A Hybrid technique for blind watermarking using Hessenberg matrix and Arnold transformation

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Abstract— In this study, a novel visually impaired picture watermarking system utilizing Hessenberg disintegration is proposed to install shading watermark picture into shading host pictures. During the time spent inserting a watermark, the watermark data of shading picture is inserted into the second line of the second segment component and the third line of the second section component in the symmetrical grid got by Hessenberg deterioration. A digital watermark is a kind of marker covertly embedded in a noise-tolerant signal such as audio or image data. It is usually used for identifying ownership of the copyright of such signal. "Watermarking" is the procedure of concealing digital information in a carrier signal; the hidden information should but does not need to be related to the carrier signal. Digital watermarks are used for the purpose to verify the authenticity or integrity of the carrier signal or to show the identity of its owners. In this research the Hessenberg decomposition is used for audio watermarking in the image. This technique is efficient in case of translation, rotation and to maintain the QoS parameters in image.

Keywords -

I. INTRODUCTION

A digital watermark is data embedded into digital intellectual property (IP) to identify its originator or owner. A digital watermark monitors online digital media uses and issues warnings against potentially unauthorized access and/or use. A digital watermark is known by other terms forensic watermark, watermarking, information hiding and data embedding. Major applications are tracing copyright infringements and for banknote authentication. Like traditional watermarks, digital watermarks are only perceptible under certain conditions, i.e. after using some algorithm, and imperceptible anytime else. [2] If a digital watermark distorts the carrier signal in a way can be apprehended which is of no use. [2] Traditional Watermarks may be applied to visible media (like images or video), while in digital watermarking, the signal may vary in format, it can be audio, pictures, video, texts or 3D models. A signal may have various distinct watermarks at the same instant of time. A digital watermark does not alter the size of the carrier signal on the contrary metadata that is added to the carries signal does so.

Digital watermarking may be used for a wide range of applications, such as:

Copyright protection

Source tracking (different watermarked content is received by different recipients)

Broadcast monitoring (television news often contains watermarked video from international agencies).

Advantages of Watermarking

1) It conceals a secret and personal message to protect a copyright of products.

2) Advantageous on demonstrating its data integrity, secure and fast digital data encryption and decryption, and verification of content.

Disadvantages of Watermarking

1) In case, loss of the private key can enable an infringer to wipe out the watermarks from all the images that belong to the specific owner leading to dangerous destabilization of the system.
2) Detection of false positives. An intruder may create confusion for monitoring software or desynchronize the detector by applying series of several unusual image processing operations.

As the data are available in the distribution network, there is consistent risk of removal of watermark by new techniques.

II. CLASSIFICATION OF WATERMARKING

Digital Watermarking techniques is categorised as:

- Text Watermarking
- Image Watermarking
- Audio Watermarking
- Video Watermarking

In other way, the digital watermarks can be divided into three different types as follows:

- Visible watermark
- Invisible-Robust watermark
- Invisible-Fragile watermark

An effective digital watermarking method must be imperceptible, and robust to typical image alterations like as compression, filtering, rotation, scaling cropping, and collusion attacks among several other digital signal processing operations. Presently, digital image watermarking techniques can be grouped into two main classes: Spatial Domain Watermarking and Frequency Domain Watermarking.

A. **Frequency Domain Watermarking**:

These methods are similar to spatial domain watermarking in that the values of selected frequencies can be altered. Because high frequencies will be lost by compression or scaling, the watermark signal is applied to lower frequencies, or better yet, applied adaptively to frequencies containing important elements of the original picture.

B**. Spatial Domain Techniques**

Techniques in spatial domain class typically have the following characteristics:

• The watermark is applied in the pixel domain.

• No transformations are applied to the host signal during watermark embedding.

• Combination with the host signal is based on simple operations, in the pixel domain.

• The watermark can be detected by correlating the expected pattern with the received signal.

C. Spread Spectrum

This technique is used for both spatial domain and frequency domain. in spread spectrum method, the watermark extraction is possible without using the original unmarked image which is beneficial.

To ensure the licensed innovation rights, Watermarking strategy is the way towards instilling the watermark into the advanced media. Watermarking strategy can be arranged into two gatherings, in particular spatial area and change space. In the spatial space, the host picture pixels are controlled and the watermark data is specifically embedded into them. In spite of the fact that the spatial area techniques have brought down computational many-sided quality and higher limit, they are powerless against different assaults and have more awful power. Then again, change area techniques not just endure different assaults, however, have great exhibitions. Despite the fact that change area techniques require predefined change and

converse change and the watermark data is conveyed over the entire scope of pixels of the host picture of neighbourhood parts, change area techniques are heartier to different assaults

III. RELATED STUDY

Ruizhen Liu and Tieniu Tan National Lab of Pattern Recognition in their paper proposed that A SVD based watermarking scheme for protecting rightful ownership watermark is added to the SVD domain of the original image. unitary transformations which adopt fixed orthogonal bases (such as discrete Fourier transform, discrete cosine transform etc.), SVD uses non-fixed orthogonal bases. It is a one-way, non-symmetrical decomposition. These properties lead to the good performance of the novel algorithm in both security and robustness.

Sumit Kumar Prajapati, AmitNaik, AnjulataYadav(2012) in their paper "Robust Digital Watermarking using DWT-DCT-SVD " suggested thata cascading approach of watermarking based on DWT-DCT-SVD is suggested. The DCT-SVD based method is very time consuming because it offers better capacity and imperceptibility. DWT-SVD method is found to be similar to the DCT-SVD scheme except that the process was fast.

V.Santhi, *(*2011) in DC Coefficients Based Watermarking Techniquefor color Images Using Singular ValueDecompositionstated that DC coefficients are perceptually mostsignificant and more robust to many unintentional attacks and intentional attacks (unauthorized removal), in this paper we proposed a robust non-blind watermarking algorithm based on DC coefficients for color images. DC coefficients are obtained by applying DWTfollowed by block based DCT technique. The RGB color spaces of the cover image are decomposed into different frequency bands using wavelet decomposition and block based DCT is applied. DC matrix is SVD decomposed to obtain singular values in which watermark is to be hidden.

A. Kannammal, K. Pavithra, S. SubhaRani(2012) in their paper Double Watermarking of Dicom Medical Images usingWavelet Decomposition Technique proposed thata digital watermarking framework in which the Electrocardiograph (ECG) and Patients demographic text ID act as double watermarks. Watermarking is done on selected texture regions using wavelet decomposition technique which is to be taken care of carefully, because selection of a region greatly affects the quality of the image. The watermarked image must also look like the original medical image (i.e. invisible watermarking is involved). Original image and the embedded watermarks are reconstructed from the watermarked image and are tested using various quality measures

VIJAYA KUMARI V, CHITRA B (2011) in their paper comparison of svd based image watermarking techniques implemented for gray scale and color images described that Singular value decomposition (SVD) based watermarking technique is implemented and comparative analysis is made for both gray scale and color images of different sizes, and their performance is evaluated using PSNR and NCC values. The Normalized correlation value obtained between original and extracted watermark image is unity for all types of images. Gray scale watermarking is not robust in case noises are present and embedding smaller image into larger image

produces better result in color image watermarking. The PSNR and NCC values are calculated for watermarked images without and with attacks. Further this can be extended for different types of attacks such as compression, scaling, cropping etc.

S.Ramakrishnan, T.Gopalakrishnan, K.Balasamy in their paper SVD Based Robust Digital Watermarking For Still Images Using Wavelet Transform aimed at developing a hybrid image watermarking algorithm which satisfies both imperceptibility and robustness requirements . It applied singular values of Wavelet Transformation's HL and LH sub bands to embed watermark. Further to increase and control the strength of the watermark, they used a scale factor. An optimal watermark embedding technique is developed to achieve minimal watermarking distortion. A secret embedding key is designed to safely embed the fragile watermarks so that the newmethod is robust to counterfeiting, even when the malicious attackers are fully aware of the watermark embedding algorithm.

IV. HESSENBERG MATRIX

In linear algebra, a Hessenberg matrix is a special kind of square matrix, one that is "almost" triangular. To be exact, an upper Hessenberg matrix has zero entries below the first subdiaconal, and a lower Hessenberg matrix has zero entries above the first super diagonal. They are named after Karl Hessenberg.

$$\begin{bmatrix} 1 & 4 & 2 & 3 \\ 3 & 4 & 1 & 7 \\ 0 & 2 & 3 & 4 \\ 0 & 0 & 1 & 3 \end{bmatrix} \quad \begin{bmatrix} 1 & 2 & 0 & 0 \\ 5 & 2 & 3 & 0 \\ 3 & 4 & 3 & 7 \\ 5 & 6 & 1 & 1 \end{bmatrix}$$

Fig 1(a) Upper Hessenberg, 1(b) Lower Hessenberg

A Hessenberg decomposition is a matrix decomposition of a matrix A into a unitary matrix P and a Hessenberg matrix H such that

$$P H P^{H} = A,$$

where P^{H} denotes the conjugate transpose.

Hessenberg decomposition is implemented in the Wolfram

Language as HessenbergDecomposition[*m*].

Hessenberg decomposition is the first step in Schur decomposition. Hessenberg decomposition on an $n \times n$ matrix requires $14\,n^3/3$ arithmetic operations.

V. FLOW CHART

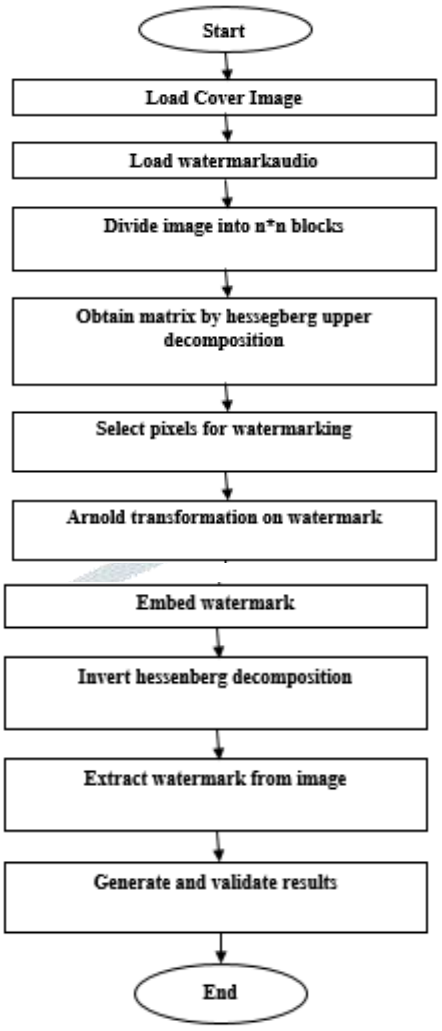

Table 1. Flow chart

VI. RESULTS AND DISCUSSION

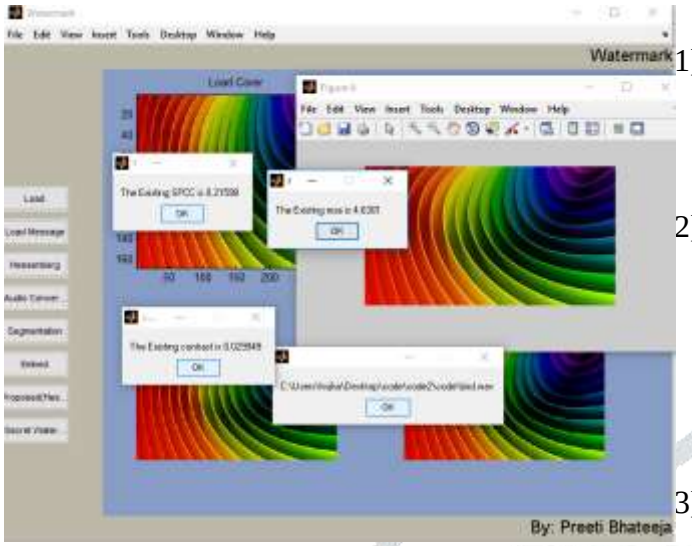

Figure1: Results

From this section it is cleared that the proposed approach is better as compare to the existing one in which the upper half was not used. IN the proposed approach the upper half of the Heisenberg decomposition is used for image operations.

VII. CONCLUSION

A hybrid colour image watermarking technique using Hessenberg decomposition and Arnold transformation is presented in this paper. On the basis of the Hessenberg decomposition, the colour watermark information is embedded into the second row of the second column element and the third row of the second column element in the orthogonal matrix Q by modifying the matrix elements based upon the upper matrix. Moreover, in the process of extracting watermark, neither the original image nor the original watermark image is needed and the embedded watermark can be successfully extracted from the attacked watermarked images with the right authorised keys. The test comes about have demonstrated this proposed calculation has higher execution in all parts of watermark imperceptibility, power, implanting limit and computational intricacy.

VIII. REFERENCES

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