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IMPEMENTATION OF CABAC BASED ENCODING AND DECODING OF IMAGES USING MATLAB

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Abstract: Here the CABAC based encoding and decoding of images using Matlab is proposed. However Huffman is lossless image compression mechanism but in this research the PSNR of Huffman and CABAC has been compared. The research work the image of graphical content is fetch in matlab using imread function. The proposed system has been found better as compare to traditional image compression mechanisms. This research has considered CABAC based implementation of image. CABAC is a lossless compression method, as it is known that the video coding standards used the CABAC. 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.

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Keyword: Image Compression, CABAC, Quantization, Matlab, PSNR, Huffman

[1] 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 image compression in case of jpeg is represented below. Here the step by step jpeg compression and jpeg decompression has been represented. The raw image data is sent for subsampling after color space conversion. Then DCT is applied to quantize the data. Quantized data is encoded to jpeg compressed image data. During decoding this data is dequanitized and inverse DCT is applied to perform inverse sub sampling there after then inverse color space conversion produces real image data.

[2]CABAC

H.264 Advanced Video Coding standard has represented following entropy coding

1. Context-based Adaptive Binary Arithmetic Coding
2. Variable-Length Coding

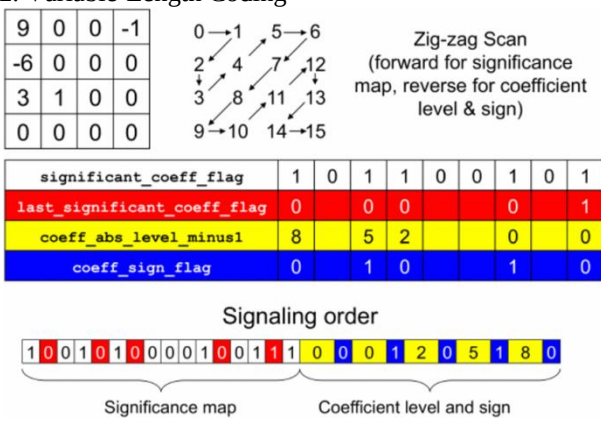

Fig 1 CABAC Encoding

In an H.264 codec, if the 1 is set the entropy coding mode, an arithmetic coding system has been applied in order to do the encoding and decoding of H.264 syntax elements. Arithmetic coding is used for H.264. **Context-based adaptive binary arithmetic** provides best compression output.

(a) It offers best performance by using probability models. These models are used for each syntax element. These are according to element's context.

(b) It adapts the probability estimation that is related to local statistics.

(c) Context-based adaptive binary arithmetic is making use of arithmetic coding. Coding a data symbol consists 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.

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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 which the bin value was 1, frequency count of 1 is also enhanced.

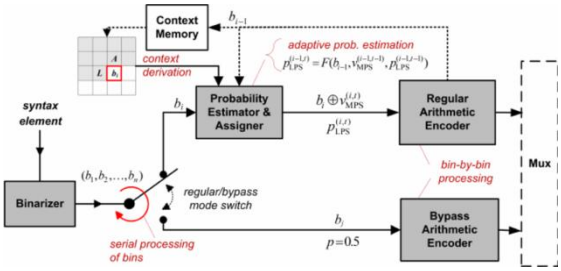

Fig 2 Working model of CABAC

[3] MATLAB

The full form of MATLAB is matrix laboratory. It is a high tech programming language. It is mainly used for the purpose of technical computing. It integrates calculation, visualization, and encoding in such a manner that it can be easily understood by an indivual. Therefore it is considered as a user friendly software .In this software all the questions and their answers are presented in a well-known numerical form. Thousands of functions are incorporated in Mat lab. It is possible to draw 2Dimension and 3Dimension graph in MATLAB. It also provide a facility to user due to which any user can write down its own function. It is feasible due to the presence of huge quantity of apparatus. It can be used for various purposes which is illustrated below

1. Math and calculation
2. For the growth of algorithm
3. It can be used for the purpose of modelling, simulation, and prototyping
4. Data analysis, exploration, and visualization
5. Scientific and engineering graphics
6. For the growth of application and Graphical User Interface

[4] MOTIVATION OF RESEARCH

The objective of research is to perform study of different image compression mechanism. This research has focused on CABAC based implementation of image. However there have been several researches in field of Image processing but the limited work has been made related to CABAC. Here in this research the Image encoding and decoding has been performed using CABAC mechanism in order to overcome the limitation of traditional work.

[5]PROBLEM STATEMENT

However 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.

Table 1 Entropy v/s Average code word

	Probability	Average code word length(Huffman Code)	Entropy
1.	0.25	0.5	0.5
2.	0.20	0.4	0.45
3.	0.18	0.54	0.48
4.	0.15	0.45	0.42
5.	0.12	0.36	0.36
6.	0.06	0.24	0.244
7.	0.04	0.16	0.18

[6]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.

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

[7] IMPLEMENTATION WORK

The result section has been divided in 5 parts

1. Fetching the graphical contents using MATLAB
2. Apply Huffman coding on image
3. Apply CABAC mechanism on image
4. Get the Peak sensitive noise ratio
5. Compare the PSNR in case of HUFFMAN and CABAC

Fetching the graphical contents using MATLAB

Here in this section the image of graphical content is fetch in matlab using imread function. Where as imshow function would be used to display image file.

```
A=imread('fil1.jpg')
imshow(A)
```

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Fig 3 Displaying image after fetching

Apply CABAC mechanism on image

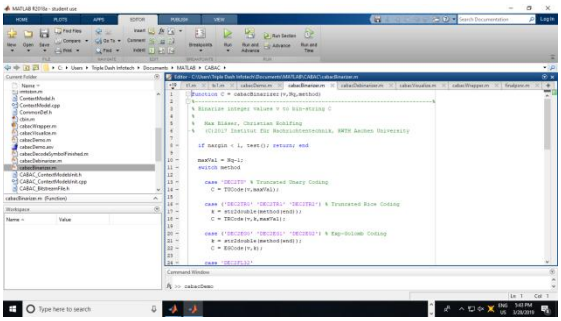

Fig 4 CABAC BINARIZER

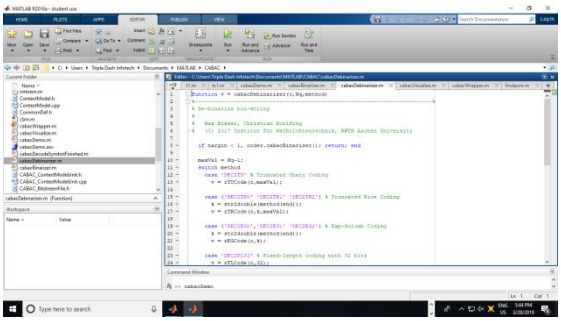

Fig 5 CABAC DEBINARIZER

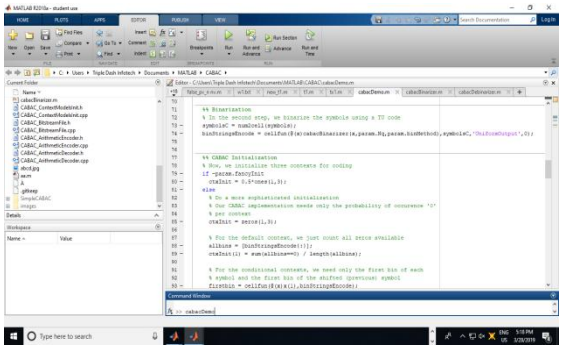

Fig 6 CABAC Implementation

After executing CABAC command following result are presented

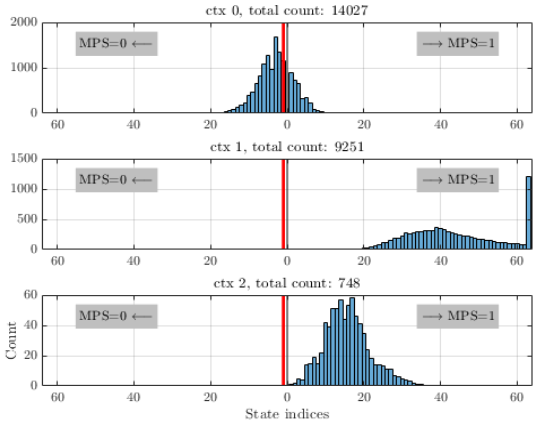

Fig 7 State Indices

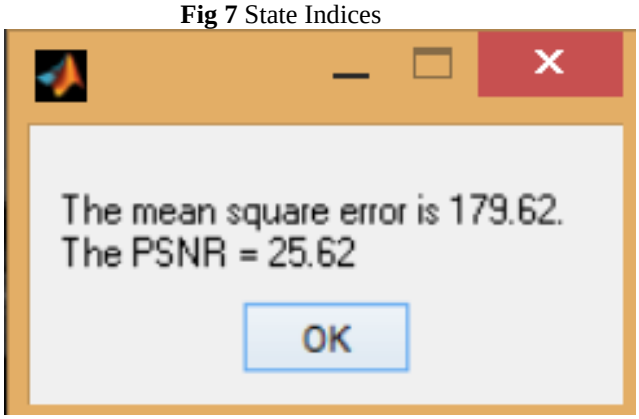

Fig 8 Mean square error

PSNR CALCULATION OF DECODED IMAGE

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Fig 9 PSNR of Decoded Image

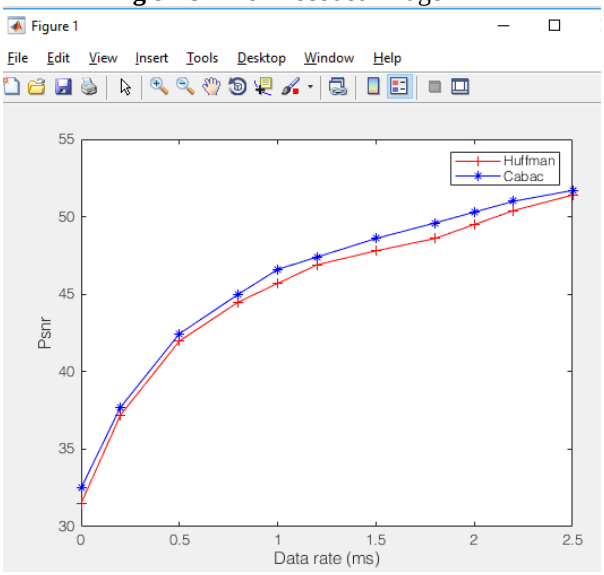

Fig 10 Comparison between HUFFMAN and CABAC

Table 2 Difference chart of HUFFMAN 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

TABL 3 DIFFERENCE CHART OF HUFFMAN AND CABAC PSNR

DATA RATE	Huffman	CABAC	Difference
0	31.5	32.5	1
0.2	37.2	37.7	0.5
0.5	41.98	42.45	0.47
0.8	44.5	45	0.5
1	45.7	46.6	0.9
1.2	46.9	47.4	0.5
1.5	47.8	48.6	0.8
1.8	48.6	49.6	1
2	49.5	50.3	0.8
2.2	50.4	51	0.6
2.5	51.4	51.7	0.3
		Average of difference	0.67

[8]CONCLUSION

However 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. The proposed system has been found better as compare to traditional image compression mechanisms. This research has considered CABAC based implementation of image. However there are many researches in field of Image processing but

thes have their limitations such as path delay. In future work there is scope to implement complete CABAC Algorithm over FPGA platform. Tradeoff among high throughput and coding efficiency might be complex operation in future implementation.

[9]SCOPE OF RESEARCH

Image Processing systems are becoming popular due to easy availability of powerful personnel computers, large size memory devices, graphics software etc. In the field which are related to electrical and computer science engineering, image processing is any form of signal processing. It is a sort of entropy encoding used in the H.264/MPEG-4 AVC and High Efficiency Video Coding (HEVC) standards. CABAC is a lossless compression method, as it is known that the video coding standards used the CABAC. 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. Tradeoff among high throughput might be the challenging operation.

REFERENCES

[1] Nehal Markandeya, Prof.Dr.Sonali Patil,"Image Compression using Huffman Coding"Nehal Markandeya, IJECS Volume 6 Issue 1 Jan., 2017 Page No.19999-20002

[2] M. Wahiba, “Implementation of parallel-pipeline H . 265 CABAC decoder on FPGA.”

[3] M. Wahiba, S. Abdellah, M. S. Azzaz, and B. Aichouche, “Design and FPGA Implementation of Residual Data in HEVC CABAC Encoder,” no. 1, pp. 1–5.

[4] “EFFICIENT REPRESENTATION AND CODING OF PREDICTION RESIDUALS AND PARAMETERS IN FRAME-BASED ANIMATED MESH COMPRESSION Detlev Marpe , Heiner Kirchhoffer , Karsten Müller , and Thomas Wiegand Image Processing Department Fraunhofer Institute for Telecommunications – Heinrich Hertz Institute,” pp. 2680–2683, 2008.

[5] V. Sanchez, P. Nasiopoulos, and R. Abugharbieh, “EFFICIENT 4D MOTION COMPENSATED LOSSLESS COMPRESSION OF DYNAMIC VOLUMETRIC MEDICAL IMAGE DATA,” pp. 549–552, 2008.

[6] A. P. Chandrakasan, “Vivienne Sze Massachusetts Institute of Technology Cambridge , MA Madhukar Budagavi Minhua Zhou Texas Instruments,” pp. 2096–2099, 2008.

[7] V. Sanchez, P. Nasiopoulos, and R. Abugharbieh, “Novel Lossless fMRI Image Compression Based on Motion Compensation and Customized,” vol. 13, no. 4, pp. 645–655, 2009.

[8] “A HIGH THROUGHPUT CABAC ALGORITHM USING SYNTAX ELEMENT PARTITIONING Vivienne Sze , Anantha P . Chandrakasan Massachusetts Institute of Technology,” pp. 773–776, 2009.

[9] E. Bezati, M. Mattavelli, D. Lausanne, and C.- Lausanne, “RVC-CAL DATAFLOW IMPLEMENTATIONS OF MPEG AVC / H . 264 CABAC DECODING Ecole Polytechnique F ´ IETR / INSA Rennes F-35708 , Rennes , France,” pp. 207–213, 2010.

[10] F. I. T. Building, “ONE-ROUND RENORMALIZATION BASED 2-BIN / CYCLE H . 264 / AVC CABAC ENCODER Zhenyu LIU and Dongsheng Wang,” pp. 369–372, 2011.

[11] M. Preiss, D. Marpe, B. Bross, V. George, H. Kirchhoffer, and D.- Berlin, “A UNIFIED AND COMPLEXITY SCALABLE ENTROPY CODING SCHEME FOR VIDEO COMPRESSION Fraunhofer Institute for Telecommunications Heinrich Hertz Institute Image Processing Department Image Communication Chair School of EE & CS Berlin Institute of Technology,” pp. 729–732, 2012.

[12] X. Zhu and L. Yu, “Binarization and Context Model Selection of CABAC Based on the Distribution of Syntax Element,” no. 2010, pp. 2010–2013, 2012.

[13] P. Jayakrishnan, “A Real Time Multi-bin CABAC Encoder for Ultra High Resolution Video,” pp. 402–405, 2013.

[14] “A 2014 MBIN / S DEEPLY PIPELINED CABAC DECODER FOR HEVC Yu-Hsin Chen , Vivienne Sze,” pp. 2110–2114, 2014.

[15] Y. Chen, S. Member, and V. Sze, “A Deeply Pipelined CABAC Decoder for HEVC,” vol. 8215, no. c, pp. 1–13, 2014.

[16] W. Wang, B. Guo, S. Zhang, and Q. Ye, “A CABAC Accelerating Algorithm Based on Adaptive Probability Estimation Update,” 2009.

[17] Y. Raut, “Quality Evaluation of HEVC Compressed CT Images,” vol. 264, 2015.

[18] S. Charfi, N. Neji, F. Kammoun, and N. Masmoudi, “Reduction In CABAC Encoding Time Of The HEVC,” 2016.

[19] C. D. M. Alonso, B. Zatt, M. Porto, and S. Bampi, “Low-power HEVC Binarizer Architecture for the CABAC Block targeting UHD Video Processing,” pp. 30–35, 2017.

[20] R. Song, D. Liu, H. Li, and F. Wu, “Neural Network-Based Arithmetic Coding of Intra Prediction Modes in HEVC,” pp. 10–13, 2017.

[21] M. Wahiba, S. Abdellah, B. Aichouche, and M. S. Azzaz, “Multiple Bypass Bins FPGA Implementation of H . 2,” 2018 Int. Conf. Appl. Smart Syst., no. November, pp. 1–5, 2018.

[22] C. Ma, D. Liu, X. Peng, and F. Wu, “CONVOLUTIONAL NEURAL NETWORK-

BASED ARITHMETIC CODING OF DC COEFFICIENTS FOR HEVC INTRA CODING," 2018 25th IEEE Int. Conf. Image Process., pp. 1772–1776, 2018.

[23] M. Wahiba and S. Abdellah, "Hardware and Software Implementation of H . 256 CABAC Encoder / Decoder," 2018 Int. Conf. Smart Commun. Netw. Technol., pp. 78–83, 2018.

[24] "A 610 MBIN / S CABAC DECODER FOR H . 265 / HEVC LEVEL 6 . 1 APPLICATIONS Yijin Zhao , Jinjia Zhou , Dajiang Zhou , Satoshi Goto Graduate School of Information , Production and Systems , Waseda University 2-7 Hibikino , Kitakyushu , 808-0135 , Japan," pp. 1268–1272, 2014.