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Reversible Data Hiding Methods : A Survey

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***Abstract*—**This paper presents a survey of various reversible data hiding methods. Data hiding is the process of hiding information in a cover media . Most commonly used media for data hiding is image. But during the hiding and extraction of data there are chances for the distortion of image. Reversible data hiding methods are used to solve this problem.

Keywords- *Reversible Data Hiding, LSB substitution method ,Histogram Modification, Differential Expansion*

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I. INTRODUCTION

Now a day's security is treated as the most important factor in the communication system. The two important methods to give security to our data are cryptography and data hiding.

Encryption is the process of converting information or data into a code, especially to prevent unauthorized access. This process converts plaintext content into unreadable cipher text. Because of the data is in unreadable format, it can easily got attention of hackers.

Data hiding is the process of hiding information in a cover media during storing or transmission. The major requirement for this is data invisibility. We can use various Medias such as audio, video, image, text, and picture for hiding information. Commonly used media for hiding information is image. The receiver can extract the data from the cover image. Data hiding can have applications in military and medical systems. In medical systems data hiding can be used to hide information about patients in their medical documents. But there are chances for distortion of cover images during the hiding and extraction of data. In the area of military intelligence and medical systems, the distortion of the cover images is not accepted. To solve this problem Reversible Data Hiding can be used.

II. REVERSIBLE DATA HIDING

We can say that a data hiding method is reversible when the cover image is recovered completely after the extraction of the hidden data

The main requirements of RDH techniques are:

1. Minimize distortion and maximize data embedding capacity
2. No errors in data and cover image after extraction

Steps of Reversible Data Hiding:

1. DataEmbedding: Hiding data inside the host image.
2. Data Extraction: extracting data from the host image.

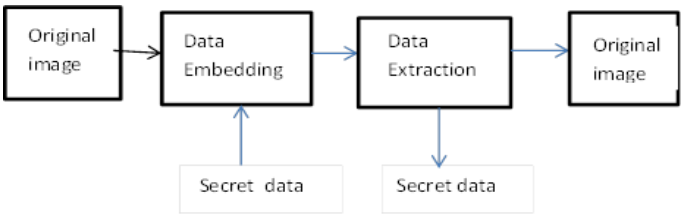

Figure 1General Block Diagram of RDH

III. IMPORTANT METHODS OF RDH

A. LSB SUBSTITUTION METHOD:

One of the earliest data-embedding methods is the LSB substitution method. It is a spatial domain data hiding technique.In this method, the Least Significant bit of each or some signal sample is replaced (over written) by a bit of the data to be hidden. In a RGB image a pixel is represented using 3 bytes usually representing R, G, and B. For LSB encoding a bit of the R, G, and B can be used. If additional capacity is required, two or more LSBs may be used. During extraction, these bits are read in the same scanning order, and payload data is reconstructed. LSB modification is a simple technique with high-embedding capacity and small embedding distortion.

Advantages [5]:

1. Chances for degradation of the original image are less.
2. More data/information can be stored in an image.

Disadvantages [5]:

1. It is less robust as the hidden data can be lost with image manipulation.
2. The hidden data can be destroyed easily by simple attacks

B. LOSSLESS GENERALIZED-LSB DATA EMBEDDING METHOD:

In [1] a generalization of the LSB-embedding method, namely G-LSB, is employed used. In the embedding phase, the lowest levels of the signal samples are replaced (over-written) by the watermark payload data bit using a quantization step followed by an addition. During extraction, the watermark payload data bit is extracted by simply reading lowest levels of the watermarked signal. G-LSB embedding enables embedding of noninteger number of bits in each signal sample

Advantages [1]:

1. High-embedding capacities
2. Complete recovery of the original host signal
3. Introduces only a small distortion between the host and image bearing the embedded data.

Disadvantage [1]:

1. The capacity of the scheme depends on the statistics of the host image.

C. DIFFERENTIAL EXPANSION METHOD:

Differential Expansion method is one of the most popular methods for Reversible Data Hiding. In [3] Tian introduced a DE technique, which discovers extra storage space by using the redundancy in the image content. In [2] Tian present a high capacity RDH method based on DE.

Data Embedding Phase [2]

This method divides the image into pair of pixels. For each pixel pair the integer average and difference are calculated. From various difference values changeable and expandable difference values are identified using reversible integer transform. Location maps of selected expandable difference value are created. Selected difference values are then converted into binary format and original LSB bits of this difference values are collected. Then difference of each changeable pixel group is expanded by keeping its average value unchanged. Data embedding is done into the expanded difference value by replacement, and finally an inverse integer transform is applied.

Data Extraction Phase [2]

The data extraction process consists of five steps .First we calculate the difference values. As in embedding different pixels of the image and apply integer transform for each pair. Then two disjoint sets are of difference value CH and NC are created. CH contains all changeable difference values and NC contains all non-changeable difference values .In the third step LSBs of all difference values in CH, are collected and form a binary bit stream .In the Fourth, the location map is decoded by a JBIG2 decoder. The fifth step is content authentication and original content restoration. We apply the inverse integer transform to reconstruct a restored image. Then the content is authenticated.

Advantages [2]:

1. This method is a high-capacity, high visual quality reversible data-embedding method for digital images.
2. This method can be applied to digital audio and video.

Disadvantages [2]:

1. There is significant degradation of visual quality due to bit replacement of grey scale pixels.

D. HISTOGRAM MODIFICATION METHOD:

Another promising strategy for RDH is histogram shift (HS). In [4] Ni et al. presented a histogram based reversible data hiding method in which the message is embedded into the histogram bin. They used maximum and minimum points to achieve low distortion, but with attendant low capacity.

Data Embedding phase [4]

Generate histogram of the image. In the histogram find the maximum point and minimum point. Assume that gray scale value of maximum point is a and minimum point is b and also a<b. Scan the image and identify the pixels with gray scale values between a and b and increment the gray scale values of that pixels by one i.e shift the histogram to the right by 1 unit. The whole image is scanned once again and once a pixel with gray scale value a is encountered check the next bit in the to be embedded bit stream. If it is one the gray scale value is incremented by 1.Otherwise leave it as it is.

Data Extraction phase [4]

Assume that gray scale value of maximum point is a and minimum point is b and also a<b. Scan the image and if a pixel with gray scale value a+1 is encountered a bit 1 is extracted. If a pixel with value a is encountered a bit 0 is extracted.

Advantages [4]

1. This method can be applied to various types of images.
2. The algorithm used with this method is simple and the execution time is short.

Disadvantages [4]

1. Capacity of embedding depends upon the number of pixels which are associated with the peak point.

IV. CONCLUSION

Now a Days Reversible data hiding methods gets more popularity in the area of data communication. The reversibility of the carrier medium at the receiver side, after the extraction of the secret data makes it more attractive. In this paper different methods for reversible data hiding are presented with advantages and disadvantages. All these methods aim to reproducing image and secret data with maximum accuracy.

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