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Design high- speed search by classifying binary code book based on edge information in block

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Abstract

While the encoding of a VQ based image coding requires a full codebook search for each input vector to find the best- matched code word (i.e. it is a time consuming process), therefore, in this paper, we have adopted a new block- scanning technique for generating the required sub code books by partition the code book depending on classified the code words and input image blocks according to edge in blocks into empty, horizontal, vertical and diagonal categories. This classification is always applying before the process that deals with code book. In our presence work, the classification idea is particularly simple for software implementation where it could reduce the search time and the computational complexity, where it produce the same decoded image quality as this obtain in the full search algorithm.

Keywords: Classification, binary code book, edge in blocks.

1. INTRODUCTION

The Block Truncation coding method preserves spatial details in the image content with low difficulty computation but it has a medium compression ratio [1,2]. Therefore, in this paper, an adaptation (vector quantization method) is required to improve the compressibility of the BTC to represent the binary form of the coded image. The applications of VQ method is limited because the encoding procedure is computationally intensive system [3,4]. Therefore, in this paper, we present a new fast search algorithm for image compression using classified binary code book which will be used to perform the encoding and decoding phases to improve the search of the binary code book. In this paper, to decreasing the time of matching searching, consequently, simplify the computational complexity one can propose an efficient image blocks classification and a new different categories binary code book (sub code book i.e. empty, horizontal, vertical and diagonal categories) by designing an algorithm for classified VQ based on edge in blocks, where the classification idea is particularly simple for software implementation where it could reduce the search time with same decoded image quality which may be obtained using full search.

2. The Block Truncation Compression technique

The BTC method was first proposed by Professors Mitchell and Delp [1,5]. This method can describe in general a "*F*x*F*" pixels image then it is divided into blocks of "*n*x*n*" pixels, for each block, the mean and the standard deviation are computed, where these values is difference from block to another, then a two level quantization for each block is made as follows; If a pixel value is greater than or equal to the mean value it is assigned the value "1", otherwise "0". Reconstruction is made with two values the mean and the standard deviation.

3. Vector Quantization (VQ)

Vector Quantization has been found to be a popular scheme in image compression where it can be processes in three steps. There are designing code book, encoding vector, and decoding vector. In other word, this method can be described as a code book is generated *CB*, $C_{W1}, C_{W2}, ..., C_{WK}$, where *K* is the number of code words which stored in the code book then an input vector (x_i) is then individually quantized to the closest code word in the code book by searching in the code book to choose code word with minimal distortion by calculating the Squared Euclidean Distance between the input vector and each code word in the code book [4]. The minimum square distortion for the vector x_i is found:

$$d_i = d_{\min(x_i, C_{wj})} \text{.....(1)}$$

Compression is achieved by using the indexes of code words for the purpose of transmission and storage. Reconstruction of the image can be implemented by technique called table look up, where the indexes are simply used as addresses to the corresponding code words in the codebook [4,6].

4. Block classification

To decrease the computational difficulty of VQ method, we have adopted a new block- scanning technique for generating the required code block. The proposed scanning method is depended on classifying the code book and input

image blocks into empty, horizontal, vertical and diagonal categories. For each block, the direction of the major edge is computed by finding the totality gradient value in the vertical and horizontal directions, as follows;

Let *p(i,j)* represents a *nxn* element in block of size *nxn*.
The vertical gradient is;

$V_{(i,j)} = p_{(i,j+1)} - p_{(i,j)}$.....(2), where *i=1…..n, j=1…..n-1.*

While, the horizontal gradient is;

$H_{(i,j)} = p_{(i+1,j)} - p_{(i,j)}$.....(3), where *i=1…..n-1, j=1…..n.*

For each processed block, the effects of total vertical edge are computed as;

$$E_V = \sum_{i=1}^{n}\sum_{j=1}^{n-1}\left|V_{(i,j)}\right| \text{.....(4)}$$

$$E_H = \sum_{j=1}^{n}\sum_{i=1}^{n-1}\left|H_{(i,j)}\right| \text{.....(5)}$$

Depending on equations 4 and 5 the classification procedure can be calculate as follows;

$$\theta = TAN^{-1}(E_V / E_H) \text{.....(6)}$$

Each block can be classified as empty when E_V and E_H are equal to zero (i.e. $\theta = 0$), but it is classified as horizontal when $0 < \theta \le 30$,or it is classified vertical class when $60 \le \theta \le 90$, otherwise it is diagonal.

To overcome the problem connected with the code book search, In this paper, we use block classification (i.e. multi code book design) based on the edge involved in block, this idea lead to reduce the searching time which required to find the best matching between input image vector and the vectors in code book.

5. The procedure of fast algorithm

The proposed algorithm (i.e. block classification and multi code book designing based on the edge) is described as follows;

Step1. Initialization, a binary code book blocks are classified to involve four sub code book (i.e. empty, horizontal, vertical and diagonal categories). Put a label for each class, "0" for empty, "1" for horizontal, "2" for vertical and "3" for diagonal.
Step2. An image is divided into 4x4 blocks, then the BTC is implemented and for each block the reconstruction values and bit plan (binary block) are determined.
Step3. Take input block from binary image then calculate E_V , E_H and θ for its.
Step4. From eq. 6 classify input block as empty when E_V and E_H are equal to zero, but it is classified as horizontal when $0 < \theta \le 30$, or it is classified vertical class when $60 \le \theta \le 90$, otherwise it is diagonal class and give the input block a label (index "i_c") of sub class (i.e. 0,1,2,3).
Step5. Calculate the distortion of matching the input vector x with code words of the corresponding class (i.e. sub code book) then give the input block a label (index "i_b") of nearest code word.
Step6. Translate two reconstruction values with two indexes "i_c" and "i_b", then go to step 3.

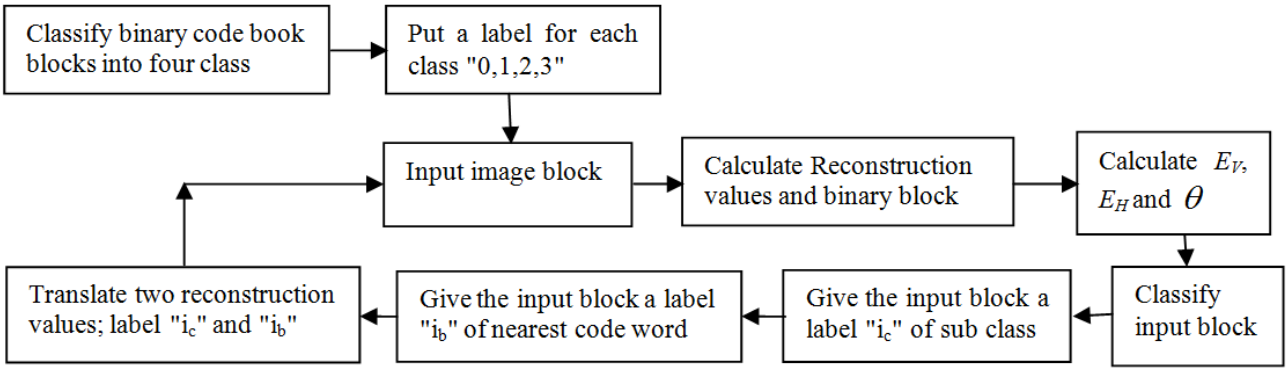

Fig. 1: The diagram of the mentioned algorithm

This method will be very efficient when we classify a code book, this idea lead to reducing in the searching time which required to find the best matching and simplified a full code book search for each input vector to find the best-matched code word. This is because many distortion computations can therefore be eliminated.

6. Experimental

We describe a new way to reducing VQ computation at the encoding and decoding by applying block classification to present a new high speed search algorithm in VQ for improved BTC method which is examined by simulation. The search in general code book has high complexity in computational, therefore the new adopted scanning method is used for category code book blocks into sub smaller codebook then this leads to decreasing the complexity in computational and more less time in searching than full search method.

At first a binary code book containing 256 code words is generated using the well- known LBG algorithm then the code book is classified to involve four sub code book (i.e. empty, horizontal, vertical and diagonal categories). The image is divided into 4x4 blocks, the BTC is implemented, where the reconstruction values for each block and bit plan are determined.

7. Conclusion

The effectiveness of applying classified method in the encoding and decoding algorithms are tested, where, the elimination efficiencies of applying classified is listed in table 1.

Table 1: Elimination efficiencies for encoding and decoding of different images.

Image name	**Elimination efficiencies for encoding**	**Elimination efficiencies for decoding**
GIRL IMAGE	82.8%	58.2%
RMB1 IMAGE	67.6%	41.2%

From This table, one can see that the proposed method was very efficient when we classified a code book depending on edge of its blocks into different categories, this idea was particularly simple for software implementation where it leaded to reducing in the searching time which required to find the best matching then simplified a full code book search for each input vector to find out the best- matched code word. In other word, the elimination efficiencies for encoding and decoding of different images were very good this is because many distortion computations can therefore be eliminated when classifying a code book.

References

[1] J. - M. Guo, " Improved block truncation coding using modified error diffusion", Electronics letters, Vol. 44, No. 7, 2008.

[2] Y. - Gi Wu, " Block truncation image bit plane coding", Optical Engineering, Vol. 41, No. 10, pp. 2476-2478, 2002.

[3] Sindhu M1 and Rajkamal R2, " Images and Its Compression Techniques – A Review", International Journal of Recent Trends in Engineering, Vol. 2, No. 4, 2009.

[4] S. H. Hang and S.H. Chen, " Fast encoding algorithm for VQ based image coding", Electronics letters, No.19 , Vol. 26, pp. 1618-1619,1990.

[5] A. S. Devi1, S. S. Priyadharsini2 and S. Athinarayanan3, " A BLOCK BASED SCHEME FOR ENHANCING LOW LUMINATED IMAGES", The International journal of Multimedia & Its Applications (IJMA), Vol.2, No.3, 2010.

[6] N. M. Nasrabadi and Y. Feng, " Vector quantization of images based upon a neural-network clustering algorithm", Visual Communications and Image Processing, SPIE Vol. 1001, pp. 207-213, 1988.

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