Data Hiding for Watermarking using SVD-DWT Technique with Different Noise Attacks

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Abstract— The world has been witnessing a rapid growth of internet technologies, proliferation in multimedia distribution and e-commerce in recent years. Moreover, the multimedia data are stored in digital form which makes the processing easy. But it leads to many drawbacks as several techniques for copying digital information have been created enabling illegal copies to be reused, manipulated or distributed. So there is an essential need for the technique which can safeguard the digital multimedia data from several types of attacks. Advances in multimedia technology increased the broadcast and delivery of multimedia content very easily but at the same time it allows illegal copying and distribution. This high speed multimedia technology brings a lot of importance in the field of watermarking to protect the digital content authentication. To protect the audio files in this regard, Digital Watermarking (DW) schemes are more useful. This paper is present DWT-SVD based technique to improved peak signal to noise ratio (PSNR) and decrease mean square error (MSE).

Keywords— Discrete Wavelet Transform (DWT), Singular Value Decomposition (SVD), PSNR, MSE.

I. INTRODUCTION

Ever since the advent of digitization, most multimedia data are available in digital form. The creators' of such data are reluctant to allow their distribution in a networked environment because of the problems of theft of intellectual property. Copyright protection of the multimedia data can be achieved by means of cryptography techniques. But once encryption is removed there is no more protection for the data. Research is done to find ways to effectively hide copyright information permanently into the digital media which can be extracted later to identify the rightful owner of the data. This is to spot the copyright violators. Steganography is an art of hiding secret information in a multimedia data. Watermarking is closely related to steganography. Though both steganography and watermarking denote techniques that are used to imperceptibly convey information by embedding it into the cover data, steganographic methods deal with only invisible data whereas the watermarking deals with both visible and invisible data. Watermarking techniques are expected to be robust against attacks.

Advanced picture watermarking should be possible in both spatial area and change space. In spatial area the watermark bits straightforwardly added to the pixels of the spread picture. Spatial space techniques can be effectively demonstrated and broke down scientifically. Anyway the inserted watermark can be effectively wrecked or evacuated by signal handling assaults, for example, sifting. The spatial space procedure utilizes human visual framework, however touchy to picture scale so same data must be inserted over and over in various areas of the host picture. The least noteworthy piece (LSB) strategy is a case of spatial space technique where the watermark is inserted into the least huge bits of the spread picture. In this strategy, first the bit planes are separated from the watermark and afterward moved to one side. The moved piece planes are added to the least critical bits of the spread picture to get the watermarked picture. The least huge bits are profoundly delicate to clamor, so the watermark can without much of a stretch be expelled by picture controls, for example, pivot and editing. In this manner, the LSB strategy gives high impalpability and less power. The connection based strategy is another case of spatial space procedures; in this technique, the watermark is changed over into Pseudo Noise succession which is then weighted and added to the spread picture bits. The watermarked picture is contrasted with the spread picture with identify the embedded watermark. The spatial area strategies are less intricate contrast with change space techniques, anyway feeble to various picture assaults. The information concealing limit of spatial area procedures is higher than that of change space strategies. Spatial area strategies offer higher power to geometrical changes.

The strength and intangibility of the watermarked pictures can be improved by performing watermarking in recurrence space. Recurrence area methods can give better heartiness against pressure and separating assaults, in light of the fact that the watermark coefficients spread all through the spread picture. In recurrence space, watermark implanting is finished by changing the picture coefficients utilizing picture changes. Veiling systems dependent on change space are more vigorous than least noteworthy piece strategy as for editing, pressure and picture preparing. The principle bit of leeway of veiling systems is that they implant watermark coefficients in huge territories of the host picture.

II. DIGITAL IMAGE WATERMARKING USING WAVELETS

A wavelet is an oscillatory capacity of limited span. The wavelet gives both spatial and recurrence depiction subtleties of the picture. The worldly data is held in this wavelet change process contrasted with different changes like DCT and DFT. Haar, Daubechies, Complex, Balanced, Stationary, Morphological, Non-tensor, Berkley, Mexican-cap, Morlet, Shannon and Biorthogonal are the various wavelets used to perform picture handling.

The DWT isn't successful to break down non-stationary sign. While brief time Fourier Transform is a successful instrument to do that activity, yet the disadvantage is that it gives steady goals at all frequencies. DWT gives both spatial and recurrence portrayal of a picture with multiresolution. The multi-goals property of the wavelet change can be utilized to misuse the way that the reaction of the human eye is diverse to high and low recurrence segments of the picture. DWT can be applied to a whole picture without utilizing square structure as utilized by the DCT, consequently decreasing the blocking ancient rarity. Wavelet is an oscillatory capacity of time or space that is occasional and of limited length with zero normal worth. A group of wavelets can be created by widening and deciphering mother wavelet. Wavelet gives time-recurrence portrayal of a sign and is utilized to break down non-stationary sign. Multi-goals system is utilized in wavelet change where various frequencies are examined with various goals. Huge wavelets give an estimated estimation of a sign, while the littler wavelets help up the littler subtleties. DWT is figured either by utilizing convolution based or lifting based methodology. In both the techniques, the yield grouping disintegrated into low-pass and high-pass sub groups, where each sub groups establishing of a large portion of the quantity of tests of the first succession. The DWT speaks to a NxN picture by N2 coefficients. The DWT can be actualized through channel bank or lifting plan. The DWT of a picture is broke down by enabling it to go through an investigation channel bank pursued by down testing. The examination channel bank comprises of low-pass and high pass channels at decay organize. At the point when a picture goes through these channel banks, the picture split into two sub groups. The low-pass channel performs averaging activity and concentrates the coarse data of the picture. While the high-pass channel performs contrast activity and concentrates the subtleties of the picture. At that point the yield of the sifting activity is down examined by two. This activity parts the picture into four groups, specifically, LL, LH, HL, and HH as appeared in figure (1). The least goals level LL comprises of the estimation part of the first picture and a large portion of the vitality is amassed in this LL band. Thus adjustments of this low recurrence sub band would cost serious and inadmissible picture corruption. So the watermark isn't inserted in LL sub band. The great zones for watermark inserting are high and center recurrence coefficients (vertical, even and corner to corner coefficients). Human visual framework is coldhearted toward these high and center recurrence sub bands and compelling watermark inserting is accomplished without being seen by human visual framework.

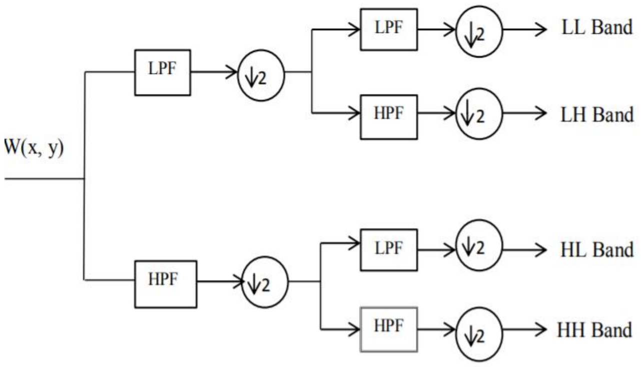

Figure 1: Wavelet Decomposition using Sub-band coding

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.

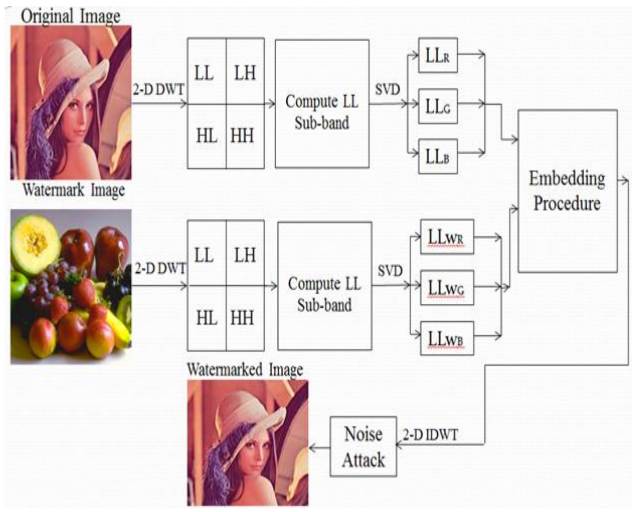

Figure 2: Flow Chart of Proposed Methodology

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.

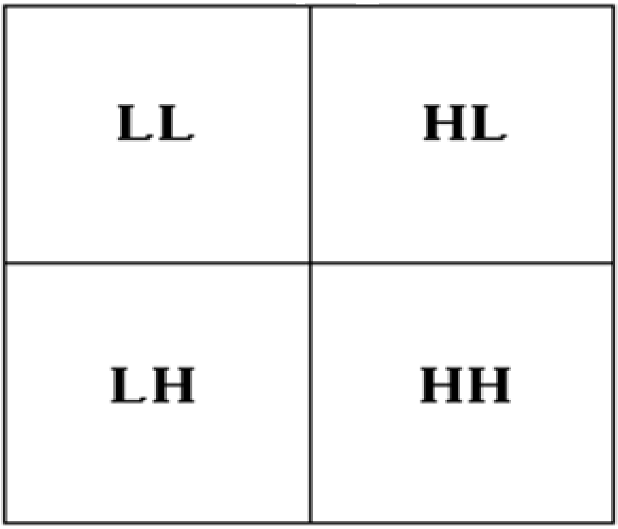

Figure 3: 2-D Discrete Wavelet Transform

IV. SIMULATION RESULTS

Figure 4; show the original Lena image of 512×512 pixel value. The random image of the original image is resized 512×512 image, resize image is shown in figure 4 (a). The original resize image is passing through 2-D DWT and 2-D DWT original resize image is shown in figure 4 (b).

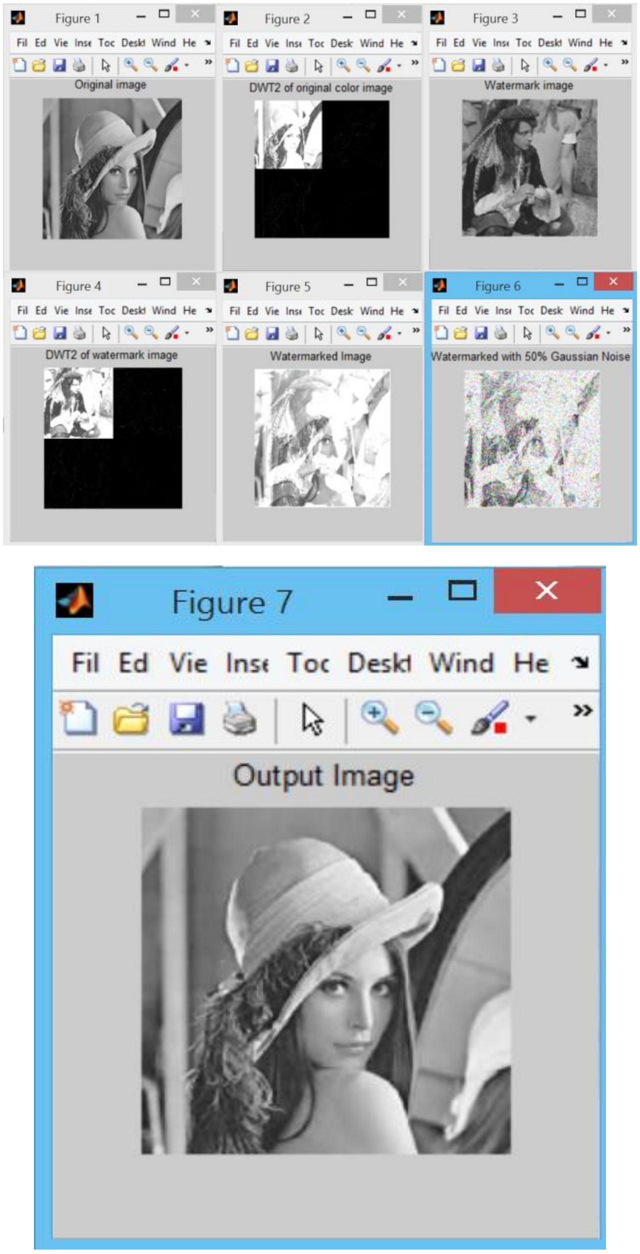

Figure 4: Experiment Image with Gaussian Noise Attack

The watermark image is 512×512 pixel value is shown in figure 4 (c) and watermark image is passing through 2-D DWT and 2-D DWT watermark resize image is shown in figure 4 (d). Both images are passing through the embedding processing and original image add with watermark image is shown in figure 4 (e). Embedding processing image attack with 50% Poisson noise is shown in figure 4 (f). Applied median filter for Poisson noise image and get output image is shown in figure 4 (g).

As shown in table 1 the PSNR, MSE, NAE and computation time result are obtained for the proposed DWT-SVD technique. From the analysis of the results, it is found that the proposed DWT-SVD technique gives superior performances.

Table 1: Result for Different Image in Gaussian Noise Attack

PSNR (dB)				
Noise Density	Lena Image	Flower Image	Home Image	Sky Image
0.01	56.432	57.321	57.993	56.932
0.02	54.942	55.032	54.065	53.904
0.03	51.903	53.032	51.435	50.905
0.04	47.903	49.954	47.043	46.903
0.05	44.932	45.032	44.903	43.904

The proposed DWT-SVD technique gives a highest PSNR 57.321 dB for Flower image and lower PSNR 43.904 dB for Sky image.

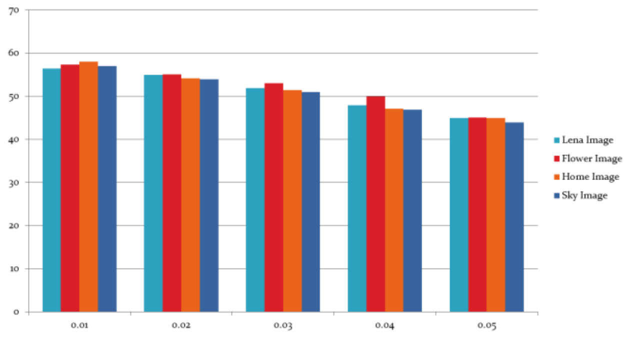

Figure 5: Bar Diagram of the Different Image with Different Parameter in Gaussian Noise Attack

Figure 5 shows the graphical illustration of the performance of DWT-SVD technique discussed in this research work in term of different parameter. From the above graphical representation it can be inferred that the proposed DWT-SVD technique gives the best performance for Lena image.

V. CONCLUSION

Digital watermarking is becoming one of the most promising methods for copyright protection of digital images, authentication, labeling and monitoring. Most of the research is going on in the field of image watermarking. The watermarking techniques proposed in this paper can be further improved to increase the hiding capacity of images without affecting the imperceptibility of the images. Online application of watermarking for video in the spatial domain becomes cumbersome due to associated high computational complexities involved. In this thesis we embed DWT-SVD and low boost filter technique to watermark the digital image efficiently. Watermarking algorithms have varied requirements according to the application, the algorithm aims to target.

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