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MULTI-SECRET SHARING AND LIGHTWEIGHT CRYPTOGRAPHIC ALGORITHMS

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Encryption, Multi-Secret Sharing, Security

ABSTRACT:

Reversible data hiding in encrypted images (RDHEI) has been introduced for preserving image privacy and data embedding. RDHEI usually involves three parties; namely, the image provider, data hider, and receiver. On the security with key setting, there are three categories: share independent secret keys (SIK), shared one key (SOK) and share no secret keys (SNK). In SIK, the image provider and data hider must respectively and independently share secret keys with the receiver, whereas in SNK, no secret key is shared. However, the literature works proposed SNK-type schemes by using homomorphic encryption (with exorbitant computation cost). In this paper, we address shared one key (SOK) setting, where only the image provider shares a secret key with the receiver, and the data hider can embed a secret message without any knowledge of this key. To realize our SOK scheme in a simple manner, we propose a new technique by using multi-secret sharing as the underlying encryption, which indeed induces a blow-up issue of the key size. For preserving the efficiency of the key size, we apply a compression by using lightweight cryptographic algorithms. Then, we demonstrate our SOK scheme based on the proposed techniques, and show effectiveness, efficiency, and security by experiments and analysis.

INTRODUCTION:

Reversible data hiding (RDH) is a notion that allows to embed the additional and secret message into cover media, such as military or medical images, and to perform a reversible procedure that extracts the hidden secret message and perfectly reconstructs the original cover content. Numerous reversible data hiding methods have been introduced over the last two decades. Two seminal ideas of RDH are difference expansion (proposed by Tian [1]) and histogram shifting (proposed by Ni et al. [2]). In the difference expansion method [1], the differences between two adjacent pixels are doubled to release a new least significant bit (LSB) plane for carrying the secret message. In the histogram shifting method [2], the zero and peak points are used to embed

the secret message by slightly modifying the pixel values. Many RDH studies have elaborated these two concepts to improve payload and image quality [3, 4, 5, 6, 7, 8, 9]. Recently, a new direction of RDH known as RDH over an encrypted image (RDHEI) has been introduced. This novel RDHEI notion was firstly introduced by Zhang in 2011 [10], and captures the following real-life scenario regarding owner privacy known as image privacy [10]. An inferior assistant or a channel administrator is in the middle of a workflow and is authorized to insert some additional data such as the origin information, image notations or authentication data, within the encrypted image, where the original image content is unknown to this party. Indeed, medical images are encrypted for preserving the patient privacy, and a database administrator only embeds a few data into the corresponding encrypted images. For the consistency of a medical image, it must guarantee that the original content can be perfectly reconstructed after decryption-then-extraction of the secret message by the receiver. That is, RDHEI not only esures the accuracy of the reconstructed cover-image and extracted secret message which are two basic tasks of RDH, but also preserves the privacy of the cover-image. More precisely, the work of Zhang [10] formalizes the model to describe the aforementioned scenario. The image provider P intends to preserve the privacy of the cover-image, but still desires a data hider H to embed a secret message. Therefore, H embeds the message into the encrypted image which is generated by P from the cover-image. Finally, the receiver R can recover the original cover-image and then extract the secret message correctly. The procedure run by R is known as decryption-then-extraction. However, the receiver also can be divided into two steps (decryption and extraction). We specify these two steps to two kinds of receivers, Rdec and Rext, and Rdec performs decryption, and Rext takes Rdec's decrypted image to extract the secret message.

RELATED WORK A comprehensive survey on RDH is presented by Shi et al. [11] to deeply analyze and highlight the advances of RDH for the recent progress. It studies aspects of RDH, including RDH into image spatial domain [1, 2], RDH into image compressed domain (e.g., JPEG) [12, 13, 14], RDH suitable for image semi-fragile authentication [15, 16, 17], etc. In particular, it also investigates RDHEI, and categorizes the existing RDHEI schemes into two classes: vacating room before encryption and vacating room after encryption by embedding strategies. For key setting, Shi et al. [11] also mentioned the other notion, so-called RDHEI based on public key encryption. However, inspired by the factor of key setting, the present studies identify the following two notions of RDHEI.1 • Share independent secret keys (SIK). R shares independent keys, keyP and keyH, with P and H respectively. Notably, these keys (keyP , keyH) are secret and used to run image encryption and embedding algorithms. Numerous insightful works [10, 18, 19, 20, 21, 22] have proposed this type of RDHEI schemes. • Share no secret key (SNK). In contrast to SIK, R does not need to share any secret key. This can be easily achieved through public key encryption where R has a public/secret key pair, and P (H, resp.) can use the public key to do image encryption (data embedding, resp.). The first solution, proposed by Chen et al. [23], is to use Paillier homomorphic encryption [24] to encrypt each

pixel and rely on specific techniques to complete data embedding. With the use of the homomorphic encryption, the follow-up works of Zhang at al. [25], Li and Li [26], and Shiu et al. [27] respectively implement some reversible data hiding techniques under the public key encryption associated with the homomorphic property. To summarize the flexibility of key setting, it is clear that only the designated party who has the secret key can be P or H in SIK. However, the advantage of SNK is that anyone can be P or H, since the keys of encryption or embedding are exactly the public key. In addition, as known, those homomorphic encryption-based SNK-type RDHEI schemes are practically inefficient since the underlying encryption schemes usually rely on complicated algebra structures and spend high computational cost. It suffices to give the following question, and we will aim for addressing it in the remainder of this paper. Can we construct an efficient scheme to satisfy the intermediate notion (between SIK and SNK) where P and R share a secret key, but no secret is shared with H? In fact, Wu et al. [28] had proposed a shared one key (SOK) scheme based on secret sharing. However, their method spends much space cost, since it encrypts a pixel into n shares, where n is the security parameter of secret sharing, and the total cost of an encrypted pixel will blow up to 8n bits.

IMAGE STEGNOGRAPHY

Image steganography comprises of transform domain, model relied steganography, spatial domain and spread spectrum. The spatial domain and transform domain contrasts with one another. Pixel value is directly used to embed a secret message in spatial domain. On the other hand, transform domain techniques accomplish embedding by initially transforming the particular image from STF (Spatial to Frequency) domain via the use of any of the mentioned transforms. They are DWT (Discrete Wavelet Transform), DCT (Discrete Cosine Transform), Ridgelet Transform, Hadamard Transform, DD DT DWT (Double Density Dual Tree DWT), Dual Tree, Curvelet Transform and so on. Then, embedding is performed in specific transform-coefficients. The recent progress in the communication and information technology generates easy and simple accessible data. In addition, establishing secure communication is the most important requirement. Various methodologies are generated to accomplish safe communication. One such methodology is steganography.

Steganography consists of four modules. They are listed below.

- CO (Cover Object) – Data hiding is performed in this CO.
- SD (Secret Data) – Within the CO, the hidden-data is positioned.
- SO (Stego Object) – state of CO after the data is hidden inside.
- SK (Stego Key) – Hide function is used for the hidden data within the CO.

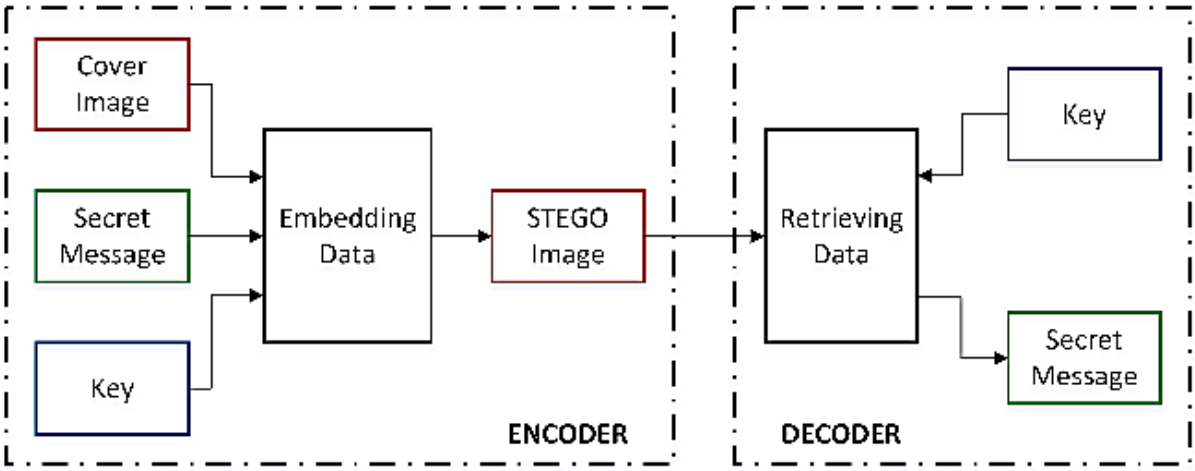

Figure.1. Fundamental steganography architecture

In the above figure.1, the cover image, secret message and key is used for embedding the data to attain the stego image. This is done is the encryption phase. In contrast, the secret message is retrieved by using the key in the decryption phase.

EXISTING SYSTEM

- LSB embedding position, and encrypt the message which control embedded position, so the hidden information cannot be extracted without the corresponding private key.
- In order to prevent the forgery of the hidden information, A text segmentation method is performed which attempts to extract the text.
- The proposed pre-processing method improves crop image performance.
- RC4 algorithm using Encryption key Generation

DISADVANTAGES

- High Encryption and Decryption Time.
- The key Generation is poor.
- It doesn't hidden data is extracted by the receiver through the reverse process.
- It is doesn't validate its performance efficiency.

PROPOSED SYSTEM

In proposed several techniques to accomplish image steganography. Initially, the image is taken as input and pre-processing is performed by using the Pixel Repetition Method. In the pre-processing technique, various unwilling distortions are suppressed and the significant image features are used for further processing. Then, recommended AES cryptosystem is used for data encryption. This process helps in achieving communication security. Proposed new LSB embedding is utilized to hide the secret data inside an image. Finally, the hidden data is extracted by the receiver through the reverse process of the A* Algorithm proposed system. The proposed system in analyzed to validate its performance efficiency.

ADVANTAGES

- Low Encryption and Decryption Time.
- It will Key Generation easy for AES algorithm.
- It hidden data is extracted by the receiver through the reverse process using A* algorithm
- It is based on analyzed to validate its performance efficiency.

LITERATURE REVIEW

Title: Image Steganography with Artificial Immune System

Year: 2017

Author: Saleh Delbarpour Ahmadi, Hedieh Sajedi

Methodology

Selects a block of the host image and then employs AIS for finding the best template for embedding message bits in the host image pixels. Consequently, our method finds the best template for embedding rapidly and there is no need to investigate whole the image for finding a

template of embedding. Algorithm has more efficiency in term of embedding capacity and the time of the embedding process compared to other methods.

Advantage

- It has more efficiency in term of embedding capacity

Disadvantage

- It requires High Cost
- It is Low Encryption and Decryption Time

Title: Hybrid method using 3-DES, DWT and LSB for secure image steganography algorithm

Year: 2018

Author: De Rosal Ignatius Moses Setiadi, Eko Hari Rachmawanto

Methodology

Steganography domains coupled with Cryptography which aimed to make confidential information more secure and inaccessible to unauthorized persons. Messages are encrypted using the 3-DES side of the cover image is decomposed into using LSB method. The last step, done Inverse DWT (IDWT) to get the stego image.

Advantage

- Image is decomposed into using LSB is Fastly Hidden

Disadvantage

- Encryption and Decryption Time is high.

Title: Achieving Data Integrity and Confidentiality Using Image Steganography and Hashing Techniques

Year: 2018

Author: Ahmed Hambouz, Yousef Shaheen, Abdelrahman Manna, Dr. Mustafa Al-Fayoumi, and Dr. Sara Tedmori

Methodology

This research paper introduced a new steganography technique that achieves both data confidentiality and integrity. Data confidentiality is achieved by embedding the data bits in a secret manner into stego image. Integrity is achieved using SHA 256 hashing algorithm to hash the decoding and encoding variables.

Advantage

SHA 256 hashing algorithm to hash the decoding and encoding.

Disadvantage

Drawback of Time and Cost.

Title: A new image steganography method with optimum pixel similarity for data hiding in medical images

Year: 2020

Author: Songul Karakus, Engin Avci

Methodology

Data hiding capacity and image quality of the cover object are important factors in image steganography. Because the deterioration of image quality can be noticed by the human vision system, it attracts the attention of attackers. Therefore, the purpose of this study is increasing the amount of data to be hidden and stego image is to ensure high image quality.

Advantage

- It is based on High Resolution Image

Disadvantage

- Drawback Of Time and Cost
- Performance Analysis is a varying.

Title: Adaptive Image Steganography based on Transform Domain via Genetic Algorithm
Year: 2017
Author: Aref Miria and Karim Faez

Methodology

This paper presents a novel approach for data hiding in frequency domain with the use of genetic algorithm. At first, cover images are mapped to a proper frequency domain using the concepts of adaptive wavelet transform and genetic algorithm. In the obtained space, using a model based on Kieu and Chang, encrypted information will be embedded in the frequency coefficients that represent edges of the image in spatial domain. So the cover image will change the least and have the most compatibility with human visual system. Simulation results show that our proposed method outperforms recently published works in terms of PSNR and PSPNR factors.

Advantage

It is possibility to get prediction of local differences between images (on the pixel level), while methods described previously provided a single value for the entire image.

Disadvantage

VDP is non-use information about color, and work only with brightness.

Title: A Study of Various Steganographic Techniques Used for Information Hiding
Year: 2013

Author: C.P.Sumath, T.Santanam and G.Umamaheswari

Methodology

In this paper different steganographic articles were studied and were categorized into different techniques. As many new application areas are identified like internet banking, mobile communication security, cloud security etc., the insight into the steganographic principles will definitely guide us to identify new areas and to improve its applications in the already existing application areas also.

Advantage

- Steganography is to embed secret data into a cover in such a way that no one apart from the sender and intended recipients even realizes there is secret data.

Disadvantage

- There is large overhead to hide very tiny amounts of information.

Title: Chaotic Map Based Random Image Steganography Using LSB Techniqu

Year: 2017

Author: Sujarani Rajendran, Manivannan Doraipandian

Methodology

A new chaotic series based image hiding scheme has proposed by using 1D logistic map. Cover image pixel position has chosen randomly for embedding the secret image bits, so it minimize the security risk and increase the efficiency of the proposed algorithm. Four different grayscale images are used for testing to prove the performance, image quality and capacity of the proposed scheme. Comparison result proved that the proposed scheme provide better result than other steganography schemes.

Advantage

- Over cryptography alone, is that messages do not attract attention to themselves.

Disadvantage

- Text files cleanly aren't big enough to cover more complex data like images or audio files.

MODULES

- Input Image
- Pre-processing
- AES Cryptosystem
- Extract the Hidden Data
- Performance Analysis

MODULES DESCRIPTION

INPUT DATA

- The data selection is the process of selecting and loading the input images from dataset.
- The dataset is used to Secret text from the input text.
- To read the image with the help of imread() function.

DATA PREPROCESSING

Pixel Repetition Method

- The image taken as input is scaled-up by the use of PRM (Pixel Repetition Method). The (X*Y) input image is scaled-up by converting the individual pivot or seed pixel into a block (2*2) by reiterating the pixel. Thus, a cover is generated with twice the input image dimensions given by (2X*2Y). The C (2X*2Y) is the CI (Cover Image) acquired from the input image.
- A (2*2) original image block is considered. Then, the scaled-up image is retrieved as shown in the below figure.3.

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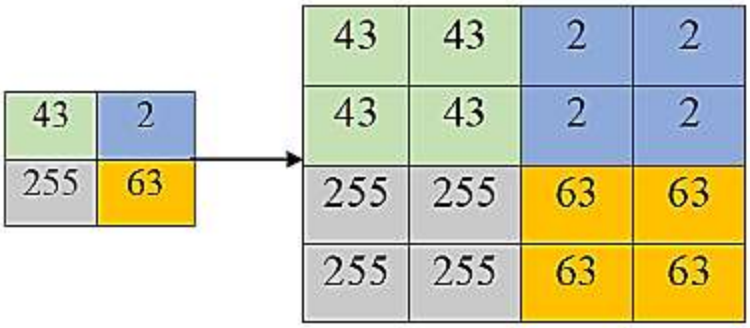

- Every pivot or seed pixel is reiterated to attain 2*2 blocks. Thus, it is termed as PRM (Pixel Repetition Method). The use of PRM to perform pre-processing minimizes the computational-complexity.

AES CRYPTOSYSTEM

- The AES (Advanced Encryption Standard) is a cryptographic-algorithm utilized for textual data encryption in an unconceivable way. It is also called as symmetric-key algorithm. This indicates that similar key is utilized for encryption as well as for decryption. It also utilizes block cipher that are of varied sizes. In recent days, AES is supported in software and hardware and hence it is a robust security algorithm. In addition, AES has various merits. They are listed below:
- The built in key length flexibility permits an extent of future proofing in contrast to the advancement in the capability for performing EK (Exhaustive Key) searches.
- This algorithm is robust against attacks as it utilizes high key size length of 128, 192 as well as 256 bits for the encryption process. Till now, there exists no real world cryptanalytic-attacks are discovered when using AES.

LSB EMBEDDING

- In this technique, the LSB (Least Significant Bits) of few or all the bytes within an image is substituted with a bits corresponding to the secret message. This method can be employed to various types and formats of data. Thus, this technique is the significant steganography method now-a-days. This technique is susceptible to steganalysis. Hence, the raw data is encrypted prior to embedding process to achieve more security. This approach has turned out

to be the basis of various methods that hide the messages within the MCD (Multimedia Carrier Data). This can also be employed in specific data domains. For instance, a hidden data is embedded into the RGB bitmap data colour values or into the JPEG image frequency coefficients. The fundamental steganography method is LSB. Here data is presented into the pixels of the cover image directly. This methodology has efficient recognizable value. Thus, normal people are unable to identify the alteration in an image. By modifying the LSB bit-plane, the insertion process is undertaken for individual pixel. This methodology has various merits. They are listed below.

- It is simple to comprehend.
- It provides easy implementation.
- It affords stego images which consists of hidden data, yet seems to have more visual fidelity.
- Least Significant Bit Steganography or LSB Steganography is the method of hiding secret data inside any form of digital media, here, Image. Images are made up of pixels which usually refer to the color of that particular pixel. In a grayscale image, these pixel values range from 0-255, 0 being black and 255 being white. In LSB Image Steganography, changing the last bit value of a pixel, won't have much of a visible change in the color. A cover image is used to embed the data in. The otput of the process is called a Stego Image
- To embed a message in an image using LSB Steganography the following steps are involved: The Cover Image is converted to greyscale. The message is converted into binary. Each pixel of the image is traversed through, and for each pixel, initiate a temporary variable, temp.

If the LSB of the Pixel Value and the message bit are the same, set temp as 0 and set temp as 1 otherwise. Update the output image pixel as image pixel value added with the temporary variable value, temp. This is done until the message is completely embedded. Once the whole message is embedded, the output image us written.

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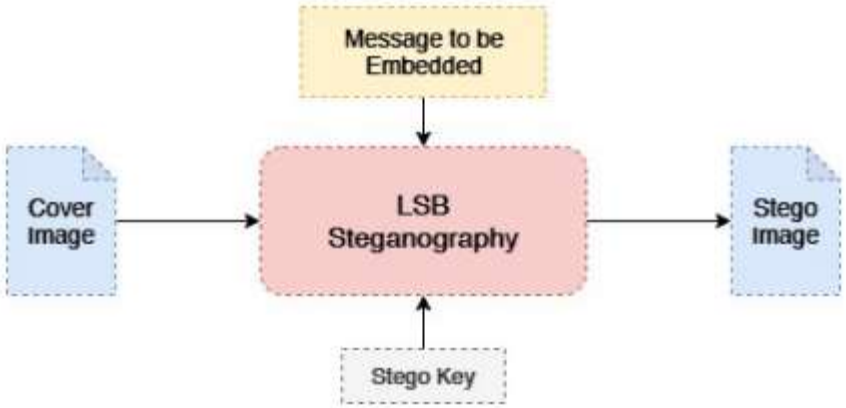

Extract the Hidden Data

- In Cover Image hidden text Retrieval
- It affords stego images which consists of hidden data, yet seems to have more visual fidelity

A*Algorithm

- Informally speaking, A* Search algorithms, unlike other traversal techniques, it has "brains". What it means is that it is really a smart algorithm which separates it from the other conventional algorithms.
- This fact is cleared in detail in below sections. And it is also worth mentioning that many games and web-based maps use this algorithm to find the shortest path very efficiently (approximation).

RESULT GENERATION

The Final Result will get generated based on the overall performance of this proposed approach is evaluated using some measures like,

PSNR

Peak signal-to-noise ratio (PSNR) is the ratio between the maximum possible power of an image and the power of corrupting noise that affects the quality of its representation.

MSE MSE is used to check how close estimates or forecasts are to actual values. Lower the MSE, the closer is forecast to actual. This is used as a model evaluation measure for regression models and the lower value indicates a better fit.

CONCLUSION

In this process, Image Encryption and Decryption Process. Image is taken as input and pre-processing is performed by using the Pixel Repetition Method. Various techniques are used to achieve image steganography through encryption and decryption. Pixel Repetition Method is used to perform pre-processing. Later, proposed AES system is used to encrypt the data and LSB embedding is utilized for embedding the data thereby performing image enhancement through the so as to extract the hidden data. To perform on analyzed to validate its performance efficiency.

FUTURE ENHANCEMENT

Various techniques are used to achieve image steganography through encryption and decryption. Pixel Repetition Method is used to perform pre-processing. Later, proposed AES system is used to encrypt the data and LSB embedding is utilized for embedding the data thereby performing image enhancement and pixel adjustment through the proposed novel OPAP based CNN so as to extract the hidden data. Many Algorithm using Society wise uses on Application.

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