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Lossy Image Compression using Novel Block Truncation Coding in Public Cloud

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Abstract: *This Paper provides the Research gap in E-Learning resource environment deals with more space complexity. In this paper is modified the existing block truncation coding algorithm. The proposed algorithm is a one that is efficient acquires the less space as well as the speed is increased on cloud by showing the experimental results and comparison of this image.*

Keywords: BTC, E-learning, Cloud and Image Measurements

I. INTRODUCTION

The image plays an important role in the digital world to convey the message mainly in e-learning. While using the images in e-learning, the size should be low. Hence, the image compression is the necessary one for storing and transmission in the cloud. Particularly, E-Learning resource environment deals with more space complexity. The E-Learning storage space complexity can be reduced with the help of image compression techniques. There are different types of image compression techniques invented for building compressed resources. There is deviation in the following parameters PSNR, CR, MSE, SNR and computation time in the existing methodologies. The drawbacks of previous methods overcome by our new method for efficient storage in Cloud environment.

II. BTC TECHNIQUES FOR IMPROVED DISPARITY IN IMAGE

To improve the nature of the BTC pictures, a few techniques have been proposed, like vector quantization (VQ) which improves the compression proportion. Vector quantization is the way toward quantizing the estimations of the pixels of the squares of pictures. This is likewise called as square quantization. The pixel esteems are encoded from a multidimensional vector space (picture pixels) into a limited arrangement of qualities from a discrete subspace of lower measurement (block pixels). Utilizing second safeguarding and visual data to further pack the picture and to hold the picture quality for constant preparing has been proposed. A cross breed coding technique by utilizing look into tables and VQ to encode the piece guide and low mean of the squares is utilized for packing the pictures; However, these strategies are typically related with high computational intricacy. Since the primary point of compression is to diminish the piece rate, the square size is expanded for higher compression proportion and lower bit rates. However, the irritating hindering curios and the obscured edges are unmistakably noticeable at the point when the Traditional BTC is applied for higher square sizes. To overcome this problem, a heuristic method has been designed which gives the modified 'low mean' intensity value 'a' and 'high mean' intensity value 'b' for each block, resulting in image reconstruction with improved contrast. Two such modified BTC methods are presented in this paper. Both the methods are based on using modified low mean 'a' and high mean 'b' values. Four number of sample images are subjected to BTC, BTC1 and BTC2. The resulting RMSE, PSNR and Contrast parameters are estimated for various block sizes of the images, and compared Image Compression is an essential procedure in the modern world where there is a requirement of storing large amount of data using as much less storage space as possible. Image compression can be achieved using various algorithms which may be divided into lossless and lossy categories. In lossless compression scheme, the reconstructed image after compression is numerically identical to the original image whereas in lossy compression techniques the compression ratio is high. Removal of redundant data is a very important part of image compression.

III. BLOCK TRUNCATION CODING

For greyscale images, Block Truncation Coding (BTC) is a form of lossy image compression method. The initial images are divided into blocks, and the quantizer is used to decrease the number of grey levels in each block while

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keeping the mean and standard deviation constant. Although BTC compression method was first applied to colour long before DXTC using a very similar approach dubbed Color Cell Compression, it is an early precursor of the well-known hardware DXTC technique.

The usual steps involved in compressing and decompressing of image are

Step 1: Specifying the Rate (bits available) and Distortion (tolerable error) parameters for the target image.
Step 2: Dividing the image data into various classes, based on their importance.
Step 3: Dividing the available bit budget among these classes, such that the distortion is a minimum.
Step 4: Quantize each class separately using the bit allocation information derived in step 3.
Step 5: Encode each class separately using an entropy coder and write to the file.
Step 6: Reconstructing the image from the compressed data is usually a faster process than compression. The steps involved are
Step 7: Read in the quantized data from the file, using an entropy decoder. (reverse of step 5).
Step 8: Dequantize the data. (reverse of step 4).
Step 9: Rebuild the image. (reverse of step 2).

IV. AMBTC COMPRESSION TECHNIQUE

An essential variety of BTC called Absolute Moment Block Truncation Coding (AMBTC) was presented by Lema and Mitchell, and it saves the higher mean and lower mean of the squares. The interpolative systems are used to code the compacted digit plane of BTC. A calculation for saving minutes which result in less mean square mistake (MSE) was prospect in. To decrease the piece rate extra, barely any versatile Block Truncation Coding methods have been advanced: A four level quantizer has been planned in and a thought of Multilevel Quantizer has been proposed in. The variety between the first picture and the remade picture is called Mean Square Error (MSE) and is determined. The Quality of the recreated picture is determined utilizing Peak Signal to Noise Ratio (PSNR) and is processed utilizing the PSNR is the reverse of MSE. Suppose, it have an image block of size 4 × 4 pixels as shown in Fig. 2a. The mean AVGof the block can be calculated using Eq. (1) as (130 + 92 + 161 + 165 + 133 + 97 + 90 +170 + 147 + 175 + 140 + 183 + 124 + 194 + 106 + 116)/4*4 = 139. To construct the bit-plane for the image block, the mean value AVG =139 is then taken as a threshold. The pixels having values greater by 1 in the bit-plane; otherwise, '0'.It is a low complexity compression scheme and is called as block prediction-residual block coding AMBTC. In this scheme, each image block is categorized into one of four types. The first type of blocks is encoded using previously encoded blocks, the second type and third type of blocks are encoded using residual block mean coding and residual block absolute mean coding respectively and the fourth type of block is encoded by AMBTC with interpolative bit plane coding. AMBTC figures the mean of each square and afterward plays out a two-level quantization so it is exceptionally straightforward however the picture quality is slightly below average. To improve the picture quality, an AMBTC-based coding plan has been portrayed in, while in this postulation the proposed plot has critical highlights which are not the same as the past plot. As a matter of first importance, to determine a superior trade-off between recreated quality and computational intricacy, the proposed plot presents a three-level order procedure. Contrasted with the past two-level order procedure introduced in, the proposed three-level arrangement strategy empowers greater flexibility in encoding/interpreting a picture. Additionally, to further improve the pressure productivity, differential heartbeat coding adjustment (DPCM) is utilized in the current plan.

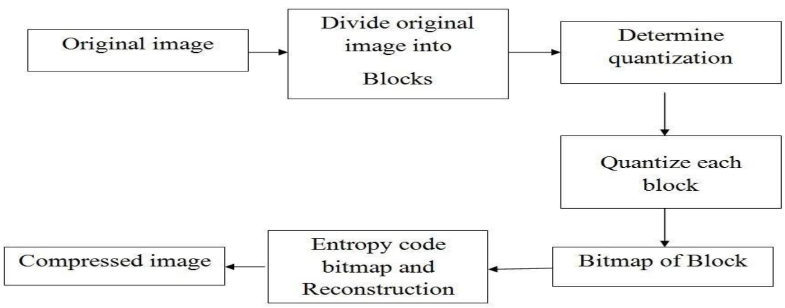

Figure 1: Block Diagram for AMBTC

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4.1. Disadvantages of BTC and AMBTC

Although the overall quality of the compressed image and the achieved compressed data rate for both BTC and AMBTC are good, but some limitations is there, that will overcome in this work. One of the drawbacks of the both methods uniform operator of the whole image is used. Both the methods do not adapt the logical statistics of the picture. This results in artifacts which are usually seen in the regions around the edges. All the edges are shapely reproduced they tend to have ragged appearance. Another problem appeared in the area with very low contrast or where the gradient of intensities is relatively uniform. In these areas the output levels of two methods are very close together. The compression representation is not efficient. An algorithm which would be used BTC and AMBTC could adapt to the local statistics of the image, would be more efficient could preserve edges resulting in better pictorial results. As any adaptive method the complexity and compression rate of this algorithm is increase, something must be considering since the advantages of BTC and AMBTC is easy and simple for implementation. Based on the different measuring parameters both methods have drawbacks to store the images in the cloud.

V. PROPOSED MODIFIED BTC ALGORITHM

In order to improve the PSNR of BTC images, the best values for the low-mean ‘a’ and high-mean ‘b’ for the BTC image blocks can be estimated using Least Mean Square Error {LMSE} method. A suitable technique has been developed in this research and the procedure is described next, using a 4x4 block example. The procedure can be used for larger size blocks also, such as 8x8, 16x16, 32 x 32 etc. Since the main aim of compression is to reduce the bit rate, the block size is increased for higher compression ratio and lower bit rates. But the annoying blocking artifacts and the blurred edges are prominently visible when the Traditional BTC is applied for higher block sizes.

BTC Techniques	No. of additions/ subtractions	No. of Divisions/ Multiplications	Square root operations
Traditional BTC	[2(k x k] + 3	[k x k] +9	2
AMBTC	[2(k x k] + 3	[k x k] +9	2
Modified BTC	[k x k] + 2	[k x k] + 2	0

Table 1: Comparison of Computational Complexities between the Traditional BTC, AMBTC and Modified BTC.

The image is high and low-pass filtered along the rows. Results of each filter are down- sampled by two. The two sub-signals correspond to the high and low frequency components along the rows, each having a size N by N/2 shown figure 2 and 3. Each of the sub-signals is then again high and low-pass filtered, but now along the column data and the results are again down-sampled by two.

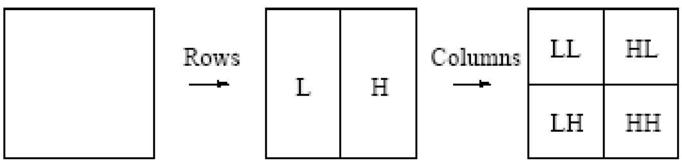

Figure 2 One DWT Decomposition

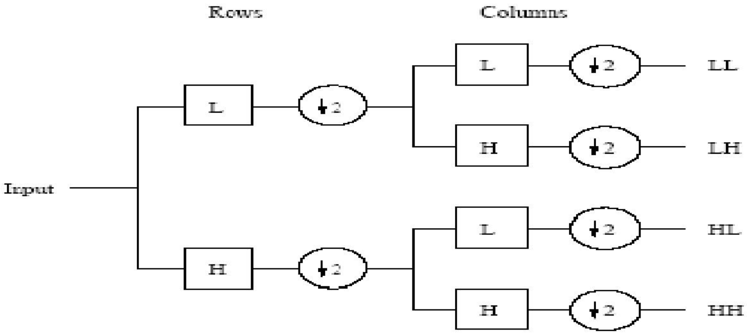

Figure 3 One Decomposition Step of the Two Dimensional image

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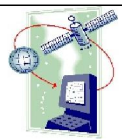
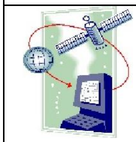
VI. EXPERIMENT RESULTS

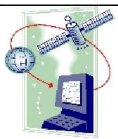
The original 'copya.jpg' image and t

The 4x4, ,8x8, 16x16, 32x32, 64x64, 256x256 and 512x512 block based processed images using the BTC, AMBTC and modified BTC techniques are shown in tables

Results and Discussion					
Input Image 4 X 4	**Image Name**	**Image Measurements**	**BTC**	**AMBTC**	**Modified BTC**
	Computer	PSNR	38.98	39.12	39.28
		CR	1.67	1.69	1.72
		MSE	13.12	13.06	12.98
		SNR	12.12	12.23	12.26
		Computation Time	1992	1892	1882
	DB	PSNR	38.88	39.10	39.22
		CR	1.69	1.70	1.74
		MSE	13.14	13.09	12.91
		SNR	12.11	12.21	12.22
		Computation Time	1998	1899	1890
	Book	PSNR	38.86	39.04	39.17
		CR	1.71	1.71	1.75
		MSE	13.15	13.12	13.21
		SNR	12.09	12.17	12.19
		Computation Time	2006	1994	1993
	VSAT	PSNR	38.64	38.76	38.12
		CR	1.72	1.72	1.76
		MSE	13.88	13.78	13.77
		SNR	12.01	12.02	12.11
		Computation Time	2160	2146	2144

Input Image 16 X 16	**Image Name**	**Image Measurements**	**BTC**	**AMBTC**	**Modified BTC**
	Computer	ps PSNR	34.65	39.10	39.24
		CR	3.68	3.71	3.73
		MSE	16.49	13.11	13.08
		SNR	9.23	12.20	12.20
		Computation Time	1650	1621	1615
	DB	ps PSNR	34.23	39.01	38.89
		CR	3.70	3.72	3.74
		MSE	16.55	13.18	13.23
		SNR	9.11	12.11	12.18
		Computation Time	1680	1651	1648

	Book	ps PSNR	34.11	38.88	38.78
		CR	3.71	3.73	3.76
		MSE	16.66	13.23	13.22
		SNR	8.92	12.02	12.01
		Computation Time	1699	1671	1657
	VSAT	ps PSNR	34.01	38.03	38.24
		CR	3.72	3.76	3.79
		MSE	16.89	13.33	13.30
		SNR	8.85	11.88	11.86
		Computation Time	1750	1722	1708

Input Image 256 X 256	Image Name	Image Measurements	BTC	AMBTC	Modified BTC
	Computer	ps PSNR	22.78	34.69	39.11
		CR	8.90	8.99	9.12
		MSE	30.08	16.89	13.34
		SNR	2.07	9.20	12.12
		Computation Time	784	776	771
	DB	ps PSNR	22.78	34.71	39.14
		CR	8.92	9.12	9.18
		MSE	30.22	16.96	13.44
		SNR	2.01	9.11	12.02
		Computation Time	788	778	775
	Book	ps PSNR	22.45	34.66	37.01
		CR	8.96	9.32	9.34
		MSE	30.22	16.96	13.44
		SNR	2.01	9.11	12.02
		Computation Time	790	781	778
	VSAT	ps PSNR	22.12	34.09	36.45
		CR	8.99	9.37	9.39
		MSE	30.29	16.99	13.67
		SNR	1.98	9.04	12.03
		Computation Time	820	812	802

Input Image 512 X 512	Image Name	Image Measurements	BTC	AMBTC	Modified BTC
	Computer	PSNR	17.92	34.55	39.00
		CR	9.94	9.23	9.25
		MSE	33.79	16.99	13.56
		SNR	1.00	9.03	12.05

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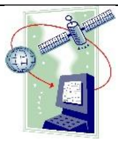
		Computation Time	469	453	448
	DB	ps PSNR	17.88	34.43	38.01
		CR	9.95	9.27	9.28
		MSE	33.88	17.95	14.66
		SNR	0.98	9.01	12.01
		Computation Time	478	467	464
	Book	ps PSNR	17.66	34.25	37.08
		CR	9.97	9.29	9.38
		MSE	33.99	17.99	15.67
		SNR	0.95	8.89	11.88
		Computation Time	499	472	468
	VSAT	ps PSNR	17.23	34.02	36.08
		CR	9.99	9.39	9.42
		MSE	34.95	19.99	20.89
		SNR	0.92	8.78	11.66
		Computation Time	516	498	489

Block Size	Technique	Elapsed time In seconds	CPU time In seconds
4x4	BTC	7.7197	3.4476
	AMBTC	6.0120	3.0888
	Modified BTC	4.2625	1.5756
8x8	BTC	5.0510	1.1700
	AMBTC	4.8926	1.1544
	Modified BTC	4.3002	0.6708
16x16	BTC	4.5638	0.5772
	AMBTC	3.7930	0.6281
	Modified BTC	3. 5721	0.4912
32x32	BTC	4.0711	0.6084
	AMBTC	3.4917	0.4524
	Modified BTC	3.2096	0.2964
64x64	BTC	3.8789	0.4197
	AMBTC	3.1327	0.4056
	Modified BTC	3.0026	0.1092

Table 2: Shows the reconstructed images of BTC, AMBTC& Modified BTC

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RMSE values of different blocks are compared for the methods like BTC, AMBTC, Modified BTC and it shown in figure 4

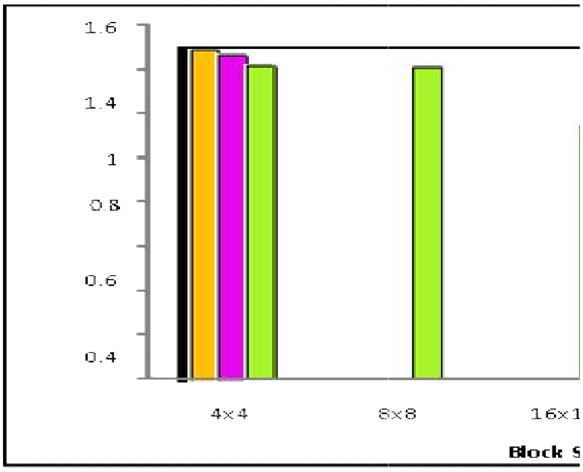

Figure 4 Graph showing the comparison of RMSE values for BTC, AMBTC and MBTC

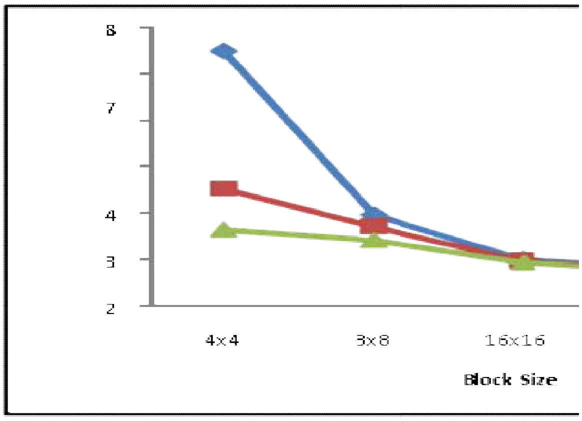

Figure 5 Graph showing CPU time for BTC, AMBTC and MBTC techniques

In this section figures, graphs and tables shows the image measurements for the different images. The performance is measured. From the results it is seen that performance of the method MBTC is better than AMBTC and BTC algorithms.

VII. CONCLUSION

In this paper discussed about the k-means clustering, BTC, AMBTC of image compression in storage environment. Implementation of BTC, AMBTC, how the image compression is done for the previous methods and measuring parameters also discussed. MBTC algorithm and its needed for efficient storage in the image compression techniques in terms of CPU time, elapsed time and results are discussed. The future enhancement of this paper add to Multiplicative Argumentative Block Truncation Coding Schemes for High Rated Image Compression.

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