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REVERSIBLE IMAGE DATA HIDING USING QUAD- TREE SEGMENTATION

P.Chaithanya
ECE Department
Kamala Institute of Technology & Science

V.Srujana
ECE Department
Kamala Institute of Technology & Science

Abstract— A novel high capacity histogram-based reversible data hiding algorithm is used in this paper .This algorithm introduce low distortion after embedding the secret message. The proposed algorithm is to consider the multiple local histograms, each of which is derived from pixels in a locally adjacent sub-image area, instead of the single histogram for the whole image area. A hierarchical segmentation scheme is developed to partition the input host image into several blocks. In this each block consist of variable size pixels under a maximal capacity criterion for each block patrician. Tree structure is used to organize the partitioned blocks for easy representation. The secret image and partition information are embedded to the host image. With the proposed segmentation method we can easily find suitable non over-lapped partition of the image to considerably increase the embedding capacity. The proposed method provides a high visual quality image comparable to the traditional one.

Keywords— histogram shifting, Image security reversible data hiding, quad-tree segmentation

I. INTRODUCTION

In this digital era, digital contents can be distributed in the internet quickly and conveniently. At the same time, the copy and distribution of digital contents can be conducted illegally in the public internet environment. Copy right holders of digital content have begun to pay attention to copyright protection technologies. Many scholars have provided various data hiding technologies to embed secrete data, copyright information, or trademark into digital contents to protect or secure the copyright, and only allow slight modification of original contents .In some data hiding or watermarking schemes, the host media which is going to be protected oris used to hide the transmission of some secret information would experience some distortion and cannot be transformed back to its original form at the extraction stage. However, in some applications for sensitive images, such as medical images, military remote-sensing images, and artworks, it is essential to be able to reverse the marked media back to its original form after the hidden data are retrieved for some legal considerations. Owing to the reversibility requirement, there have been research efforts on reversible watermarking that can recover the original images from the watermarked images as demand.

In [8], Tain presents a difference expansion method for reversible watermarking. The method can provide very high hiding capacity, but it also destroys the original image very much. There are also several variants of difference expansion proposed to improve the stego- image quality and hiding capacity [9-12]. In [13], Ni brings up a histogram shifting algorithm. The algorithm is simpler and requires less computation than most of other watermarking algorithms. Histogram shifting method uses maximum and minimum points of the histogram of the input image, and shifts all of the pixels which intensities between the maximum and minimum points for hiding message bits at the maximum point. Since it modifies the intensities of pixels slightly, it can preserve very high peak signal-to-noise ratio (PSNR) after embedding the secret message in the image. However, the capacity that Ni's algorithm can provide might not be sufficient for most applications; so many scholars have studied and tried to improve Ni's algorithm. For instance, Hwang uses the intensities between the maximum points to raise capacity [14], but the increased amount of hiding data is not significant. In 2009, Chung brings up a method which used a dynamic programming procedure [15] to maximize histogram shifting hiding capacity. The method increases capacity indeed, but it has two drawbacks: the method is suitable only for specific type of images and his technique needs much execution time.

Histogram shifting method is used for the preserving the quality of image and improve its hiding capacity.The method is enhanced to utilize the characteristics of an image for maximizing its hiding capacity.

We focus on dividing a histogram in several parts and shifting them individually for hiding more data in them instead of shifting a whole histogram. Without loss of generality, suppose we divide a histogram into two or more parts. Then, each of the divided histograms would appear more concentrated due to the spatial continuity of natural images, and is easier to find suitable maximum and minimum points for hiding message without too much overhead.

In literature [16] it is clearly mention that , the summery of individual hiding capacities from the divided histograms would also be larger than that without division in most cases ,which divides the image into four blocks and hide information in each of them, our proposed algorithm emphases on how to maximally expand the hiding capacity through a hierarchical partition strategy. In proposed algorithm to increase the hiding capacity one of the histogram shifting technique quad tree segmentation approach is used.

The designed algorithm works simply in the spatial domain of images without any signal transformation process.

II. REVERSABLE DATA HIDING

Reversible data hiding can be defined as an approach where the data is hidden in the cover media that may be an image. A reversible data hiding is an approach, which can recover the original image lossless after the data have been extracted from the cover image. Reversible data embedding, which can be called lossless data embedding, embeds confidential data (which is called a payload) into a digital image in a reversible manner.

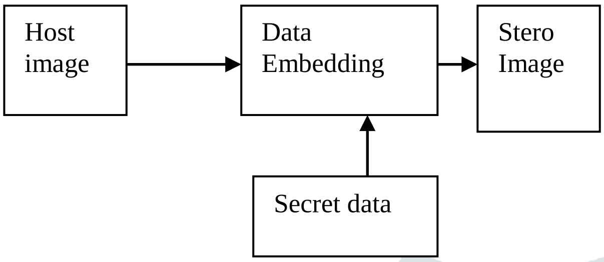

Fig.1 Reversible data hiding at transmitter

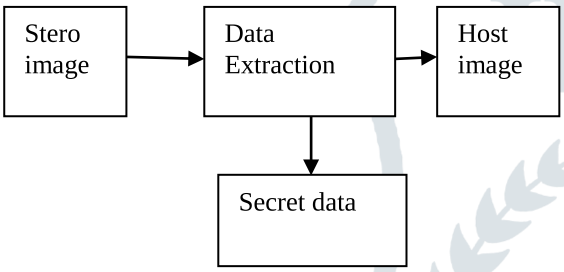

Fig.2 Reversible data hiding at receiver

Reversible data embedding, which is also called lossless data embedding, As a basic requirement, the quality degradation on the image after data embedding should be low An interesting feature of reversible data embedding is the reversibility, that is, one can remove the embedded data to restore the original image

The data embedding process will usually introduce permanent loss to the cover medium. However in some applications such as military, medical, and law forensics where degradation of cover is not allowed.

The block diagram of RDH is shown in Fig.2. Watermarking & Reversible Steganography can restore the original carrier without any or with ignorable distortion after the extraction of hidden data. Thus reversible data hiding method are now getting popular. In this paper some important reversible data hiding techniques for digital images are explained and the results are analysed.

In image processing image segmentation is an important and challenging process .The image segmentation approaches can be categorized into two types based on properties of image.

1. Discontinuity detection based approach
2. Similarity Detection based approach

III.IMAGE SEGMENTATION TECHNIQUES

Thresholding Method: In image segmentation one of the simplest technique **is** thresholding method. The methods divide the image pixels with respect to their intensity level.Thesemethodsareusedoverimageshavinglighterobjectsth anbackground.These methods can be selected manually or automatically based on prior knowledge or information of image features. There are basically three types of thresholding

Global Thresholding: In this method we choose appropriate threshold value T. The value of T is constant for total image . Based on the value of it the output image can be obtained from host image**.**

$$q(x,y) = 1, if\ p(x,y) > T$$

$$0, if\ p(x,y) \leq T$$

Variable Thresholding: In this method we choose variable threshold value based on the image. The selection of threshold value can be two types.Local Threshold*:* In this method the value of T is obtained from the neighbourhood of x and y. Adaptive Threshold*:* The value of T is a function of x and y

Multiple Thresholding: In this method multiple threshold values are taken from like T0 and T1. image. Type of thresholding, there are multiple threshold values. By using these output image can be calculated as:

$$q(x,y) = m, if\ p(x,y) > T1$$
$$n, if\ P(x,y) \leq T1$$
$$o, if\ p(x,y) \leq T0$$

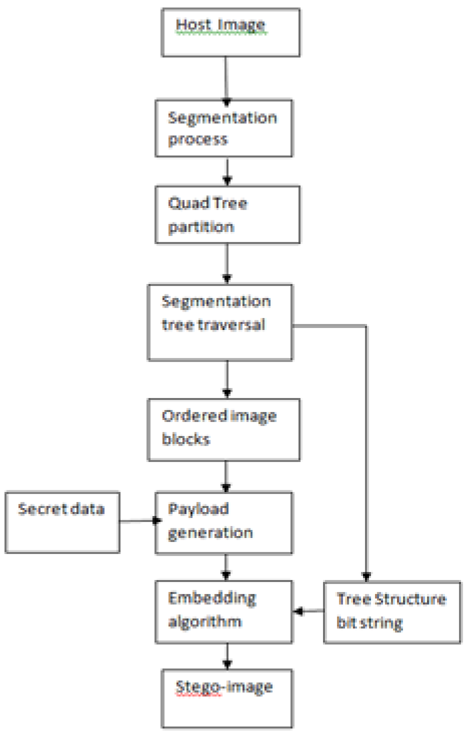

Fig. 1 Flow chart for data hiding process

Quad-tree Segmentation: The proposed algorithm aims at embedding the secrete data to no overlapped blocks of pixels using is to gram shifting technique. These blocks are generated from partitioning the input image and organized as a form of quad-tree structure. With the nature of histogram shifting technique, lower contrast block scan accommodate more bits of secrete data while higher contrast blocks hide relatively less amount of secrete data bits. Therefore, the higher contrast blocks are required to be divide into smaller sub blocks. In that sub blocks most of them become smoother and altogether provide larger hiding capacity.

IV. RESULTS

The host image is taken and its histogram is found. Based on the histogram ,the image is portioned i.e quadtree decomposition, the image is represented in blocks and showing the decomposed image .The input message/data to be hidden ,embed the data in the image. Finally shows the data hidden in the image.

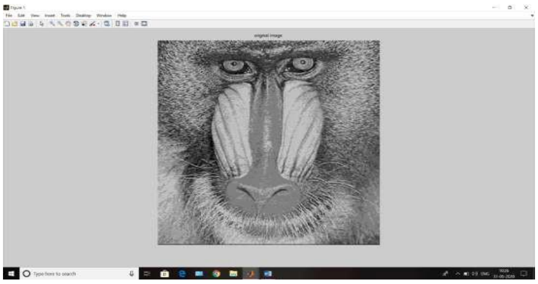

Fig.4 Original Image of Baboon

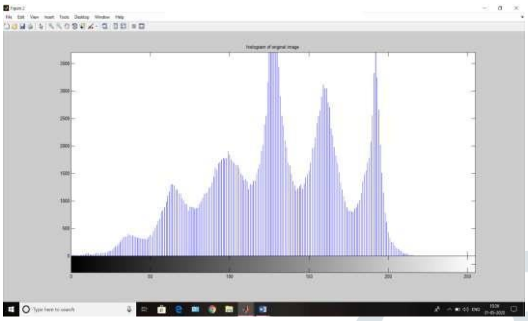

Fig.5 Histogram of original image

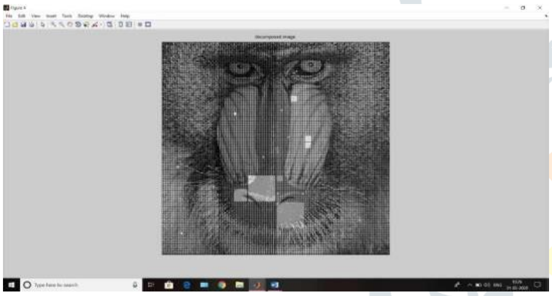

Fig.6 Decomposed image blocks

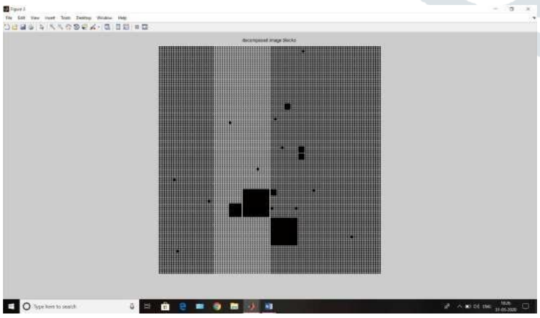

Fig.7 Decomposed image

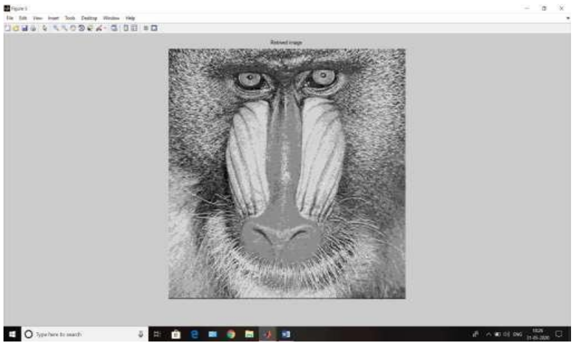

Fig .8 Retrived image

V. CONCLUSION

In this paper, the quad-tree segmentation is used for increasing the hiding capacity of the reversible image data hiding scheme that embeds secret data through shifting the histogram of image pixel**s.** With the proposed segmentation method we can easily find suitable non over-lapped partition of the image to considerably increase the embedding capacity. The proposed method provides a high visual quality image comparable to the traditional one.

The host image can be exactly recovered without any additional information. And improving the algorithm robustness, and applying it to the medical and satellite images for the better visibility, will be our future work.

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