Secure Reversible Data Hiding on Histogram Based Contrast Enhancement Algorithm

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Abstract -- Reversible data hiding scheme can recover the original image without any distortion from the marked image after the hidden data have been extracted. Several key concepts have been developed in literature, among them public key modulation is a technique used for reversible image data hiding schemes. However, it increases time consumption and computation complexity. So in this project, a reversible data hiding (RDH) algorithm with histogram based contrast enhancement technique is proposed for images. For contrast enhancement Gaussian Mixture Model based Contrast Enhancement algorithm is used which enhances the contrast of a image to improve its visual quality. The highest two bins in the histogram are selected for data embedding so that histogram equalization can be performed by repeating the process. The original image is recovered when the side information is along with the host image.

Indexed Terms: RDHE scheme, Secure, Contrast enhancement Gaussian mixture model, histogram, MATLAB.

I. INTRODUCTION

Reversible data hiding process links two types of data that are embedded data and cover media data. The cover media become unclear [3] because of data hiding and should not reversed back to the original image that is the cover data have everlasting distortion even after the[1-2] hidden image have been detached. To distribute a furtive image with people, a content holder may encrypt the image earlier than transmission because encryption is an effective way to protect private information [5]. It may be also estimated that the original substance can be improved without any fault after decryption and recover of extra figure at the receiver side. Reversible data hiding scheme for encrypted figure is appropriate. This module currently produces a new high capacity reversible data hiding scheme for encrypted images based upon MSB prediction [6-8]. To predict error we use two approaches, the first approach is CPE-HCRDH to correct the prediction error before encryption and the second approach is EPE-HCRDH to encrypt the original picture for past encryption step [9].

The remaining content of this paper is explained as different parts. In part 2, the problem identification and formulation is related to the existing method. In part 3, explains the proposed algorithm description to solve the issues. Experimental outcome and argument are described in part 4. Lastly, the conclusion and future enhancement are explained in part 5.

II. PROBLEM IDENTIFICATION

Due to furtive process the image security becomes important for digital images on transmission, military purpose and much application. The data compression method is a best method for reducing the transmission time [11]. Because transmission through network plays a vital role in day to day life. The data get protected by encryption and data hiding algorithm [12].

In this module we propose to use the MSB ethics instead of the LSB ethics to embed the unseen image. According to this loom the encrypted field is same and easy to obtain the predicted MSB ethics during the decryption. The universal scheme of this solution method with having RDHE in the encrypted field. Embed the furtive image by MSB substitution and the values are lost during the data hiding phase, but it is essential to predict them without errors during the decoding phase.

There are two approaches they must be fully reversible or maximum capacity. The first loom is correction of prediction errors (CPE-HCRDH), but we are most able to insert one bit per pixel. By using large database, it can make available to numerical analysis for evaluating the protection level of these schemes. The second loom is embedded prediction errors (EPE-HCRDH), the novel image is completely reconstructed and have to become accustomed the insert image. Thus this method can make the hidden image as more secure than the existing method.

The decoding algorithm is also self-possessed of two ladders which are the withdrawal of image and the decryption-removing [20]. The extraction of the image is just enough to read the bits by using the secret key. During decryption, the marked encrypted images can be removed by analyzing their standard deviations. The general operations of data hiding is that all the pixels in the wrap image are used for the embedding the furtive image by efficient LSB substitution method.

III. PROBLEM SOLUTION

Reversible data hiding (RDH) has been studied in the community of signal processing and also referred as invertible or lossless data hiding. RDH is to embed information into a host signal to generate the original signal that can be recovered after extracting the embedded data. The technique of RDH is useful in some sensitive applications. In the literature, most of the proposed algorithms are for digital images to embed invisible data or a visible watermark. To evaluate the performance of a RDH algorithm, the hiding rate and the marked image quality are important metrics. There exists a trade-off between them because increasing the hiding rate often causes more distortion in image content. The peak signal-to-noise ratio (PSNR) value of the marked image is often calculated for distortion. In contrast, the more recent algorithms manipulate the more centrally distributed prediction errors by exploiting the correlations between neighboring pixels so that less distortion is caused by data hiding. For the images acquired with poor illumination, improving the visual quality is more important than keeping the PSNR value high. Although the PSNR value of the enhanced image is often low, the visibility of image details has been improved. To our best knowledge, there is no existing RDH algorithm that performs the task of contrast enhancement so as to improve the visual quality of host images. So in this study, we aim at inventing a new RDH algorithm to achieve the property of contrast enhancement instead of just keeping the PSNR value high.

3.1. BLOCK DIAGRAM

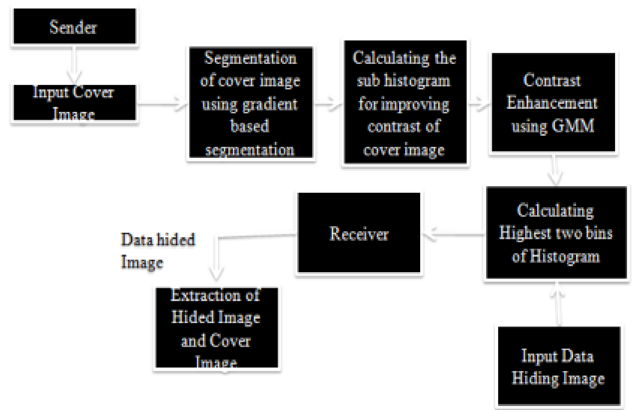


Fig3.1. Block Diagram

Our main concept is divided into following steps. The step 1 is load the image, the step 2 is segmenting the loaded image, the step 3 is calculating the image, the step 4 is contrast the enhancement image, the step 5 has calculate the histogram image, the step 6 is receiving the image, the step 7 is inserting the new image for hiding and final step is extracting cover image.

3.2. BLOCK DESCRIPTION

The sender sends the input image and the image get segment using gradient based segmentation. The gradient based segmentation sets the segmented image as sub histogram image. Then calculate the sub histogram image for improving contrast of cover image. To improve the contrast, use the method contrast enhancement having Gaussian Mixture Model. Using Gaussian Mixture Model calculate the highest two bins of histogram. After calculating the bins in the histogram insert the picture to hide in the cover image. The receiver receives the hidden image and extracts the hidden image and cover image.

3.3. CONTRAST ENHANCEMENT

Each of the two peaks in the histogram is split into two adjacent bins with the similar or same heights because the numbers of 0s and 1s in the message bits are required to be almost equal. To increase the hiding rate, the highest two bins in the modified histogram are further chosen to be split all pixels counted in the histogram. The same process can be repeated by splitting each of the two peaks into two adjacent bins with the similar heights to achieve the histogram equalization effect. The solutions to this problem called contrast enhancement methods. This method has several applications in medical imaging, remote sensing, machine vision applications, consumer electronics and so forth. They can be classified into two general categories they are histogram based and non-histogram-based methods. One of the leading works on contrast enhancement is Histogram Equalization (HE) it tries to spread out the intensity values of the histogram on the entire intensity range.

3.4. GAUSSIAN MIXTURE MODEL BASED CONTRAST ENHANCEMENT(GMMCE)

The idea using the Gaussian Mixture Modeling (GMM), the structure of a histogram is clarified and then the details of the proposed Gaussian mixture model-based contrast enhancement method are explained.

It effectively broadens out the narrow histogram of a low contrast image and generates its broadened version in such a way that the visual quality is improved. Despite its simplicity this straightforward method suffers from major drawbacks such as inability to preserve overall brightness of the image when the raw image is too dark or too bright or over enhancing the histogram when there are large peaks in the histogram. To overcome these well-known drawbacks some extensions to HE have been proposed.

3.5. HISTOGRAM MODELLING BY GAUSSIAN

Any arbitrary image can be assumed to be composed of individual meaningful regions occupying near the homogeneous areas of the image. Each region in natural images has a Gaussian-shaped histogram indicate their corresponding average intensity levels and details. To form the global histogram the Gaussians are separated by their mean values and their variance. Based on the fact that low contrast images have narrow histograms if one departs the important means from each other, the contrasts of individual areas are enhanced, and the visual quality of the image is improved. The structure of an image is directly reflected in its histogram manner that any significant peak in the histogram is actually the mean intensity value corresponding either to a vast near homogeneous zone of the image or to several zones which together occupy a major portion of the area. These intensity levels are particularly important to the global visual quality of the image and should be carefully treated during any enhancement process.

3.6. FLOW CHART FOR SENDER

The Flowchart explains the process of sender, the process gets start with inserting an input cover image. After inserting the input image, it gets segmented by using gradient based segmentation method. After segmentation the image get contrast and it contrast enhancement by using the Gaussian Mixture model. The Gaussian Mixture model calculates the histogram value for cover image.

Thus, the calculation of histogram for cover image is based on highest two bins of histogram. After calculating the highest two bins in the histogram the new image get inserted for hiding in the cover image. The condition for hiding the image in the cover image is having the image which is smaller than the cover image. If the condition gets satisfied the image gets hided. If the condition is not satisfied, then resize the image and get process for hiding.

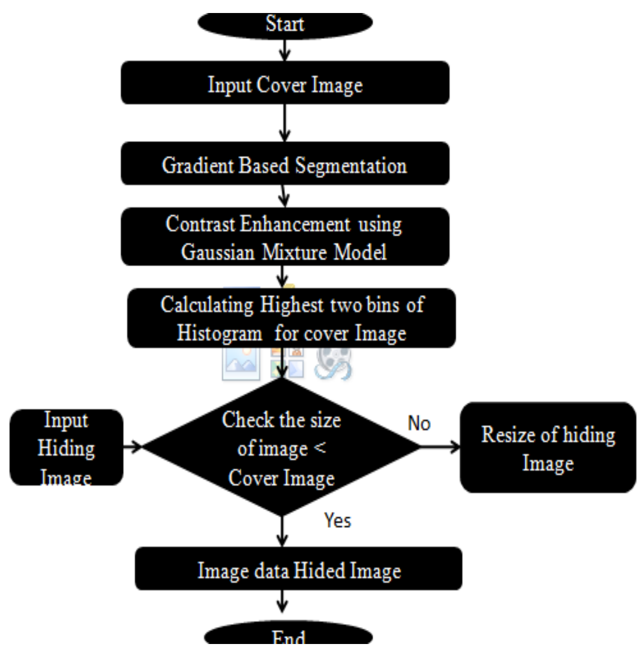


Fig3.6 Sender flowchart

3.7. FLOWCHART FOR RECEIVER

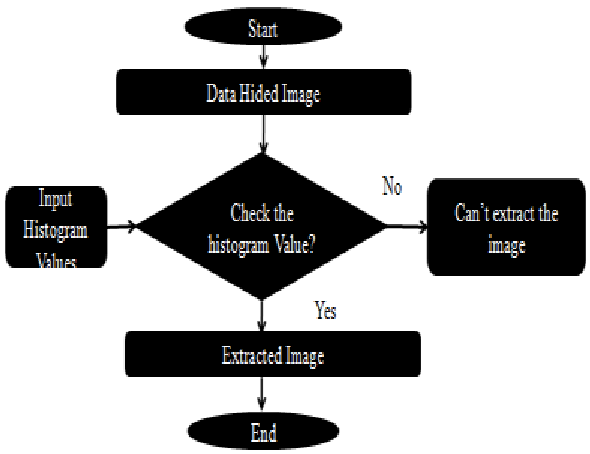


Fig3.7 Receiver flowchart

The flow chart for the receiver is processed when the sender sends the hidden image to the receiver. The hidden image gets received and gets process with the condition to check the histogram value. If the histogram value gets satisfied the image gets extracted and histogram value is not satisfied means the image will not extracted. After extracting the hidden image the process get finished

3.8. ADVANTAGE OF PROPOSED SYSTEM

- Reduces error rate during prediction
- Improves the embedding bit rate in encrypted image.
- High security against attackers.

IV. RESULT AND DISCUSSION

4.1. INPUT IMAGE

Figure 4.1 shows input image is in the size of 512x512 pixels and its file is in (.png) format. Each element in the array is called pixel.

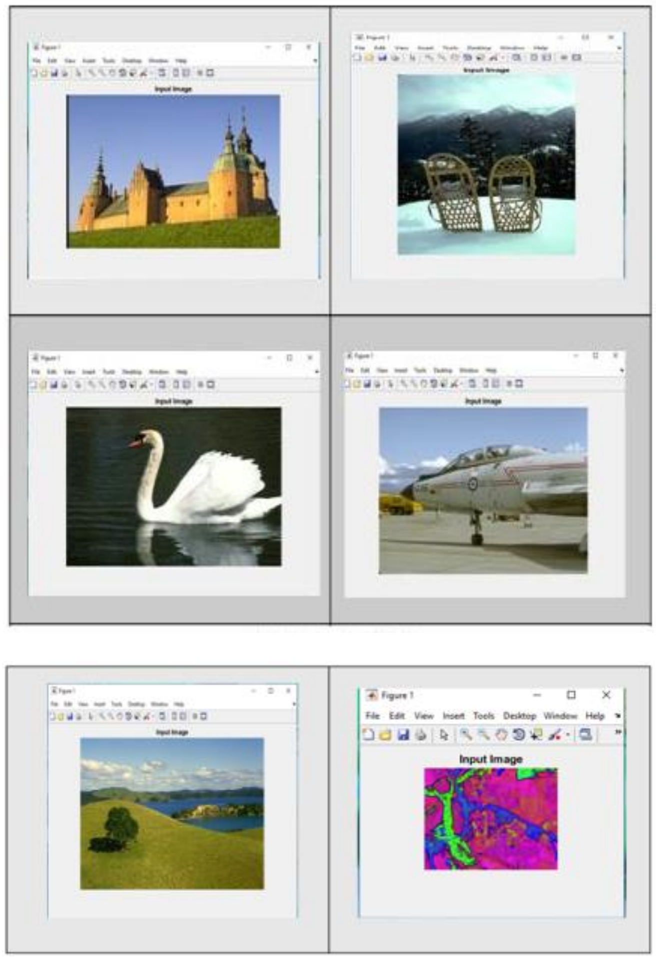


Fig 4.1 Input images

Here there is a different types of input image can be placed to encrypt the image by encryption schemes to hide the original image and recover the original image while sharing through users.

4.2 HISTOGRAM IMAGE

Figure 4.2 shows an image histogram is a type of histogram that acts as a graphical representation of tonal distribution in a digital image. It plots the number of pixels for each tonal value. The horizontal axis of the graph represents the tonal variation and the vertical axis represent the number of pixel in particular tone.

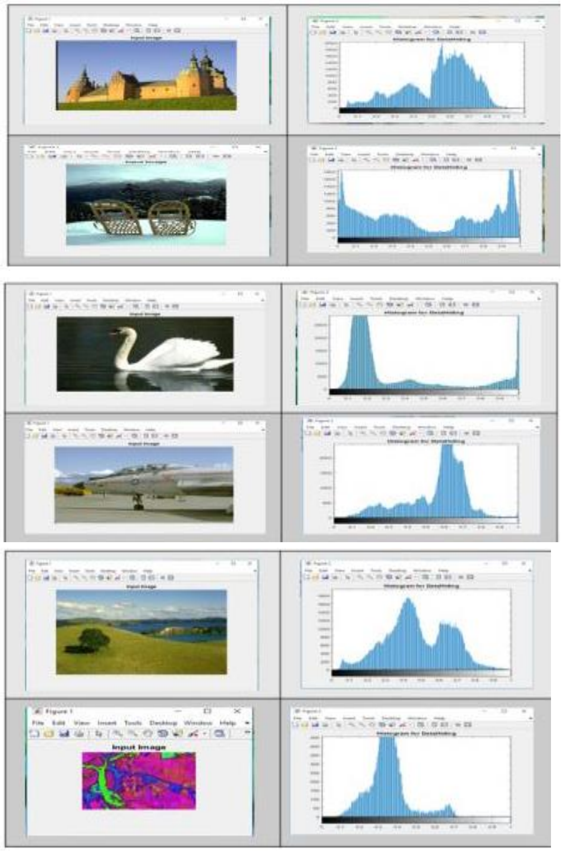
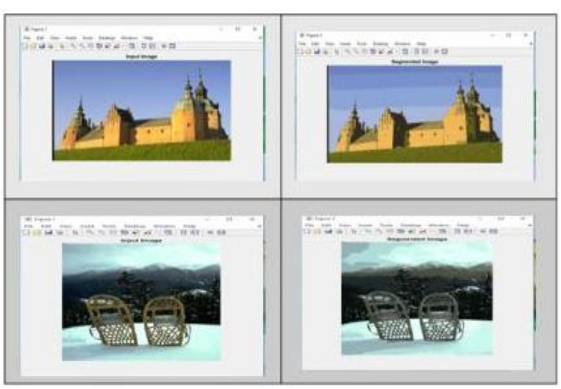


Fig 4.2 Histogram image

4.3 SEGMENTED IMAGE

Figure 4.3 shows the image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify and change the representation of an image into something that is more meaningful and easier to analyze.



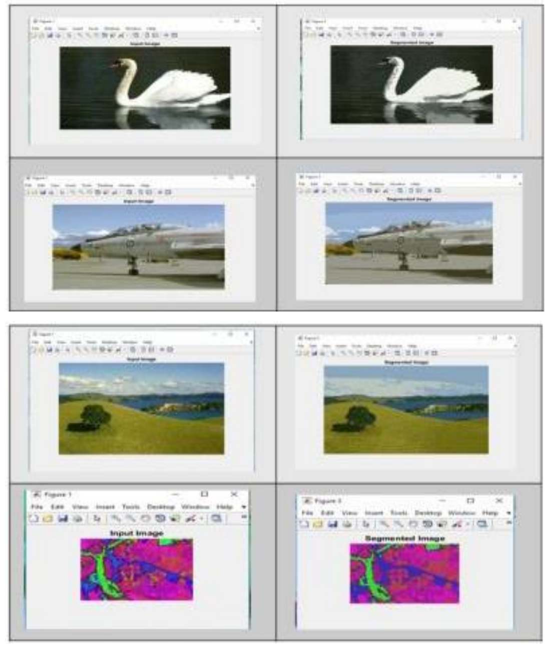
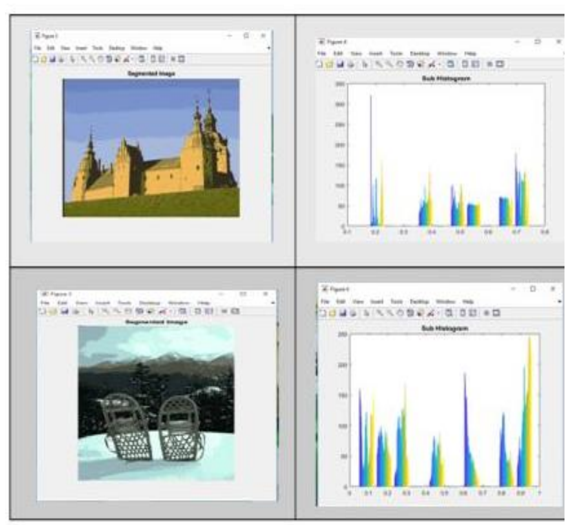


Fig 4.3 Segmented images

4.4 SUBHISTOGRAM IMAGE

Figure 4.4 shows the sub histogram is an accurate representation of the distribution of numerical data. It is an estimate of the probability distribution of a continuous variable. It differs from a bar graph, in the sense that a bar graph relates two variables but a histogram relates only one. To construct a histogram, the first step is to bin the range of values that is divide the entire range of values into a series of intervals and then count how many values fall into each interval. The bins must be adjacent and are often of equal size.



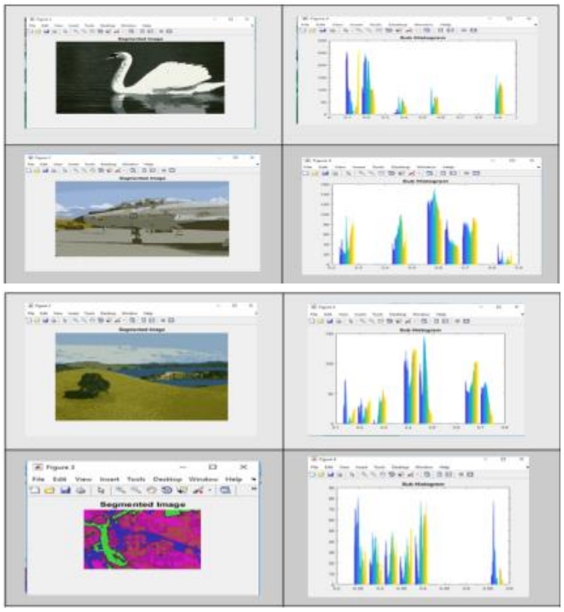


Fig 4.4. Sub histogram images

4.5 CONTRAST ENHANCEMENT

Figure 6.5 shows the contrast enhancement image; this image get process and it get enhanced. The neighborhood changes during the pixel to pixel to the transaction.

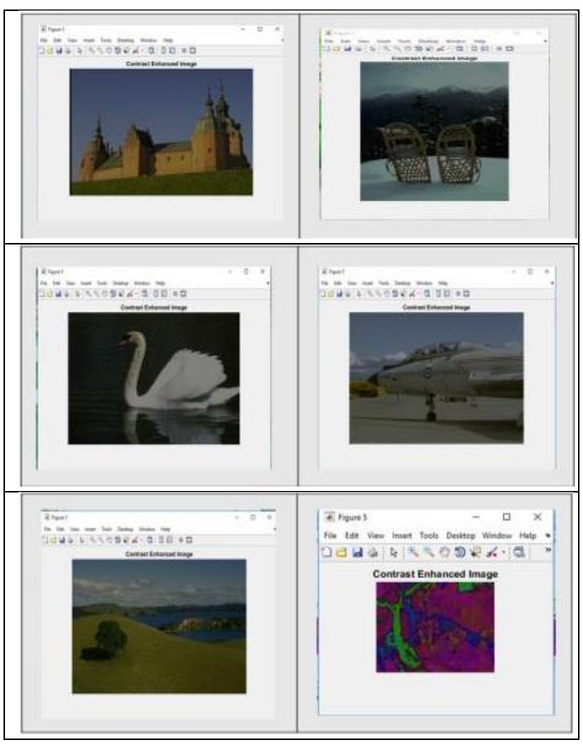


Fig 4.5 Contrast enhancement images

4.6 HIDING IMAGES

Figure 4.6 shows the hiding image. This image is in 50x50 because the hiding image is smaller than the input cover image.

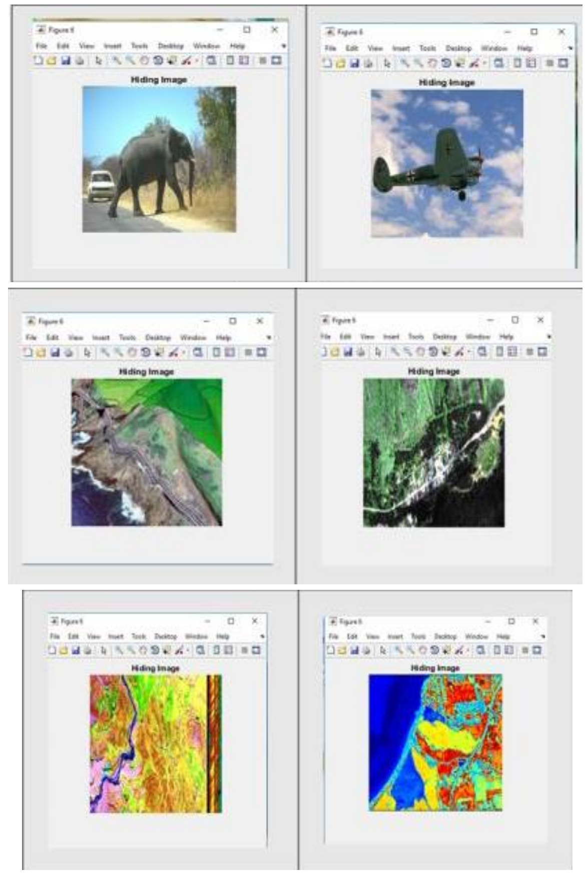
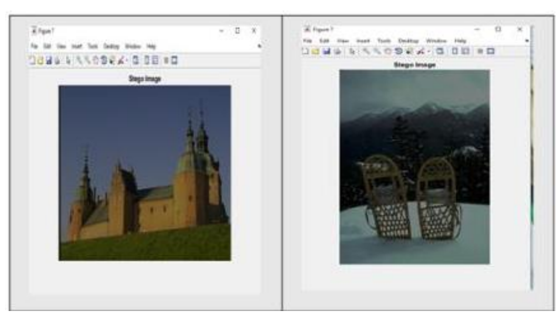


Fig 4.6 Hiding images

4.7 WATERMARKED IMAGE

Figure 4.7 shows the watermarked image and Watermarking is the process of image hiding in a carrier signal and it should not need to contain a relation to the carrier signal. To verify the authenticity digital watermarks are used.



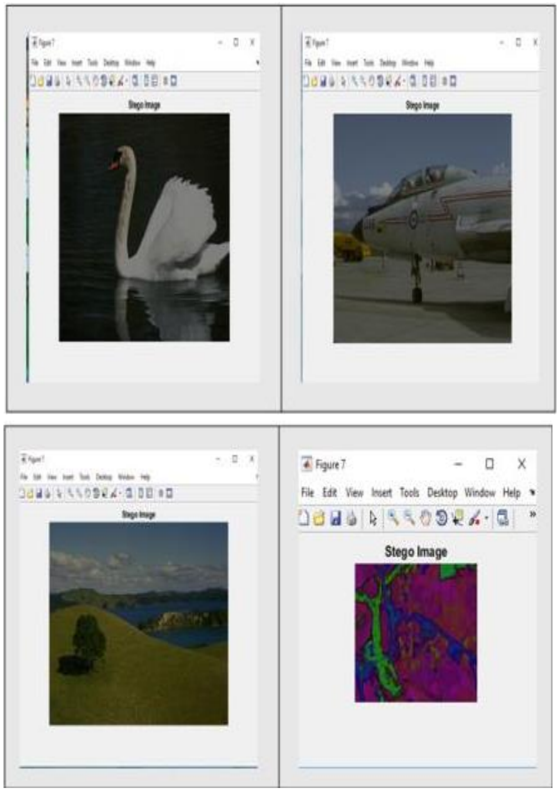


Fig 4.7 Watermarked images

4.8 RECEIVING HIDING IMAGE

Figure 4.8 shows that the receiving images at vertical and horizontal pixels for input and encrypted image. Then the quality of encryption for the first input image was obtained.

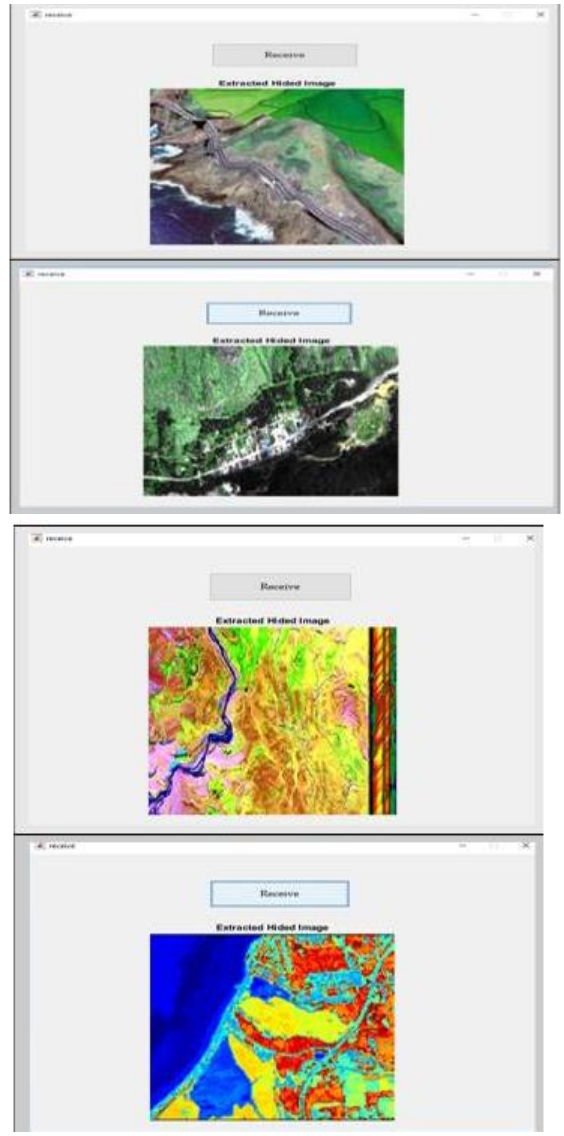


Fig 4.8 Receiving hiding image.

4.9 EXTRACTED COVER IMAGE

In figure 4.9 the extracted cover images are shown, extraction starts from an initial set of measured data and builds derived values. Feature extraction is a dimensionality reduction process, where an initial set of raw variables is reduced to more manageable groups for processing, while still accurately and completely describing the original data set.

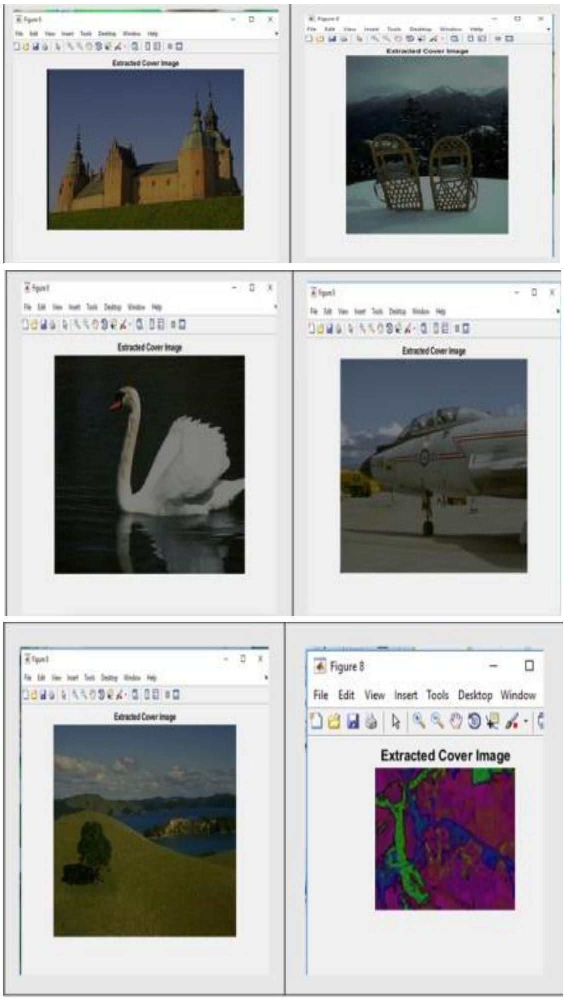


Fig 4.9 Extracted cover image

4.10 COMPARITION

Figure 4.10 shows the comparison image, the blowfish algorithm and the contrast enhancement using Gaussian mixture model.

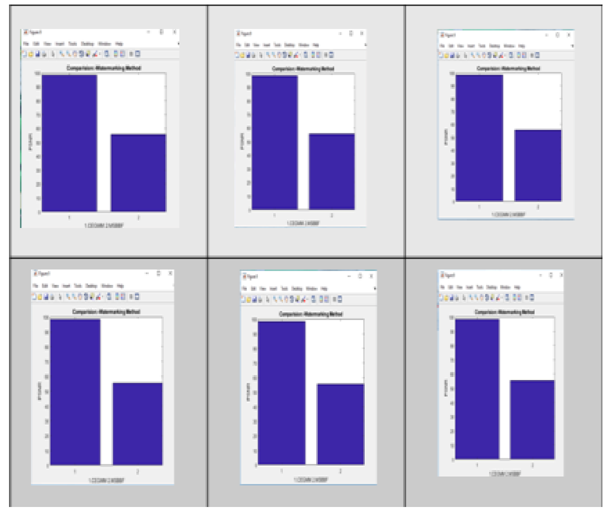
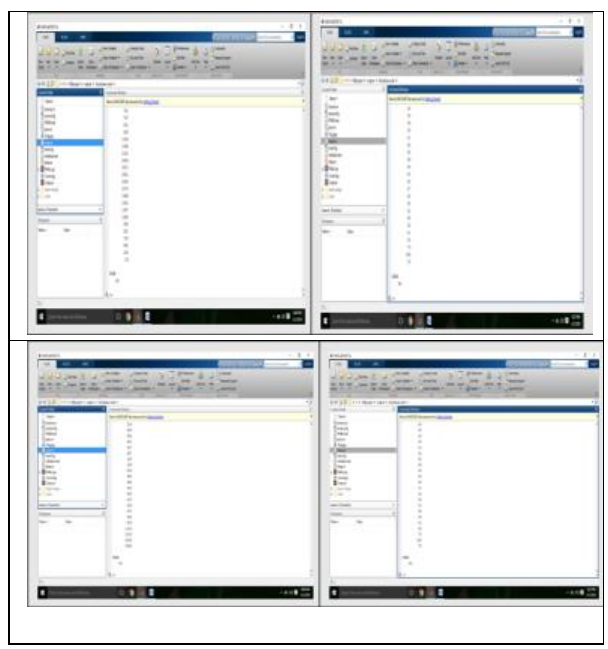


Fig 4.8 Comparison images

4.11PSNR VALUE

Figure 4.11 shows the PSNR, peak signal-to-noise ratio is an ratio between the maximum possible power of a signal and the power of corrupting noise. Because many signals have a very wide dynamic range, PSNR is usually expressed in terms of the logarithmic decibel scale.



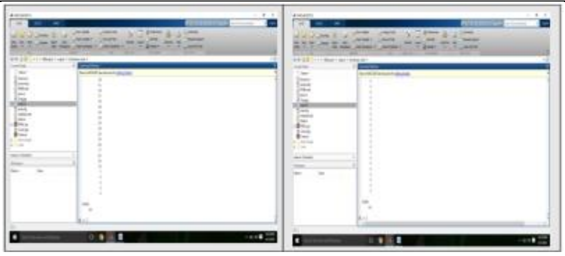


Fig 4.8 PSNR value

V. CONCLUSION

In this project, a new reversible data hiding algorithm has been proposed with the property of contrast enhancement. In this, a new contrast enhancement method named Gaussian Mixture Model based Contrast Enhancement (GMMCE) has been introduced. First, it is claimed that the shape preservation of narrow histograms during contrast enhancement can avoid unnatural artifacts, such as saturation and wash-out. Based on this claim, the proposed method models the histogram of low contrast image by the combination of a limited number of Gaussians where each Gaussian presents a dominant intensity level of the image. This modeling attempts to reflect the shape of a narrow histogram in the parameters of individual Gaussians, to convey it to a broadened version.

The global contrast enhancement of the image was achieved by the enhancement of sub-histograms separated by the mean value of the Gaussians of the GMM. Basically, the two peaks (i.e. the highest two bins) in the histogram are selected for data embedding so that histogram equalization can be simultaneously performed by repeating the process.

In future various data hiding schemes are combined to give a better security and QR code is used for encoding the data. It will be more secure than other techniques.

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