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REVERSIBLE DATA HIDING BY RRBE WITH CONTRAST AND IR ENHANCEMENT

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Abstract - *The work proposes a new method for reversible data and image hiding by RRBE with contrast enhancement and IR enhancement. RDH Algorithm performs image contrast enhancement and RRBE. Instead of trying to keep PSNR value high, the proposed algorithm enhances the contrast of an input image to improve its visual quality. In this system data extraction and image recovery are free of any error. System deals with Steganography, it is a technique of hiding information in other information from third persons. Experimental results present a method for image enhancement that estimates illumination and reflectance (IR) by Optimization algorithm.*

Key Words: **Reversible Data Hiding, Image Enhancement, Illumination, Reflectance, Contrast Enhancement, Visual Quality, RRBE-Reversible Room Before Encryption.**

1.INTRODUCTION

Reversible data hiding is used to hide information, like text or image in digital media such as, audio, video etc. Owing to reversible data hiding, some distortion may occur in the original cover image and cannot be reversible back to the original cover image. Such a reversible data hiding is called lossy reversible data hiding. But in some applications such as medical image system, law enforcement system, remote sensing system, military imaging system, video news system, google image search system etc. it is desired to recover the original cover image content with greater accuracy and quality for legal considerations.

The reversible data hiding scheme that satisfies this requirement is called reversible. Reversible data hiding is first proposed for authentication security and it's applications. It's important feature is reversibility. It hides the secret data , the data can be text or image in the digital input image. In such a way that only the authorized person could decode the secret data like text or image and restore the original cover image. The performance of a reversible data hiding algorithm is measured by its payload capacity, time complexity, better visual quality and security.

Steganography is the art of hidden the communication with the aim of hiding the communication through the sender and receiver. Steganography is derived from secret communication science. The purpose of steganography is hiding any sign of message. In cases that the transferring of encoded data is difficult, then we should hide the existence of communication. The steganography domain could be divided into two categories. First one is spatial and second one is transformation domains.

Nowadays, with the development of information technology more and more images and text are available on the network. So there is a need to provide some kind of security to such important information. When the first person transmits the cover image to the second person, there may be third person present in between who may capture the cover image. After capturing the cover image the third person may view the meaningful information in the cover image. This may not be the problem in some small cases. But if we consider medical images it is the main problem. So in this system we can secured our data like image or text in the cover image in the transmission. In Reversible data hiding there is two types of data technique are present. In the first type the image is hidden i.e. different images can be inserted in the cover image and it is secured. In the second type the text is hidden and secured. This hidden technique is called Reversible data hiding in text or image. This technique can be used for a wide range of applications, like for providing copyright protection to the images, military images, medical images, etc.

RRBE means that Reserving Room Before Encryption. It is a technique by which the content owner first reserves the space on the cover image and convert the cover image into encrypted format. The process is in reversible data hiding and the reserving space for data is before encryption. The cover image is recovered before encryption without any loss of information in the data. In VRAE (Vacating room after encryption) images is losslessly is sometimes difficult and it is not efficient. So if we use reverse data hiding technique, the reserving room before image encryption, in encrypted images would be more natural and much easier.

RDH algorithm is used for image contrast enhancement. The property of contrast enhancement is by keeping the PSNR value high. By Histogram Equalization of pixel values, image contrast enhancement is achieved. It is by modifying the histogram pixel values. The product of illumination and reflectance is analyzed by optimization algorithm. Based on the light reflection a cover image is combined with illumination and reflectance. So for better

visual of image is completed with IR (Illumination and Reflectance). Based on the intrinsic properties of illumination and reflectance (IR) the cover image is enhanced and estimated by formulated linear domain and optimization algorithm. It is introduced for the enhancemet of illumination and reflectance of a cover image.

2. BACK GROUND

2.1 Reversible data hiding (rdh)

Reversible data hiding, proposed for digital cover images. These techniques are mainly designed to solve the problem of lossless embedding of large messages in digital images. So that after the embedded message is extracted, the image can be recovered completely to its original image before embedding occurred. The input data can also be embedded in text, image, audio, video etc. The size of the embedded input data should not larger than the size of cover image. The main applications of Reversible Data Hiding are medical images, military images, law forensics etc. Suppose in a medical field, medical image data base is stored in a data center. It can be embedded by notations into an encrypted section of medical image. It can be done by RDH algorithm. With the notations, the server can verify it is integrity, and the patients's privacy is protected. Reversible data hiding techniques are designed to solve the problem of lossless embedding of data in digital images so that after the embedded data is extracted, the image can be recovered completely to its original image before embedding occurred.

2.2 Data embedding

For Data Embedding, we need three inputs, they are (1) The data to be embedded (secret data). (2) The cover image (host image) (3) The key. By combining these three suitable algorithm is generated. which produce a stego cover image, that can be stored or transmitted. To the other end the decoder(extractor) receives the stego cover image and the key and extracts the data. The motivation of reversible data embedding is it's is free from distortion. The metrics to determine the performance of data embedding algorithm are
1) Payload capacity limit (Embedded information size is determined)
(2) Visual quality (visual quality on the embedded image is determined)
(3) Complexity (algorithm complexity is determined)

2.3 Data extraction

According to the data-hiding, the original image is encrypted using an encryption key. By using a data-hiding key the additional data are embedded. And it is into encrypted image. In an encrypted image, there is an additional data that maybe text or image. If the receiver has only the data-hiding key, only if he can extract the additional data(Text/Image). If he has only the encryption key, he can decrypt the received data(Text/Image). To obtain a cover image similar to the original cover image, but cannot extract the embedded additional data. If the receiver has both data-hiding key and encryption key, he can extract the additional data by recover the original cover image without any errors. Only if the amount of additional data is not too large.

2.4 Steganography

Steganography is the art for covert information hide the existence of the message from intruder. Steganography is derived from secret communication science environment. Reversible data hiding is a technique in steganography. Steganography methods are used Steganography system requires different type of data they are image file, Text file etc. Steganography achieves the security to the message as well as content of the data. It is a technique for hiding information by embedding messages.

2.5 Image enhancement

Image enhancement in digital image processing is the process of adjusting digital images. The output of the enhanced image is more suitable for display, remove noise, brighten an image, identify key features etc. Image enhancement methods are contrast enhancement, illumination and reflectance enhancement, histogram equalization, unsharp mask filtering etc. Our visual system is more sensitive to contrast than luminance. So we can recognize the world by considerable changes in illumination. Many algorithms are used for enhancement. For contrast enhancement RDH algorithm is used. And for illumination and reflectance optimization algorithm is used.

3. EXISTING SYSTEM

So much systems are worked in RDH algorithm, optimization algorithms etc. In existing system reversible data hiding technique, proposed a practical version of Wong's watermarking technique. It's for Reversible data embedding using a difference expansion. By using encryption key the image is compressed and encrypted. The data to hide is embedded in to the image by using the data hiding key in the system. In Reversible data embedding, which embedded invisible data into a digital image in a reversible fashion. Explore the redundancy in digital images to achieve very high embedding capacity, and keep the distortion low. Review of Reversible Data Hiding Techniques explain Reversible image hiding scheme using predictive coding and histogram shifting.

For providing security to the image embedded with secret information we take help of histogram shifting and encryption techniques.

In power-constrained contrast enhancement algorithm, multiscale retinex for OLED display, retinex

processing for automatic image enhancement are used. In some efficient compression of encrypted grayscale image, Image hiding techniques embed a secret image into another image.

Disadvantages

- PWLC does not correctly extract the hidden data, and fails to recover perfectly the original cover image.
- DHTC flips only low-visibility pixels to insert the hidden data.
- Reversible data hiding is not in encrypted images.
- Security is not provided in data hiding.
- Some reversible data hiding algorithm has not considered the medical, satellite images for the better visibility.
- And also the value of L is taken statically which has limited the scope of the reversible data hiding algorithm.
- The language feature used is limited.
- Limit the module size.
- Payload capacity is limited.
- Only high PSNR value can improve visual quality.

4. PROPOSED SYSTEM

The proposed scheme is made up of data recovery, data hiding and image enhancement phases. The RDH Algorithm achieves image contrast enhancement and reserving room before encryption(RRBE). Optimization Algorithm is used for Illumination Reflectance Enhancement(IRE) System deals with Steganography, it is a technique of hiding information in other information from third persons. Reversible data for hiding can be text/image. Experimental results present a reversible data with better visible quality. Reversible data hiding (RDH) in images is a technique, by which the original cover can be recovered without any errors after the embedded message is extracted. Try to the PSNR value high. The highest two peak values in the histogram are selected for data embedding. This histogram equalization can be performed by repeating the same process.

Three stages on RRBE with RDH,

(1) Encrypted cover image generation.
(2) Data (Text/Image) hiding in encrypted cover image.
(3) Data (Text/Image) extraction and cover image recovery.

The proposed method can achieve real reversibility, that is, data extraction and image recovery are free from errors. Based on the simplification of light reflection, an observed image can be modeled as the product of the illumination and the reflectance. After estimating illumination and reflectance, the resultant image is in perfect lighting environment. Data hiding in reversible manner in encrypted images are providing double security. Here the main process is image encryption as well as data hiding in encrypted images.

Advantages:

- It is easy for the receiver to reversibly embed data in the encrypted cover image.
- Data extraction and data recovery are free from any type of errors.
- After estimating illumination and reflectance, the resultant image is in perfect lighting environment.
- Data hiding in reversible manner in encrypted images are providing double security for the data, they are image encryption and data hiding.
- Here memory space can be reserved before encryption(RRBE) which requires small amount of time for data extraction & image recovery.
- Image data plays vital role in every aspects of system such as Google image search, medical image, military imagery and law forensics.

5. IMPLEMENTATION MODULES

5.1 Text/Image Hiding

Text/Image hiding technique aims to embed some secret information into a cover image. The highest two bins in the histogram are selected for data embedding. So that histogram equalization can be simultaneously performed by repeating the same process until we get the output image.

The RDH algorithm is given below

->8-bit gray-level image *I*
->calculated pixel value with a gray-level value j for j ε {0,1, ... 254,255}.
->hi Image Histogram
->Number of pixel with a value j is hi (j)
->Number of pixels in I is N
->Smaller and higher pixel values are Is & Ir

Data embedding is performed by

i1 = i-1, for I <IS
IS – bk, for I = IS
I, for IS < i < IR
IR + 1, for i = IR
I + 1, for i > IR,
->Modified pixel value is i'
->kth message bit (0/1) to be hidden

5.2 Text/Image Recovery

Reversible Text/Image hiding means that original content can be recovered without loss after the embedded data is extracted. The information is embedded along with the message bits into the received image so that the original cover image is completely recovered. The proposed algorithm was implemented in two images ie , input cover image and output cover image. It is easy for the receiver to reversibly embed data in the encrypted cover image. Data

extraction and data recovery are free from any type of errors. Data Recovery are performed by
b'= 1, if i' = IS - 1
0, if i' = IS
0, if i' = IR
1, if i' = IR + 1

->IS and IR need to be retrieved
->I' marked image
Original LSB's of 16 excluded pixels are obtained from extra bin value. Then excluded pixels can be restored and recovered by the following operation

i = i' + 1, for i' < IS – 1
IS, for i' = IS – 1
IR, for i' = IR or i' = IR + 1
i' – 1, for i' > IR + 1

5.3 Image Enhancement

There are two types enhancement are present
(1) Contrast Enhancement
(2) Illumination and Reflectance
Instead of trying to keep the PSNR value high, the proposed algorithm enhances the contrast of a host image to improve its visual quality. The experimental results have shown that the image contrast can be enhanced by splitting a number of histogram peaks pair by pair. From the RDH algorithm, all pixels counted in h1 are within {1,……254}.There is no bounding pixel values in between 0 or 255.Therefore the pixel values of 0 and 255 are changed into 1 and 254.So there is no underflow and overflow of pixel values. For IRE, the optimization algorithm is better choice. The characteristics of the logarithmic transformation are analyzed to show better performance for estimating illumination and reflectance. Given below is the steps for Optimization Algorithm:
(1) Observed the image(S) with parameters α, β, γ, λ, stopping parameters ε1, ε2.
->Parameters are set as α-1000, β-0.01, γ-0.1,λ-10,ε1-0.1,ε2-0.1
(2) I is Initialized using Gaussian low pass filtering of the observed image.
I0 -> Gaussian filtering of S
R0=0 Value of R in between 0 $ 1
b0=0,I0= average of S, set j=1,S <= I
The Gaussian function is: $G(x) = 1/\sqrt{2\Pi\varepsilon}\,\hat{}\,2 * e\hat{}\,x^2/2\varepsilon^2$
(3) Repeat Iterations of j, if εr <=ε1 and εi<=ε2, stop iteration.
(4) Otherwise j=j+1 and continue iteration.
(5) Output is illumination(I), reflectance(R).

6. SYSTEM ARCHITECTURE

In this system the input image can hide data and it is reversible. Before hiding the data reserve space for data by RDH algorithm. After that the data is recovered. Here the data can be text/image. Input image is completely recovered. Enhancement of that image by contrast and illumination reflectance. Output image is with better visual quality recovered. In that figure we can see the architecture of the proposed system. RDH Algorithm achieves image contrast enhancement and reserving room before encryption(RRBE). Optimization Algorithm is used for Illumination Reflectance Enhancement(IRE). System deals with steganography, it is a technique of hiding information in other information from third person. Reversible data for hiding can be text/image Experimental results present a reversible data with better visible quality. Reversible data hiding (RDH) in images is a technique, by which the original cover can be losslessly recovered after the embedded message is extracted. Instead of trying to keep the PSNR value high. The highest two bins in the histogram are selected for data embedding. This histogram equalization can be performed by repeating the process.
Three stages on RRBE with RDH,
-> Generation of encrypted image.
-> Data hiding in encrypted image.
-> Data extraction and image recovery.
The proposed method can achieve real reversibility, that is, data extraction and image recovery are free of any error. Based on the simplification of light reflection, an observed image can be modeled as the product of the illumination and the reflectance. After estimating illumination and reflectance, the resultant image is in perfect lighting environment. Data hiding in reversible manner in encrypted images is providing double security for the data such as image encryption as well as data hiding in encrypted images both are done here.

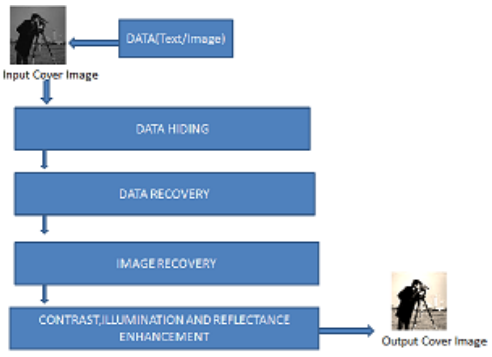

Fig 1: Architecture of the proposed Model

7. FUTURE WORK

Future work will be to continue to study the characteristics of image and data hiding methods to increase capacity, PSNR, and security. The presented algorithm may be modified easily to work with video where each frame is regarded as a single image. However, the modification should be made more efficient by taking advantage of video properties. There should be deep research on increasing the size of the storing data and media data without any latency even if the size of the data increases without any limit. In future we can use audio, video in case of reflection as cover for hiding the data. Improving the algorithm robustness and applying it to the medical and satellite images for the better visibility, will be our future work. The existing system contains some disadvantages so the future scope is to remove the disadvantages by adding reversible manner means, data extraction and recovery of image are free of errors. The PSNR will be improved to get original cover back.

8. CONCLUSION

With the increased use of internet, proposed system focuses mainly on RDH as the secured way of communicating over insecure channels of internet. Image data plays vital role in every aspects of system such as Google image search, medical image, military imagery and law forensics. In this proposed system a new method for reversible data and image hiding by RRBE with contrast enhancement and IR enhancement. RDH Algorithm performs image contrast enhancement and RRBE. This System deals with steganography, it is a technique of hiding information in other information from third persons. Experimental results present a method for image enhancement that estimates illumination and reflectance (IR) by optimization algorithm. In future it may possible that memory space can be reserved before encryption which requires less amount of time for data extraction & image recovery. In this system the data is recovered from the input image and that image is enhanced with some parameters.

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