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Secure data hiding Using Robust Firefly Algorithm

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Abstract— In recent times a lot of work has been carried out in the field of reversible data hiding (RDH) to prevent the secret data from theft, illegal copying and to provide copyright protection. In RDH the cover image will be recovered after extracting the secret data which was inserted in that image. This paper presents a new technique in reversible data hiding technique based on robust Firefly algorithm. The optimal location to hide the secret data will be found by firefly algorithm. The image scrambling is applied by Framelet Transform to prevent perceptual visibility 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 which is humble, symmetric and orthogonal wavelet and the direct weighting factor is used in secret embedding and extraction process.

Keywords—Reversible data hiding techniques, Robust Firefly algorithm ,DWT, image denoising.

1. INTRODUCTION

Digital image hiding technique is mainly recognized for the practical importance in the intellectual property rights. The upcoming technology has become more advanced and fast development by the use of digital image hiding.Digital watermarking is a technique of inserting some information into the given data, which is extracted later or being detected for various purposes. The data embedded is called as image hiding and the given data is original information. With the fast enhancement of multimedia technologies and the increasing attractiveness of the internet, information or data hiding methods have become more and more widely applied to achieve authentication.

The proposed system aims to hide the secret data by finding the best location in the cover image such that the resultant stego image is in good quality. The objective function for the firefly algorithm is based on the stego image quality. The Structural Similarity Index Measure is used to calculate the stego image quality. The objective of this research 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, and high visual quality of image and can achieve good performance. And cover image the will be recovered back after extracting the secret data which was embedded in that image.

The fields like medical, military, remote sensing and judicial require the cover object needs to be recovered back after extraction of the secret data. This type of data hiding is called as Reversible Data Hiding (RDH).Lots of research has been done in the area of reversible data hiding. In last few years numerous efficient methods have been proposed for reversible data hiding.

2. LITERATURE REVIEW

2.1 A reversible data hiding method using 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 [1].

2.2 Data Hiding Scheme with Edge Prediction and

Difference Expansion

A survey on traditional data hiding techniques which are mainly based on reducing the embedding distortion. Data Hiding Scheme with Edge Prediction and Difference Expansion to decrease the distortion caused by the hiding of secret data. Like these there have been many techniques that have been proposed [2].

2.3 A new reversible data hiding techniques

Diverse reversible data hiding techniques are analyzed. All previous methods embed data by reversibly vacating room from the encrypted images, which may be results into some errors on data extraction and/or image restoration and the process by reserving room before encryption with a conventional RDH algorithm, it is easy for the data hider to reversibly embed data in the encrypted image. This paper also concerns with a method that embeds image/ text data invisibly into a video depending on Integer Wavelet Transform and to reduce the mean square distortion between the original and watermarked image and to enhance Peak signal to noise ratio [3, 4].

Also many other works have been carried out in the field of reversible data hiding by reserving room before encryption with a traditional RDH algorithm, and hence easier for the data hider to reversibly embed data in the encrypted image. The proposed method can achieve real reversibility in terms of data extraction and image recovery is free of any error [5].

2.4 Standard Firefly Algorithm (SFA)

Firefly Algorithm being a new nature-inspired algorithm has been used extensively for solving various optimization problems. The standard version namely, Standard Firefly Algorithm (SFA) which uses the flashing behavior of fireflies during night to obtain an optimization solution to a given problem. Two new modified variants of the SFA were introduced which eliminated some of the limitations of the SFA[6].

2.5 A new reversible image data hiding (RIDH)

A new reversible image data hiding approach over encrypted domain. The data embedding is performed using a public key modulation method, in which access to the secret encryption key is not desired. At the decoder side, a dominant two-class SVM classifier is planned to distinguish encrypted and non-encrypted image patches, allowing us in cooperation to decode the embedded message and the original image signal. The proposed approach provides superior embedding capacity, and is able to entirely reconstruct the original image as well as the embedded message [7].

2.6 Content based image retrieval system using Framelet Transform

Content based image retrieval (CBIR) system using Framelet Transform united with gray level co-occurrence matrix (GLCM).The proposed method is shift invariant capturing edge information more precisely than traditional transform domain methods as well as able to handle images of arbitrary size[8].

2.7 Image denoising technique

Image denoising technique, multiresolution bilateral filter, where bilateral filtering is useful to the estimate (low-frequency) subbands of a signal decomposed by making use of wavelet filter bank.The multiresolution bilateral filter is combined with wavelet thresholding to form a novel image denoising structure, which turns out to be very effective in eliminating noise in real noisy images[9,10].

3. PROPOSED MODEL

3.1 Finding optimal location to hide data Using Firefly Algorithm

The firefly module finds the optimum location using an objective function. These locations are then used for the secret data embedding. The firefly algorithm is an iterative algorithm. In each iteration, the stego image block for each firefly is obtained by embedding 'r 'bits of secret data in that firefly position. Once this process is completed then the Structure Similarity Index Measure (SSIM) for the cover and stego image is calculated. Then the BER is calculated by extracting the secret bits from stego image block. The best location is found when the following conditions occur:

- Number of iteration exceeds maximum number of iterations.
- No improvement is obtained in the successive iterations.
- An acceptable result has been found.

Firefly allows good localization both in time and spatial frequency domain and it has higher compression ratio to avoid blocking artifacts.

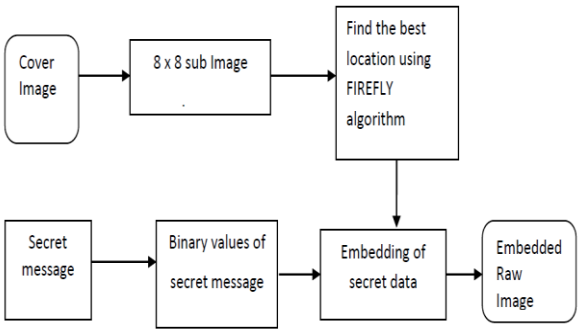

Fig 1. Data hiding using Firefly algorithm

3.2 Image Hiding Using Discrete Wavelet Transform With Framelet Transform

The proposed algorithm is greatly image adaptive and the secret image can be strengthening in the most significant parts of the image. The proposed algorithm prevent perceptual visibility of embedded secret image signal, preserves the image quality and itis robust against most frequent image processing distortions. Additionally, the hierarchical nature of wavelet transform allows for detection of image hiding at a variety of resolutions, resulting in reduction of the computational load needed for secret image detection based on the noise level.

3.3 Image Denoising using 2D Bilateral Filter

The firefly algorithm introduces the salt and pepper noise. Image denoising consists of the manipulation of the image data to produce a visual high quality image. Finding efficient image denoising methods is still valid challenge in image processing. 2D bilateral filter is used to filter the image after hidden the secret information.

The Gaussian filter is a local and linear filter that smoothest the whole image irrespective of its edges or details, whereas the bilateral filter is also a local but non-linear, consider both gray level similarities and geometric closeness of the neighboring pixels without flattening edges. The extension of bilateral filter ismultiresolution bilateral filter, where bilateral filter is applied to approximation sub-bands of an image decomposed and after each level of wavelet reconstruction. The use of bilateral filter on the approximation subband results in loss of some image information, whereas that after each level of wavelet reconstruction compresses the gray levels thereby resulting in a cartoon-like appearance. To tackle these problems, it is proposed to use the blend of Gaussian/bilateral filter and its method noise thresholding using wavelets. The proposed methods have the advantage of less computational time compared to other methods.

4. PROPOSED EMBEDING ANG EXTRACTION STEPS

4.1 Embedding of secrete data

Step 1: Get the cover image of size MxN.
Step 2**:** The cover image divided into number of 8x8 size non overlapping blocks. It is denoted as Bi, to be hidden in a block is denoted as r = L/n. where i= 1,2,…. , n.
Step 3: Select the hiding image (secrete data).
Step 4: Convert it into vector format.
Step 5: The secret data is converted into binary and then secret word W is formed by concatenating the binary bits. The length of W be L
Step 6: Find the best location in each block using firefly algorithm.
Step 7: The r bits from secret word W is embedded in the best pixel of each block. For this purpose DWT and IDWT is used.
Step 8: Calculate inter block sequence.
Step 9: Embedded raw image (stego image) is obtained.

4.2 Extracting the secrete data

Step 1: Stego image is scanned in the same order which is used in embedding process.
Step 2: Divide the stego image into 8x8 pixel blocks.
Step 3: Calculate inter block sequence.
Step 4: Apply Harr transform for extraction.
Step 5: Obtain cover image and secrete data.

5. EXPECTED RESULT

The system needs to be developed which can secure and successful embedding of secrete data into optimal location of image with hidden image compression and also it is able to extract the secrete data and the cover image is require to be recovered back following the extraction of secrete data and display the embedded data such that the resultant stego image is in good quality.

6. CONCLUSION

In this paper "secure data hiding using robust firefly algorithm" for hiding secret data into cover image with image compression and extracting the secrete data from stego image has been proposed. This method finds the optimal locations to hide the secret data using FA. The secret data is embedded in those locations via DWT and IDWT. An embedded raw image is filtered after hidden the secrete data. Later on data will be extracted so that the covered image is recovered back which is good in quality.

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