Ch. Seetha Devi* et al.
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The Image Stenography Using Single Value Decomposition And Zig Zag Map

CH.SEETHA DEVI
PG Student, Department Of CSE, Gudlavalleru Engineering College,

Dr.M.BABURAO M.tech, Ph.D
Associate Professor & HOD of CSE, Department Of CSE, Gudlavalleru Eng College

Abstract: **Hiding the secret message in to cover image is an important role in digital media. The paper presents the image stenography using svd (single value decomposition) and zig zag map. This technique embed secret message either left or right or combinationations singular vector using key which is generated by zig zag map and apply various noise attacks. The proposed method mainly used in protects the electronic products copyrights. The main objective of proposed method is to hiding secret message in to cover image and then transmit it. The experimental results that the proposed prposedy method provide high level of imperceptibility, robustness, high peak signal to noise ratio (PSNR) and mean square error (MSE) with embedding strength against many existing methods.**

***Index Terms*—Image Steganography; Singular Value Decomposition; Zig Zag Map And Embedding Strength;**

I. INTRODUCTION

The very term steganography named after the amalgam of two Greek words namely „Stegos" and „Grafia". Stegos stands for „Cover" and grafia stands for „Writing" [1]. Video Steganography simply referring about concealing the secret data into the video stream [2]. It is an extension of image steganography. Since, we already know that a series of consecutive and equally time-spaced static images, exploiting our own visual system i.e. Human Visual System, are called as Video stream [3]. It even consists of audio most of the times now days. This is the reason why many of the image steganographic techniques are applicable for the video steganography too. The best advantage of video steganography over image steganography is that it"s better data hiding capacity and the popularity and a frequent data sharing in form of video over the internet especially through the social networking websites [4]. Thanks to the cheaper cost of data rates over the internet. The positive surge in digital communication over the internet arise higher requirements of security to maintain the secrecy of communication. Video steganography is a suitable tool for it [5].

SVD is forceful and dependable orthogonal matrix decomposition method. Because of SVD conceptual and constancy reasons, it becomes much more popular in signal processing area. A fundamental property of the SVD is his relationship with the rank of a matrix and its ability to bring matrices of a certain rank. Rarely are represented by digital images through a low rank matrices, and consequently is able to characterize the amount of the comparatively small group of realizing images. This connotation increases the manipulation of two distinguished signal from the partial spaces [6]. The use of the singular value decomposition (SVD) in image squeeze has been studied extensively [7], If the image when considering the form of a matrix, has a low rank, or can be approximated well enough by the matrix of low rank, then SVD can be used to find this approximation and strengthen this concourse low rank can be represented in a much more compressed than the original image.

II. PROPOSED METHOD

The block diagram of proposed method as shown in fig.1.The proposed method has follow two steps i.e. embedding of secret message into the cover image at one end and its decoding from the stego image at the other end. For encoding, embedding of the secret message based on DCT. Singular Value Decomposition (SVD) is used for realizing Singular vectors of cover image. For the decoding process, the reverse procedure has been followed using inverse SVD and IDCT respectively.

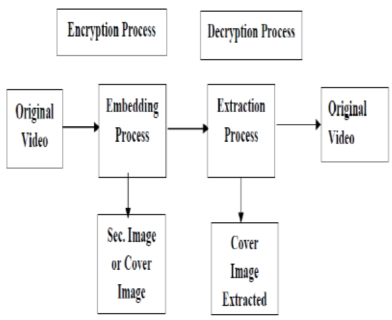

Fig.1. block diagram of proposed method

In the above block diagram, firstly the original color cover image is converted into gray images and then the transformed coefficient DCT is applied on selected frequency bands then SVD provides the singular values in subsequent step. Same steps is followed for decoding too. Now the singular vectors of each image is merged with singular vector of each planes of stego image at particular scaling factor. The following expression is used for getting the stego image:

M(i, j) = So(i, j) + α * Sw(i, j)

M(i, j): Stego Image;

So(i, j)= Singular values of image;

Sw(i, j)= Singular values of stego image;

α= Scaling Factor

Now, for the decoding of the stego image reverse procedure is applied. The decoding method can be acquired by following expression:

Sw(i, j) = (M(i, j) – S0(i, j)) / α

Assume that the SVD is applied to an input image A of size n×n square matrix with real K ≤n.

The SVD of A can be represented by

$$A=USU^T$$

a) Embedded algorithm

- Read the image and split the input image (color image) into RGB.
- : Perform SVD on component matrices to generate:

  AR=UR SR VRT
- Select K value, K= (no. of columns /7), construct the image using the selected singular vector K: U matrix of size n×K (UR, UG, UB), S matrix of size K×K (SR, SG, SB) and V matrix of size n×K (VR, VG, VB) by using the key from PRNG-ZZM.
- The cover image matrix can be represented by

  $A= USV^T$
- An= Un +Vn+Sn, An=nK+nK+K , An=K (2n+1) For high resolution image n2>> K (2n+1) so Image is compressed
- Let Key the output from zig zag map and Key1= [Keyc, Keyc]
- Where Keyc the complement of Key. The Key1 is matrix depend on the Key and Keyc (of size n×K).
- Convert the output matrix from step 5 (A n×k) to integers value by using quantization.
- Find four LSB bits of each pixels of the cover image .Embed the eight bits of the secret image into 4LSB of RGB pixels of the cover image in the under to 3,3,2 respectively .
- Form the stego image.

b) Decoding algorithm

- Read stego image and split the stego image into RGB.
- Extract 3 bits from stego image.
- Merge the bits to construct matrix of integers, And convent integers matrix to real value (quantization inverse).
- Extract the matrices (UR,UG,UB), (SR,SG,SB) and (VR,VG,VB) Depend on the key (K) AR=UR SR VRT, AG=UG SG VGT and AB=UB SB VBT to get cover image

III. PERFORMANCE EVALUATION

Performance of our proposed system is evaluated with the help of peak signal to noise ratio (PSNR) and the mean squared error. The PSNR attributed to the present work to calculate the extracted image quality in comparison with the original hidden image. The PSNR is given by;

$$PSNR = 10 \log_{10} (255^2/MSE)$$

Where, the Mean Square Error between the original image I of size M × N and the extracted image Is are evaluated by following expression;

$$MSE = \frac{1}{MN}\left[\sum_{i=1}^{M}\sum_{j=1}^{N}\left(I(i,j) - I_s(i,j)\right)^2\right]$$

Based on our testing, the values of MSE (mean square error) and PSNR with respect to embedding strength are summarized

IV. CONCLUSION

In this paper, we have presented image steganography technique using SVD and DCT. It is a high level of imperceptibility, robustness, high peak signal to noise ratio (PSNR) and mean square error (MSE) with embedding strength. The experimental outcomes indicate that the SVD based system has high quality of the steganography having low MSE values and high PSNR values compare to existing methods.

V. REFERENCES

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