FRACTAL IMAGE CODING: A NEW APPROACH WITH BLOCK MERGING

Ashish Awasthi*

Manish Kumar*

Abstract:

The most of the fractal coding schemes proposed so far are based on Iterated Function Systems, Range block and domain blocks partition. In this paper, a scheme is proposed which is based on searching the blocks in image that have some common information and then after finding such block we make major block to hold or store a large amount of data in small space. In this scheme, the range blocks are made by searching and merging method. Here we define two types of major blocks, dark blocks and non-dark blocks, according to the different brightness level inside blocks. These major blocks of different types are extracted from the input image. These major blocks leads to the reduction in smaller primary blocks and making larger major blocks and also result in reduction of encoded bits.

Keywords: Fractal Image coding, similar blocks, major blocks, domain block etc.

* Dept. of Computer Application, Shri Ramswaroop Memorial Group of Professional Colleges, Lucknow, UP, INDIA

1. Introduction:

Fractal image coding (FIC) was introduced in 90's. Since then FIC methods have been studied in a variety of way. Fractal image coding is considered to be the 2nd generation of coding method [1].

In fractal image coding the concept of contractive transform and fixed point theorem is generally used. The first automatic scheme was introduced by A.E. Jacqin and Y. Fisher. In their scheme they modified the partition scheme and proposed a better scheme which is better in performance. In these schemes the original image is first partitioned in range and domain blocks and the process of matching from range to domain is implemented. Fractal image coding has many good features.

a. The first is resolution independence by which the decoded images of the larger size can be got without block effect.

b. The second is high coding ratio was recorded in the article of Barnsley [2], who is the father of fractal image coding.

c. The third feature include two phase : coding and decoding, coding process include many ways to code image while decoding process is much faster than coding as employs generally an iterative process.

2. Existing Methods:

The existing methods of fractal image coding schemes follow the following process:

i. Partition of images based on range blocks

ii. Pool of domain blocks

iii. Types of transformation imposed on domain blocks

iv. Search process to find appropriate domain block

v. Transformation parameters representations

The above mentioned processes have the following schemes of partitions for fractal

image coding

i. Fixed Size Square Block [3]-[5]

ii. Quadtree [6]-[8]

iii. Horizontal-Vertical [9]

iv. Irregular Regions [10]- [13]

v. Polygon Blocks [15]

vi. Overlapped Blocks [16]

As a general concept the fractal image coding is done by using range blocks and domain blocks where an image is partitioned into the same sized range blocks and then some domain blocks are made from image.

3. Proposed Approach:

As we know that a image in grey scale is stored in memory in double dimension array form where each location of 2d array represents a pixel value.

3.1. Proposed Process for major blocks creation:

At the coder, an original image is simply split into nonoverlapping small square blocks. They are represented by primary blocks p. Primary blocks are merged into major blocks **M.** Merging primary blocks is processed in two step as shown in Fig. 1,2,3. At the first step merging, primary blocks are merged using a difference of brightness values. At the second step merging, non-merged blocks are processed.

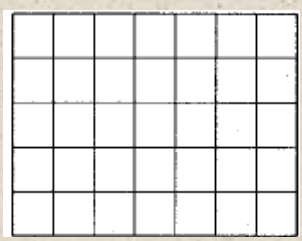

Fig. 1: Creation of primary blocks

Once the primary blocks are created then the major blocks are created by merging the primary blocks.

As shown fig 2.

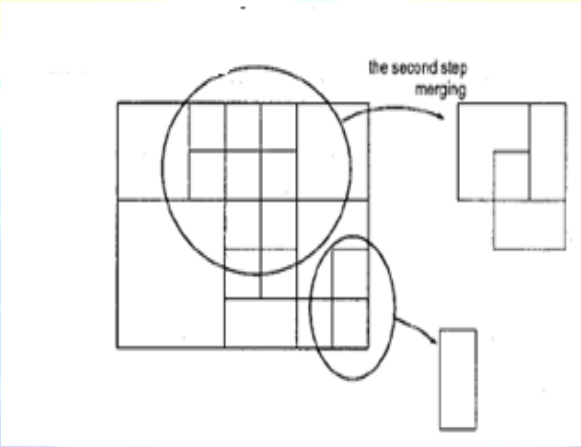

Fig. 2: Major blocks creation (after merging primary blocks at first step)

After first step merging now the major blocks are created again as shown in fig. 3

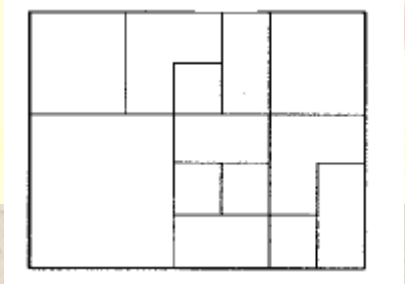

Fig 3: New major block after second step merging

Following are the steps for creation of major blocks whether they are dark-blocks or non-dark blocks.

At the first step merging, a primary block p is merged according to the order shown below:

1. First of all take a threshold value of brightness in block p.

2. A difference of brightness level values in a block p is calculated. If the value is more than the threshold value, go to 6. else go to 3.

3. p and a neighboring primary block p' are merged into a block P(a slight big block).

4. A difference of brightness values in P is calculated. If the value is more than the threshold value, go to 6.else go to 5.

5. Furthermore P and p' are merged into a block P, and go to 3.

6. If a block is p,p is used as a major block M . If a block is P, a block which P is excluded p' is used as a major block M.

If a neighboring primary block p' overlaps a major block M, which has been made before, merging primary blocks is continued by merging a next primitive block.

Range blocks are classified into two categories, a block as "dark block" and a block lock "non-dark block". If a major block is "non-dark block" and is not merged at the first step, the block is merged at second step merging.

The merging method is as follows:

1. If neither a primary block b nor a primary block b' are merged at first step merging, they are merged into a block P, and go to 2. If not, merging primary blocks is not done.

2. The most suitable domain block of P is searched. If an error between P and a transformed domain block is less than the threshold value, go to 3. If not, a block which P is excluded p' is made a major block M, and merging primary blocks is stopped.

3. If a neighboring block p' on P is not merged at first step merging, the block is merged into a block P and go to 2. If not, a block P is made a major block M, and merging primary blocks is stopped.

3.2. Proposed Process for coding blocks:

If a major block is "dark block", the average gray level of the major block and parameter of the shape of major block is sent to the decoder. If a major block is "non-dark block", a domain block is searched as a error between a major block and a domain block is small. The parameter of geometric transformation and brightness transformation and the parameter of the shape of the major block are sent to the decoder.

The shape of a major block is uniquely determined by the number of primary blocks consisting of it. We use Elias's code words to encode the number of blocks [17].

At the decoder, a voluntary image is split as an original image at the encoder is split into no overlapping blocks each other. The image is transformed iteratively using the sent parameters and an approximate image of an original image is reproduced.

4. Conclusion and future scope :

The concept of merging the neighbored primary blocks in a image is a process which produces the major blocks from primary blocks having the relevant information of image in a larger block. This concept leads to reduction in the size of the image so as the number of bits also.Futher more this concept can be extended by using the concept of chain coding in fractal image coding.

5. References:

- Zhao Yao, Wang Hongxing, Yuan BaoZong, "Advances in Fractal Image Coding", ACTA ELECTRONICA SINICA., Vol 28, No. 4, pp.95~101, April 2000.
- Michal F.Barnsley and Alan D.Sloan, "A Better Way to Compress Images", BYTE, pp.215~223, January 1988.

- G. E. Oien, S. Lepsoy, and T. A. Ramstad, "An inner product space approach to image coding by contractive transformations," in Proc. IEEE Int. Conf. Acoustics, Speech, and Signal Processing,Toronto, Ont., Canada, May 1991, vol. 4, pp. 2773–2776.
- D. M. Monro, "Class of fractal transforms," Electron. Lett., vol. 29, pp. 362–363, Feb. 1993.
- N. T. Thao, "A hybrid fractal-DCT coding scheme for image compression, "in Proc. IEEE Int. Conf. Image Processing, Lausanne, Switzerland, Sept. 1996, vol. I, pp. 169–172.
- A. E. Jacquin, "Fractal image coding based on a theory of iterated contractive image transformations," *Proc. SPIE: Vis. Commun. Image Process.*, M. Kunt, Ed., Lausanne, Switzerland, vol. 1360 pp. 227– 239, Oct. 1990.
- "A novel fractal block-coding technique for digital images," in *Proc. IEEE Int. Conf. Acoustics,Speech and Signal Processing*,Albuquerque, NM, Apr. 1990, vol. 4, pp. 2225–2228.
- "Image coding based on a fractal theory of iterated contractive image transformations," *IEEE Trans Image Processing*, vol. 1, pp.18–30, Jan. 1992.
- D. Saupe *et al.*, "Optimal hierarchical partitions for fractal image compression," in *Proc. IEEE Int Conf. Image Processing*, Chicago, IL,Oct. 1998, vol. 1, pp. 737–741.
- L. Thomas and F. Deravi, "Region-based fractal image compression using heuristic search," *IEEE Trans. Image Processing*,vol. 4, pp. 832–838, June 1995.
- D. Saupe and M. Ruhl, "Evolutionary fractal image compression," in *Proc. IEEE Int. Conf ImageProcessing*, Lausanne, Switzerland, Sept.1996, vol. I, pp. 129–132.
- M. Tanimoto, H. Ohyama, and T. Kimoto, "A new fractal image coding scheme Employing blocks of variable shapes," in *Proc. IEEE Int. Conf. Image Processing*,Lausanne, Switzerland, Sept. 1996, vol. 1, pp. 137–140.
- M. Ruhl, H. Hartenstein, and D. Saupe,"Adaptive partitioning for fractal image compression," in *Proc. IEEE Int. Conf. Image Processing*, Santa Barbara, CA, Oct.1997, vol. II, pp. 310–313.

- E. Reusens, "Partitioning complexity issue for iterated functions systems based image coding," in *Proc. Eur.Signal Processing Conf.*, Edinburgh, U.K., Sept. 1994, vol. 1, pp. 171–174.
- F. Davoine, J. Svensson, and J.-M.Chassery, "A mixed triangular and quadrilateral partition for fractal image coding," in *Proc. IEEE Int. Conf. Image Processing*, Washington, D.C., Oct. .1995, vol. III, pp. 284–287.
- E. Reusens, "Overlapped adaptive partitioning for image coding based on the theory of iterated functions systems," in *Proc. IEEE Int. Conf. Acoustics, Speech and Signal Processing*, Adelaide, Australia, Apr.1994, vol. 5, pp. 569–572.
- P. Elias: "Universal codeword sets and representations of the integers," IEEE Trans. Inform. Theory, Vol. 21, No. 2, pp. 194-203 (Mar. 1975).