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ENHANCEMENT COMPRESSION DIGITAL IMAGE USING A NEW TECHNIQUES IN FRACTAL METHOD

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Abstract— **Image compression is considered to be one of the most important problems in computer storage and transmission. Various compression methods have been introduced to achieve high compression ratios and high image qualities in low computational time.**

Fractal Image Compression is one of the techniques that offers an advantage in reconstructing images of high quality with reasonable compression ratio and fast decoding process. But, on the other hand, the encoding part of this method is considered to be highly time-consuming process. The time consumption is a result of the matching block process used for eight orients.

This study proposes a method with new approach of matching with one computed affine transformation to accelerate the encoding time, which increases the efficiency to approximately ten times the traditional method for the same image size and block number. The difference between the encoding time for the two methods is proportional to number of blocks, which leads to high performance. The rate of encoding time with block number is very small compared to the traditional method, which leads to increase in its competitively compared with all other methods.

However, the proposed method still produces a comparable reconstructed image quality and compression ratio comparable to that seen in Traditional Fractal Image Compression.

Index Terms—**CR, SNR, PSNR, E.T., Digital Image, Image Comresssion.**

I. INTRODUCTION

Data compression is the removal of redundant data. This, therefore, reduces the number of binary bits necessary to represent the information contained within that data. To achieve the best possible compression requires, not only an understanding of the nature of data in its binary representation but also how we as humans interpret the information that the data represents [1]. Fractal image compression is a modern lossy data compression technique; it is a process to find a small finite set of mathematical equations that can describe the image. By sending the parameters of these equations to the decoder, we can reconstruct the original image [2]. A fractal is a geometric form, which has the unique feature of having extremely high visual self-similar irregular details while containing very low information content. Several methods for image compression have been developed based on different characteristics of fractals. One method is based on “Iterated Function Systems” (IFS) proposed by Barnsley (1988). This method uses the self-similar and self-affine property of fractals. Such a system consists of sets of transformations including translation, rotation, and scaling. On the encoder side of a fractal image coding system, a set of fractals is generated from the input image. These fractals can be used to reconstruct the image at the decoder side. Since these fractals are represented by very compact fractal transformations, they require very small amounts of data to be expressed and stored as formulas. Therefore, the information needed to be transmitted is very small. The second fractal image coding method based on the fractal dimension [3, 4].

II. GENERAL CONCEPT

The encoding step in fractal image compression is slow because most of the time is spent in searching and discarding of unrelated domain blocks. In the proposed work, it is intended to find means to speed up the encoding step in fractal image compression, while maintaining and/or increasing the image quality and compression ratio.

The design of efficient domain search techniques to reduce long encoding time has been one of the most active areas of research in fractal image compression, resulting in a number of solutions. Most of the proposed techniques while attempt to accelerate the searching are based on sum kinds of feature vector assigned to ranges and domains [5]. Another mean is based on creating equations for modifying search techniques in order to reduce the encoding time. In this paper we will be concerned with our proposed fasten algorithm and the results obtained from applying this algorithm. In addition, present a comparison between the results of applying traditional technique with those of our proposed technique.

III. Maximum and Minimum Block Size

Maximum block size represents the maximum size of the range block corresponds to the minimum depth of the tree partitioning, while minimum block size represents minimum size of the range block corresponds to the maximum depth of the tree partitioning[6].

IV. Proposed Algorithm

A. - Encoding Algorithm

Here, in our proposed algorithm, we attempt to accelerate the encoding time by modifying the search procedure; the present algorithm lies in the following steps: after partition of the original image into non-overlapping blocks and begins the search technique for each range block. Normally, each range block is compared with all domain blocks and for each domain block, there are 8-cases to compare with .Then compute for is (8-cases) the scale, offset, and store the affine transformation for the best case from the 8-cases. But, here we find the absolute difference between the gray level values of the range block and each case of domain blocks; after that we find the minimum summation of these differences and compute for this case that satisfies (corresponds to) the minimum difference from 8-cases (compute S and O). Thus, here we reduce the computational process from 8-times to the one.

B. Decoding Algorithm

Here, one can easily reconstruct the encoded image from the compressed file.

V. Experimental Result:

Table (1): Minimum and maximum block sizes and their effects on the compression results before and after application of speeding up method.

If = 0.7 Ratio = 0.1 Domain Step = 4 Quantization Scale =100 Quantization Offset =1 Maximum Scale = 1.9	Minimum Scale = -1.9 Minimum Offset =-256 Maximum Offset =256 Number Bits of O =7 Number Bits of S =10 Iteration number =8

Min. block size	Max. block size	Block no.	Before Applying Speeding-Up method				After Applying Speeding-Up Method			
			CR	SNR	PSNR	E.T. (sec.)	CR	SNR	PSNR	E.T. (sec.)
2	8	3838	4.01	22.7	30.0	445	4.50	22.9	30.2	53
2	16	3154	4.88	20.8	28.2	390	5.01	20.7	28.0	48
2	32	3010	5.12	20.6	27.9	365	5.30	20.0	27.6	47
4	8	2011	7.66	20.0	27.1	135	8.00	19.7	27.1	44
4	16	1447	10.64	19.3	26.7	100	10.65	19.5	26.9	42
4	32	1357	11.35	17.6	25.1	95	12.0	17.9	25.0	41
8	16	613	25.11	16.2	23.6	49	25.50	15.0	24.0	22
8	32	553	27.83	15.1	22.6	45	28.0	16.0	22.8	20
16	32	214	71.72	11.9	19.3	40	72.0	10.6	18.1	18

The results presented in table (1) show that when we select a big value to maximum block size and minimum block size, we obtain a high compression ratio, low reconstructed image quality (SNR, PSNR), short encoding time and small number of blocks. While, when we continue reducing the chosen values of maximum and minimum block size we will obtain low compression ratio, high reconstructed image quality, long encoding time and large number of blocks as shown in Figures (1, 2, 3).

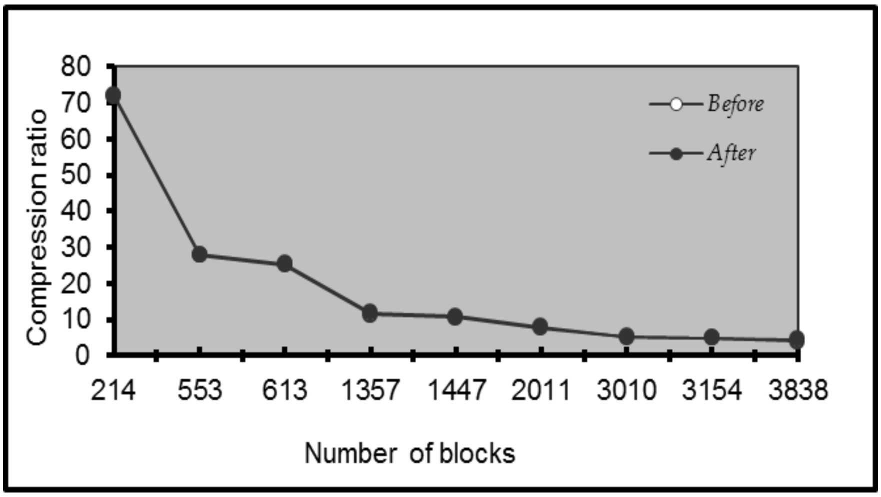

Fig. (1): Effect of number of blocks on compression ratio before and after applying speeding up method.

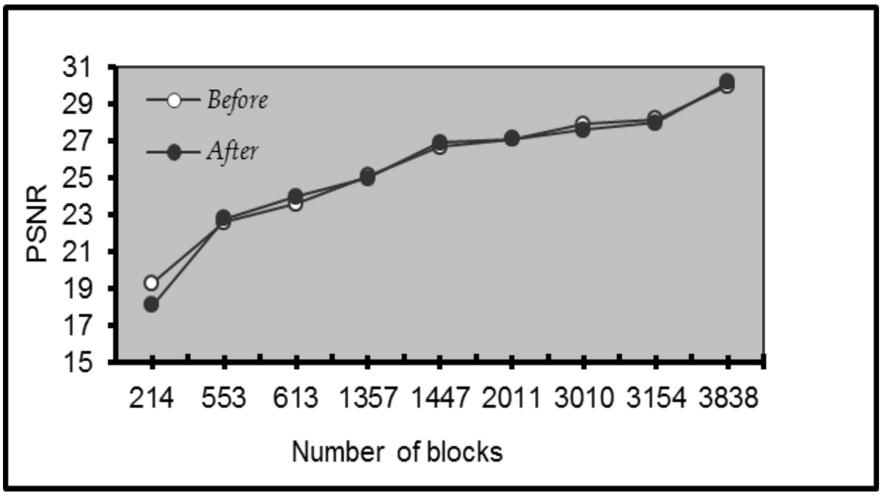

Fig. (2): Effect of number of blocks on reconstructed image quality before and after applying speeding up method.

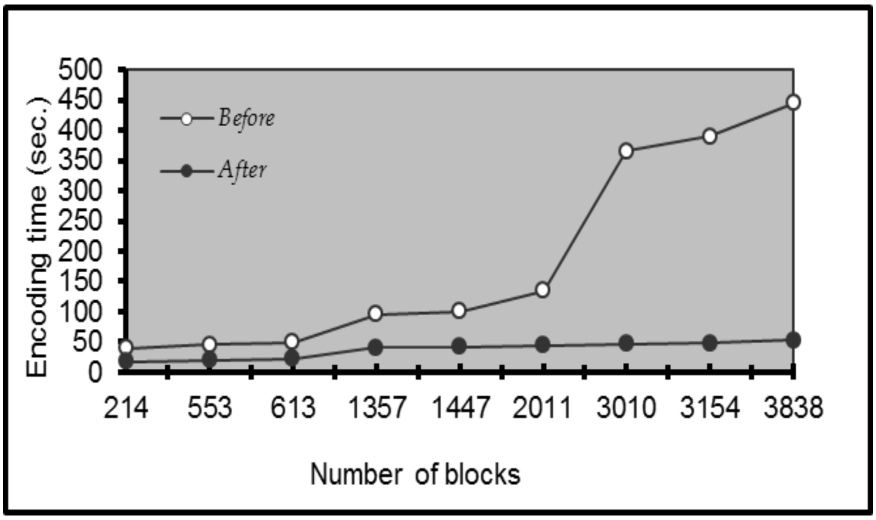

Fig. (3): Effect of number of blocks on encoding time before and after applying speeding up method**.**

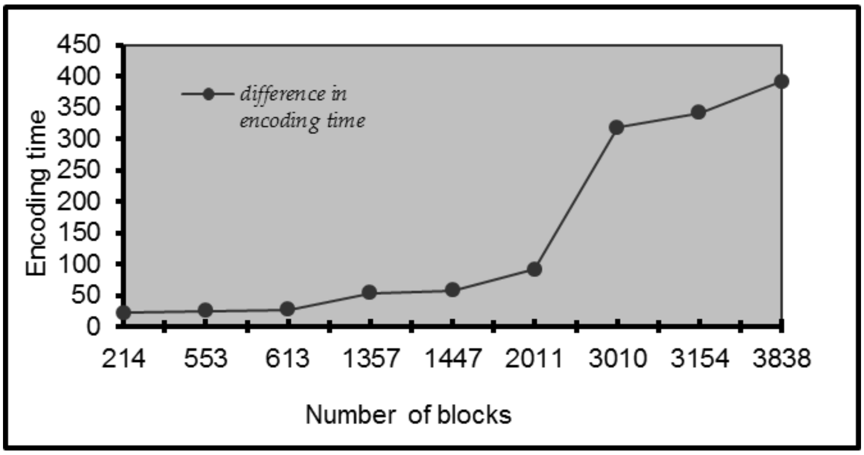

Fig. (4): The difference in encoding time obtained by application of speed up method.

These results can be analyzed as follows:
In the first case when the size of the chosen range block is big, it means there are a small number of range blocks that are needed for search operation which is short time consuming in matching operation. After ending the search operation, the saving of the block information of best domain block that matches this range block (of the search operation) must be started. In this regard, choosing big block size will generate a small number of range blocks, and since each block requires saving best matched domain block information (X, Y, scale, offset and symmetry), there will be a small number of total bits needed for saving all block's information in the compressed file which in turn will generate a high compression ratio.
The number of chosen blocks directly affects the quality of reconstructed image. Since there is a small number of blocks generated by choosing a big value for maximum and minimum block size there will be a little chance for matching the chosen range block with the domain block in domain pool (i.e. this would not cover well the blocks containing tiny details); totally, this would result in low quality of reconstructed image.

VI. SUMMARY

As discussed previously, the encoding part of the fractal method of image compression is considered to be highly a time-consuming process; and in this work, we implement a new arithmetic approach to decrease the encoding time.

The results obtained from this work support the following conclusions about the behavior and performance of the suggested arithmetic procedure.

1) The proposed method is faster by ten times the traditional fractal method for the same size of image and the block number approximate 4000. This is quite important since it represents an increase in efficiency.

2) The time difference between the proposed method and the traditional method is proportional to the number of blocks that are used in the encoding part. This is important since a large number of blocks are needed to present the details of the image during compression. Therefore, an increase in performance is achieved.

3) The rate difference in the encoding time with block number of the proposed method is very small compared with that of the traditional method. This increases the method competitively for compressing large images in comparison with other image compression methods.

4) The matching process in the proposed method needs less programming code than that of the normal method and this makes it simple and require less memory size.

5) The compression results (C.R., SNR and PSNR) are almost the same when a comparison is made between our method and other traditional methods. Furthermore, the effects on these compression results can be shown as: SNR, PSNR and E.T. are directly proportional to blocks number while C.R. is inversely proportional.

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