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Double-Faced Data Hiding Techniques in Images using RIT: A Survey

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Abstract: ***RDH is the technique of reversible data hiding. It maintains the original image losslessly retrieved after data embedded is obtained while protecting the image content's as confidential. In this survey paper, we studied different reversible data hiding methods. All existing methods embed data by reversibly vacating room from the encrypted images which may result into some errors on data extraction or image restoration. Also in literature survey it is shown that DE, interpolation technique, prediction and sorting, histogram modification are the generalized methods for hiding data, but these methods are implemented only in plain images. In recent past all these methods are used in encrypted images to enhanced security. All these methods have their own advantages but no single approach is feasible as well as applicable for all the case such as, data hiding, security & privacy, image recovery etc. We have analyzed that there is need of high security as well as maintaining quality of original image during transmission and exchange of image***

1. Introduction

In recent era, internet is a common way for data transmission. More and more data is available on the internet due to growth in information technology. With growth in digital data there have some security problems. To release the burden of data management user preferred outsourcing of data to the cloud. For data privacy and security many user utilized cryptography techniques for data encryption before uploading it on cloud. In order to confidentially convey secret messages stenography is the efficient way used by user for multimedia data hiding. In stenography, carrier can be images, audio or video. Original image is treated as cover image and the other image in which data is embedded known as stego image. But the problem is occurred during embedding some distortion in stego image. It is known as "embedding distortion". To recover the original image there is well known technique is available known as, "RDH", it is reversible data hiding technique which can extracts embedded message from image without losing original image. It can establish on security and stenography techniques. Many applications such as, law forensics, military imagery, medical imagery etc required original cover without any distortion. RDH contains two types of data hiding techniques namely, Reversible and Non-reversible. The reversible data hiding in encrypted images (RDH-EI) is based on the technique RIT i.e. reversible image transformation. Both methods represent the semantic lossless compression by which some space will be preserved for extracting data embedded in image. There are some properties of data hiding schemes given as below:

1. Inconspicuous: This property is related to the human intuitive transparency.
2. Strength: This property is to retrieves the hidden information.
3. Un-Detestability: It is the complications in detecting existence of any hidden message in carrier image.
4. Security: It is the property by which embedded information cannot get to targeted attacks.

RDH-EI technique watermarks the information and protects it from intruders. Using watermarking one can find out the where the data and image is modified by intruders or other users. It found as more secure image encryption technique. Cryptography is an art of secured data transmission from sender to receiver. In cryptography process, key is used for encryption and decryption over cloud environment for secure data transmission. The concept of data hiding is also known as, cryptography. For embedding data a technique is existed known as decompression algorithm. To achieve the rate of distortion this algorithm constructs the recursive code for binary bounds by it reduce the distortion and improve the RDH scheme. But this algorithm has limitations on designing recursive codes for gray scale images. Another lossless embedding's measures the performance of system using reversible embedding. In this technique after data embedding quality degradation is very low.

2. Related Work

In this section we continue our discussion with the related work on existing RDH techniques with their merits and demerits. It is given as, K. Hwang and D. Li [1], suggested trusty –overlay network over multiple data centers. It is for implementation of establishing trust between service providers and data owner. Cloud provides the facility of pay-for –use over the internet. In reality with the cloud environment is the trust is social problem. The suggested technology helped to enhance trust, justice, reputation, credibility, and assurance in Internet applications. In this paper to addressed the data integrity issues a reputation-based trust-management scheme is introduced with data coloring and software watermarking. For secured infrastructure as a service (IaaS) they represented an example of Amazon's Elastic Compute Cloud. Data coloring approach disconnects the user access and isolates sensitive information from provider access. This approach protects the data objects from getting damaged, stolen or deleted. Also watermark based schemes acquires less overheads in the coloring as well as de-coloring process.

F. Bao, H. Deng [2], represented two tailored reversible watermarking schemes for the clinical atlas by exploiting its inherent characteristics. From both of the schemes first scheme is designed for atlases with homochromous structures. It achieves the reversibility. Whereas the second scheme is employed to any atlas in palette format, and inquires zero

misuse to the watermarked atlas by simply modifying the palette. In this paper, author discussed about security issues to digital medical data which categorized into three aspects such as, confidentiality, availability and authentication. In this paper author mainly explores the aspect of authentication of medical images.

S. Asoodeh, F. Alajaji, et al [3], studied a problem of two dimensional source code encryption into specified index. They provide general converse result for number of information. In this paper, they aimed to compress private as well as public sources with secured source coding problem in which encoder must compressed the source code into specified index. Dealing with the problem of two-dimensional source code encryption they gives more and more basic utility equivocation tradeoff. But in this paper, there is problem with moment that the bounds are tight in general. Furthermore, they were planning for developing schemes for general cases.

W. Zhang, X. Hu, et al [4], introduced reversible data hiding scheme i.e. RDH. It consists of two phases such as; in the first phase host sequence is constructed with the accurate histogram through prediction errors. In another phase they were focused on method of histogram modification for RDH. In this phase they utilized compression and decompression processes. They create equivalency between loseless data compression and RDH. The proposed RDH approach is more improved for larger images. It is useful in medical imaginary, military imaginary etc. The proposed approach covers the precious as well as damaged images. It is quite helpful in the video error-dissimulation coding. In this paper they proposed code construction for memory-less hosts. In future work they going to propose an interesting problem of rate-distortion bound and going to present efficient working of the host memory sequence.

V. Sachnev, H.J. Kim, et al [5] and I. Dragoi,. Coltuc, [6], proposed reversible and loseless watermarking algorithm without using location information. For comparison of proposed reversible watermarking scheme different images are used and compared with the other four methods. By reducing the size of location map key goals are achieved. Location maps contain the flags having value either 0 or 1. Basically location maps are huge in size; if they are compressed they may occupy part of payload. The proposed approach moderately increases the capacity and it also required additional information. It exploits the prediction errors with less variance so that better improvements can achieve. For low distortion data hiding sorted prediction is utilized efficiently. In this paper the proposed histogram shift method moderately decreases the size of location map sometimes.

In [6], author discussed about local prediction in various expansions of reversible watermarking. In this least square predictor is evaluated on square block pixel center. The proposed local predictor applies the predictor order and it is more general. The substitution should be applied on LSB to neglect artifacts where the compression ratio is low. There are four contexts namely, rhombus context and the ones of MED, GAP and SGAP predictors for which reversible watermarking was analyzed. The proposed approach outperformed the global least square and fixed prediction based counterparts and presets the best results. In this paper experimental results conducted on the local prediction with a basic difference expansion scheme.

W. Zhang, X. Hu, et al and N. Yu, et al[7]-[8], introduced RCC i.e. recursive code construction approach. It is developed for rate distortion bound of RDH. They proposed OTPM method i.e. optimal transition probability matrix for specific distortion metrics. The proposed method calculates rate distortion bound of RDH for general cases. The parameters of OTPM methods are required to evaluate capacity for RDH in the process of encoding and decoding. RCC reduces the embedding distortion of RDH. In RDH, it firstly solves the problem of optimization. Hamming distance is useful in RDH for other distortion metrics. In this paper, the proposed unified algorithm estimates the optimal transition probability matrix for generalized distortion metrics. With the experimental results the proposed approach represents s the better performance and generalization under different applications.

In [8], a fast algorithm is introduced to resolve optimal marked-signal distribution. As we know familiar with RDH which is reversible data hiding technique basically used to hide the information with their characteristic. It is further extracted and covers itself. In DE i.e. different expansion approach differences of each pixel groups are expanded. The proposed algorithm estimates the optimal marginal distribution which is faster than the BFI algorithm. Therefore, it seems that the proposed algorithm performed better than the previous BFI algorithm and it is efficient as well as scalable for practical applications.

J. Zhou, W. Sun et al [9], proposed a novel reversible image data hiding method (RIDH). In this paper two class SVM classifier is designed to separate out encrypted and non-encrypted patches of images. This method provides higher embedding capacity and it also able to reconstruct original image and embedded message. Mainly, RIDH algorithm is designed for plaintext documents. In this message bits are embedded into the original image hence we can say that it works for lossless compression algorithm for compression certain features of images. The DE i.e. different expansion method improves the prediction error expansion (PEE)-based strategies which offers the state-of-the-art capacity distortion performance. The proposed two-class SVM classifier can efficiently separate outs the encrypted and non-encrypted patches of image.

X. Zhang [10], discussed about separable reversible data hiding in encrypted images. There are two phases in which firstly, content owner encrypts the original uncompressed image using keys by which encryption is required. In this paper, proposed method content owner encrypts the original uncompressed image using encryption key.

Z. Qian and X. Zhang [11], proposed RDH method in encrypted images using distributed source coding. In this paper LDPC i.e. low density parity check codes are used to select bit series Slepian-Wolf encoded. In this paper author aims to embed payload in encrypted images. A separable reversible data hiding method is used for encrypted images. With the help of embedding keys and the original image can be perfectly recovered with high embedding payloads and good quality of image reconstruction. It neglects the operations of room-reserving by the sender. In this paper, experimental results shows that the previous methods such as, VRAE method, DSC substantially increases the payload. Encryption and embedding keys are used to protect embedding and recovery an adversary is unable to break into the system without these keys.

W. Zhang, K. Ma, et al. [12], presented l reversible data hiding technique in encrypted images. While embedding data pixels are estimated before encryption and AES algorithm is applied to the other pixels of images. An experimental result

on proposed system outputs the feasibility and efficiency of the proposed approach. To enhance the performance of reversing the order of encryption and vacating room is introduced in this paper. The proposed method mainly developed for four steps namely: vacating room and encrypting image, data hiding in the encrypted image, data extraction and image recovery. The proposed method achieves better performance in three aspects such as, complete reversibility, higher PSNR under given embedding rate, seperability between data extraction and image decryption.

X. Cao,L. Du, et al [13], explored the better correlation between neighbor pixels by considering the patch-level sparse representation when hiding the secret data. The proposed RDH method aims to recover both the embedded secret information and the original cover image. In this paper, high capacity separable reversible data hiding in encrypted images (HC_SRDHEI) is proposed to better exploit the correlations of neighbor pixels. A patch-based RDHEI scheme defined correlation of pixels within the patch. It performed significantly better than the traditional RDHEI methods. RDHEI scheme is mainly divided into two categories namely, VRAE and RRBE. The proposed method HC_SRDHEI works for three aspects such as, generation of encrypted image, hiding data into encrypted image and extraction of data and recovery of image.

3. Conclusion

In this paper, we have reviewed some existing techniques of reversible image data hiding. We analyzed that the techniques such as, RDH, embedding key, HC_SRDHEI, RIDH etc works better for hiding data into encrypted image and extraction of data. According to literature survey, with the advantage of all these existing techniques they have some limitation of security and privacy while outsourcing images and data to the cloud. As per our analysis from this complete literature, RDH-EI method [14] is based on reversible image transformation permit the user to transform the content of original image into the another target image with the same size in encrypted format which may helpful to preserve privacy of outsourced image. Also it could satisfy the quality of image as well as capacity of large embedding's.

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