Privacy Protection of Medical Data using Histogram Shifting Based Reversible Data Hiding

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***Abstract*— The project presents privacy protection of medical images with information using histogram shifting based reversible data hiding. An Embedding module involves image encoding and histogram shifting based difference expansion. First of all, the patients' privacies need to be preserved. Therefore, embedding secret data into the medical images would be one of the useful methods for protecting the privacies. Next, because external data are hidden into the original image, some alterations are supposed to be induced. After data embedding, the output image should be as similar as its original counterpart and medical doctors may lead to proper treatment by using the images with hidden data when necessary. Reversible data hiding is a newly developed branch in data hiding or watermarking researches. Reversibility means the hiding data and host image recovered without any distortion. Later on, the medical image containing data might be retrieved by medical doctors while necessary and both the original image and the hidden data can be perfectly recovered with the algorithm corresponding to the embedding scheme. Finally Peak Signal to Noise Ratio (PSNR) and Mean Square Error (MSE) will be used to evaluate the final performance**

Keywords — Embedding performance, Histogram Shifting (HS), Reversible Data Hiding (RDH), Steganography.

I. INTRODUCTION

Recently, data hiding has played an important role in protecting (or securing) sensitive data. Most data hiding techniques perform data embedment by altering the contents of a host media. As a result, the host image cannot be completely restored after the data extraction. These types are called irreversible data hiding techniques. To maintain the originality of host image or signal, particularly those associated with, medical and military fields and media with geographic information, reversible data hiding techniques are used. Reversible data hiding, also known as lossless data hiding, enables the recovery of both the original host media and the secret message from the stego-images. Some of the data hiding methods are given below.

The Internet serves as an important role for data sharing. In that some confidential data might be copied, stolen, modified, or even destroyed by an intruder. Therefore, security problems become an important issue. Though encryption provides certain security, they make the secret messages meaningless. These meaningless or unnatural messages usually attract intruder attention. To avoid that new security approach arises called “Steganography”. Steganography is used to hiding the secret data into another transmission medium to achieve secret communication. It increase the security, does not replace cryptography. For most image data hiding methods, the host image is permanently distorted and it cannot be restored from the host image or content. But in some applications such as medical and military fields any distortion due to data embedding is intolerable and the availability of the original image is in high required. Reversible Data hiding” (RDH) is one of the solutions for that, in which the host image can be fully restored after data embedding. Its possibility is mainly due to the lossless compressibility of host images.

II. STEGANOGRAPHY

Steganography is the art and science of hidden messages in such a way that no one, apart from the sender and receiver, suspect the existence of the information. It means "concealed writing." The hidden messages will appear to be (or be part of) something else: secret messages, images, articles, any lists, or some other cover text. For example, the hidden message appears to be invisible ink between the visible lines of a private letter.

III .TECHNIQUES

Steganography has been widely used in historical times and the present day. Some examples are Hidden messages within wax tablets in ancient Greece, people wrote messages on the wood, and then covered it with wax upon which an innocent covering message was written.

A. Difference Expansion Techniques

In difference Expansion (DE) technique are used to derive high capacity, low-distortion reversible data hiding. This technique divided the image into pairs of pixels, and a secret message was embedded into the difference between the pixels of each pair that was not expected to cause overflow/ underflow issues. Simulation showed that the payload size

and the perceived quality of the marked images generated by this technique were better than those achieved by the existing method.

B. LSB based data hiding

One of the earliest data embedding methods is the LSB (least significant bit) modification. In this well-known method, the LSB of each signal sample is replaced (over-written) by a payload data bit. During extraction, these bits are read in the same scanning order, and payload data is reconstructed.

IV. DATA EMBEDDING

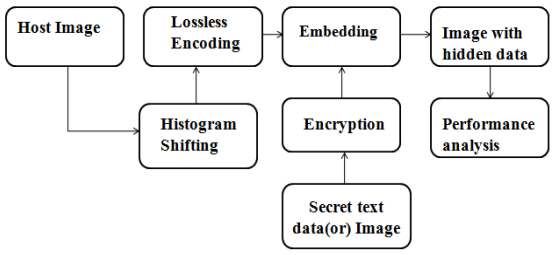

Fig.1. Block Diagram of Data Embedding

A.Input Image

In imaging science, image processing is any form of signal processing for which the input is an image, such as a photograph or video frame

B. Image Histogram

An image histogram is a type of histogram that acts as a graphical representation of the tonal distribution in an image. Image histograms are present on many modern cameras. The histogram plots the number of pixels in the image (vertical axis) with a particular brightness value (horizontal axis).

C. Histogram Shifting

In this method, peak of image histogram is utilized to embed data. In that certain pixels are used to create vacant spaces, some other pixels are used to carry hidden data to fill those vacant spaces.

D. Encoding Process

Here Run length encoding is used to reduce redundant pixel values in an image. The advantages of RLE encoding are that it's, in principle, very easy to comprehend and implement compared with other compression techniques used today. However, the compression results depend heavily upon the input. In the best case, RLE can reduce data to merely two numbers if all the values in the original data are exactly the same, regardless of the size of the input. Another advantage of RLE is a lossless (or reversible) compression technique.

E .Encryption

Chaos encryption is one of the advanced encryption standard to encrypt the privacy data for secure transmission. It encrypts the original text data's with encryption key value generated from chaotic sequence. Here logistic map is used for generation of chaotic map sequence. It is very useful to transmit the secret data through unsecure channel securely which prevents data hacking.

F. Embedding Process

Consider an image I. select an integer a from $1 \leq a \leq 253$, the embedded image I get into the following way.

$I_{i,j} - 1$, if $I_{i,j} < a$
$I_{i,j} - m$, if $I_{i,j} = a$
$I_{i,j} + m$, if $I_{i,j} = a + 1$
$I_{i,j} + 1$, if $I_{i,j} > a + 1$

Where (i, j) is a pixel value and $m \in \{0, 1\}$ is a data bit to be embedded.

V. DATA EXTRACTION

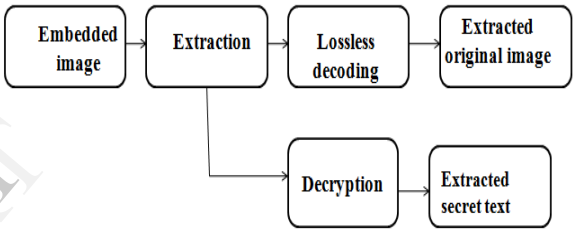

Fig.2. Block Diagram of Data Extraction

A. Data Extraction

The extracted image I_1 get into the following way.

1) If $I_{i,j} < a - 1$, there is no hidden data and its original value is $I_{i,j+1}$.

2) If $I_{i,j} \in \{a - 1, a\}$, the pixel is used to carry hidden data and its original value is a. The embedded data bit is $m = a - I_{i,j}$.

3) If $I_{i,j} \in \{a + 1, a + 2\}$, the pixel is used to carry hidden data and its original value is a+1. The embedded data bit is $m = I_{i,j} - (a + 1)$.

4) If $I_{i,j} > a+2$, there is no hidden data and the original value is $I_{i,j} -1$.

B. Decoding

It is a very simple form of data compression in which runs of data (that is, sequences in which the same data value occurs in many consecutive data elements) are stored as a single data value and count, rather than as the original run. This is most useful on data that contains many such runs: for example, simple graphic images such as icons, line drawings.

C. Reversible Data Hiding (RDH)

The original cover can be losslessly restored after the embedded information is extracted**.** As is known, a RDH algorithm usually depends on some parameters (e.g., the

integer *a* defined) and these parameters should be communicated to decoder. In some applications, even any degradation of the original cover is not allowed, such as medical imagery, military imagery and law forensics so Reversible Data Hiding needed.

VI. RESULTS

In this section the experimental results of the method based on two techniques to evaluate the hiding performance. First one is the capacity of hiding data and another one is the imperceptibility of the stego image, also called the quality of stego image.

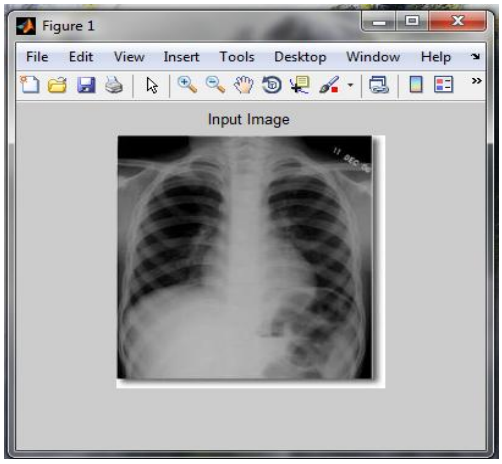

Fig.3. Input Image

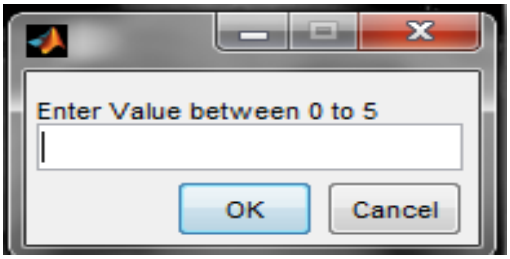

Fig.4.Shifting Level

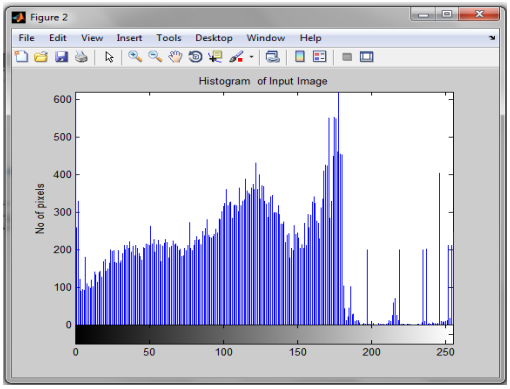

Fig.5. Histogram of an Input Image

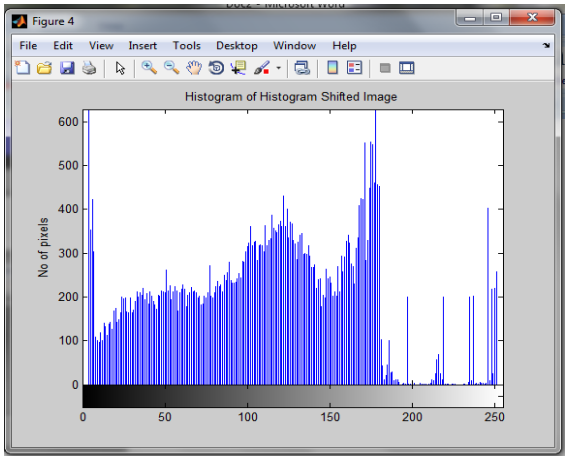

Fig.6. Histogram Shifted Image

PATIENT NAME --- SELVI
ID NUMBER --- 2352
DIAGNOSIS --- MIXED CONNECTIVE TISSUE DISEASE WITH COSTOCHONDRITIS
SERVICE --- DR.K.ABIRAMI,MD.,DM.,(NEPHROLOGIST)

COMPLAINTS ON REPORTING

This lady is a known case of MIXED CONNECTIVE TISSUE disease ,diagnosed in 2005.manifestati include molar rash ,oral ulcers ,arthritis,raynaud's & sclerodactyly. Her serology at that time was ANA positive, anti ds DNA positive ,low compliments and elaveted ESR.she has been on omnacortil and hydroxychloroquine sin last elavation in march 2007,ESR was normal .patient presented with pain lower chest and tenderness with no history of fever.

COMPONENT / TEST ITEM	RESULT	REFERENGE RANGE
Neutrophil	74%	
Eosinophil	02%	
Lymphocytes	24	

Fig.7. Secret message

¤µ ½±º Ô°µ¹ÔÔÙÙÙÔÔÔ§±¸¸ç½ùþ½°Ô°¡¶±ÔÔÔÔÔÙÙÙÔÔÆÇÁÆùþ
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º¹½ ½§ùþ§±¸ç½·±ÔÔÔÔÔÔÔÙÙÙÔÔÔ°¡Ú¿Úµ¶½¡µ¹½Ø¹ºÚØºÚÙØÏº±
¤¼¼)¸»³¹½§ Ÿùþùþ·»¹¤¸µ½° §Ô»°Ô±
¤»¦½°³ÔÔùþÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔ œ‡Ô•Ô‡Ô•ÔŸš›ƒšÔ—•‡‘Ô,’Ô¹½¬
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€Ô‘˜•,•€›šÔšÔ™•†—œÔÆÄÅÅØ±§¦Ôƒ•‡Ô››†™•˜ÔÚ„•€‘š€Ô„‡‘•‡š€‘Ôƒ€œÔ
„•šÔ˜›ƒ‘†Ô—œ‘‡€Ô•šÔ€‘š‘†š‘‡‡‡Ôƒ€œùþÔ§›ÔœŒ‡€›†Ô›’Ô‘‘,‘†Úùþùþ·»¹¤»°
±° ÔÚÔ ±§ Ô½ ±¹ÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔÔ¦±§¡ ÔÔÔÔÔÔÔÔÔÔÔÔ¦±²±¦±°³
±Ô¦µ°³±ùþÔÔùþÔÔÔ°‘

Fig.8.Encrypted message

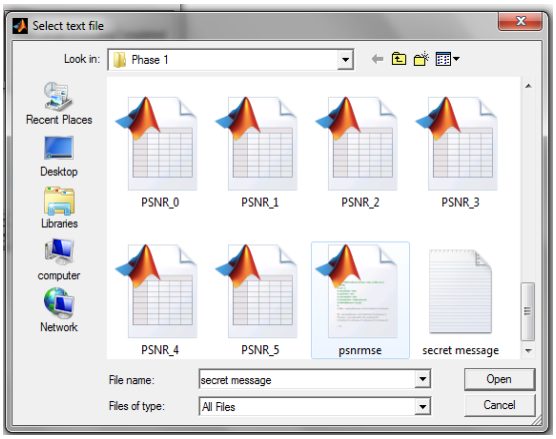

Fig.9. Selected Secret Message

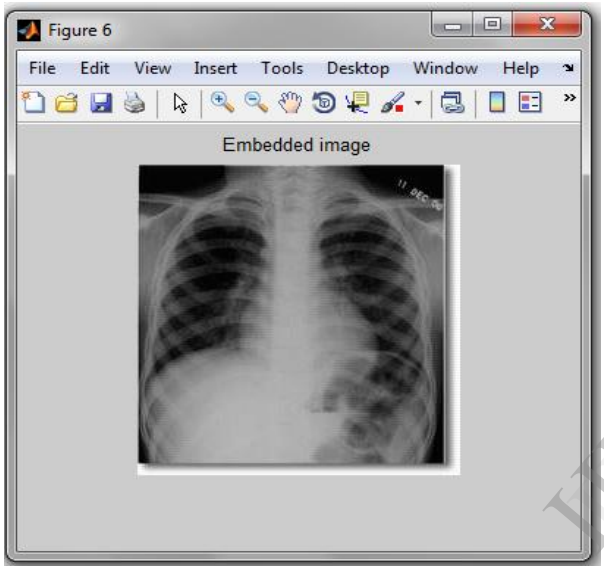

Fig.10. Embedded Image

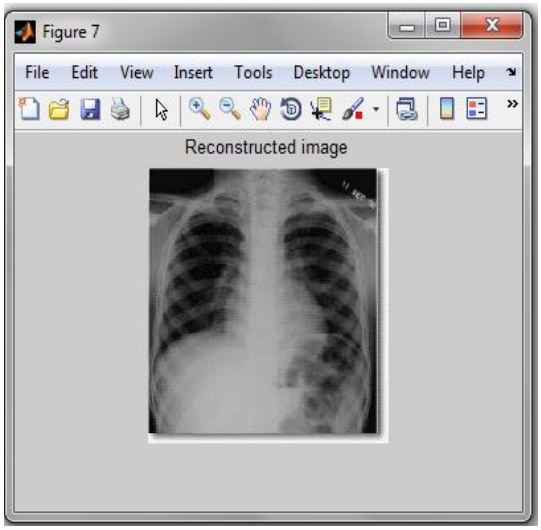

Fig.11. Reconstructed Image

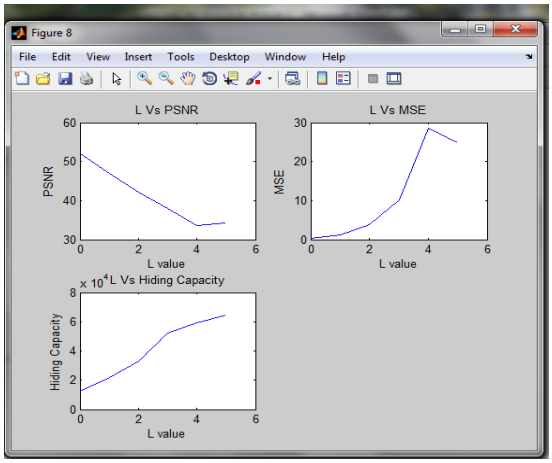

Fig.12. Performance analysis

VI .CONCLUSION

The work dealt with the techniques for a new and efficient steganographic method for embedding secret messages into images without producing any major changes has been proposed. Using this method we can extract the original image from sago –image with less distortion. Using this method we also can increase a hiding capacity

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