

# Reversible Data Hiding Using BAT Optimization for Encrypted Images

<sup>1</sup>Gazal Betab, <sup>2</sup>Er. Rama Rani

<sup>1</sup>Research Scholar, <sup>2</sup>Assistant Professor,

<sup>1,2</sup>Department of CSE DAV University, Jalandhar,  
Punjab, India

## Abstract-

**D**ue to the development of latest technologies in communication and computer networks, exchange of images between places has become a usual practice these days. Text fusion in images is an important technology for image processing. We have lots of information related to the reports and need lots of space to store and the proper position and name which relates that image with that data. Reversible data hiding is a method to embed extra message into some unsatisfactory spread media, for example, medical or military images with a reversible way so that the original content can be accurately restored. Generally data hiding is utilized for communication which is secret. In this paper, a technique is proposed for reversible data hiding in encrypted images. An algorithm is proposed which will first find out the area of interest and after that noisy pixel. BAT algorithm is used to find the coordinates of the noisy pixels and will embed text data on it and after that rest of the data will be fed into the border area of the images.

**Keywords**— Image encryption, reversible data hiding, separable reversible data hiding, AOI, NAOI, BAT, image recovery

## I. INTRODUCTION

In the current patterns of the world, the technologies have propelled so much that a large portion of the individuals favour utilizing the internet as an essential medium to exchange information from one end to another over the world. There are numerous conceivable approaches to transmit information by utilizing the internet: by means of chats, emails etc. the transition of data is made exceptionally straightforward, quick and precise using the internet. One of the primary issues with sending information over the internet is “security risk” it causes i.e. the individual or secret information can be hacked or stolen from multiple points of view. In this manner, it gets to be critical to check over information security, as it is a standout amongst the most vital elements that need consideration during the procedure of transferring of data. [1]

The amount of digital images has expanded quickly on the internet. Security of image gets to be progressively imperative for numerous applications, such as, video surveillance, medical and military applications, and confidential transmission. Case in point, the need of secure and quick diagnosis is important in the medical world. These days, an image transmission is a day by day routine and it is important to discover an effective approach to transmit them over networks. The compression of data is vital to lessen the transmission time. The assurance of this multimedia data could be possible with data hiding or encryption algorithms. Since few years, main issue is to attempt to consolidate encryption, data hiding and compression in one step. [2]

Data hiding is a method that is utilized to hide data in computerized media, for example, video, audio, images etc. The data that is hidden relies on the motivation behind application. Owing to data hiding, some alteration may happen in the original and can't be reversed back to its original medium.

Such a hiding of data is called lossy data hiding. In applications, for example, law enforcement, military imaging, medical image system, and remote sensing etc. it is required to recoup the content of original image with more noteworthy exactness for lawful considerations. The scheme of data hiding that fulfills this prerequisite is known as lossless or reversible data hiding. Reversible data hiding was initially proposed for validation and its essential highlight is reversibility. It hides the secret information in the digital image in such a way that just the approved individual could interpret the secret data and restore the original image. A few data hiding techniques have been proposed. The execution of reversible data embedding algorithm is measured by its complexity and capacity of payload, visual security and quality. Prior systems have lower embedding limit and also poor quality of image. As the capacity of embedding and quality of image has been improved, this strategy turned into a secret channel of communication. Not just ought to the algorithm of data hiding be given significance. The image on which the information is hidden ought to additionally be exceptionally secured. [2]

## II. REVERSIBLE DATA HIDING

Reversible data hiding is a method to embed extra message into some twisting-unsatisfactory spread media, for example, medical or military images, with a reversible way so that the original content can be accurately restored.

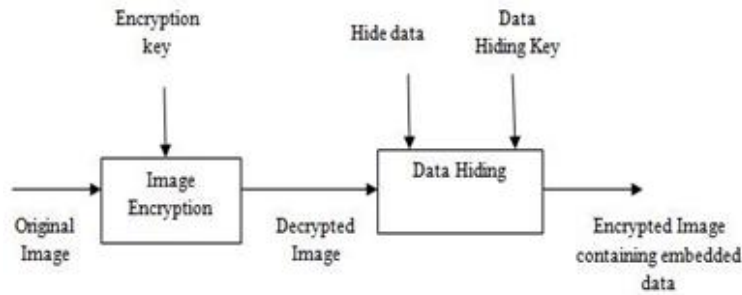


Fig.1 Data Hiding in Encrypted Image [3]

Reversible data hiding in images is a procedure that hides information in digital images for communication which is secret. It is a procedure to hide extra message into spread media with a reversible way so that the original message can be accurately restored after extraction of the message which is hidden. Generally, data hiding is utilized for communication which is secret. In few applications, the embedded carriers are afterwards encoded to keep the carrier from being broke down to uncover the vicinity of embedment. Different applications could be for when the carrier owner may not need the other individual, including data hider, to know the matter of the carrier before hiding of data is really performed, for example, confidential medical images or military images. For this situation, the owner of the content before sending to the data hider for embedment of data. The receiver side can separate the embedded message and recoup the original image.

As a compelling and famous means for protection of privacy, encryption changes over the conventional signal into data which is incomprehensible so that the general processing of signal regularly takes place before encryption or after decryption. On the other hand, in a few circumstances, that an owner of content does not believe the service provider, the capacity to control the scrambled information when keeping the plain matter secret is required. At the point when data which is secret to be transmitted are encoded, provider of channel with no any information of the cryptographic key might compress the encoded information because of the restricted resource of channel. Encryption is a compelling method of the protection of privacy. To impart a secret image with another individual, owner of content may encrypt the image before transmission.

### III. SEPARABLE REVERSIBLE DATA HIDING

As the name itself demonstrates that it is the technique of reversible data which is separable. The separable means which has the capacity to separate. As such, we can separate the few things, activities utilizing the suitable criteria. This is the concept of separable reversible data hiding. The partition of activities i.e. extraction of original image and also extraction of payload. This separation obliges some essential reason to happen. In separable data hiding key which is explained by Xin peng Zhang the separation exists as per keys. Here at the side of receiver, there are three separate cases are experienced. The separation of obtaining the information and getting the spread media come to be exists. That is the reason; it is called as Reversible Data hiding. [2]

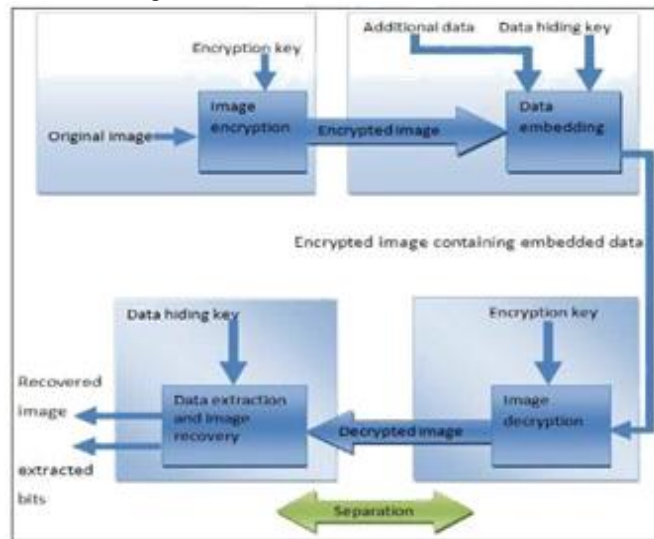


Fig.2 Separable reversible data hiding in an encrypted image [4]

### IV. RELATED WORK

Lots of research work has been done in the area of separable reversible data hiding. Many efficient methods have been proposed for reversible data hiding for encrypted images. Some important work in the area of reversible data hiding is as follows:

In reference [5], a novel approach for separable reversible data hiding in encrypted images is proposed. In the first stage, owner of the matter encrypts the original image which is uncompressed by utilizing the encryption key. At that point, data hider may compress the least significant bits of the encrypted image utilizing and key of data hiding to make an inadequate space to oblige some extra information. With an encoded image containing additional information, if a receiver has the key of data hiding, he can obtain the extra information however he doesn't know the content of an image.

If the receiver has both the key of encryption and key of data hiding, he can obtain the extra information and also recuperate the original content with no lapse by misusing the spatial relationship in regular image when the amount of extra information is not too very expansive.

In Paper [6], authors propose an authenticated and secure discrete reversible data hiding in cipher images manages authentication and security. In the first stage, owner of the content encodes the image which is original and uncompressed utilizing an encryption key. At that point, data hider may compress the least significant bits of the encrypted image utilizing and key of data hiding to make an inadequate space to oblige some extra information. With an encoded image containing additional information, if a receiver has the key of data hiding, he can obtain the extra information however he doesn't know the content of an image. If the receiver has both the key of encryption and key of data hiding, he can obtain the extra information and also recuperate the original content with no lapse by misusing the spatial relationship in regular image when the amount of extra information is not too very vast. It is additionally a downside that if the receiver has any one key as known, and afterward he can take any one data from the encoded information. SHA-1 algorithm is being utilized keeping in mind to achieve authentication.

Reference [7] explains about the technique for reversible data hiding in encrypted images using DCT. Reversible data hiding is a strategy to insert extra message into some spread media with a reversible way so that the original content can be consummately restored after extraction of the message which is hidden. The extraction of data can be accomplished by analyzing the block smoothness. This paper adopts a plan for measuring the blocks smoothness, and uses the scheme of closest match to further diminishing the rate of error of removed bits. The results of experiment reveal that the proposed technique offers better execution over side match system.

In reference [8], more consideration is paid to reversible data hiding in images that are encrypted, since it keeps up the amazing property that the original cover can be losslessly recuperated after inserted data is obtained while securing the content of an image confidentially. All past techniques embed information by reversibly memory space from the encrypted images, which may be liable to few errors on extraction of data or restoration of image. A novel strategy is proposed in this paper by saving space of memory before encryption with a conventional RDH (Reversible Data Hiding) technique, and accordingly it is simple for the information hider to reversibly embed information in the image.

In paper [9], method of data hiding by adjusting histogram of medical images and dissimilarities in view of division of block is proposed. Reversible data hiding by utilizing method of modification of histogram considers the distinctions of the pixels which enhance the capacity of data hiding. To improve the capacity of data hiding, the method of block division is preferred.

## **V. MOTIVATION**

Reversible data hiding is a procedure through which original image can be recuperated back losslessly after embedded message is extracted. This technique is used in law forensics, military and medical images where no alteration of the original image is permitted. The main aim of this study is to hide the data in encrypted images. In this work, AOI (area of interest) is find out and fuse the related document in the NAOI (non area of interest) of the image. The data is fused at the borders of the images and then build the particular and pre-defined border space. The algorithm is proposed which will first find out the area of interest and then noisy pixels of an image. BAT algorithm is used to find the coordinates of the noisy pixels.

The research is based on following objectives:

1. To Study various reversible data hiding techniques with evaluation parameters.
2. To study and implement BAT algorithm for generating hash key.
3. Implementing hash key for data fusion into the host image.
4. Decrypting host image and data from embedded image.
5. Evaluating various parameters for calculating the percentage of improvement.

## **VI. PROPOSED SCHEME**

Generally there are two types of techniques of data hiding- separable reversible data hiding and non-separable reversible data hiding. The aim of this research is to hide the data reversibly using BAT optimization for encrypted images. In it, area of interest is find out for particular image and then fuse the related document in the NAOI of the image. The technique used is to fuse data at the borders of the image and build the particular and pre-defined border space. An algorithm is proposed which will first find out area of interest and then use BAT algorithm to find out the coordinates of the noisy pixels and embed text data on these pixels and rest data will be fed into the border area of images.

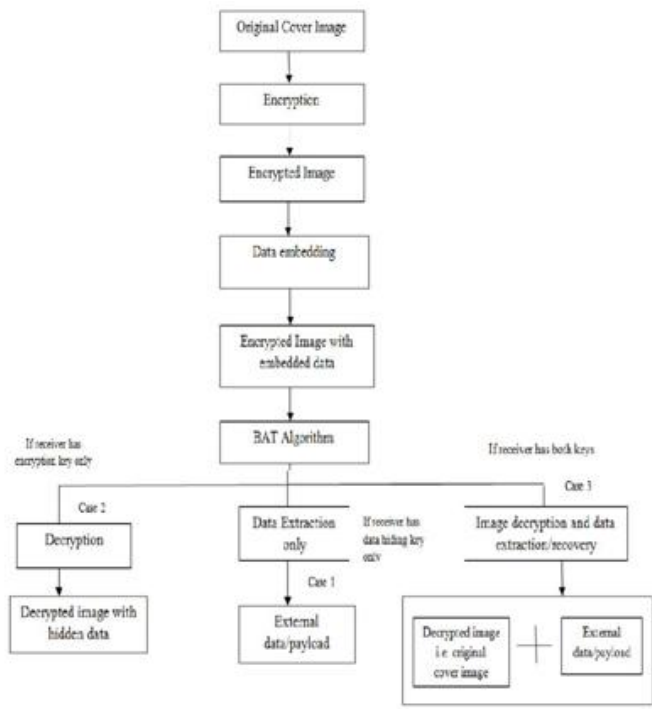


Fig. 3 Flowchart of proposed work

**VII. RESULTS AND DISCUSSIONS**

This section presents the simulated results of encryption and data hiding.

**Encryption**

The S-Box encryption technique is used to encrypt the data. The hash key is generated by using BAT Algorithm and the key is further used in the encryption.

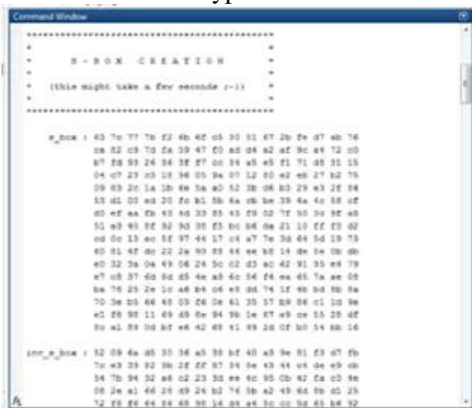


Figure 4: Encryption of the data to be sent

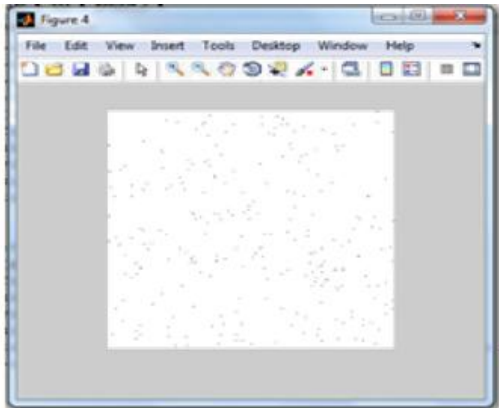


Figure 6: The hidden data at NAO

**Data Hiding**

The data which is to be sent is stored in the NAOI region of the image so that the authentic receiver can only view it properly.

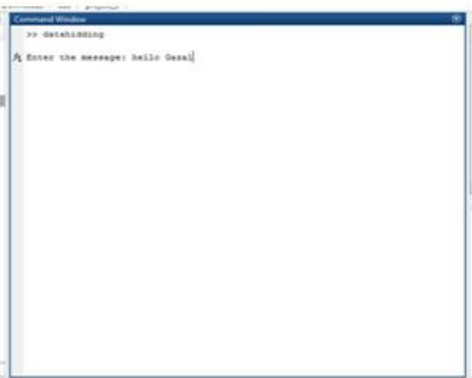


Figure 5: The data to hide

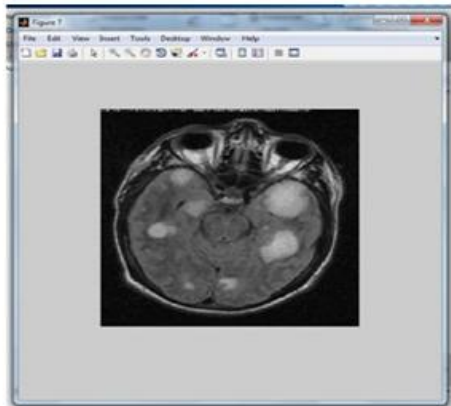


Figure 7: The final to be sent

### VIII. CONCLUSION

The main aim of this research is to implement BAT algorithm for encrypted images to hide the data. Reversible data hiding is a procedure in which original image can be regained back without any loss and also after getting the embedded message. It hides the secret information in the digital image in such a way that just the approved individual could interpret the secret data and restore the original image. We have used BAT algorithm for hiding data. Hence if the image is transmitted, it is secured. Our proposed algorithm has shown better results than the algorithms already present for encryption of images.

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