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Secured Digital Watermarking of Colour Images

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Abstract:
In this paper we propose a new invisible digital watermarking scheme for color images based on singular vector domains. In this new approach, Standard watermark can be embedded into the three color channels (R, G, B) of the host image in order to increase the robustness of the watermark. The proposed method demonstrates that color image watermarking is possible without affecting its visual quality and also allows for reasonable compromise between robustness and invisibility of watermarks. This research, based on our earlier work, consists of embedding a gray watermark into a gray host and a color watermark into a color host based on the singular vector domain. The main feature of our scheme is to use all channels of RGB color space to embed watermark. Hence we are embedding maximum amount of watermark and also make it more secure. For further security we are using AES encryption scheme.
Keywords:- SVD, Digital Watermark (DWM), AES, Secured DWM, PSNR, RMSE .

I. INTRODUCTION

With the rapid development of Internet and multimedia, the piracy towards digital media is becoming quite serious. We live in digital age and the development of technology has filled our lives with many colors. So the protection of the color image is the need of current era. The security of digital colour images is enhanced by embedding large capacity of watermark data. The amount of watermarking information and robustness of embedding scheme significantly influence the overall security. Imperceptions and robustness are thus the two most important properties of digital watermarking. Increasing imperceptions often causes the loss of robustness and vice versa, so the watermarking designers have to compromise between the two properties.

Miyara et al. [1] proposed a new digital watermarking method of three bands RGB color images based on PCA. This consists of embedding the same digital watermark into three RGB channels of the color image based on PCA Eigen-images. Piva et al. [2] introduced another color image

watermarking scheme based on the cross-correlation of RGB-channels. Here DCT transformation is first performed separately on each color channel. A set of coefficients is then selected from each color channel, which is used to embed the watermark by modifying these coefficients. Zhang and Du [3] proposed an algorithm based on the RGB color space. They proposed to embed color watermark into a color host image. It fully uses he characteristics of HVS, fulfills the self-adaptive embedding of watermarking, and balances the imperceptions and robustness.

Cheng et al. [4] proposed algorithm based on embedding the watermark image three times in different frequency bands that are low, medium and high; result of that the watermark can not be totally destroyed by either low pass, medium or high pass filter. The concept of using more than one watermark has also been suggested by Raval and Rege [5], in which multiple watermarks are embedded in LL and HH bands after application of a DWT. Gorodetski et al. [6] used SVD domain for watermarking a RGB image by quantized the singular value of each channel. But, this is shown to resist only for JPEG compression.

The watermarking techniques can be classified into two categories: spatial domain and transform domain techniques. In spatial domain technique the watermark embedding is achieved by directly modifying the pixel values of the host image. In transform domain technique , the host image is first converted into frequency domain by transformation method such as the discrete cosine transform (DCT), discrete Fourier transform (DFT) or discreet wavelet transform (DWT) ,etc. then, transform domain coefficients are altered by the watermark. The inverse transform is finally applied in order to obtain the watermarked image.

II. SINGULAR VALUE DECOMPOSITION

- A singular value decomposition of an n × n real-valued matrix A is a factorization A = U(Σ)VT with several constraints.

- Σ is a diagonal matrix with real, nonnegative diagonal entries σ1, σ2, . . . , σn such that σ1 ≥ σ2 ≥ · · · ≥ σn.

• U and VT must be real and orthogonal, which means
VTV = UTU = I, the identity matrix; alternately a matrix is orthogonal if its column vectors are pairwise orthogonal
unit vectors.

• Singular values of A are the diagonal entries of Σ, σ1, σ2, . . . , σn. These are of theform √λ where λ is an is an eigenvalue of AA . These eigenvalues λ are always real and nonnegative, and are uniquely determined.

• Singular vectors of A are the columns of U and V , respectively called the left singular vectors and right singular vectors. Singular vectors for U will be pairwise orthogonal unit vectors, as will those for V .

In this algorithm, the singular value decomposition A = U(Σ)VT is taken of the entire image.The watermark, also taken as a matrix, W, is added to the Σ matrix in the singular value decomposition, with a scale factor a to vary the impact of the watermark on the image. The SVD is performed on the new matrix Σ + aW = UW ΣW VTW . Then the watermarked image AW= U(ΣW)VT is recomposed. By reversing the steps, the watermark can be extracted, given UW , Σ, and VTW .

III. LEAST SIGNI CANT BITTECHNIQUES

One basic steganographic embedding technique for image files is the least significant bit embedding. This technique exploits the human eye's inability to detect insignificant changes in the values of the pixels of an image file.

• Bitmap image files consist of an array of pixels.

• A pixel is a single point in a graphic image. Each pixel has a value corresponding to the intensity of colors (or the intensity of gray) that pixel represents. This value is recorded in the data file for that image.

• The least significant bit (LSB) of a pixel, or pixel value, in an image file is the 1's digit of its binary expansion. It corresponds to the evenness or oddness of the pixel's value; i.e., even numbers' LSBs are 0, odd numbers' LSBs are 1.

• The least significant bit plane in an image is the collection of least significant bits of the pixels of the image.

• Changes made directly to the pixels of an image are said to be made in the spatial domain, that is the space of the pixels of the image.

IV. TENTATIVE APPROACH

Important steps are outlined below:-

1) Apply SVD operation on the image and the standard watermark.

2) This produces the Singular values of both the image and the standard watermark.

3) Apply LSB (Least Significant Bit)Technique on the image to get the Coefficients to add the watermark with negligible image distortion as compared to adding it directly to the image.

4) The Watermarked Embedded Image is further encrypted using the AES (Advanced Encryption Scheme) for Security purpose.

5) This encrypted Watermarked Image is transmitted via suitable Channel & decrypted at receiver end to extract the watermark & the original image.

6) The extracted watermark is further compared with the original standard watermark using the Peak Signal to Noise Ratio and Mean Square Error values.

7) Alteration indicates intrusion & overall security of image data is enhanced.

8) The scheme is tested by applying different kind of attacks like Additive noise, Histogram equalization, Gaussian Noise etc. to the watermarked image.

V. CONCLUSION:

From the above discussion it is clear that applying the LSB technique via SVD reduces distortion and the AES ensures the security of the image. Comparative results confirm the hypothesis.

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