT

The proposed calculations are tried utilizing 256x256 8bit/pixel image. In the reproduction, pictures are tainted by Salt and Pepper commotion. The commotion level shifts from 10% to 90% with augmentation of 10% and the execution is quantitatively measured by Mean square Error (MSE) and Peak Signal to Noise Ratio (PSNR).

Mean Square Error (MSE)

$$= \frac{1}{N_1 N_2} \sum_{j=1}^{N_2} \sum_{i=1}^{N_1} (f(i,j) - g(i,j))^2 \qquad (1)$$

Peak Signal to Noise Ratio (PSNR) in dB

$$= 10 \times \log_{10}\left(\frac{255^2}{MSE}\right) \qquad (2)$$

Where MSE remains for Mean Square Error, PSNR remains for Peak Signal to Noise Ratio. From the reproduction result appeared in Table I to II, it is watched that the execution of proposed calculation is enhanced PSNR than the current calculations at medium and highnoise level.

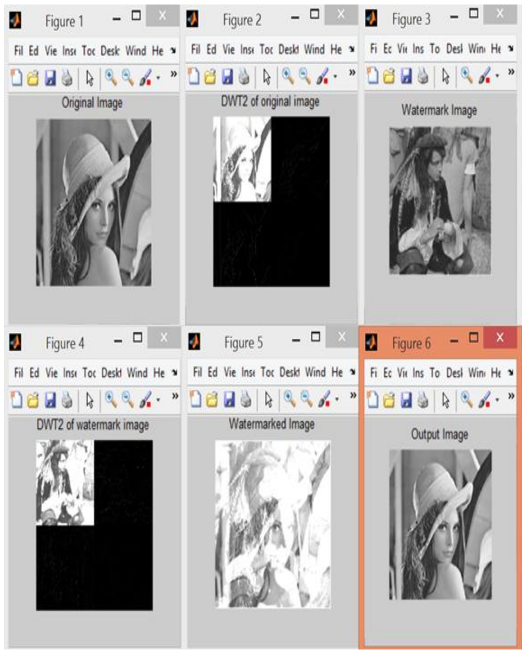

Figure 3: Experiment Lena Image without Noise Attack

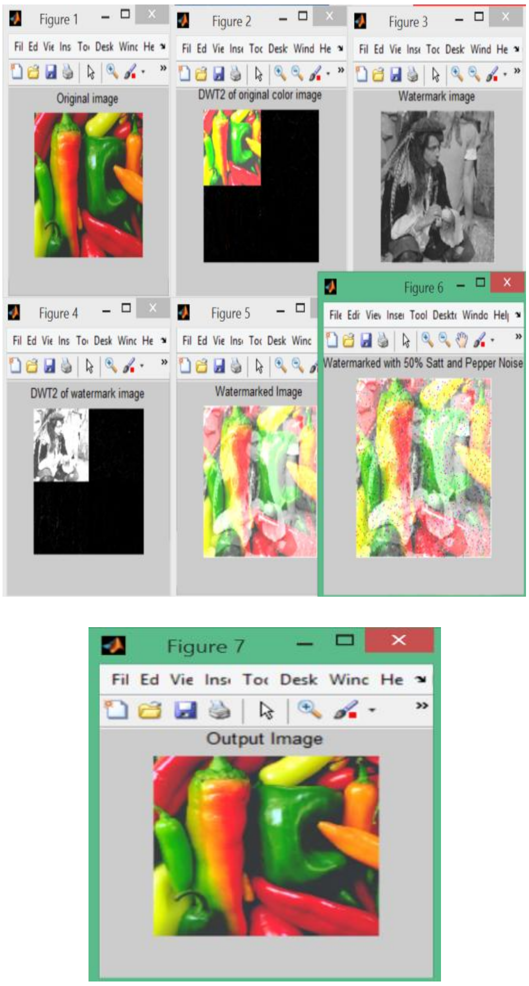

Figure 4: Experiment Pepper Image for Salt and Pepper Noise Attack

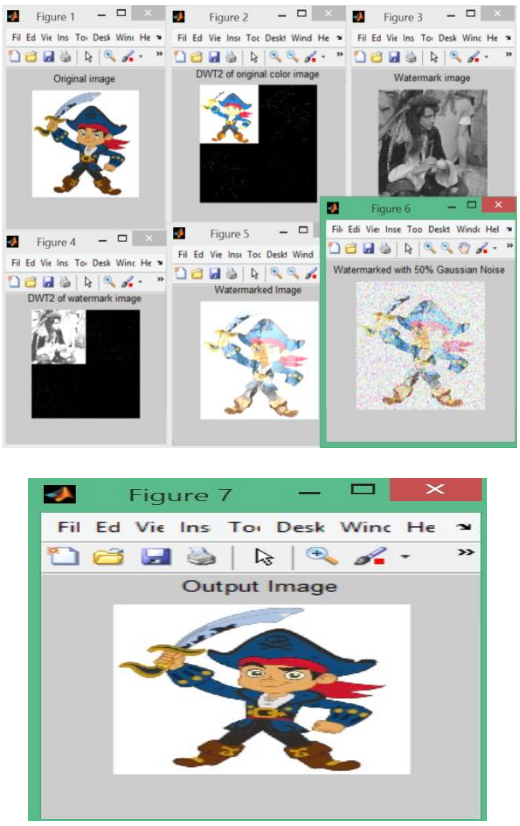

Figure 5: Experiment Pepper Image for Gaussian Noise Attack

Table 1: Experimental Result for Without Noise Attack

Image	PSNR (dB)	MSE	NAE	CT (ns)
Lena Image	35.289	77.561	18.65	2.532
Pepper Image	32.834	144.00	42.98	3.145
Pirate Image	36.898	53.855	17.211	2.647

Table 2: Experimental Result for Salt and Pepper Noise Attack

Image	PSNR (dB)	MSE	NAE	CT (ns)
Lena Image	50.571	2.294	0.405	2.532
Pepper Image	48.471	3.772	0.742	3.145
Pirate Image	49.652	2.842	0.399	2.647

Table 3: Experimental Result for Gaussian Noise Attack

Image	PSNR (dB)	MSE	NAE	CT (ns)
Lena Image	61.959	0.166	0.026	2.532
Pepper Image	58.618	3.772	0.043	3.145
Pirate Image	54.242	1.000	0.133	2.647

Table 4: Comparison Result

	Previous Algorithm	Proposed Algorithm
Image	PSNR (dB)	PSNR (dB)
Lena Image	48.7012	61.959
Pepper Image	48.3254	58.618
Pirate Image	49.5019	54.242

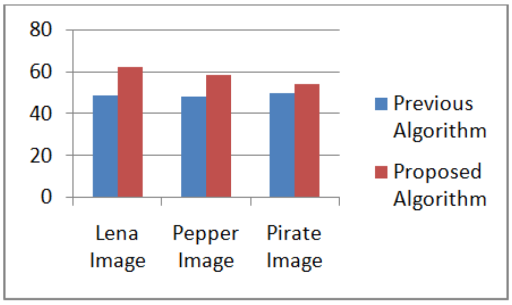

Figure 6: Bar Graph of the Previous and Proposed Algorithm

V. CONCLUSION

In this paper DWT-SVD is proposed to overcome the drawback of DCT based watermarking scheme. The redundancy in the DWT provides the robustness to the watermarked image. As the embedding of watermark image occurs in all sub-bands, more information can be transferred and principal components help to avoid the false positive problem. Thus the proposed scheme can satisfy the capacity, robustness and imperceptibility.

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