Robust and Secure Data Hiding Technique using FA and DWT

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Abstract **-**The objective of proposed technique is to create a secure data hiding system to hide the covert data by discovering the acute location in the cover image such that the generated stego image is superior, provide high security with a lesser amount of memory usage, low computational complexity, high visual quality and can accomplish good performance. In RDH the cover image will be retrieved after extracting the secret data which was embedded in that image. This paper presents a new technique in reversible data hiding technique based on Firefly algorithm (FA).

The best possible location to cover the secret data will be found by firefly algorithm. The firefly algorithm generates the salt and pepper noise. Image de-noising consists of the manipulation of the image data to construct a visually high quality image. 2D bilateral filter is used to filter the image after hidden the secret information. In this system, a robust digital color image watermarking method using Discrete Wavelet Transform(DWT) is proposed. DWT is used for embedding the secret data into cover image and then IDWT is applied to recover original image.Reverse process is applied for extraction of secrete data.

The Experimental result shows that proposed method achieved better MSE and higher PSNR. This makes the proposed method more effective and secure for hiding the data.

Index Terms **–** *FA,DWT,2D bilateral filter, Harr Transform.*

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I. INTRODUCTION

Digital watermarking is a technique of inserting some data into the given media, which is extracted later or being detected for various purposes. With the fast improvement of multimedia technologies and the growinglure of the internet, information or data hiding methods have become more and more extensively applied to achieve authentication.

The aim of proposed method is to create a new data hiding system to hide the secret data by finding the best location in the cover image such that the resultant stego image is in good quality, provide high security with less memory usage, low computational complexity, high visual quality and can achieve good performance. And cover image the will be recovered after extracting the secret data which was embedded in that image[1].

A. Problem Definition

In recent times a lot of work has been carried out in the field of reversible data hiding. And all the techniques proposed have, in their unique way, proven to be very useful. But the main hindrance that remains is that degradation in the extracted image quality, data compression is not efficient, higher computation complexity, high memory occupation. Further research needs to be undertaken to tackle this drawbacks. Other drawback is, introduces noise after embedding and hide only gray scale image.

B. Scope

The proposed methodcan be widely used in medical, military, remote sensing and judicial field that require the cover object needs to be recovered back after extraction of the secret data. The digital watermarking technique can be used for applications, like providing copyright protection to the films, videos, etc. The proposed method can also be used for the validation of data like images, videos, electronic documents etc.

The main application of data hiding technique lies in IPR Protection, Authentication, Military, medical and law enforcement. Unauthorized distribution of viable images can be prevented by using digital watermarking techniques.Digital watermarking techniques are also used extremely in secure transfer of data. The limitation of this method is that only spatial correlation of the pixels inside the single 2-D block is considered and the correlation from the pixels of the neighboring blocks is neglected.

II. LITERATURE REVIEW

A.An Efficient data hiding scheme using firefly algorithm in spatial domain

A reversible data hiding technique based on Firefly algorithm (FA). The optimal location to hide the secret data will be found by firefly algorithm as put forward by A.Amsaveni and C.Arunkumar. Where, histogram shifting

technique is used to embed the secret data in the cover image.Histogram shifting proposed by Ni et al. in which the intensity of the pixel is used to hide the secret data [1].

B.Secure data hiding using robust firefly algorithm

This paper presents a new technique in RDH based on robust Firefly algorithm. The optimal location to hide the secret data will be found by firefly algorithm. The image climbing is applied by Framelet Transform to inhibit perceptual brightness of embedded secret image signal which increase the security level.2D bilateral filter is used to filter the image after hidden the secret information. The decomposition is done with Haar[2].

C. Reversible Data Hiding in Encrypted Image

A separable reversible data hiding in encrypted image proposed, the original image is encrypted using an encryption key and the data to be hidden data are embedded into the encrypted image using data-hiding key. With an encrypted image containing additional data, if the receiver has only the data-hiding key, he can extract the hidden data though receiver does not know the image content. If receiver has only the encryption key, he can decrypt the received data to obtain an image similar to the original one, but cannot extract the embedded additional data[4].

D. Reversible Data Hiding in Encrypted Images by Reserving Room before Encryption

A novel method by reserving room before encryption with a traditional RDH method, and thus it is easy for the data hider to reversibly embed data in the scrambled image. The proposed method can achieve real reversibility, that is, data extraction and image recovery are free of any error. Since losslessly vacating room from the encrypted images is relatively difficult and sometimes inefficient. If we reverse the order of encryption and evacuating room, the RDH tasks in encrypted images would be more natural and much easier which leads us to the novel framework, RRBE. The content owner first reserves enough space on original image and then convert it into its encrypted form with the encryption key [5].

E. Performance Evaluation of a New Modified Firefly Algorithm

Firefly Algorithm being a new nature inspired algorithm has been widely used for solvingdifferent optimization problems. The Standard Firefly Algorithm which uses the flashing behaviour of fireflies during night to obtain an optimization solution to a given problem.Two new modified deviations of the SFA were introduced which reduced some of the limitations of the SFA. In this work, a new modified version of the SFA algorithm namely, New Modified Firefly Algorithm has been proposed and later its performance on various parameters is compared with SFA and its two more variants. Results show that the proposed algorithm is better in performance in comparison to all the other algorithms [6].

F. Secure Reversible Image Data Hiding over Encrypted Domain via Key Modulation

This work proposes a reversible image data embeddingscheme over encrypted domain. The data inserting is achieved through a public key modulation method, in which access to the secret encryption key is not needed. At the receiver side, a powerful two-class SVM classifier is designed to distinguish encrypted and non-encrypted image areas, allowing us to jointly decode the inserted message and the original image signal. The proposed approach provides higher embedding capacity, and is able to perfectlyreconstruct the original image as well as the hidden message [7].

G. Multiresolution Bilateral Filtering for Image Denoising

In this paper, the first contribution is arealistic study of the optimal bilateral filter parameter selection in image de-noising applications. The second contribution is an extension of the bilateral filter i.emulti-resolution bilateral filter, which is applied to the low-frequency sub-bands of the signaldecayed using a wavelet filter bank. The multiresolution bilateral filter is combined with wavelet thresholding to form a new image de-noising framework, which turns out to be very effective in eliminating noise in real noisy images [8].

H. DWT Based Watermarking Algorithm using Haar Wavelet

In this paper, we introduce a suitable method of watermarking because the watermark protects the right of digital products and the integrity of certification. The main focused of Watermarking is developing new techniques for watermark embedding and detection. Experimental results show that the embedded watermark is crystal clear and quite robust in face of various watermark images at high compression ratios and provides good results in terms of inaudibility [11].

III. IMPLEMENTATION

The proposed system uses a firefly algorithm based data hiding technique.The optimal location to hide the secret data will be found by firefly algorithm. Image de-noising involves the manipulation of the image data to produce a visually high quality image.2D bilateral filter is used to filter the image after hidden the secret information. The scrambled secret image is embedded using Discrete Wavelet Transform.In order to verify our method we carried out experiments on many standard images like peppers, Lena, baboon, fruits, Onion as well as general images like Bluewater, Scene, Strawberry, Tulips etc. of various dimensions .

The proposed method is implemented in two stages. In the first stage secrete data is embedded into cover image, in the second stage secrete data is extracted and cover image is recovered back from stegoimage.The visual comparison ofcover image, stego image and recovered image by proposed method for various images with their MSE and PSNR parameters are as given below.

*PSNR (Peak Signal to Noise Ratio):*PSNR is used to measure the quality of reconstruction of lossy and lossless compression. The signal in this case is the original data and the noise is the blunder introduced by compression. When comparing compression codecs, PSNR is an approximation to human view of reconstruction quality. Although a higher Peak Signal to Noise Ratio generally indicates that the reconstruction is of

higher quality, in some cases it may not. PSNR is most easily defined via the mean squared error. PSNR is measured in decibel(dB).

$$PSNR=10 \cdot \log_{10}\left(\frac{MAX_I^2}{MSE}\right) \quad \ldots\ldots\ldots\ldots \quad (1)$$

*MSE (Mean Square Error):*The Mean Square Error and the Peak Signal to Noise Ratio are the two error metrics used to compare image density quality. The MSE represents the cumulative squared error between the compressed and the original image, whereas PSNR represents a measure of the peak error. Lower the value of MSE, the lower the error.

$$MSE=\frac{1}{MxN}\sum_{i=0}^{N-1}\sum_{j=0}^{M-1}[x(i,j)-y(i,j)]^2 \ldots\ldots\ldots (2)$$

For each image secret data is given as shown in below figure.
secret data is given as shown in below figure.

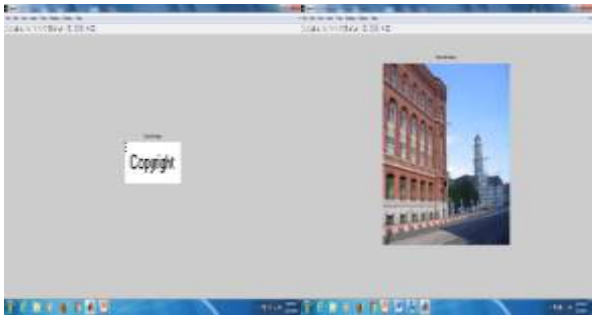

Fig.1(a)Secret data for original method (b) Secret data for proposed method

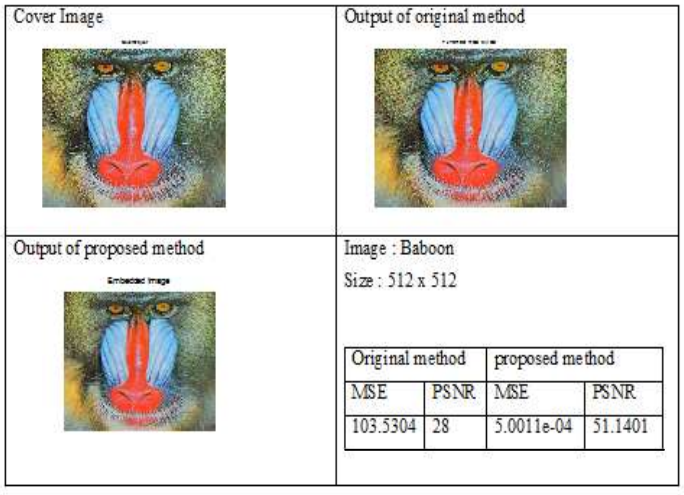

Fig. 2Visual comparison of proposed method for baboon image

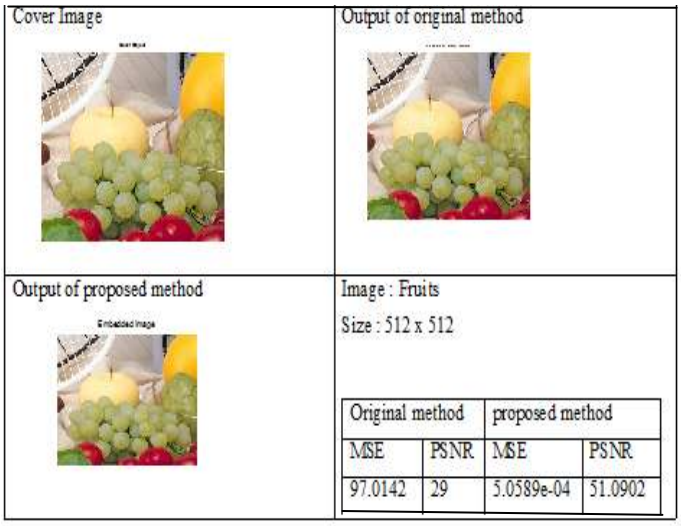

Fig.3Visual comparison of proposed method for Fruits image

TABLE I

COMPARISION OF PROPOSED METHOD FOR VARIOUS IMAGES

		Data hiding using firefly algorithm		Data hiding using robust FA algorithm	
Image	**Size**	**MSE**	**PSNR**	**MSE**	**PSNR**
Baboon	512 x 512	103.5304	28	5.0011e-04	51.1401
Peppers	512 x 384	100.2461	29	5.0932e-04	51.0609
Lena	512 x 512	103.6352	28	5.0028e-04	51.1386
Fruits	512 x 512	97.0142	29	5.0589e-04	51.0902
Flower	300 x 300	100.1204	29	4.9965e-04	51.1441
Onion	440 x 300	99.4815	29	5.2415e-04	50.9362
Nature	640 x 480	94.9403	29	4.9371e-04	51.1961
Bluewater	800 x 600	92.2792	29	4.9925e-04	51.1477
Strawberry	768 x 512	103.4196	28	5.0083e-04	51.1339
Tulips	1024 x 768	94.8463	29	5.1915e-04	50.9779

IV. CONCLUSION

In this research, we have implemented reversible data hiding method to hide secrete data into cover image and extract secrete data back with hidden image compression. We have given both, data hiding using firefly algorithm and data hiding using robust firefly algorithm. In the original method, the gray scale image is embedded into cover image by DWT,then key image is used to protect secret data and embedded raw image is obtained. Embedded raw image introduced some noise, so to eliminate noise 2D Bilateral filter is used which remove Gaussian and random noises. And finally filtered RGB image is obtained. The secret data is extracted from cover image using same key. After extraction it displays PSNR and MSE using firefly algorithm. The main drawback of original method is introduced noise after embedding, so filtering is required and it embed only gray scale image (secret data) of small size. Because of this image quality degrades and it is less secure.

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