Secure data hiding scheme using Firefly Algorithm

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Abstract : A great deal of work has recently been done in the field of reversible data hiding(RDH) to prevent theft of secret data, illegal copying and protect copyright. In RDH, the cover image is recovered after the secret data inserted in the image is extracted.This paper presents a new reversible technology for data hiding based on a robust Firefly algorithm. The optimum location for hiding the secret data is the firefly algorithm. Framelet Transform applies image scrambling to prevent perceptual visibility of the embedded secret image.. After secret information is hidden, the 2D bilateral filter is used to filter an image. The decomposition is done with a humble, symmetrical and orthogonal wavelet hair and the direct weighting factor is used in the secret process of embedding and extraction. The hidden image becomes computationally high memory data. The image must be compressed by the SPIHT image compression algorithm during transmission.

IndexTerms **- Reversible data hiding techniques, Robust Firefly algorithm ,DWT with Framelet Transform, image denoising, SPHIT image compression**

I. INTRODUCTION

The technique of digital image hiding is recognized mainly for the practical importance of intellectual property rights. The next technology is advanced and rapidly developed by using digital image hiding. Digital watermarking is a technique for introducing some information. The embedded data is called an image hiding, and the data given is the original data. With the rapid improvement of multimedia technologies and the growing attractiveness of the Internet, information or data hiding methods are increasingly being used to obtain authentication.

Data hiding methods are ways to incorporate additional messages into host signals by changing their original content without introducing any perceptual changes. The proposed system aims to hide the secret data by finding the best place in the cover image so that the resulting stego image is of good quality. The objective function of the fire algorithm depends on the image quality of the stego. The measurement of structural similarity is used to calculate the image quality of the stego. The aim of this research is to create a new data hiding system to hide the secret data by finding the best position in the cover image so that the resulting stego image is of good quality, ensures a high degree of security with less memory usage, low computational complexity, high visual image quality and good performance and the cover image is recovered after the secret data is extracted that has been embedded in that image. Many fields such as medical, military, remote sensing and judicial require that the cover object be recovered after the secret data has been extracted. This type of data hiding is referred to as reversible data hiding(RDH). In the field of reversible data hiding, much research was done. In recent years, numerous efficient methods for reversible data hiding have been proposed.

II. LITERATURE REVIEW

A reversible method of hiding data with Firefly algorithm (FA) as presented by A.Amsaveni and C.Arunkumar[1] provides the optimum location to hide the secret data. Where histogram shifting is used to incorporate the secret data into the cover image.
A survey on traditional techniques of data hiding based primarily on reducing embedding distortion is studied[2]. Data hiding scheme with edge prediction and differential increase to reduce the distortion caused by secret data hiding. Like these, there have been many practices Various reversible techniques of data hiding are analyzed. All previous methods incorporate data by reversibly vacating room from encrypted images, which can lead to some errors in data extraction and/or image recovery and the process by reserving room with conventional RDH before encryption.

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In the field of reversible data hiding, many other works have also been carried out by reserving rooms before encryption with a traditional RDH algorithm and thus making it easier for the data hider to reversibly integrate data into the encrypted image. The proposed method can achieve real data extraction reversibility and image recovery is free of errors[3].
The data hider can easily reversibly integrate data into the encrypted image[4,5]. This paper also deals with a method that invisibly incorporates image / text data into a video depending on the Integer Wavelet Transformation and reduces the mean square distortion between the original and watermarked image and improves the peak signal to noise ratio.
In a new reversible image data hiding approach (RIDH) across encrypted domains, the embedding of data is carried out using a public key modulation method that does not require access to the secret encryption key. A dominant two - class SVM classifier on the decoder side is designed to distinguish encrypted and unencrypted image patches, enabling us to decode the embedded message and the original image signal in cooperation. The approach proposed offers superior embedding capacity and can completely reconstruct both the original image and the embedded message[6].

As a new nature-inspired algorithm, Firefly Algorithm has been extensively used to solve various optimization problems. The standard version, Standard Firefly Algorithm (SFA), which uses the flashing behavior of fireflies at night to optimize the problem. Two new modified variants of the SFA have been introduced that removed some of the SFA's limitations[7].
The SPHIT algorithm compression of images has high speed, low memory requirements and full reversibility[8]. The conventional imaging coding techniques are used to compress the redundant data in an image. These techniques are now being replaced with a digital wavelet compression method.
Content-based image retrieval (CBIR) system using Framelet Transform combined with gray levelco-occurrence matrix (GLCM)[9]. The proposed method is shift invariant capturing edge information more accurately than traditional transform domain methods and capable of handling arbitrary images.
The bilateral multi-resolution filter combines with wavelet thresholding to form a new image denoising structure that is very effective in eliminating noise in real noisy image The hair wavelet method provides better PSNR and SSIM values than other methods and more integration capacity[10].
Image denoising technique, bilateral multi-resolution filter[11,12], where bilateral filtering is useful for estimating (low frequency) subbands of a signal decomposed by the use of a wavelet filter.

III. PROPOSED MODEL

A. Finding the best place to hide data using the Firefly Algorithm
With an objective function, the firefly module finds the optimal position. These locations are then used for the embedding of secret data.The firefly algorithm (FA) is an iterative algorithm The stego image block for each firefly is obtained in each iteration by inserting secret data bits into the firefly position. Once this process has been completed, the Structure Similarity Index Measure (SSIM) is calculated for the cover and the image. The BER is then calculated by removing the secret bits from the image block of the stego. When the following conditions happen, the best location is found:

- The iteration number exceeds the maximum iteration number.
- There is no improvement in the successive iterations.
- There has been an acceptable outcome.

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Firefly enables good time and spatial frequency localization and has a higher compression ratio to avoid blocking artifacts.

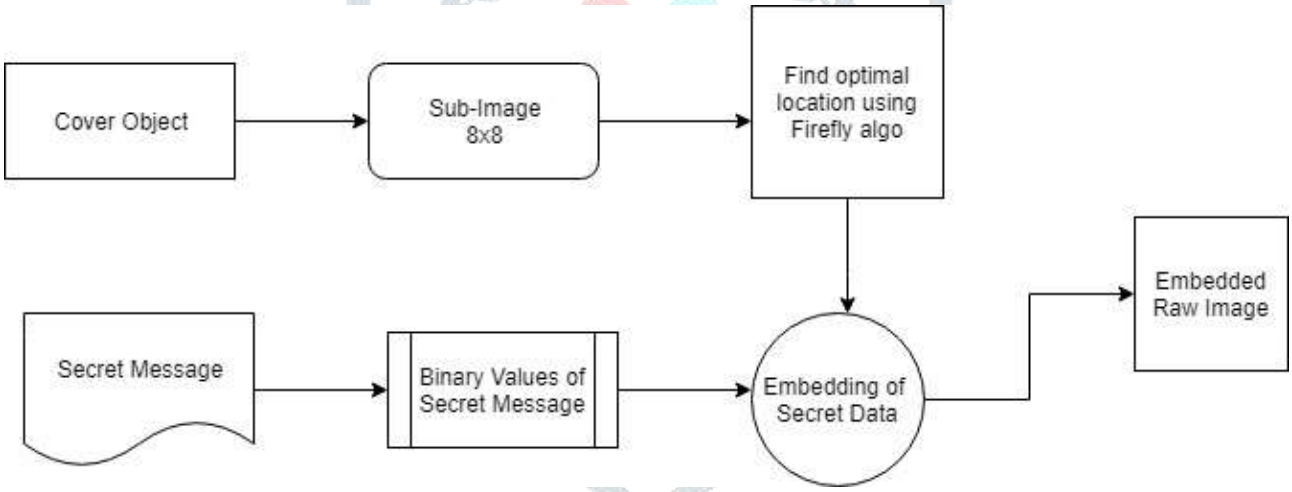

Fig 1: Data Embedding process using Firefly Algorithm

B. Using discrete wavelet transformation with framelet transformation
The proposed algorithm is highly adaptable to the image and the secret image in the most important parts of the image can be strengthened. The proposed algorithm prevents perceptive visibility of the embedded secret image signal, preserves image quality and is robust against the most frequent distortions in image processing. In addition, the hierarchical nature of the wavelet transformation allows image hiding to be detected at a variety of resolutions, reducing the calculation load required for secret image detection based on the noise level.

C. Denoise image by 2D Bilateral Filter
The fire algorithm introduces noise of salt and pepper type Image denoising consists of the image data manipulation to produce a high - quality visual image. Finding efficient image detection methods remains a valid challenge in the processing of images.
After secret information is hidden, the 2D bilateral filter is used to filter an image. The Gaussian filter is a local and linear filter that smoothes the entire image regardless of its edges or details, while the bilateral filter is also a local but non - linear filter that takes into account both gray level similarities and the geometric closeness of the adjacent pixels without flattening edges. The extension of the bilateral filter is a bilateral multi-resolution filter in which the bilateral filter is applied to the approximation of sub-bands of a decomposed image and after each wavelet reconstruction level. The use of bilateral filters on the approximation sub-band leads to the loss of certain image information, whereas after each level of wavelet reconstruction the gray levels are compressed, resulting in

a cartoon-like look. In order to address these problems, it is proposed that the Gaussian / bilateral filter blend and its noise thresholding method be used with wavelets. The methods proposed have the advantage of less calculation time than other methods.

D. Compression of images with SPIHT algorithm

The old image code technology compresses the redundant data in an image. But these methods have been replaced by a compression method based on wavelet transformation, as these methods have high speed, fewer memory requirements and total reversibility. Now SPIHT considers a place foe wavelet compression in this work with the wavelet encoding scheme and the final results for bit error rate, PSNR and MSE as well.

IV. EMBEDING PROPERTY ANG EXTRACTION STEPS

A. Secret data embedding

Step 1: Get the MxN size cover image
Step 2: Cover image divided in non - overlapping blocks of 8x8 size. It is referred to as Bi, which is hidden in a block is referred to as r= L / n. Where i=1,2,..n.
Step 3: Select the image hiding(data secretion).
Step 4: Convert to format of vectors.
Step 5: Secret data is converted to binary and the secret word W is formed by the binary bits concatenation. W's Length be L
Step 6: Find the best location with the firefly algorithm in each block.
Step 7: The r bits of secret word W are embedded in each block in the best pixel. DWT is used for this purpose.
Step 8: Inter-block sequence calculation.
Step 9: The embedded raw image is obtained (stego image).

B. Secret data extraction

Step 1: Stego image is scanned in the same order as the embed process is used.
Step 2: Divide the image into blocks of 8x8 pixels.
Step 3: Inter-block sequence calculation.
Step 4: Apply Extraction IDWT.
Step 5: Obtain image cover and confidential data.

V. EXPECTED RESULT

The system needs to be developed that can secure and successfully integrate secret data into optimal image location with hidden image compression and also extract secret data and recover the cover image after extracting secret data and displaying the embedded data so that the resulting stego image is of good quality. The performance analysis is calculated in terms of Peak signal to noise ratio and mean square error.

VI. CONCLUSION

In this paper, Secure data hiding using a firefly algorithm with hidden image compression has been proposed to hide secret data into an image cover with image compression and to extract the secret data from a stego image. This method finds the ideal location to conceal the secret data using FA. The secret data is incorporated through DWT and IDWT in these locations. An embedded raw image is filtered after the secret data is hidden. The image is is compressed compressed using SPIHT during transmission. The data is then extracted to recover the covered image, which is good in quality.

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