QUALITY IMAGE COMPRESSION USING CABAC AND QUADTREE TECHNIQUES

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Abstract: Image compression is the process of reducing the size of image is known as image compression. There are two mechanisms to compress image. Here the Cabac and Quadtree Techniques are applied to compress the image. Coding of data symbol consists of several stages and a tree data structure is known as quadtree. In quadtree, there are exactly four children in every internal node. Quadtrees has been known as the analog of octrees which are two-dimensional. It has been used for partition of a two-dimensional space. It has been done by recursively subdividing it into four quadrants or regions. There are several researches made in the field of image compression. Such researches are also considered in the chapter. This work would be considered best verified and simulated. It would synthesize CABAC decoding mechanism using Matlab. It would be capable to execute complete CABAC Algorithm as future work. The research work would be beneficial in future time. The result of the research work has proved that the proposed techniques are much better techniques than the traditional.

Keyword: Image Compression, Cabac, Huffman, SBAC PSNR, Quadtree

I. INTRODUCTION

The process of reducing the size of image is known as image compression. There are two mechanisms to compress image. One is loosy mechanism where the quality of image is degraded. The second mechanism is lossless where the quality image is retained even after image size reduction. The systems which are used to compress the graphical content are becoming famous. The cause of the popularity is to simply feasibility of efficient personnel computers. In the present time the large size memory appliances, the graphics software etc are easy to use.. CABAC is a lossless compression method, as it is known that the video coding standards used the CABAC.

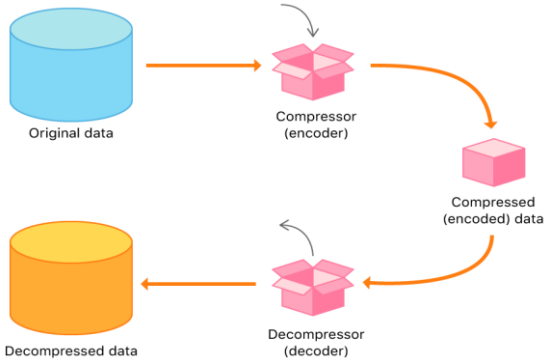


Fig 1 Image Compression

II. CABAC

Coding a data symbol consist of several stages. Some of those stages have been discussed below

1. Binarization: Context-based adaptive binary arithmetic is making use of Binary Arithmetic Coding. Only binary decisions are encoded. This binary data is 0 and 1. Non-binary-valued symbol is binarized. In other words it could be said that it is converted into a binary code before arithmetic coding. Transform coefficient or motion vector is the example. Such sequence of activity is just like sequence of steps taken to convert data symbol to a variable length code. However binary code is further encoded using arithmetic coder. It is encoded before transmission. Phase no 2, 3 and 4 are repeated again and again in case of each bit of binarized symbol.

2. Context model selection: A context model has been determined as a probability model. This model is related to one or more bins of binarized symbol. This model is selected from a collection of accessible models. These models depend on statistics of freshly-coded data symbols. The Context model holds the chances of each bin being 1 or 0.

3. Arithmetic encoding: An arithmetic coder makes encoding of every bin. It has been done along with chosen probability model. There are only two sub-ranges for each bin. These are parallels to 0 and 1.

4. Probability update: the particular context model has been updated. It has been done on the base of actual coded value. For example in a case, in whichthe bin value was 1, frequency count of

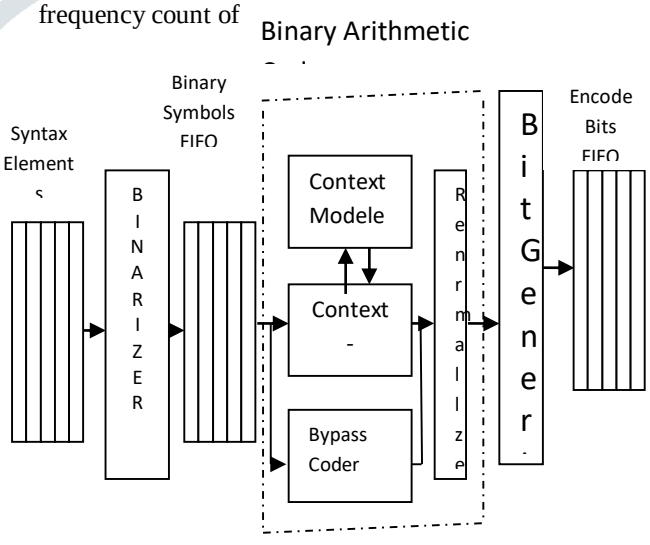
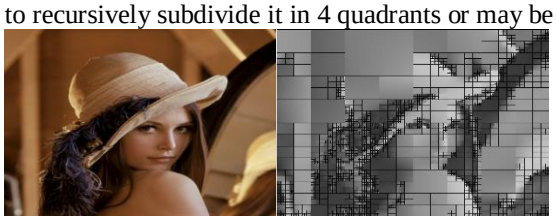


Fig 1 Working Model of CABAC

QUADTREE

A tree data structure is known as quadtree. In quadtree, there are exactly 4 children in every internal node. Quadtrees are the two-dimensional analog of octrees. It has been applied to do the partition of a two-dimensional space. It has been done to recursively subdivide it in 4 quadrants or may be regions.



Before After

Fig 2 The picture before applying and applying the Quadtree

Lossless image compression eliminated the useless portion of the image with temporal redundancy. The useless portion has grouped with the quadtree system. Temporal redundancy has been removed with the tree coding. The quadtree of the graphic content has been generated of the given graphical content. After that the breadth first search has been used in order to do the encoding of the quadtree. In quadtree dependent coding system, To store the internal nodes has been determined necessary. An internal node's code has dependency on the kind of node of the children of it. Seven bits has been applied in order to denote an internal node. In this way the number of bits are required to store the graphical is according to the amount of internal nodes.

III. LITERATURE REVIEW

In this research the related researches to the CABAC decoder also have been discussed There are several researches in the field of CABAC decoding in which some have been given below:

Nehal Markandeya [1] proposed Image Compression using Huffman Coding. This work is investigating image compression with the help of block truncation coding.

M. Wahiba[2] did implementation of parallel-pipeline H.265 CABAC decoder on FPGA.

M. Wahiba, et al [3] proposed the design and FPGA implementation of residual data in HEVC CABAC Encoder.

In 2008, Detlev Marpe et al [4] wrote on efficient representation. They also defined the coding of prediction residuals.

In 2008, V. Sanchez, et al [5] discussed capable four dimensional motions. It has been rewarded lossless compression of modifiable volumetric medical image information. By below given table it has been mentioned as:

In 2008, A. P. Chandrakasan[6] stated the parallel CABAC. It has been used for low power video coding.

In 2009, V. Sanchez, et al [7] proposed the Novel Lossless fMRI Image Compression. In 2009, Vivienne Sze et al [8] offered a high throughput CABAC algorithm. They have used the syntax element partitioning. Allowing the parallel processing has become the rapidly essential for video decoding.

In 2010, E. Bezati, et al [9] has explained implementation of decoder for MPEG AVC as well as CABAC entropy.

In 2011, F. I. T. Building [10] did research on one-round renormalization. It was based on 2-bin / cycle h 264 / AVC CABAC encoder. CABAC has been considered as advanced entropy coding tool employed. It has been used by main and higher profiles.

In 2012, M. Preiss, et al [11] discussed the unified and complexity scalable entropy coding mechanism. This mechanism has been used for video compression. The proposed work applied a single set of tools. These tools are used to configure and obtain the same complexity-performance.

In 2012, X. Zhu et al[12] wrote on binarization and context model selection. This mechanism was CABAC dependent on distribution of syntax element. The presented work has provided us an innovative binarization and CS technology.

In 2013, P. Jaya krishnan[13] performed research on a real time multi-bin cabac encoder. The objective of research is to make ultra high resolution video. Context Adaptive Binary Arithmetic Coding encoder has become the essential role in H.264/AVC.

In 2009, W. Wang, et al [14] has introduced a CABAC mechanism for accelerating. This mechanism is dependent over adaptive probability estimation modification. Results performance has been shown in following table.

In 2014,Yu-Hsin Chen et al[15] introduced 2014 MBIN / s deeply pipelined CABAC decoder. It ahs been found that the research is related to HEVC.

In 2014 Y. Chen, et al [16] discussed a deeply pipelined CABAC decoder. The objective of research is to consider HEVC facilitating level 6.2 High-tier Applications. In order to highlight the issues of throughput, a lot of alteration has been with CABAC.

In 1997, Marcus J. Nadenau et al. [17] analyzed the Opponent Color. They also consider the Human Vision with Wavelets to compress the Image modern image compression codec's produce embedded bit streams along with the optimal rate-distortion properties.

In 1998, Hidenori Sakanashi, et al[18] discussed the hardware chip for high precision printer image compression. In the research work a data compression chip has been performed. In has been done to highly-precision electro photographic printer. Here the evolvable Hardware has been used.

In 2001, M. Klimesh, et al [19] presented the hardware implementation related to lossless graphic compression algorithm. For this purpose programmable gate array has been used.

In 2001, M Saenz, et al et al[20]considered an estimate of colour embedded wavelet graphic compression methods**.** In this paper we have investigated the use of color transformations,

In 2001, Panrong Xiao et al [21] classified image compression by wavelet transform electronic theses and dissertations. The research work has described the basic wavelet theory, They also discusses the EZW coding algorithm.

In 2002, William A. Pearlman et al [22] explained the trends of tree-related, set-partitioning compression methodology in still. They also discussed the image systems. Along with these they also considered the high compression efficiency coding systems will require many other features.

In 2003, Miroslav Galabovet al[23] identified the fractal image compression. The results presented above were obtained using the MATLAB Software.

In 2004, Anna Linderhed et al [24] evaluated the image compression based on empirical mode decomposition.

In 2005, Xie Kaia et al [25] outlined the HVS-based medical image compression**.** In this paper, we use the lifting step approach for wavelet decomposition.

In 2005, Zhang Zhongshan et al [26] stated a modified technique related to remote sensing graphic compression dependent on fractal with wavelet domain.

In 2006, John Kominek et al [27] proposed the algorithm for fast fractal image compression.

In 2006, Matthew J. Zukoski et al [28] provide the concept of medical image compression. Due to some causes community of the medical are not willing to admit these methods.

In 2009, F. Keissarian[29] provided an improved the quadtrees-dependent graphic compression method. In the research work, a new image compression technique is proposed in graphic variable block size technique has been accepted adopted. For this purpose quad tree decomposition technique has been used in order to code the images. In 2015, E. Chetan et al[30] stated the fractal graphic compression. For this purpose the quad tree has been used. Image compression has an essential role in the day to day execution activities

IV. PROBLEM STATEMENT

Although there are several researches has been made in the past time. Almost are useful but each also have the limitation parallel to their advantages. The comparative analysis of SBAC and Huffman has been made in traditional researches. But the result in case of SBAC and Huffman is almost same. The CABAC is supposed to yield the better results. However Huffman is lossless image compression mechanism but in this research the PSNR of Huffman and CABAC has been compared. Here the two image compression techniques are proposed named CABAC and Quadtree.

V. PROPOSED WORK

The process flow of proposed work is as follow:

1. Take image sample for compression.

The image is taken using imread function of matlab and this image would be converted into matrix form

2. Apply compression mechanisms such as Huffman based image compression mechanism.

i) The traditional Huffman based image compression mechanism would be applied on this stored matrix.

ii) Apply the CABAC mechanism in order to reduce the size of image and maintain the image quality.

3. The Comparative analysis of traditional and CABAC based encoding would be made here.

The limitation of traditional work and benefit of proposed work of traditional work would be represented in this research

VI. RESULT AND DISCUSSION

Apply CABAC mechanism on image

CABAC BINARIZER

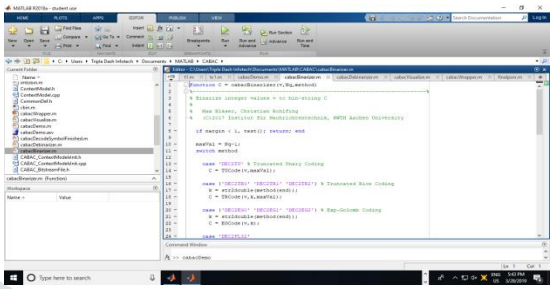


Fig 3 CABAC BINARIZER

CABAC DEBINARIZER

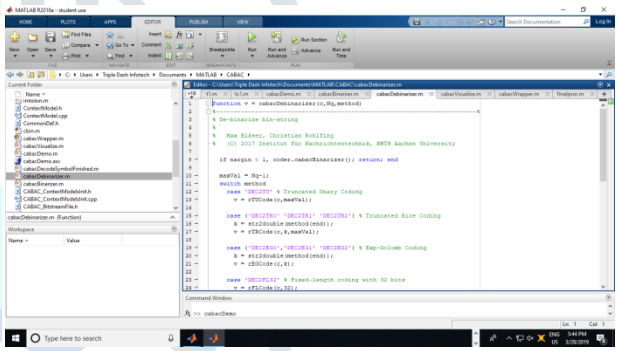


Fig 4 CABAC DEBINARIZER

CABAC WRAPPER

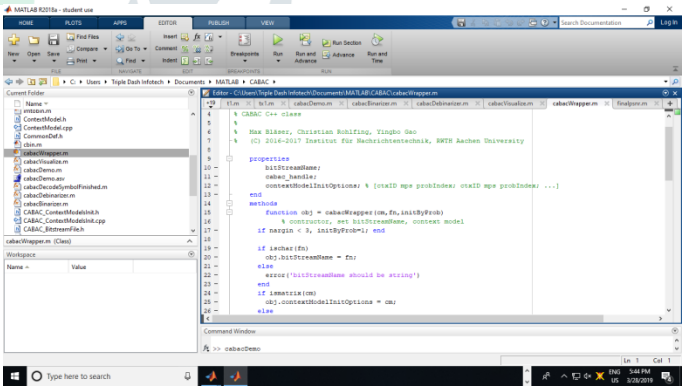


Fig 5 CABAC WRAPPER

CABAC VISUALIZE

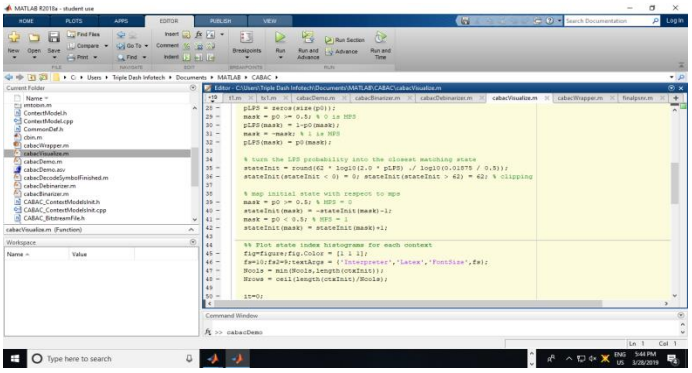


Fig 6 CABAC VISUALIZE

After opening the hierarchy of cabac the cabac Demo command is given

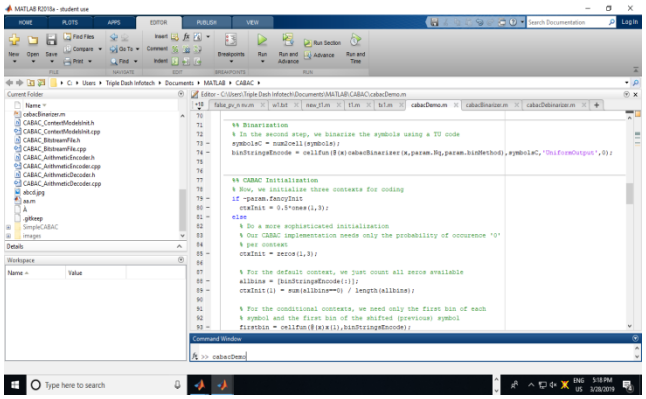


Fig 7 CABAC IMPLEMENTATION

After executing CABAC command following result are presented.

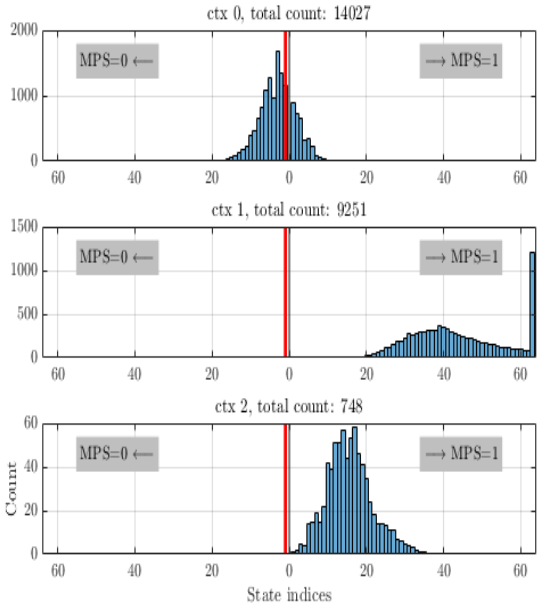


Fig 8 State indices

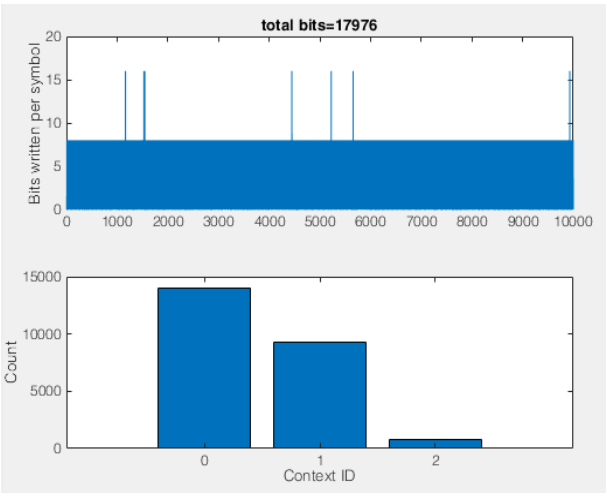


Fig 9 Bit written per symbol

Matlab code to simulate the comparative chart

```
fidl=fopen('data.txt');
c=textscan(fidl,'%f %f %f');
a=c{1};
bb=c{2};
cc=c{3};
plot(a,bb,'r+-');
hold on
plot(a,cc,'b*-');
legend('Huffman','Cabac');
fclose(fidl)
xlabel('Data rate (ms)')
ylabel('Psnr')
```

Fig 10 Following chart is plotted representing the difference between Huffman and CABAC

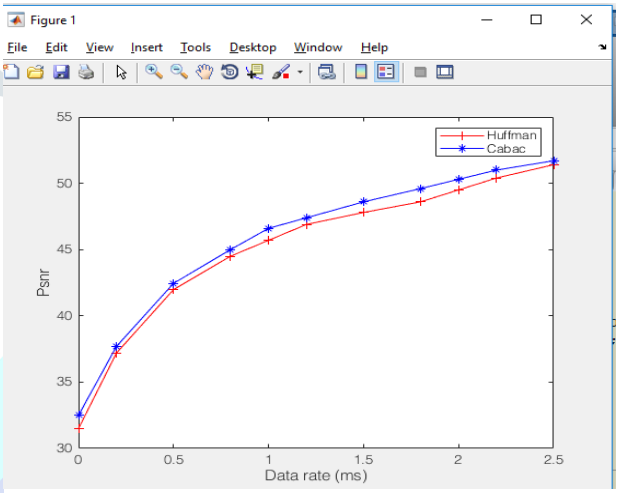


Fig 11 Comparison between HUFFMAN and CABAC

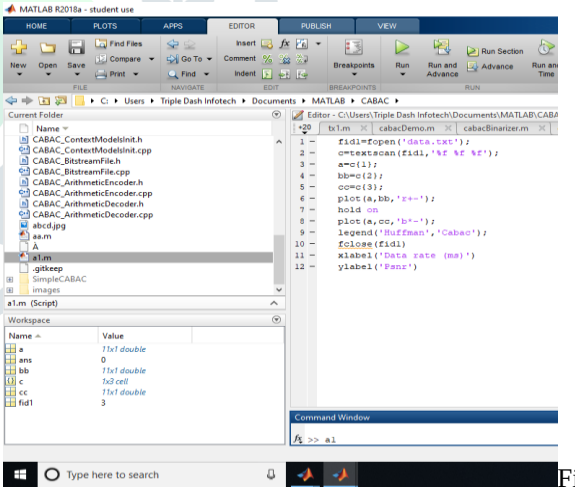


Fig 12 Running Matlab script

From above simulation it has been observed that the difference in case of tradition work where sbac was compared with Huffman code is 0.074.

Table 6 Difference chart of HUMAN and SBAC PSNR

HUFFMAN PSNR	SBAC PSNR	DIFFERENCE
30.18	30.22	0.04
32.71	32.99	0.28
34.91	34.95	0.04
35.99	35.84	-0.15
37.47	37.53	0.06
38.1	38.01	-0.09
39.23	39.65	0.42
40.17	40.02	-0.15
41.41	41.15	0.26
42.42	41.49	0.93
	Average of Difference	-0.074

The difference in case of proposed work where sbac was compared with Huffman code is 0.67

VII. CONCLUSION

Here the Cabac and Quadtree Techniques are applied to compress the image. Coding a data symbol consists of several stages and A tree data structure is known as quadtree. In quadtree, there are exactly four children in each internal node.This work would be considered best verified and simulated. It would synthesize the pipeline-parallel CABAC decoding mechanism using Matlab. It would be capable to execute complete CABAC Algorithm over FPGA platform as future work. The research work would be beneficial in future time. The result of the research work has proved that the proposed techniques are much better techniques. But the result in case of SBAC and Huffman is almost same. The CABAC is supposed to yield the better results. However Huffman is lossless image compression mechanism but in this research the PSNR of Huffman and CABAC has been compared. The proposed system has been found better as compare to traditional image compression mechanisms. This research has considered CABAC based implementation of image.

VIII. SCOPE OF RESEARCH

The Cabac and Quad tree Techniques would be proved beneficial for image compression. The research work would be beneficial in future time. The result of the research work has proved that the proposed techniques are much better techniques. This work would be considered best verified and simulated. It would synthesize the pipeline-parallel CABAC decoding mechanism using Matlab. It would be capable to execute complete CABAC Algorithm over Quad tree platform as future work. Tradeoff among high throughput might be the challenging operation.

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