

# CT-Scan Image Compression Using BTC Method with Square Truncation Block

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**ABSTRACT:** Digital images are in general stored in memories, preprocessed, transmitted and reprocessed for final applications. The quantum of binary data to be handled by an image processor is enormous. The problem of how one stores and transmits a digital image has been a topic of research for more than 40 years and was initially driven by military applications. BTC based algorithm is designed to compress the biomedical CT-scan image. A new application of block truncation coding (BTC) is presented to compress gray as well as rgb CT-scan images with square overlapping truncation matrix. The compressed image characteristics parameters such as signal to noise ratio (SNR), peak signal to noise ratio (PSNR), root mean square error (RMSE), and mean absolute error (MAE) with respect to original images are computed.

**KEYWORDS:** CT-Scan, BTC, Image Parameter, SNR, PSNR.

## I.INTRODUCTION

One Bio medical imaging is the technique and process of creating visual representations of the interior of a body for clinical analysis and medical intervention. Bio medical imaging seeks to reveal internal structures hidden by the skin and bones, as well as to diagnose and treat disease. Bio medical imaging also establishes a database of normal anatomy and physiology to make it possible to identify abnormalities. Although imaging of removed organs and tissues can be performed for medical reasons, such procedures are usually considered part of pathology instead of bio medical imaging. It includes the analysis, enhancement and display of images captured via x-ray, ultrasound, MRI, nuclear medicine and optical imaging technologies [1]. As a discipline and in its widest sense, it is part of biological imaging and incorporates radiology which uses the bio imaging technologies of X-ray radiography, magnetic resonance imaging, medical ultrasonography or ultrasound, endoscopy, elastography, tactile imaging, thermography, medical photography and nuclear medicine functional imaging techniques as positron emission tomography. Measurement and recording techniques which are not primarily designed to produce images, such as electroencephalography (EEG), magneto encephalography (MEG), electrocardiography (ECG), and others represent other technologies which produce data susceptible to representation as a parameter graph vs. time or maps which contain information about the measurement locations. In a limited comparison these technologies can be considered as forms of bio medical imaging in another discipline.

The use of medical imaging techniques has transformed healthcare over the years, providing tools for better visualization, accurate diagnosis and determining proper treatment for a variety of disorders including that of the neurological, cardiovascular, gastrointestinal, reproductive, endocrine, respiratory and immunological systems. However, it is vital to the health and wellbeing of patients, as well as the healthcare system, to be properly informed about the use, benefits and risks associated with each imaging technique. More importantly, communication between patients, practitioners, and healthcare facilities is essential to help reduce the use of repetitive testing, minimize the risks associated with each technique. Medical imaging can now play a central role in the global healthcare system as it contributes to improved patient outcome and more cost-efficient healthcare in all major disease entities. Medical imaging has an important role in the care of all organ systems and disease entities, and better and increased medical imaging research may benefit the entire process of health and disease management, including: prevention, individual risk assessment, screening targeted subpopulations with increased, risk of specific disease entities, early detection of subclinical disease, optimal choice of treatment based on personalized medicine, image-guided minimally invasive surgery and interventions, prognosis, non-invasive monitoring of treatment effects for response-adjusted treatment in

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 7, July 2016

case of poor response, patient follow-up to adjust multidrug therapy in chronic disease, early detection of recurrence and decision making tool for treatment [1].

With the continuing growth of modern communication technology, demand for image transmission and storage is increasing rapidly. Advanced in computer technology for mass storage and digital processing have paved the way for implementing advanced data compression techniques to improve the efficiency of transmission and storage of images. Applications of data compression are primarily in transmission and storage of information [3]. Typically, a compressed image when decoded to reconstruct its original form will be accompanied by some distortion. The efficiency of a compression algorithm is measured by its data compression ability, the resulting distortion and as well by its implementation complexity. The complexity of data compression algorithms is a particularly important consideration in their hardware implementation image transmission application are in broadcast television, remote sensing via satellite, aircraft, radar, sonar, teleconferencing, computer communication, facsimile Transmission.....etc. image storage is required most commonly for education, and business document, medical image used in-patient monitoring system....etc. because of their wide application, data compression and coding schemes have been of great importance in digital image processing application of data compression is also possible in the development of fast algorithms where the number of operation required to implement an algorithm is reduced by working with the compressed data.

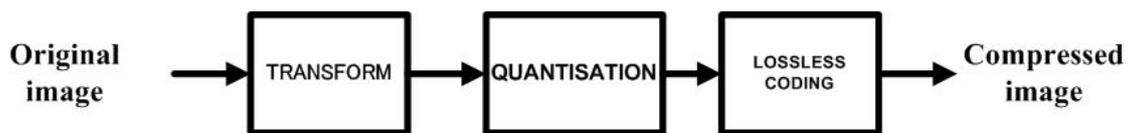


Fig.1. Image compression model

## II.METHODOLOGY

The research work is carried to compress biomedical gray scale image (CT-Scan images) using Block Truncation Coding (BTC) technique. The work is divided into two major parts. The main goal of image compression is to reduce redundancy in the image as much as possible. Block Truncation Coding (BTC) is one of the simple and easy to implement image compression algorithms. The size of truncation matrices ranging from 8 bit to 256 bit with step size of 8 bits. Figure 2 shows basic steps of BTC algorithm.

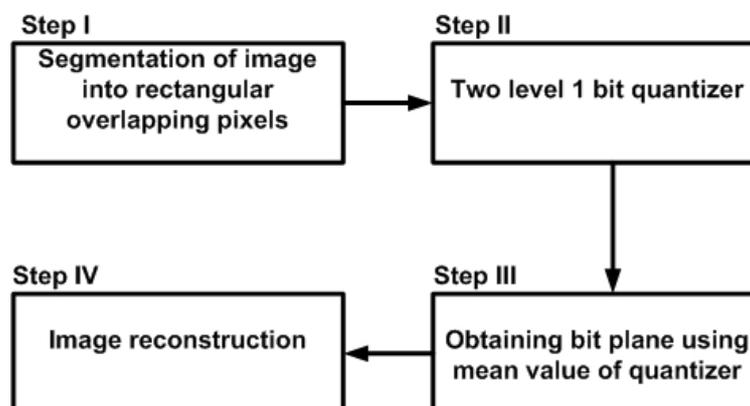


Fig.2 Steps involve in BTC coding.

In second part various image characteristic parameters such as signal to noise ratio (SNR), peak signal to noise ratio (PSNR), root mean square error (RMSE), and mean absolute error (MAE) are estimated for compressed image with respect to original image. Compressed image degrade the quality of the image which needed to be investigated. Root mean square error (RMSE) corresponds to pixels in the reference image  $I_r$  and the fused image  $I_f$ .

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(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 7, July 2016

### III. RESULT AND DISCUSSION

BTC based CT-scan image compression is carried out to estimate the compression ratio and image quality parameters. Square truncation matrixes are used ranging from 8bit to 1024 bits. Figure 3 shows the original CT-scan image used for compression.



Fig. 3 CT scan image used in the research work.

The capability of BTC based compression depends upon the complete coverage of image by truncation matrix. Various iteration of truncation matrix such as 8x8, 16x16, 24x24....., and 1024x1024 are taken and compressed output images are obtained. Table 1 shows the size of compressed image size with respect to truncation matrix size. It can be observed from the values in Table 1, as the size of truncation matrix is increased, high compression ratio is obtained. But it severely effects the visualization of the image.

Table 1 Size of compressed image w.r.t square truncation matrix in BTC.

Truncation Matrix		O/P Image Size Kb	Truncation Matrix		O/P Image Size Kb
M	N		M	N	
8	8	467	144	144	386
16	16	470	152	152	399
24	24	471	160	160	376
32	32	453	168	168	377
40	40	454	176	176	383
48	48	436	184	184	388
56	56	435	192	192	380
64	64	422	200	200	382
72	72	423	208	208	371
80	80	412	216	216	378

# International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 5, Issue 7, July 2016

88	88	414	224	224	363
96	96	407	232	232	365
104	104	404	240	240	376
112	112	400	248	248	395
120	120	405	256	256	362
128	128	393	512	512	309
136	136	397	1024	1024	228

In order to monitor the information content of the image various image characteristics parameters are computed. The traditional BTC method has been applied to CT-Scan image and the performance parameters such as PSNR, SNR, RMSE, and MAE have been estimated and compared. It is seen that as the block size is increased for processing, the visual quality of the image degrades rapidly with severe blocking artifacts and blurred edges. As the compression of the images increases the characteristic parameters such as PSNR and SNR decreases whereas RMSE and MAE value of compressed image with respect to original image. It is concluded from the results that with truncation matrix size of 256 x 256, acceptable range of image characteristic parameter value and good visualization of compressed image is obtained.

## IV.CONCLUSION

Block Truncation Coding (BTC) is an apparently elegant and efficient time-domain compression technique. BTC is attractive in many applications that require low complexity and moderate data rates. BTC involves replacing the original intensity value of each pixel in a block either by a 'low mean' intensity value 'a' or a 'high mean' intensity value 'b' based on a threshold intensity value. The pixel range for square truncation was 8 x 8 to 512 x 512. It was observed from the results that the compression of image using rectangular truncation matrix is lower as compared to square truncation matrix. With lower truncation matrix i.e. 8x8 size of compressed image is 467 Kb. Similarly for higher value of truncation matrix 1024 x 1024 size of compressed image is 228 Kb.

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