A REVIEW ON ENCODING AND DECODING FOR FRACTAL IMAGE COMPRESSION

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ABSTRACT

Image compression is a process of reducing or eliminating all redundant or irrelevant data. The new compression technique called Fractal image compression. This scheme works by partitioning an image into blocks and using contractive mapping to map each range blocks to its matched domains. In present study we review the work on encoding and decoding to compress the image by fractal image compression with IFS.

Keywords: Affine Transformation, Contractive Mapping. Fractal Encoding And Decoding, IFS, Self-Similarity.

I INTRODUCTION

Day by Day, the demands for higher and faster technologies are rapidly increasing for everyone. Now a days before purchasing computers, customers are concerned about two things (1) the speed of the CPU and (2) the storage and memory capacity. Image compression helps to reduce the memory capacity and to have faster transmission rate [1].

There are two types of image compression is present. They are lossy and loss-less method.

(1) In lossy method:- The reconstructed image contains degradation relative to the original and lossy technique image quality degradation in each compression step. Lossy compression technique lead to loss of data with higher com-pression ratio. (2) Lossless method:- The reconstructed image after compression is numerically identical to the original image. Lossless compression gives good quality of compressed images [2].

Compression is important both for speed of transmission and efficiency of storage.

II FRACTAL IN IMAGE COMPRESSION

Lossy image coding by partitioned iterated function system (PIFS), popularly known as Fractal Image Compression, has recently become an active area of research. Fractal theories are totally different from the others [1].

The idea fractal image compression is to find subspaces (or sub images) of the original image space, which can be regenerated using IFS. Where possible, if on IFS can be used in place of several IFS's which reproduced similar sub images, it is more efficient in terms of storage space to use that one IFS. It is more likely that an image will require more than one IFS to reproduce a compressed image, which closely resembles the original [3].

Fractal image compression is also called as fractal image encoding because compressed image is represented by contractive transforms and mathematical functions (iterated functions) required for reconstruction of original image[4], [5]. A. E. Jacquin suggested to have the range and domain blocks to be always in the shape of a square and the domain size to be twice the size of the range [1].

In fractal compression system the first image is partitioned to form of range blocks then domain blocks are selected. This choice depend on the type of partitioned scheme used then set of transformation are selected which are applied on domain blocks to range blocks and determines the convergence properties of decoding [1].

2.1 Fractal Image compression has the following features [1]:

- Compression has high complexity.
- Fast image decoding.
- High compression ratio can be achieved.`
- It is resolution independent.

2.2 Fractal Image Compression has three basic steps [1] :

- Partition the image.
- Encoding.
- Decoding.

III FRACTAL IMAGE COMPRESSION ALGORITHM

3.1 Encoding

The image should be used in this compression are of the square size. The image is partitioned into non-overlapping square blocks R_n (range blocks) of size $B * B$ and large over lapping square blocks D_n(domain blocks) of size $2B * 2B$. That means, the pixels in the domain are average in group of four so that the domain is reduced to the size of range [2].

For a range block R_n, we would find the best domain block D_n with the corresponding mapping T_n . Apply IFS transformation from domain block to range block. To use IFS to reproduce images by partitioning an image into blocks, typically $8 * 8$ or $16 * 16$ pixels, it becomes possible to map small portions of an image to large portions. The smaller portions are reproduced by using affine transformations. These transformation effectively map squares to parallelograms through translation , scaling, skewing, rotation etc [6].

The affine transformation of the pixel values is found that minimizes the rms difference between the transformed domain pixel values and range pixel value. Select best domain with best transformation (compare each range block with whole domain blocks to find the best match). In this way an image can be stored as a collection of affine transformations that can be used to reproduce a near copy of original image [2].

Once the best matching domain block is obtained, the reconstruction error is estimated. If it is small than the threshold, a fractal code is generated, otherwise the range block is split into four sub blocks of size $B/2 * B/2$. Pixels to be considered in the next level of the quadtree decomposition. The partitioning process finishes when a minimum block size is reached [7].

3.2 Decoding

The decoding in fractal compression is much faster compressed with the encoding, here the time depends on the number of iterations, however, we will see that only a few iterations are required to reach the fixed point or attractor [1].

Load the saved coefficients. For decoding, an image consists of iteration T from any initial image. In every iteration, for each range R_n , the domain D_n that maps to it shrunk by two in each dimension by averaging non-overlapping groups of pixels and stored the fractal codes information $\{Dxi;\ Dyi;\ si;\ oi;\ Ui\}$ that is location of the domain block in the image space, contrast factor, brightness and type of affine transformation. The shrunk domain pixel values are multiplied by s_i added to and o_i placed in the location in the range determined by the orientation information. This is one decoding iteration

We can define $T_i : F \rightarrow F$ operating on image f(x, y) by

$$T_i(f)(x,y) = s_i\, f\big(T(x,y)\big) + o_i$$

Provided T_i is invertible and $(x, y) \epsilon R$

The decoding step is iterated until the fixed point is approximated [2].

IV CONCLUSION

In this paper, we have described the nature of image compression system based on a fractal theory of iterated contractive image transformations. The advantage of using fractal image compression is that for each range block we have to save only few coefficients, which will give the ability of obtaining a very high compression ratio.

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