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A Review Paper on Data Hiding in Encrypted Image by Reversible Image Transformation

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Abstract—*Presently, a new reversible image transformation technique is proposed, this technique not only enhances the quality of the encrypted image but also it can restore the secret image in lossless manner. Furthermore, is delegate data to the cloud. Therefore, the cloud can easily add additional data into the encrypted image by any RDH methods. It is very crucial to secure data and allow the cloud server to manage the data at the meantime. Under such demands, proposes a method of Reversible Data Hiding in Encrypted Image based on Reversible Image Transformation. Other from all existing encryption methods, RIT based method allow user to transmute the data of original image into another target image with the same size. Which secure the original image, the transmuted image which appears like the target image which is used as the encrypted image, and the transmutation can be done between the micro blocks with small size, which enhance the quality of the encrypted image.*

Keywords— Encrypted image, Reversible data hiding, Image encryption, Reversible image transformation, Privacy protection.

I. INTRODUCTION

Now a days, Outsourcing photos to cloud and sharing photos through social media increasingly famous, which in the meantime make it challenging to ensure the protection of photos. For example, recently many private photos of Hollywood actress leaked from iCloud [1].

There are two common methodologies, encryption and data hiding, to protect image contents from leakage. Although encryption solves the privacy problem, but the messy codes of ciphertext with special form are easy to cause the attention of attackers who will plan to breakout the accounts of encryption users. Data hiding technology embeds message into covers such as the image, audio or video, which protects the content of secret file. There are two types of data hiding, Reversible, and Non-reversible.

Traditional data hiding method is suitable for embedding a small message into a large cover, e.g., an image. However, Reversible data hiding in images is a technique by which the original cover can loselessly recover after the embedded messages are extracted e.g., image metadata, labels, notations or authentication information into the encrypted images without accessing the original contents. The original image is required to be perfectly recovered and the hidden message completely extracted on the receiving side. Many applications such as law enforcement, Medical application [2] for example keeping patient‘s information secret, a military application where the invisibility of secret hidden data is of high demand. Also, these application requires lossless recovery of the original image and hence the need of reversibility.

The system proposes a framework of Camouflage of Image by Reversible Image Transformation (RIT). RIT-based RDH-EI shifts the semantic of the original image to the semantic of another image and thus protects the privacy of the original image and reversibility means that they can be loselessly restored from the transformed image. Therefore RIT can be viewed as a special encryption scheme, called “Semantic Transfer Encryption (STE)”.Because the camouflage image is in a form of plaintext, it will avoid the notation of the cloud server, and the cloud server can easily embed additional data into the camouflage image with traditional RDH methods for plaintext images.

II. LITERATURE SURVEY

There are many are techniques available regarding reversible data hiding in encrypted image such as follows.

A. Secret Fragment Visible Mosaic Images to Information Hiding

Lai et al. [3] proposes an image transformation technique, which selects a target image similar to the secret image, then replaces each block of the target image by a similar block of the secret image and embeds the map between secret blocks and target blocks; it forms an Encrypted image of the secret image. A greedy search method is used to find the most similar block. Although Lai et al.’s method is reversible, it is only suitable for a target image similar with the secret image, and the visual quality of encrypted image is not so good.

B. Via Secret Fragment Visible Mosaic Images by Nearly Reversible Color Transformations

Lee et al. [4] improve Lai et al.’s method by transforming

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the secret image to a randomly selected target image without any use of database. In Lee et al.'s method, each block of the secret image is transformed to a block of the target image with a reversible color transformation [5], and then the required information for restoring secret image, such as parameters, indexes of block, is added into the transformed blocks, it gives Encrypted image. Lee et al.'s method can transform a secret image to a randomly selected target image, and increase quality of the encrypted image. However, in Lee et al.'s method, the transformation is not reversible. So that secret image cannot be losslessly reconstructed.

C. By Reserving Room before Encryption

Authors [6] proposed a novel method for RDH in encrypted images, for that method they do not "vacate room after encryption" as done previously but "reserve room before encryption with a traditional RDH algorithm, and thus it is easy for the data hider to reversibly embed data in the encrypted image. The proposed method can achieve real reversibility that is data extraction and image recoveries are error free. First up all they empty out room by embedding LSBs of some pixels into other pixels with a traditional RDH method and then encrypt the image, so the positions of these LSBs in the encrypted image can be used to embed data. Not only the proposed method separate data extraction from image decryption but also achieves excellent performance.

D. With Public Key Cryptography

This correspondence [7] proposed a lossless, reversible and data hiding schemes for public-key-encrypted images probabilistic and homomorphic properties of cryptosystems. With these schemes, the pixel division/reorganization is avoided and the encryption/decryption is performed on the cover pixels directly so that the amount of encrypted data and the computational complexity are lowered. Due to data embedding on encrypted domain may result in a little bit distortion in plaintext domain due to the homomorphic property, the embedded data can be extracted and the original content can be recovered from the directly decrypted image. With the combined technique, a receiver may extract a part of embedded data before decryption, and extract another part of embedded data and recover the original plaintext image after decryption.

E. ***Via Key Modulation***

The data embedding is achieved through a public key modulation [8] mechanism, which allows us to embed the data via simple XOR operations, without accessing the secret encryption key. At the decoder side, a powerful two-class SVM classifier is designed to distinguish encrypted and non-encrypted image patches, allowing us to jointly decode the embedded message and the original image signal**.** The proposed approach provides higher embedding capacity and is able to perfectly reconstruct the original image as well as the embedded message.

F. With Distributed Source Encoding

This technique [9] aims to enhance scheme of reversible data hiding (RDH) in encrypted images using Slepian-Wolf source encoding which was inspired by DSC? After the original image is encrypted by the content owner using a stream cipher, the data-hider compresses a series of selected bits taken from the encrypted image to make spare room to accommodate for the secret data. With two different keys, the proposed method is separable. The hidden data can be completely extracted using the embedding key, and the original image can be approximately reconstructed with high quality using the encryption key. If the receiver has both the embedding and encryption keys, receiver can extract the secret data and perfectly recover the original image. The proposed method achieves a high embedding payload and good image reconstruction quality and avoids the operations of room-reserving by the sender.

G. By Patch-level Sparse Representation

In [10] proposed a novel method called the HC_SRDHEI, which inherits the merits of RRBE, and the separability property of RDH methods in encrypted images for a better relation between neighbor pixels, we propose consider the patch-level sparse representation when hiding the secret data. Compared to state-of-the-art alternatives, the room vacated for data hiding. The data hider simply adopts the pixel replacement to substitute the available room with additional secret data. The data extraction and cover image recovery are separable, and are free of any error. Experimental results on three datasets shows that the proposed method has average MER can reach 1.7 times as large as the previous best alternative method provides. The performance analysis implies that proposed method has a very good potential for practical applications.

H. Using Side Match

W. Hong [11] proposed an improved version of Zhang's reversible data hiding method in encrypted images. Which divides the encrypted image into blocks, and each block carries one bit by flipping three LSBs of a set of pre-defined pixels. The data extraction and image recovery can be achieved by examining the block smoothness. Data recovery of block is performed in descending order of the absolute smoothness difference between two candidate blocks. The side match technique is employed to further reduce the error rate.

I. Encrypted Image based on Chaotic Map

A reversible data hiding technique in encrypted images based on chaotic maps [12] in which the secret data is embedded into the encrypted image and the original cover image can be loselessly recovered at the receiver end. Chaos-

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based cryptosystems are being widely used for practical applications due to their properties like pseudo randomness, sensitivity on initial conditions and system parameters and the combination of reduced execution time, high security and high complexity to break the cryptosystem. This proposed system provides improved retrieved cover image quality, High data hiding capacity, Data extraction without error and a Lower bound PSNR of 50.91dB it gives better results than the existing system.

III. COMPARISONS BETWEEN EXISTING TECHNIQUES

Paper	Authors, year	Technique Used	Advantages	Drawbacks
Separable reversible data hiding in encrypted image	X. Zhang, 2012	Separable reversible data hiding, which consists of image encryption, data embed and extraction & Image recovery phases.	Simple Less computation	Data compression is not efficient
Reversible image watermarking using interpolation technique	Lixin Luo, Z. Chen, Xiao Zeng and Z Xiong 2010	It is used for minimize interpolation-error & the difference between interpolation value and Corresponding pixel value.	Which can embed a large amount of data into images, and achieves better image quality.	Any mistake in the Calculation of interpolation will affect the secret information.
Improve various reversible data hiding schemes via optimal codes for binary covers.	W. Zhang, B. Chen, and N. Yu 2012	Decompression algorithm. is used as the coding scheme for embedding data.	Code construction is proved to be optimal when the compression algo Reaches entropy.	Problem occurs in design codes for gray scale covers.
Reversible data hiding with optimal value transfer.	Xinpeng Zhang, 2013	Rule of value modification under a payload distortion criterion is found by using an iterative procedure, and it propose practical reversible data hiding scheme.	The mechanism gives a new rule of value modification and it can be used on various cover values	Computation complexity prediction will higher

IV. PROPOSED WORK

In the present paper, we will make a method in two aspects:

• Modify the transformation to be reversible.

• Improve the quality of camouflage image by setting the smaller tile size.

The proposed method is an improvement of Lee et al.'s method [4]. The proposed method, do transformation for channel R, G, B of a color image separately, so we just take the transformation on gray images (one channel) as an example. In proposed method the secret image and the target image are divided into N non-overlapping blocks with the same size, which are called tiles. The secret tiles are sorted into a sequence B_i and the target tiles are sorted into another sequence T_i according to the SD of the pixels in each tile. And then the i^{th} secret tile is transformed to the i^{th} target tile with the reversible image transformation.

Proposed work is divided into three modules namely:--

- Content Owner,
- Data Hider
- Receiver

V. CONCLUSION

Traditional techniques of reversible data hiding in encrypted image had some limitation, which are unable to protect image content, it can not protect the privacy of data, low hiding capacity and complex computations, clarity of the image will be poor, data compression is not efficient, some problem in the decoding section.

Under such demands to overcome this kind of drawbacks proposes a novel framework of Data Hiding in Encrypted Image by Reversible Image Transformation (RIT), which can transform a secret image to a randomly selected target image for getting a encrypted image which is used as the encryption of secret image with good visual quality, and the secret image can be restored without any loss. It can protect the image content. So it is interesting to implement RDH in encrypted images (RDH-EI), by which the cloud server can

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reversibly embed data into the image but cannot get any knowledge about the image contents. Our further work includes improving the transformation and RDH methods, transmuting the two encrypted image (secret image) into only one target image and extend idea to the video or audio.

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