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Enhanced BTC and AMBTC using image Steganography

Rituraj Rusia

Ph.D. (CS) Research Scholar,
MGCGVV, Chitrakoot (MP) India

Bharat Mishra

Associate Professor,
Deptt. of Physical Science,
MGCGVV, Chitrakoot (MP) India

R.K.Tiwari

Professor and Head,
Deptt. of Physics, Govt. M. S. Golwalkar College, Rewa (MP) India

Abstract: This paper compares the performance of BTC and AMBTC through image processing (IP). The proposed plan is implemented in MATLAB platform using the preferred steganography set of regulations. In this paper we used block truncation coding to achieve compression while preserving some sample moments. We also used absolute moment block truncation coding (AMBTC). We found that AMBTC represent the better performance value than BTC in the terms of PSNR and MSE.

Keywords: Image Steganography; BTC; AMBTC; PSNR; MSE.

I. Introduction

Data communication is the basic need of every growing area in all over world. At the time of data transmission, data security is very important, so that it could be accessed only by the authorized person. In cryptography technique, the message is encoded into another message, such that only the sender and receiver knew the way to decrypt it.

Steganography is a high powerful security provider. Good imperceptibility and sufficient data capacity are two properties which should be possessed by all the steganography techniques [1][2]. It is an intelligent technique to hide secret information in hosting media to protect it from indiscernible by unauthorized access or the intruder, in a manner of complete silence and deceptive which make hosting media carry and secret data [3]. To overcome this limitation, the steganography technique was introduced. In steganography, various techniques are used. The techniques are LSB, Data Compression, Masking and Filtering, Distortion Technique, etc. are used.

During the transmission of data over the network, bandwidth utilization became a major issue. It is a time to use the compressed images as cover image for data hiding for consuming less bandwidth. The Compression techniques may be categorized widely into loss or lossless compression. Loss compression preserve a higher compression ratio, because it permits a few adequate degradations. BTC is a popular image compression technique among the minimum calculation complexity, although its compression ratio is usually low. AMBTC gives better performance than BTC because it reserves the sample mean as well as the model initial complete middle instant. So, the AMBTC has been used in the image compression [4]. In the AMBTC compressed image, reversible data hiding scheme is applied in which each block is compressed into two quantization levels and a bitmap.

II. Literature review

A large number of data compression algorithms have been developed and used. A brief review of the literature in proposed here.

Ryan A. Subong, et. al. (2018), studied the image steganographic technique in which the small data of private message swap the smallest giant sample of the RGB unit of duvet figure similar to most of LSB image steganography techniques [5]. Muhammad Arslan Usman, et al. (2018), studied the brand original image steganography method designed for protecting clinical information. The outcomes display the future techniques that make sure the privacy and confidentiality of patient information even as keeping imperceptibility [6]. Sanjay I. Nipani, et. al. (2017), studied the image steganography that make use of picture as front media to grasp the secrecy notes with an excessive high protection. The research paper offers the techniques which hides the manuscript information

within the figure. A DWT utilizes the value of characteristic which establishes a function to endure embedding [7]. Sunil Kumar Yadav, et. al. (2017), have studied the 2-DWT, SVD and FFT in steganography methods. The outcomes totally depend on PSNR, SNR, WPSNR, Structural Content and MSE to determine the image function for future technique and final results evaluation through previous processes of hidden data [8].

Himani Trivedi, et. al., (2017), have put into practice of hiding secret message. Study gives review of various video steganography strategies, they pointed out that if we work on hybrid of spatial and frequency domain method then we can achieve high security, high capacity and robustness to data [9].

Ramadhan J. Mstafaet. al. (2016), have presented, a rigid and conserve video steganographic algorithm within the DWT and DCT technique that rely on Multiple Object Tracking technique and ECC [10]. AlaviKunhuet. al. (2016), proposed, the record mapping based on hybrid DWT and DCT colour watermarking techniques for video files [11]. Ch. Sathi Raju et. al. (2016), presents the hybrid DCT and DWT compression techniques are used toward exploit the benefits of pairs methods. The technique includes to create color information of the white band and restricted band pictures in a halfway arrangement and after that producing the decompressed picture. The excellence of reduce image is calculated the state of MSE, SNR and PSNR [12].

Kapde S.K., et. al. (2012), have presented that BTC and AMBTC are lossy image compression algorithm which are straightforward and simple to execute the image compression method. The basic BTC and AMBTC are an image compression technique which usage a Q level quantizer to quantize a given region of the image. Both of two techniques depend on the implementation of the image divided into non-overlapping blocks. They differ in reducing the level of redundancy in different ways. [13]. Somasundaramet. al. (2012), presented the comprehensive description of AMBTC to condense images. AMBTC, have pairs of quantizers utilized and thus pixel of restructure chunk obtain each one of the two quantizers. In general, the elements of a bitplane of size 1 bit are used in the variants of BTC. But in this method it has been extended to two bits. Compressed has also been raised from 2 to 4. So, the quality of the reconstructed images has been improved significantly from 33.62 to 38.12 with the increase in bpp by 1. [14].

Santosh D. Harihara, et. al., (2013), presented the AMBTC intended for color or gray image compression correspondingly. The compression approach decreases the estimated density and get optimal MSE and PSNR which is enhanced version of BTC, acquire with maintain total moments. The AMBTC is a coding methods which conserve the spatial aspect of digital images as attained sensible compression proportion. Recommended innovative approach to compression 3 color images by using AMBTC [15]. J. A. Garcia, et. al. (2003), A novel technique to obtain an optimal compression ratio for lossy coding based on the relationship between information theory and test hypothesis problem. The best achievable compression ratio determines a range between the source fidelity and the coding rate between the qualified and non-acquired areas in the trade-off. The resultant performance is bound to be directly achieved by a creative process, as suggested in a theorem, which relates the relationship between the best achievable compression ratio and the Kullback-leibler information benefit [16].

III. Proposed Methodology

Image Steganography is explained as message or document which can be transferred in excess of the network secretly and securely. The original image can be lossless reconstructed at the receiver after extracting the secret data. If the difference between the reconstruction values does not exceed the defined threshold, the secret data is hidden into the bitmap of the currently processed image block. Otherwise, no secret data is being hidden and the currently Processed image block is remained unchanged.

a. Absolute moment block truncation coding:

In this scheme, an image is first decomposed into some non-overlapping $k \times k$ -sized sub-blocks, such as 2×2 , 3×3 or 4×4 and so on. The block size, k is often set to be 4 in the conventional AMBTC encoding scheme. For subblocks, sample mean pixel value, $\bar{x}$ and sample absolute central moment, $\bar{\alpha}$ are described in below equation [17].

$$\bar{\alpha} = 1/m \sum_{i=1}^m |x_i - \bar{x}|$$

Where x_i denotes the pixel value of non-overlapping blocks and m denotes the number of pixels in each block i.e. 4×4 . Quantization levels are calculated from

$$\begin{aligned} a &= \bar{x} - (\bar{\alpha}/2) \cdot m/(m-q) \\ b &= \bar{x} + (\bar{\alpha}/2) \cdot m/q \end{aligned}$$

Where q denotes the number of pixels larger than the block mean value. Lastly, the 4×4 bitmap C of the block pixels is written as

$$C = \begin{cases} 1 & \text{if } x_i > \bar{x} \\ 0 & \text{otherwise} \end{cases}$$

The two quantization levels and bitmap $\{a, b, C\}$ are transferred to the receiver side. On the receiver side, block can be recovered with the help of a, b and C .

b. Block Truncation Coding for Color Image

For a gray level image, 128 bits are needed for a block of 4×4 . But only 32 bits are needed in the same block size after processing with BTC. Bits needed in original color image and BTC compressed color image are 384 and 96 respectively. Due to the low complexity and low compression rate, BTC can be used in the embedding phase for color image. The processing of the BTC is as follows. First, divide the color image into non-overlapping blocks sized $n \times m$ for the Red, Green, and Blue plane, respectively. Mean value per block in three dimensions can be calculated as,

$$\bar{B}_i^{(R,G,B)} = \frac{1}{n \times m} \sum_{p=0}^{n-1} \sum_{q=0}^{m-1} b_i^{(R,G,B)}(p, q),$$

where, $\{R, G, B\}$ represents the Red, Green and Blue planes, n and m represent the height and width of the block, B_i represents the i -th block in the color image [18].

The proposed process is shown in the Figure-1.

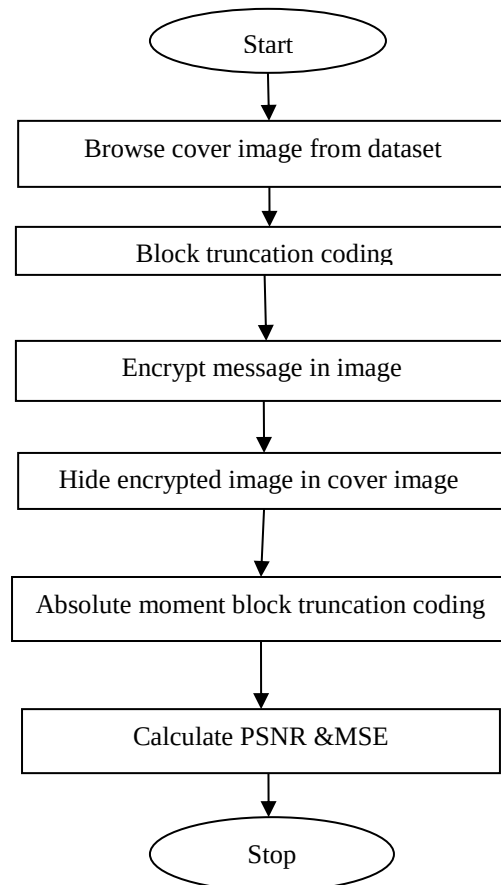


Figure-1: Block dig of Propose Process

Our image is divided into blocks of $n \times n$ pixels. The individual blocks are quantized the resulting block has the same sample mean and the same sample first absolute central moment of each original block. The mean value contains information about central tendency; this is the same central tendency information in the original BTC. But in propose method, the sample first absolute central moment contains information about dispersion about the

mean. Therefore, two of the most important local characteristics of the spatial block grey levels are preserved: central tendency and deviation from the center.

Proposed Algorithm

Step1: Browse a cover image to from the dataset.

Step2: Apply Block Truncation Coding (BTC).

Step3: Encrypt message in image.

Step4: Hide encrypted image into cover image.

Step5: Then use technique for AMBTC.

Step6: image quality.

Step7: Calculate PSNR and MSE value of image steganography result analysis work.

$$PSNR(x) = \frac{10 \log((double(m).^2))}{MSE(x)}$$

Where m = maximum value of the Cover Image

IV. Result & Discussion

The proposed scheme is implemented in MATLAB platform using standard BTC and AMBTC techniques for steganography algorithm and using JPEG compression. MATLAB incorporate the requirements of an image processing studies because of its inherent traits and helps to solve issues with matrix and vector formulations. When we run the MATLAB code using proposed algorithm the first menu displayed is as follows (Figure-2).

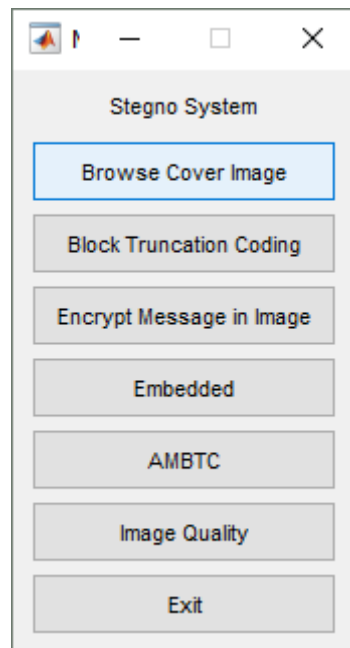


Figure-2: Menu bar displayed during runtime.

When we select the first case “Browse cover image”, a browse window is appeared on the screen. After selecting image, the following cover image is appeared on screen (Figure-3).



Figure-3: Original cover image which is selected from dataset.

In the cover image, a LSB bit to be substituted like 1. The cover image is appeared on the screen using LSB bit substituted by 1 (Figure-4).

Enter the no of LSB bits to be substituted: 1



Figure-4: After applying LSB Bit

When we select the second case “Block Truncation Coding”, LSB bit image is shown as (Figure-5).

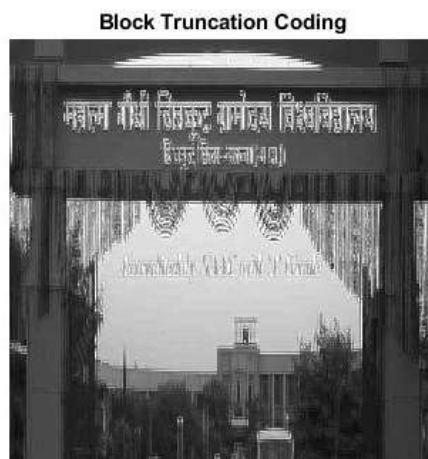


Figure-5: After applying Block Truncation Coding

When we select the third case “Encrypt message in Image”, the encrypted image is shown as (Figure-6).

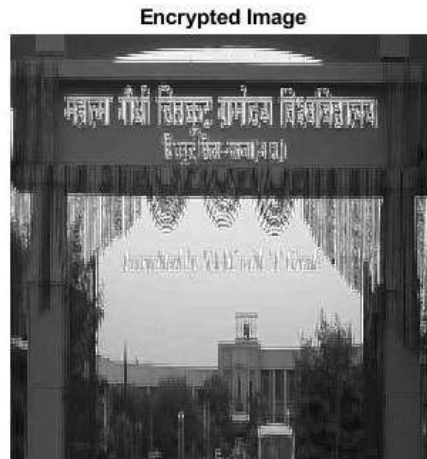


Figure-6: Encrypted Image

When we select the fourth case “Embedded”, the embedded image is shown as (Figure-7).

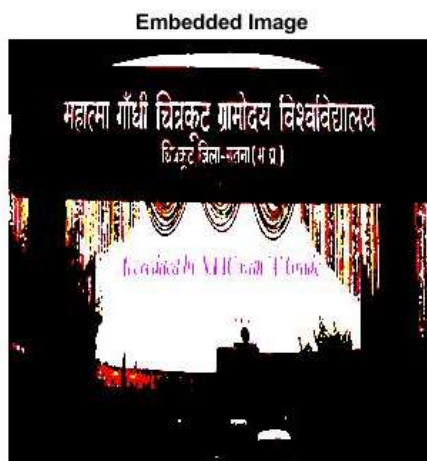


Figure-7: Hide Encrypted Image into cover image.

When we select the fifth case “AMBTC”, the AMBTC compressed technique is applied and AMBTC compressed image is shown as (Figure-8).

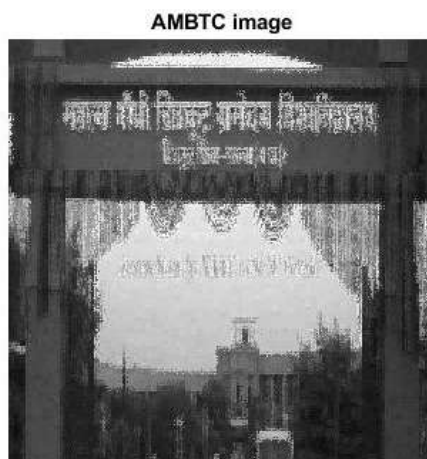


Figure-8: After applying technique AMBTC image.

When we select the sixth case “Image Quality”, the image quality is shown as

Mean Square Error = 840.0735

Peak Signal to Noise Ratio = 22.6652

When we run the MATLAB code for extraction, a browse window appeared on the screen for selecting embedded image. After selecting embedded image, second browse window appeared on the screen for selecting encrypted

image. After selecting encrypted image, the extracted image is shown as (Figure-9) and extracted text is shown on the screen.

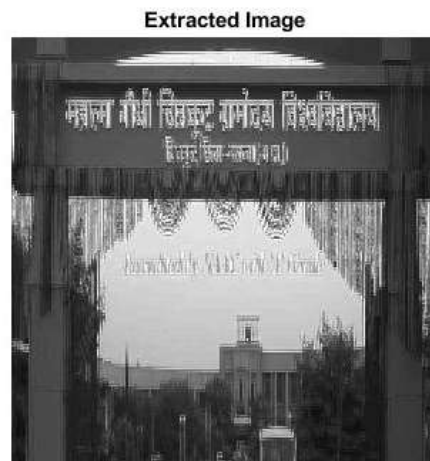
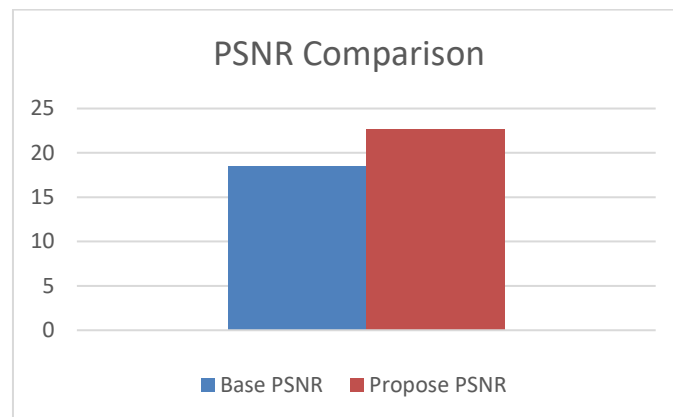


Figure-9: Extracted image.

Table1. Comparison between base and Proposed PSNR

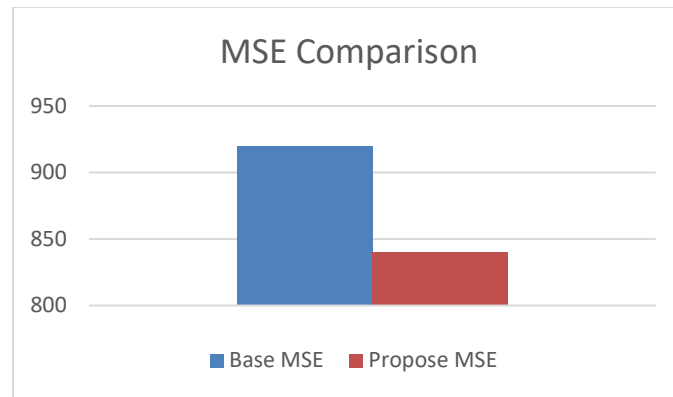
Base PSNR	Proposed PSNR
18.4937	22.6652



Graph.1 Comparison between base and Proposed PSNR

Table2. Comparison between Base MSE and Proposed MSE

Base MSE	Proposed MSE
919.8323	840.0735



Graph.2 Comparison graph between Base MSE and Proposed MSE

From the above analysis we found that the proposed algorithm enhances the PSNR. We have also compared the base MSE and proposed MSE. We observed a significant decrease in MSE.

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