Reversible Data Hiding VIA Optimal Code for Image

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Abstract: *Digital watermarking often referred to as data hiding for assuring the information. Data hiding in image processing may occur the permanent distortion and hence the original cover medium may not be able to be reversed exactly, after the hidden data have been extracted out. In our previous work, generalize the method of decompression algorithm as the coding scheme for embedding data and prove the codes can reach the rate–distortion bound as long as the compression algorithm reaches entropy and uses a binary covers for embedding messages. A code construction for recursive reversible data-hiding established a rate–distortion model. In our work presents a novel lossless data-embedding technique, which enables the exact recovery of the original image upon the extraction of the embedded information. After the Decompression, the original message will retrieved. The marked cover is reconstructed and extracting the original message from the cover. In our research work, improve the histogram shifting of compressing features and to construct the recursive code for gray scale covers.*

Keywords: *Difference expansion, Evenodd method, Datahiding, Watermarking, Histogramshifting, Reversible*

I. INTRODUCTION

Data hiding is the general term for embedding message into the covers such as image,audio and video files. The term hiding means making the information imperceptible or keeping the existence of the information secret which is used fot integrity, authentication, media notation, etc. The image that will be embedded the secret data is called the cover image or otherwise called as the stego image. The first stage extracting the portion from the original cover. The second stage is to compressing the features of the original cover and that saves the space for the payloads. The third stage embeds the messages into the feature sequence and called as the marked cover or stego image. The embedding process may introduce the some permanent distortion to the cover, that is the original image cannot reconstructed from the original cover. In this case we need a special kind of data hiding method, which is referred as reversible data hiding. A higher hiding capacity means use more secret data can embedded into the cover. A reversible data hiding, which is also called a distortion-free or lossless data hiding, is a technique that not only embeds the secret data into cover images, but also used for restoring the original images from the stego images after the embedded data have been extracted.

In our previous work, many reversible data hiding schemes were proposed, and most of them use the following techniques: lossless compression technique, difference expansion technique (DE), histogram shifting technique (HS), Interpolation technique. These schemes are either high hiding capacity and poor stego image quality or good stego image quality and low hiding capacity. The distortion are introduced in the original cover. In this paper, a novel reversible data hiding scheme is proposed. The proposed scheme uses an Even-Odd embedding method to reconstruct the image without distortion.

II. RELATED WORK

2.1 Lossless Compression Technique

The reversible data hiding schemes based on lossless compression were proposed The key point of these schemes is to find a subset B in the original. The first methodology is based on lossless compression of subsets or features of the samples comprising the digital object X. If the object X contains a subset B, or a set of features B from X Such that B can be losslessly compressed and be randomized without causing perceptible quality of or object X. The extraction of the hidden message proceeds by extracting the subset B and joining with the bit stream consisting of the compressed bit stream and the message. Replace the set B with its compressed form C(B) and the secret data M , showed in Figure 1. X and X′ indicate the cover image and stego image, respectively.

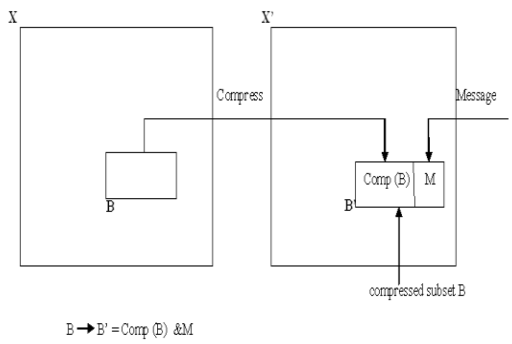


Fig. 1. A data hiding using the lossless compression technique

2.2 Histogram Shifting Technique

The reversible data hiding schemes based on histogram shifting were proposed. In these schemes, peak point in the histogram of the cover image is used to select the embedding area for the secret data, then the part [Peak point +1, Zero point] is shifted to get the embedding area. These schemes were improved by using the histogram of the difference image or predict error image instead of the original image to get a higher peak point. If the peak point is high, the hiding capacity will be large.

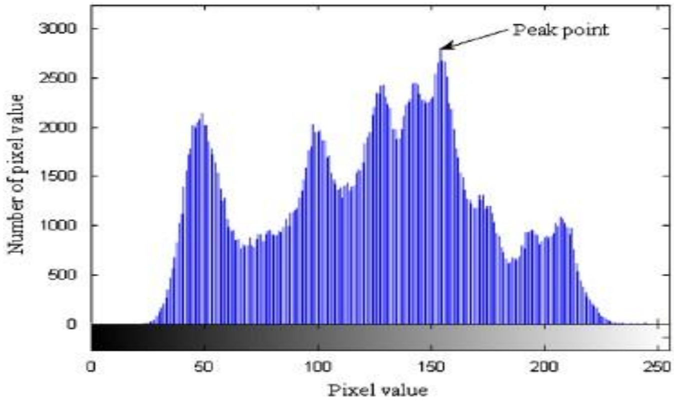


Fig. 2. Histogram of image "Lena"

III. REVERSIBLE DATA HIDING

It introduces a generalization of the well-known LSB (least significant bit) modification method as the underlying irreversible (lossy) embedding technique. This technique modifies the lowest levels- instead of bit planes- of the host signal to accommodate the payload information. In the second part, a lossless data embedding algorithm for continuous-tone images is built on the generalized LSB modification method. This spatial domain algorithm modifies the lowest levels of the raw pixel values as signal features. As in all Type-II algorithms, recovery of the original image is enabled by compressing, transmitting, and recovering these features. This property of the proposed method provides excellent compression of relatively simple image features. Earlier algorithms in the literature tend to select more complex features to improve the compression performance- thus the lossless embedding capacity.

(a) The data hiding where the cover image is subdivided into blocks, and one bit is inserted in each block by flipping the pixel with the lowest visibility. The blocks with even (odd) number of black pixels has bit zero (one) embedded. In this technique, the original image cannot be recovered even if the original parities of black pixels are known, because the precise flipped pixel inside each block cannot be localized.

(b) The second is an efficient compression of the portion to be overwritten by the hidden data.

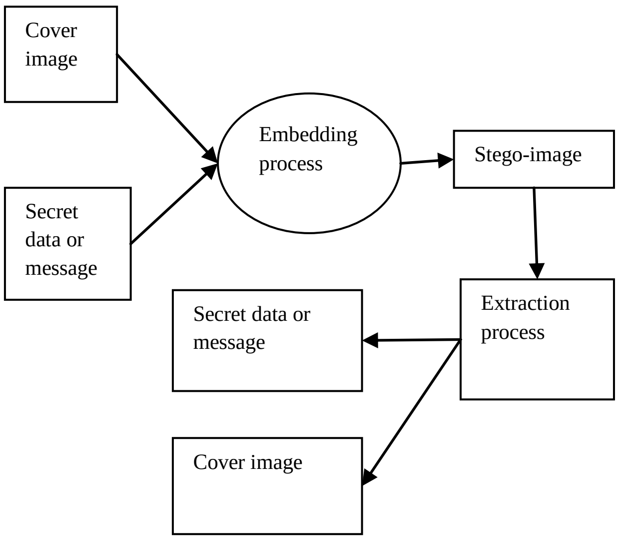


Fig 3. A system architecture of reversible data hiding

3.1. Preprocessing

In this module the preprocessing of database is done. Generally representation of images uses too many features, but only a few of them may be related to the target image. Data hiding method is not easy way to implement the image into the message without storing the images in the database .In this preprocessing module stores the number of the images in the database .In this preprocessing stage feature extraction is performed for image stored in the database. The cover image or original image extracted the feature, removal of the noisy data in the image.

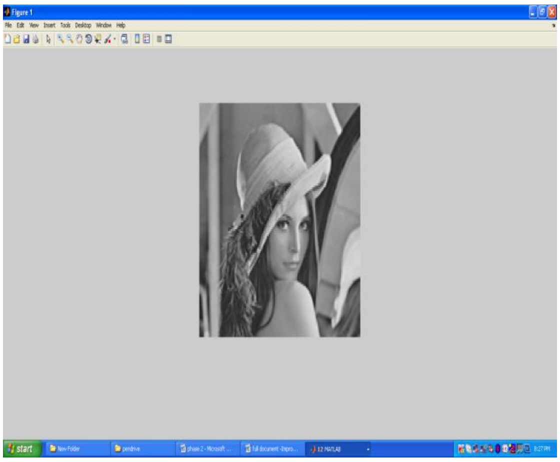


Fig 5. Input image "lena"

3.2. Implement of DE algorithm

In this module reversible data hiding based on difference expansion require location maps to recover cover images, larger embedding capacity can be achieved by constructing a longer feature sequence that can be perfectly compressed. One of such constructions is difference expansion in which the features are the differences between two neighboring pixels. The features are compressed by expansion, i.e., the differences are multiplied by 2, and thus, the LSBs of the differences can be used for embedding messages.DE the features (differences) are compressed by expansion operation**.**

The integer average is

$L=((x+y))/2$ (1)

The difference value is

$h=x-y$ (2)

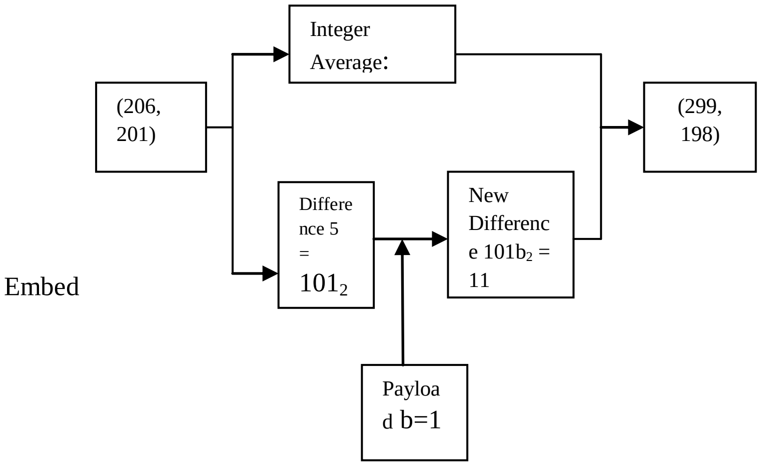


Fig 4.difference expansion algoriothm

3.3 Data embedding

Adaptive arithmetic coder (AAC) as the embedding code, the proposed codes realize continuous embedding rates and reach the maximum embedding rate at the least admissible distortion. Set a proper length for the last block Denote the estimated length of the last block by K_{last}.After compression, the left room in the last block is about $K_{last(}1\text{-}H_2(p_0))$bits, in which we will embed not only the information for reconstructing the second last block but also some overhead information. On one hand, to reconstruct the second last block, we need, at most k/2 , bits because the number of "1's" in is not more than $y_{last\ -1}$.On the other hand, the overhead consists of some parameters necessary to the recipient, the length of which is denoted by L_{over} . Thus, the estimated length of the last block is enough, if

$K_{last}(1 - H_2(p_0)) \geq k/2 + L_{over}$ (3)

The proposed scheme gains from embedding capacity by taking full advantage of the large quantities of smaller difference values where secret data can be embedded. The proposed scheme offers several advantages, namely, the location map is required, the embedding capacity can be adjusted depending on the practical applications, and the high embedding capacity with minimal visual distortion can be achieved.

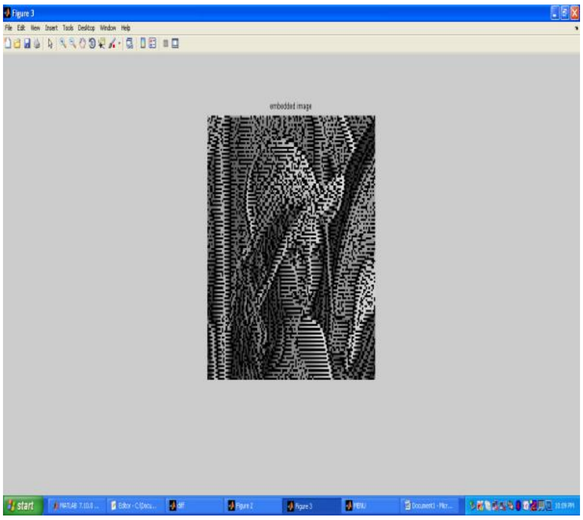


Fig 6. Embedding message into the image

3.4. Generating marked cover

In this module after embedding the message into the feature sequence ,then generate the marked cover .One direct reversible embedding method is to compress the feature sequence and append messages after it to form a modified feature sequence, by which replace the original features to generate the marked cover. Therefore, after extracting the message, the receiver can restore the original cover by decompressing the features. Receiver could extract messages from the marked cover with the help of the reconstructed cover because of reversibility. To extract the message and reconstruct the cover, the extraction process must be performed in a backward manner. To extract messages from the ith block, To reconstruct the cover block and extract messages from the y_1 marked block , we first count the number of “1’s” in , that is, equal to 3. Second, we extract messages from the second marked block and decompress the extracted messages successively until we get a 3-bit decompressed sequence.

3.5. Even-Odd Embedding Method

Reversible data hiding is very useful for some extremely image such like medical images and military images. In the reversible data hiding schemes, some schemes are good performance at hiding capacity but have a bad stego image quality, some schemes are good stego image quality but have a low hiding capacity. It is difficult to find the trade-off between the hiding capacity and stego image quality. In this paper, a novel reversible data hiding scheme is proposed. The proposed scheme uses a new embedding method, which is called Even-Odd embedding method, to keep the stego image quality in an acceptable level, and uses the multi-layer embedding to increase the hiding capacity.

IV. PERFORMANCE EVALUATION

In this module we compare the performance of the existing and the proposed system shows embedding rate and retrieval accuracy of the image and messages.

PSNR is most easily defined via the mean squared error (*MSE*). Given a noise-free $m \times n$ monochrome image I and its noisy approximation K, *MSE* is defined as:

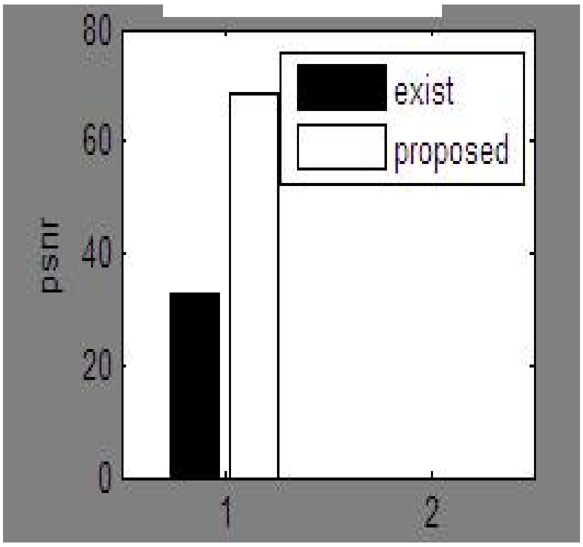
$$MSE = \frac{1}{mn} \sum_{i=0}^{m-1} \sum_{j=0}^{n-1} [I(i,j) - K(i,j)]^2$$

The PSNR is defined as:

$$PSNR = 10.\log_{10}\left(\frac{MAX_I^2}{MSE}\right)$$

V. RESULTS AND DISCUSSIONS

Figure 4 shows the hiding capacity and PSNR value of the even and odd embedding method. It is found that accuracy of data hiding capacity and PSNR is higher than existing system.



VI. CONCLUSION

In this paper the image is taken from database and hiding the information or message are stored in that image for security purpose. After that it sends to the receiver. The receiver extracted that original message from stego image.(i.e) the image with hiding data called as stego image. The proposed system increased the hiding capacity and PSNR value.

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