International Journal of
Emerging Research in Management &Technology
ISSN: 2278-9359 (Volume-4, Issue-4)

Research Article | **April 2015**

Block Truncation Encoding For Image Compression Technique

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Abstract:

This document provides the investigation on Compression of gray-level images by using Block Truncation coding Technique. Block Truncation Coding (BTC) is also known as a moment preserving compression technique. Block truncation coding (BTC) technique has paying attention throughout the last few years as a simple source encoding technique to achieve better quality image reproduction. It is basically follows the concept of lossy Image Compression. This document provides the comparative study of BTC technique and proposed a method that is based on Block Truncation algorithm for image compression, in a suitable manner of algorithm.

Keyword: Block Truncation coding (BTC), Quantization, Moment Preserving (MP) gray scale image

I. INTRODUCTION

Block truncation coding (BTC) is a very simple and fast lossy Image Compression Technique for digitized gray scale images. This technique introduced by Delp and Mitchell. Delp E.J et al , [1]. The basic concept behind of Block Truncation coding is to perform *moment preserving* (MP) quantization for particular blocks of pixels by which the quality of the image data will remain acceptable and requirement of storage space will decrease. Pennebaker W.B. et al [2], The Compression of image data grows continuously day by day. Because large storage and high bandwidth needed to transmits for large size of images. This is quite costly. Therefore the compression of images is very essential. Mohammed M, et al [3]. The BTC compression technique is the lossy image compression technique. It is apply simple method on monochrome images, which involves less complexity of computational.

The basic algorithm of Block Truncation encoding preserves the standard deviation and the standard mean on the Image data. Eskicioglu A. M et al,[4].

Basically the Block truncation algorithm divides into separate task that is

1). Performing the Quantization
2).Coding the Quantization
3). Bit plan Reduction

Each part of algorithm is analyzed also separately. The quantized data of image block can be expressed by two statistical values that are standard mean and standard deviation. The standard deviation represents the variation quantity and standard mean represents the mid value of a block of the pixels Franti P et al, [5].

Block encoding is suitable for applying on different variety of blocks. May be one image have combination of text block, picture block, smooth block. The smooth block is very flat and contains a single colour, text may fill by solid multi colours and picture block have different intensity value. [6]

II. WORKING OF BLOCK TRUNCATION ENCODING

Block truncation coding (BTC) is a fast and effective lossy image compression technique for gray scale images or black and white image. In this technique, an image is firstly segmented into small blocks size of pixels that is 4 x 4 or other size as 8 x8 and so on as per requirement by the help of quantization then reducing the number of gray levels within each block.. Block Truncation Coding (BTC) technique is proposed in 1979 for compression of grayscale images. Bansod. S.et al, [7].

Performing the Quantization step involves the dividing the images in smaller set from large set is known as quantization and selecting the threshold pixel value from image.

The second step is Coding the Quantization, encode the given quantization data of an image block. Before sending data to encoder, there must be important choice of which data should be encoded. Standard BTC have two alternative approaches for sending the quantization data to the decoder

a). The first approach the quantization data is describe by two statistical values that is mid –value and variation quantity

b). other one is to compute the quantization levels. In this approach one can decrease both the computation and the quantization error computation needed at the decoding phase.

Next step is Reduction in bit plan; use less bit plan for representing quantized data.

Above are the three basic steps of standard Block Truncation Coding (BTC). The basic block diagram of BTC technique is as following.

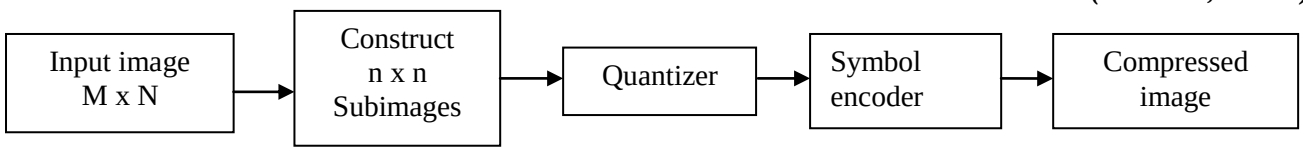

Fig 1. The Basic block diagram of BTC for image compression

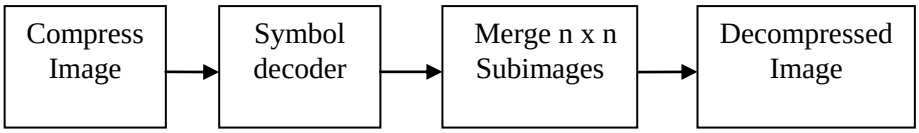

Fig 2. The Basic block diagram of BTC for image decompression

Advantages of Block Truncation Coding
1. Block Truncation encoding is very fast encoding of lossy image compression technique.
2. Block Truncation Encoding requires little memory space
3. BTC technique easy to implement
4. Standard BTC involves less computational complexity.
5. This technique very less prone to transmission errors.

Disadvantages of BTC
1. It required high bit-rate when compared to method like
Vector quantization and discrete cosine transform etc
2. Blocky appearance in the reconstructed image in some cases □

BTC Algorithm
Setp1. Input images divide into several non overlapping block of size n x n. For example 4 x 4 or 8x8 and so on.
Step 2. Compute the two statistical values $\bar{x}$ (mean) and σ (standard deviation). Both values are calculated for each block of Image by using following equations.

A) $x = 1/n \sum_{i=1}^{n} \quad x_i$

B) $\sigma = \sqrt{1/n} = \sum_{i=1}^{n} \quad (x_i=\bar{x}_i)$

Here x_i represent the i_{th} pixel value of the image block and n is represents total number of pixel in particular block
Step3. The $\bar{x}$ and σ are termed as a quantizers of this technique. The $\bar{x}$ is the threshold value of presenting bit plan and obtained by comparing each pixel value of image with defined threshold value.

$$B = \begin{cases} 1 & x_i \geq \bar{x} \\ 0 & x_i \leq \bar{x} \end{cases}$$

Here block of pixel is represents as a B
"1" to represent a pixel whose gray level is grater "0" to represent a pixel whose gray level is less
By this process each block reduce the bit plan.
Step 4. In decoding phase encoded block are reconstruct by replacing 1 as H (high intensity) and 0 as a L (low intensity) which are given by as follow.
$H=\bar{x}+ \sigma \sqrt{p/q}$
$L=\bar{x}+ \sigma \sqrt{q/p}$
Where p and q are the number of 0's and 1's in the compressed bit plane respectively.

Modified Block Truncation Algorithm
The basic scheme of Block Truncation encoding to improve the system working and performance and also decrease the memory that is obtain by BTC passed images This manuscript proposed some modification in Block Truncation Encoding scheme; this modification provides prime improvement in compression rate of image data.

Proposed Algorithm
Block Truncation Coding suitable for gray scale images (black and white),if input image is RGB image, it should be convert into gray scale image then apply compression technique on it. The proposed algorithm is quite simple method and also easy to understands. It includes the several MTLAB syntaxes for compression and array for saving resulting value.

Compression

Step1. Input and read the Image for Compression If source image is coloured image it convert into gray scale image from following MATLAB syntax

I=imread (img);

I=rgb2gray (I);

Here I is representing an image, "**rgb2gray"** command helps to convert image into gray scale and imread is reads images.

Step2. Define the block size and divide the source image into several block of same size, the block size may be 2x2 or 4x4 block.

Step 3. This step is matching step. Here consider 2x2 blocks that is only 2 row and 2 columns from entire image and matches the intensity value of pixel.

If: Intensity value of first block and second block is same then saves only the first vector value of block in array and increment by 2 .

For example: 2x2 block of image is as following.

1,1	1,2
2,1	2,2

And second block with different intensity

1,3	1,4
2,3	2,4

Same intensity A = $\begin{bmatrix} \mathbf{i} & \mathbf{j} \\ 1 & 1 \\ 1 & 3 \end{bmatrix}$ here i is represents rows and j is represents columns

Else: The intensity in not matched of first two pixels of block then save each vector value of image block in another array that is as following

4,5	4,6
5,5	5,6

Not same intensity B = $\begin{bmatrix} \mathbf{i} & \mathbf{j} \\ 4 & 5 \\ 4 & 6 \\ 5 & 5 \\ 5 & 6 \end{bmatrix}$ here i is represents rows and j is represents columns

NOTE: By this, whole image will be saving in a two different array. The same intensity pixel's vector value will be save into array titled as "Same intensity A" and different intensity pixel's vector value will be save into array titled as "Not same intensity B ". By which all the pixel value of source image is save in a array.

Step4. Reduce the size of array by join the more than two rows with same pixel intensity value and different column value in a single row of array. Example of merging of row is as following.

Sa = $\begin{bmatrix} i & j & R & G & B \\ 14 & 20 & 66 & 66 & 66 \\ 14 & 22 & 66 & 66 & 66 \\ 14 & 24 & 47 & 77 & 98 \\ 14 & 26 & 47 & 77 & 98 \\ 14 & 28 & 47 & 77 & 98 \\ 14 & 30 & 92 & 48 & 50 \end{bmatrix}$ after merging rows with same intensity value Sa = $\begin{bmatrix} i & j & R & G & B \\ 14 & 20 & 66 & 66 & 66 \\ 14 & 24 & 47 & 77 & 98 \\ 14 & 30 & 92 & 48 & 50 \end{bmatrix}$

Here i represent the particular row in image and j represents the column, RGB is respectively Red Green Blue value of exacting position of image.

Decompression

Step1. Firstly check the both compressed array that titled as 'sa' array and 'nsa' array and acquire the size of image.

Step2. Construct the vacant array titled as reconstruct array for reconstruction of compressed image.

Step3. Scan both compressed array and value put into reconstruct array.

Step3. For reconstructing compressed image

I. Build first row (i^{th} row) of compressed image with putting pixel value of image block from compressed array to vacant array.

II. Construct $i+1^{th}$ row then next row till the end of the row.

Step 4. The step 3 is repeated until vacant reconstruct array fill by pixel value from compressed array.

Step 5. The Reconstruct array is store as a decompressed image.

Step 6. Display the decompressed image file

III. CONCLUSION

A proposed approach for gray scale Image Compression based on the existing Block Truncation Encoding standard, this document presents the review of Block Truncation Lossy Image Compression Technique (BTC). This manuscript provides step by step explanation of BTC and also presents a new algorithm for compression of gray scale images which achieves better results than the existing methods .The proposed algorithm inherit the methodology of existing BTC technique that is apply on 2x2 block or 4x4 block of source image for compression and produce compressed images that is suitable for transmitting over the internet easy to store, easy to maintain because of small size.

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