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# Image Authentication Based on Reversible Image Data Hiding Technique and PBCT

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***Abstract***— *Novel binary change technique (PBCT) is reversible picture information concealing dependent on picture validation and called the proposed strategy. An existing method as a swap for the proposed procedure of attempting to keep the PSNR esteem high and upgrades the validation of unique picture information to improve its information concealing quality. The twofold piece changes in the histogram are chosen for information implanting. Reversible information stowing away can be characterized as a methodology where the information is covered up in the host media, for example, picture, sound and video records. Reversible data hiding (RDH) or lossless information stowing away is a strategy by which the first spread can be losslessly reestablished after the implanted data is extricated. Concealing data pulverizes the host picture, although the bending acquainted by stowing away is subtle with the human visual framework. Reversible information concealing strategies are intended to tackle the issue of lossless inserting of huge messages in computerized pictures so that after the implanted message is removed, the picture can be reestablished totally to its unique state before installing happened. To shield this information from unapproved access and altering different techniques for information concealing like cryptography, hashing, confirmation has been created and are by and by today. Picture information concealing handling time more mistake at that point conquer this detriment and with no loss of unique information picture are removing by novel binary change technique (PBCT). Reversible information concealing strategies recoups the first transporter precisely after the extraction of the mystery encoded information. Reversible information concealing procedures are grouped depending on the novel binary change technique (PBCT)) of implementation. In this investigation, they will examine one such information concealing method called picture verification dependent on reversible picture information concealing method and PBCT. PBCT is the way toward hiding delicate data in any media to move it safely over the fundamental untrustworthy and unstable correspondence organize. The proposed strategy contrasts with existing procedure different boundaries based like PSNR and MSE. The proposed technique is improving PSNR and minimization error values in image data hiding both techniques comparative analysis of find best image authentication.*

***KEYWORDS:- Reversible Data Hiding, Image Encryption, Image Decryption, Data Hiding, Image Recovery, Image Protection, Block Histogram Shifting, Image Recovery, Error Rate, PSNR.***

## I. Introduction

Today, in the digital era, any sort of data such as images, text, audio, can be digitized and stored indefinitely and can be transmitted at high speeds. Therefore there is a need to hide secret identification inside certain types of digital data. This information can be used to identify attempts to tamper with sensitive data, to embed annotations and to prove copyright ownership. Storing, hiding, or embedding secret information in all types of digital data is one of the tasks of the field of steganography. Secret data can be embedded in various types of cover. If the data are embedded in an image (cover image), the result is a stego-image (or stegoimage) object. The data can also be embedded in the text file, audio, video etc. Embedding data in a cover is a technological challenge. The size of the embedded data should not increase the size of cover as it becomes noticeable to an attacker who is familiar to the original cover [1]. Therefore secret data should be embedded in "holes" in the cover (places where the cover data have redundancies). Data hiding is the art and science of communicating secret data in an appropriate multimedia carrier, e.g., image, audio, and video files. Digital Steganography and watermarking are the two kinds of data hiding. Reversible data hiding can be defined as an approach where the data is hidden in the host media that may be a cover image. A reversible data hiding is an algorithm, which can recover the original image losslessly after the data have been extracted. Reversible data embedding, which is also called lossless data embedding, embeds invisible data (which is called a payload) into a digital image in a reversible fashion. As a basic requirement, the quality degradation on the image after data embedding should below. An intriguing feature of reversible data embedding is the reversibility; that is, one can remove the embedded data to restore the original image [2].

### Reversible Data Hiding Technique

Data hiding is a term encompassing a wide range of applications for embedding messages in the content. Usually, hiding information destroys the host image even though the distortion introduced by hiding is invisible to the human visual system. However, there are some sharp images for which any embedding distortion of the image is intolerable, such as medical images, military images or artwork preservation. For images like in the medical field, even slight changes are unacceptable because of the potential risk of a physician misinterpreting the image. In other applications, such as remote sensing it is also desired that the original cover media can be recovered because of the required high-precision nature. In these cases, a special kind of data hiding method called reversible data hiding or lossless data hiding is used. Reversible data hiding (RDH) techniques designed to solve the problem of lossless embedding of large messages in digital images so that after the embedded message extracted, the image can be entirely restored to its original state before embedding occurred. Steps of RDH data embedding, data extraction. 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 [3]. In these cases, a special kind of data hiding method called reversible data hiding or lossless data hiding is used. Reversible Data Hiding (RDH) in digital images is a technique that embeds data in digital images by altering the pixel values of image for secret communication, and the cover image can be recovered to its original form after the extraction of the secret data from it. The block diagram of RDH shown in Figure 1 in which 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 is now getting popular. In this paper, some important reversible data hiding techniques for digital images are explained, and the results are analyzed [4, 5].

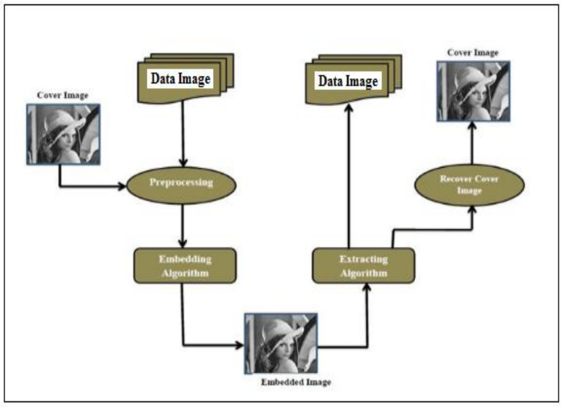


Figure1 General Block diagram of Reversible Data Hiding

## II. Related Work

Ni et al. [6] proposed a reversible data hiding method; their method uses the histogram of an original image to embed secret messages. In the histogram, they found multiple pairs of peak and zero points, where a peak point corresponds to the pixel value with a maximum number of pixels in the cover image assume and a zero point corresponds to the pixel value with no pixel in the cover image assumes. It uses a pair of peak and zero points to embed the secret messages.

Naseem et al. [7] presented an Optimized Bit Plane Splicing algorithm to hide the data in the images. This method incorporates a different approach than the traditional bit plane splicing technique. In this approach, instead of just hiding the data pixel by pixel and plane by plane, the procedure involves hiding the data based on the intensity of the pixels. The intensity of the pixels in categorized into different ranges and depending on the intensity of the pixel, the number of bits chosen that will be used to hide data in that particular plane. Also, the bits are hidden randomly in the plane instead of hiding them adjacent to each other, and the planes are transmitted sporadically, thus making it difficult to guess and intercept the transmitted data.

Zhaoxia Yin et al. [8] since there is good potential for practical applications such as encrypted image authentication, content owner identification and privacy protection, reversible data hiding in an encrypted image (RDHEI) has attracted increasing attention in recent years. In this paper, we propose and evaluate a new separable RDHEI framework. Additional data can be embedded into a cipher image previously encrypted using Josephus traversal and a stream cipher. A block histogram shifting (BHS) approach using self-hidden peak pixels is adopted to perform reversible data embedding. Depending on the keys held, legal receivers can extract only the embedded data with the data hiding key, or, they can decrypt an image very similar to the original with the decryption key. They can extract both the embedded data and recover the original image error-free if both keys are available. The results demonstrate that higher embedding payload, a better quality of the decrypted-marked image and error-free image recovery achieved.

Kuo et al. [9] presented a reversible technique that is based on the block division to conceal the data in the image. In this approach, the cover image divided into several equal blocks, and then the histogram generated for each of these blocks. Maximum and minimum points are computed for these histograms so that the embedding space can be generated to hide the data at the same time increasing the embedding capacity of the image. A one-bit change used to record the change of the minimum points.

P. H. Pawar et al. [10] use a histogram-based RDH method. In this approach, the cover image divided into several equal blocks/tiles, and then the histogram generated for each of these blocks. Maximum and minimum points are computed for these histograms so that the embedding space can be generated to hide the data at the same time increasing the embedding capacity of the image. A one-bit change used to record the change of the minimum points. This improves the level of hiding places. This technique of block division successfully enhances the data hiding capacity because the total data that can be hidden in multiple blocks is generally larger than that can be hidden in a single cover image.

Dey et al. [11] have proposed a novel approach to hide data in stego-images which is an improvement over the Fibonacci decomposition method. In this method, the authors have exploited Prime Numbers to hide data in the images. The main agenda is to increase the number of bit planes of the image so that not only the LSB planes but even the higher bit planes can be used to hide to data. This is done by converting the original bit planes to some other binary number system using prime numbers as the weighted function so that the number of bits to represent each pixel increases which in turn can be used hide data in higher bit planes. The authors have also performed a comparison of the Fibonacci decomposition method with the traditional LSB data hiding technique showing that the former outperforms the latter method and comparing Fibonacci Decomposition method with the proposed method which outclasses the former method. Also, the proposed method generates the stego-image, which is virtually indistinguishable from the original image.

Rajkumar et al. [12] Lossless data hiding is the technique of embedding data in an image and retrieval of the data with the lossless reconstruction of the original image. In this paper, we present a novel lossless data hiding scheme based on histogram modification. This technique is based on differences of adjacent pixels for embedding data and has more hiding capacity compared to existing methods. The number of message bits that can be embedded into an image equals the number of pixels associated with the peak point. Here, a histogram was shifting. proposes the differences between adjacent pixels instead of the simple pixel value considered, since image neighbour pixels are strongly correlated the difference expected to be very close to zero, at the sending side, the image is scanned in an inverse s-order as shown in figure 2 and then calculate the pixel difference between pixels and peak points of the histogram are determined

Wen-Chung et al. [13] the authors have proposed a method that segments the image into blocks of equal sizes. Also, the process involved in this method is reversible; hence there is no loss of hidden data. The approach followed in this scheme to conceal data is quite different. In this technique, the histograms of the blocks of images are taken, and they are shifted to the minimum point of the histogram, and then the data is hidden between these points. The improvement of this technique is that it provides a higher capacity to hide data than the previous method.

Jigsaw-based approach [14] used to transfer data over the communication channel securely. In this scheme, the data is fragmented in a block of variable sizes, and a message authentication code used to authenticate every piece of data. Also, every message is prefixed and suffixed with a binary one along with XOR-ing the data with the randomly generated one-time pad. By fragmenting the data, the attacker is unable to make sense of the data at the same time; he cannot access the data unless he possesses the authentication code for the data.

Soo-Chang et al. [15]. A low computational complexity noise-balanced error diffusion (NBEDF) technique proposed for embedding watermark into error-diffused images. The visual decoding pattern can be perceived when two or more similar NBEDF images are overlaid each other, even in a high activity region. Furthermore, with the modified, improved version of NBEDF, the two halftone images can be made from two total different grey-tone images and still provide a clear and sharp visual decoding pattern. With the self-decoding techniques, we can also decode the pattern by only one NBEDF image. However, the NBEDF method is not so robust to the damage due to printing or other distortions. Thus, a kernels-alternated error diffusion (KAEDF) technique proposed. We find that the two well-known kernels proposed by Jarvis and Stucki are very compatible by alternately using them in the halftone process. In the decoder, because the spectral distribution of Jarvis and Stucki kernels are different in the 2-D fast Fourier transform domain, we use the cumulative squared Euclidean distance criterion to determine each cell in a watermarked halftone image either belonging to Jarvis or Stucki, and then decode the watermark.

Furthermore, because of the detailed textures of Jarvis and Stucki patterns are somewhat different in the spatial domain, the lookup table (LUT) technique also used for fast decoding. From the simulation results, the correct decoding rates using both techniques are high and extremely robust, even after printing and scanning processes. Finally, we extend the hybrid NBEDF and KAEDF algorithms to two colour EDF halftone images, where eight independent KAEDF watermarks and 16 NBEDF.

## III. SIMULATION TOOL MATLAB

MATLAB (an abbreviation of "matrix laboratory") is a multi-paradigm numerical computing environment and proprietary programming language developed by Math Works. It allows matrix manipulations, data, implementation of algorithms, creation of user interfaces, plotting of functions, interfacing with programs written in other languages. It is intended primarily for numerical computing; an optional toolbox uses the MuPAD symbolic engine allowing access to symbolic computing abilities. An additional package, Simulink, adds graphical multi-domain simulation and model-based design for dynamic and embedded systems. It is simulating on MATLAB, and for this work, we use

Intel Core 2 is the processor. Matlab setup may be a high-level language, and technical calculate and interactive surroundings for algorithmic program development, information visualization, records analysis, and numeric computation MATLAB may be a software system program that permits you to try to information manipulation and visualization, calculations, mathematics and programming. It is wont to do easily moreover as terribly subtle tasks. Image procedure function provides a comprehensive set of reference normal method graphical tools for image process, analysis, visualization, and algorithmic program development. You'll be able to perform image improvement, image declaring, feature detection, noise decrease, image segmentation, abstraction transformations, and image registration. Several functions within the tool case are multithreaded to require good thing about multicore and digital computer computers. The Performance analysis of MATLAB used for these thesis simulation results of image process provides processor optimized libraries for quick execution and image computation. It uses its JIT (just in time) compilation technology to produce execution speeds that rival ancient programming languages. It may also more advantage of multicore and digital computer computers, MATLAB gives several multi-rib algebras and numerical perform. These functions mechanically execute on multiple procedure thread during a single MATLAB session, enabling them to execute quicker on multicore computers. During this thesis, all increased pictures results were performed in MATLAB to induce AN increased results of a compressed and decompressed image, and once colourization of a decompressed image, image quality and numerical price once analysis. To check the planned technique, Simulation victimization MATLAB performed on input pictures. A simulation tool is that the language and interactive environment utilized by many engineers and scientists worldwide. It lets them explore and visualize ideas and collaborate across completely different disciplines with signal and image process, communication and computation of results. MATLAB provides tools to accumulate, analyze, and visualize information, change you to achieve insight into your information during a fraction of the time it might take mistreatment spreadsheets or ancient programming languages. It may also document and share the results through plots and reports or as revealed MATLAB code.

## IV. RESULTS ANALYSIS

Experimental1: *(a)* Image data hiding (watermarking) technique are an evaluation of the image quality low and also called low robustness vital issue. The image quality low and also called low robustness of reconstructed original images can be evaluated in terms of PSNR and MSE in objective evaluation, statistical properties considered. By adjusting the parameters, robust can be achieved for image data hiding algorithm against the attack and also secure to an unauthorized person. In jpg standard format image used like aarogya setu_logo data image and AIIMS hospital Bhopal cover image. Aarogya setu_logo data image (in size 300x168, 4.26KB) and AIIMS hospital Bhopal cover image (in size 1283x500, 169KB) analysis on base MSE and PSNR.

*(b)* Aarogya setu_logo data image and AIIMS hospital Bhopal building cover image analysis on base MSE and PSNR.

Table 1 Robustness comparisons between ERDHT and PBCT using AIIMS hospital Bhopal building image.

| Technique | Experimental images | MSE (in db) | PSNR (in db) |
|---|---|---|---|
| ERDHT | AIIMS hospital Bhopal (1283x500) & Aarogya setu_logo as data image (300x168) | 0.03175 | 34.931 |
| PBCT | | 0.00013416 | 89.597 |

Figure 2 Robustness comparisons between ERDHT and PBCT using AIIMS hospital Bhopal building image

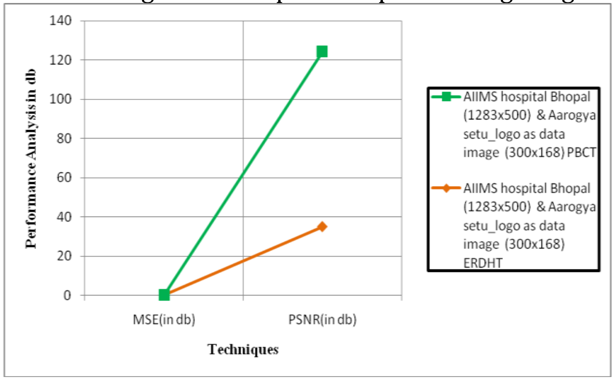
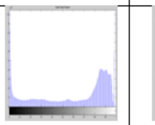
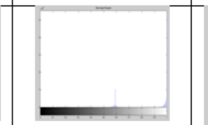
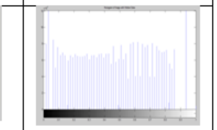
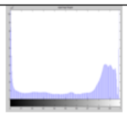
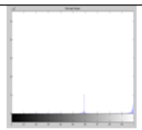
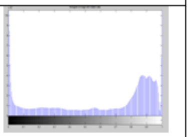


Table 2 Histogram comparison between ERDHT and PBCT based on Experimentation1

| Technique | Cover image convert into Histogram | Data image convert into Histogram | Data image hiding insert into cover image then generate Data Hiding Histogram |
|---|---|---|---|
| ERDHT |  |  |  |
| PBCT |  |  |  |

*(c)* Result graph between ERDHT and PBCT

Data image as Aarogya setu_logo and AIIMS hospital Bhopal building image as a cover image both are embedding and also convert into histogram get data hiding image. Embedding process time MSE in PBCT is less compare to ERDHT. Data were hiding image a logo image as an original image extract in Aarogya setu_logo image and AIIMS hospital Bhopal building image as a host image. In this process, PSNR value in PBCT is high as compare to ERDHT.

*(d)* Robustness comparisons between ERDHT and PBCT based on Histogram Analysis.

## V. CONCLUSION

Image authentication based on reversible image data hiding technique and proposed binary change technique (PBCT). The graph value of proposed binary change technique output shows that it has less or minimal disturbances meaning that the viewer gets the best and enhanced quality of image and data. Reversible data hiding in an encrypted image is getting more attention these days because of security maintaining requirements. Reversible data hiding techniques are getting popular because of the reversibility of the carrier medium in the receiving end after extraction of secret data. In this paper, different types of reversible data hiding techniques for digital images least significant bit substitution, HSBT, histogram modification each studied, analyzed and compared. The learning results show each method has its advantage and disadvantages, and the focus of all methods is on a high payload with less degradation of data and low robustness. The performance can be evaluated by determining the visual quality of the image and by determining the PSNR of an algorithm. Data hiding in encrypted images provide more security for the image data performed with the high demand of image in various fields researchers get attracted for analysis. As unfavourable weather condition makes high data lose, so recovering in those is done by extracting features from the image. It also obtained that colour and edge feature plays a vital role in image data hiding. Here the frequency-based watermarking technique is good for invisible embedding. Still, insufficient data embedded in the image without lossless and reversible data hiding techniques; more efficient data embedding can be done in encrypted images. The concept of data hiding and their applications in the security of digital data communication across a network studied in recent methods in reversible data hiding is presented. Proposed technique the original image can be exactly recovered without any additional information. Hence the proposed approach has made the image enhancement reversible, high PSNR, low MSE, and also improving the robustness.

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