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Hybrid DWT-SVD Digital Image Watermarking

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Abstract

The protection of the multimedia data is one of the main issue in the global village. Several procedures are implemented to protect the digital data. Watermarking provide the robust solution for multimedia contents security. It can be easily used to protect the digital color images form illegal use and increase the stoutness of images against intentional and unintentional attacks by computer hackers and crackers. Singular Value Decomposition (SVD) and Discrete Wavelet Transformation (DWT) is a hybrid watermarking process because it is efficiently implemented during the embedding and extracting stages of digital images watermarking. Embedding information does not affect the quality of original images. Embedded information is hidden from the non-authorized person. Using DWT-SVD method, the original and watermark images was divided into separate color channels RGB. R channels of both images were selected for embedding using secret beta key. Reverse procedure was applied to extract the watermark image for authentication or verification of contents. The values of PSNR, NC, MSE, SSIM, RMSE, SNR were determined seemed well sheltered.

Keywords: DWT; SVD; PSNR; MSE; SSIM; SNR; NC.

1. Introduction

The ubiquitous nature of digital network systems means large numbers of people can be copied digital contents without any cost. People can easily download images and video, audio files and distribute them with other peoples and also may be modify the original contents [1]. So there is an urgent need to provide protection of such digital media.

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There are many technologies to evaluate such problems like digital signatures. But there is a problem with these solutions because they require more bandwidth. Due to some limitations of previous technologies, a new technique came into being and this technique is called digital watermarking. Watermarking algorithms are used to embed digital content to provide to provide copyright protection and ownership identification. Many commercial firms around the world give the facility of copyright protection to their clients. The watermark can be visible or invisible, visible watermark is seen by the observer and invisible watermark can be identified by some decoding processes. For these reason, the watermark must be robust enough so that nobody can destroyed or changed the digital content. Security is a main problem which requires that watermark can be modified by the real owner.

1.1 Discrete Wavelet Transform (DWT)

To hierarchically decompose an image discrete Wavelet transform (DWT) is used because it is a mathematical tool for image decomposition. It is useful for processing of Non-stationary signals are also processed by this technique. The transform is consist on small waves, called wavelets, that varying frequency. Spatial and frequency detail are also provided by this technique. Mother wavelet is a fixed function that is used to create wavelets details and their translation [1]. DWT is use for the image description in multi resolution form. Decoding can be implemented in a sequence steps from a low resolution to the higher resolution. The DWT separate the signals into high and low frequency sections. Information related to edge components exist in high frequency section, and the low frequency section is selected again for splitting into high and low frequency sections [5]. The components having low frequency are mostly selected for watermarking. In two dimensional decomposition, on each level DWT is performed in the vertical direction and again followed by the DWT in the horizontal direction. In the first level of decomposition, there are resulted four sub-bands namely LL1, LH1, HL1, and HH1. For further level of decomposition, the LL sub band of the DWT1 level is used for 2DWT decomposition as a input which decompose the LL1 band into the four sub- bands LL2, LH2, HL2, and HH2 [4]. Similarly decomposition of third level is applied on LL2 with the help of DWT and received four sub bands LL3, LH3, HL3, and HH3. LH1, HL1, and HH1 are considered to be highest frequency bands in the image decomposition, while LL3 considered to be the lowest frequency band.

Image decomposition is shown in the figure.

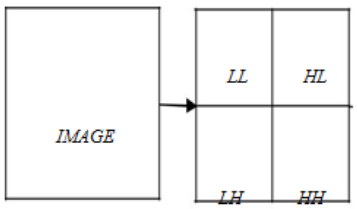

Figure 1: *One level Decomposition*

1.2 SVD

To solve many difficult mathematical problems a simple linear algebra technique is used which is called Singular value decomposition .This technique is also used in digital image watermarking for embedding and extraction process [8]. Images are considered to be square matrix using SVD, without the loss of image quality. So SVD technique can be easily implemented to any kind of digital images either the images may be grayscale or RGB. The orthogonal transform belongs to SVD which can decompose the given matrix into three equal size of matrixes of same size from which one matric is called diagonal and others two are orthogonal [3]. Diagonal matrix are used in digital image watermarking technique to embed the watermark into the original digital content. Square matrix are not require to decompose the matrix using SVD technique.

2. Methodology

First separate the RGB colors of both host and watermark image. 2DWT technique was applied on the R plane of host image. SVD was applied on the watermark R plane. The figure 3 explain the complete embedding procedure. Reverse method was applied for extraction.

The proposed methodology is given in the given figures.

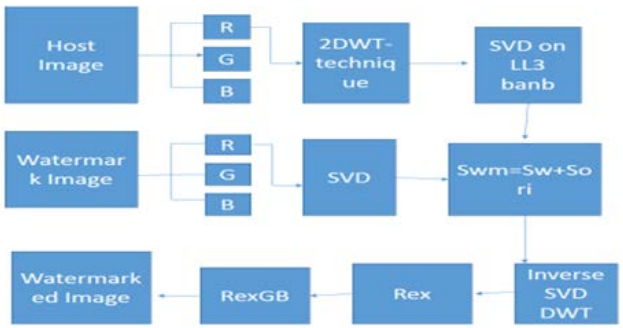

Figure 2: Procedure for embedding watermark into host image

3. Experimental Result

Table 1: Robustness of Watermarked image against different attacks

Attacks	PSNR	MSE	SSIM	RMSE	SNR
Salt and pepper	35.2672	19.3358	0.9847	0.2328	48.1160
Mean Filter	22.9708	328.0992	0.9038	0.0039	42.4542
Gaussian noise	23.1555	314.4330	0.5213.	0.3543	42.8772
Average filter	22.8699	335.8109	0.7673	0.0064	43.1206.

Median Filter	22.6924	349.8141	0.7608	0.0071	43.0575.
Sharpen	26.3931	149.1992	0.9466.	0.5320	43.6138.
Rotate	30.9875	75.9820	1.000	0.2665	38.9982

4. Conclusion

The experimental show the robustness of watermarked image against different geometric attacks. The highest value of PSNR indicate the robustness of watermarked image. Using DWT-SVD method, the original and watermark images was divided into separate color channels RGB. R channels of both images were selected for embedding using secret beta key. Reverse procedure was applied to extract the watermark image for authentication or verification of contents. The values of PSNR, NC, MSE, SSIM, RMSE, SNR were determined seemed well sheltered. . Hybrid DWT-SVD provide protection to digital contents.

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