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A Review on APCC based Fractal Image Compression

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Abstract-.An ***increasing rate of multi-media increases the verity of multi-media data such as image video voice and text. The size of these data need more space for storage and more bandwidth for transmission. For the flexibility of storage and transmission used lossless image compression technique. The lossless image compression is very efficient but faced the problem of compression ratio. In series of image compression fractal transform function are used. Fractal transform based by virtue of symmetry. The symmetry nature of fractal wavelet transform provides block level image compression technique. But the process of computational is poor then the performances of fractal transform function are decease. In this paper presents review of lossless image compression based on fractal transform function and used block co-efficient technique***

Keywords— Lossless Image Compression, Fractal Transform, Block Coding, Correlation Coefficient.

INTRODUCTION

The use of efficient and robust data compression methods has become of fundamental importance in nowadays communication systems due to the large amount of information being transmitted and stored. Fractal image compression is one of the most promising techniques for image compression due to its resolution independence, fast decompression, and its ability of obtaining high compression rates with smaller quality degradation compared to traditional compression methods. Compression and decompression technology of digital image has become an important aspect in the storing and transferring of digital image in information society. At present, fractal image compression has become one of the most promising encoding technology in the new generation of image compression for its novel idea, high compression ratio and resolution independence[1].

The basic idea of fractal image compression technique was introduced by Barnsley et al in 1988[2]. Image encrypting methods can encode covert images in the space domain or in the spatial frequency domain. About the encoding cases for the space domain, encoded covert images can be reconstructed without any distortion usually. However, the covert images are protected with lower security often, so Unauthorized people can usually decode the covert images more easily [3]. Fractal image compression has become an important lossy technique due to its capacity of achieving high compression ratio and high reconstructed image quality . The basic idea of fractal image compression is to exploit self-similarities present in the image to reduce the amount of redundancy. Many methods for encoding covert images in the space domain have been proposed. Image-transform or image-mapping methods, cellular automata methods, chaotic sequence methods, and image-scrambling methods are some examples. The above methods are easy for both encoding and decoding, but the executing time of the decoding processes is usually long. Fractal image compression (FIC) is an image coding technology based on the local similarity of image structure [4]. In recent years, many fast fractal encoding methods have been proposed to improve the fractal image en-coding. In each case the approach is taken to reduce the number of domain blocks to be matched, by the use of such methods as classification, local variances, features, and adaptive search. The bottleneck in the PIFS fractal coding scheme is the time spent in the encoding process [5]. In order to alleviate this serious encoding time problem, several efficient fractal encoding algorithms have been developed. These encoding algorithms include the domain pool selection approach, the partitioned-based approach, and the search strategy-based approach. The basic fractal image compression scheme (BFIC) is base d on contractive transformations and PIFS in a two-dimensional metric space [6]. The PIFS, which is essentially a set of contraction mappings, are determined by analyzing the image. These mappings can exploit the self-similarity that is commonly present in most images. That is part A of a certain image is similar to another part B of the image, by doing an arbitrary number of contractive transformations that can bring A and B together. Wavelet transform is used to decompose the original image to various frequency sub-bands in which the attributes can be extracted from the wavelet coefficients belonging to different sub-bands [7]. T he distribution of wavelet coefficients can be use d in context-based multi scale classification of document image [8]. The fast and efficient algorithm was applied to triangular mesh to approximate surface data using wavelet transform coefficients. It directly determined local area complexity in an image and divide s square cells depending on complexity.MD coding has emerged as an attractive frame-work for robust transmission over unreliable networks. It can efficiently combat packet loss without any retransmission thus, satisfying the demand of real-time services and relieving the network congestion [9]. In MD coding, two or more bit streams called descriptions of the same image are generated, which can be independently decoded. At the same time, the descriptions should carry correlated information (redundancy). Similarly images are compressed by removing spatial redundancy and temporal redundancy using intra frame coding and interframe coding respectively[10]. Block matching motion estimation is a vital process for many motion compensated video coding standards [11]. A novel fractal compression scheme is proposed to meet both the efficiency and the reconstructed image quality requirements. This scheme is based on the fact that the affine similarity between two image blocks is equivalent to the absolute value of Pearson's correlation coefficient (APCC) between them [12].

FRACTAL IMAGE COMPRESSION (FIC)

FIC has because an important lossy technique due to its capacity of achieving high compression ratio and high reconstructed image quality. The basic idea of fractal image compression is to exploit self-similarity present in the image to reduce the amount of redundancy on the other hand the main disadvantage of fractal encoding is its high computation cost due to the search used to find self similarities [4]. Barnsley in 1988 was first to suggest the use of a set of transformations into compactly store images, the self-similarity contained in the image ate represented by iterated function system (IFS). An iteration function system is a finite set of contraction mapping on a complete metric space [5]. Jaquin in 1991 was proposed to partition the image into square blocks search for region or blocks of the image which ate self-similar according to certain criterion and once a match in found Compute the transformation [7].

In fractal encoding the image is divided into range and domain blocks the smaller non-overlapping range blocks R. cover the entire image, where as larger domain block D are usually constructed from a subset of the original image. For each range block the set of domain blocks is search for the best match. The size of the domain block collected has a significant impact on the matching efficiency of each range block to its domain block and on the reconstructed image quality. A contractive transformation is used to map each range block to its matched domain block. The transformations aims at minimizing a metric distortion measure during the search process similarly transform parameter between the range block and its corresponding domain block ate used to encode the range block [8].

To improve the reconstructed image quality eight transformation are applied to all domain block [10]. the transformation operation by rotating 90 degree clockwise the original and the mirror domain block, to obtain the best match for each range block R the entire domain pool D and sD+o1 exits to minimize the square l^2 distance with R, where s and o are the affine scalar parameter and pixel equal to 1.

$$MSE\ (R, sD+o1) = \| R - (sD+o1) \|_2 \qquad \text{----------(I)}$$

Where $\|.\|_2$ is the two-norm and all the subsystem of range cells group into the PIFS of the original image. Minimizing MSE in equation (I) by the mean square error (MSE) have to find out the value of s, o and simplified energy function H, for the range block R, maximizing energy function in the domain pool is equivalent to minimizing MSE in equation (I). The reconstructed of the image is a process of iterating computation if achieves the attractor of the PIFS, which is a fractal representation of the original image. The affine similarity between two image block in FIC is equivalent to the solution value at the Pearson's Correlation Coefficient between them, the most affine similar block for R is the block having the largest absolution value of Pearson's correlation coefficient with R [12].

CLASSIFICATION WITH APCC

The absolute value of the Pearson's correlation coefficient (APCC) should be an efficient feature to speed up encoding because the affine similarity between two blocks FIC is equivalent to the APCC between them. Correlation Coefficient between two variables and it ranges between -1 and 1. If the two variables are in perfect linear relationship, the coefficient will be either -1 or 1. The sign depends on whether the variable ate positively or negative related. The correlation coefficient is 0 there is no linear relationship between the variable two different type of correlation coefficient are in use. One is called the Pearson product-moment correlation coefficient which is based on the rank product-moment correlation coefficient is more widely used in measuring the association coefficient is more widely used in measuring the association between the variable [11].

First the fisher proposed a FIC classification scheme to speed up encoding in which a method divided the domain pool with classification the domain block into three classes. In this scheme the every range or domain block id firstly divided into sub-blocks according to the mid-horizontal axis and the mid-vertical axis. Then all range and domain blocks are classified into three classes according to the means of luminance in the four sub-blocks. We are considering the four sub-blocks are a1, a2, a3, and a4 form the upper left to the lower right respectively. The domain blocks D is transforms to eight blocks by eight transformations in FIC.

If a1, a2, a3, and a4 are very each other in D. there is one and only one block derived from the one of the their condition.

$$a1 \geq a2 \geq a3 \geq a4$$
$$a1 \geq a2 \geq a4 \geq a3$$
$$a1 \geq a4 \geq a2 \geq a3 \qquad \text{----------- (II)}$$

Then block D is classified into one of the three classes in accordance with the coding which one if its generated blocks the corresponding transformation T, which transform D into this class can also be obtained. If the some values are same in classes then two of more blocks from D may meet two or all of the condition. The blocks can be classified into two or all classes. The domain pool without enlarging with the eight transformations is called crude domain pool and the domain pool enlarges with that transformation is called fractal image compression domain pool. In this scheme for the simplicity every block is classified into only one class according to priority order of class 1, class 2, class 3 expressed in equation (II) even if some sub-blocks of the block have the same of luminance. Then the index if the block D in the crude domain pool. The transformation in D to the class it belongs to and these domain classes filled with the transformation domain blocks ate retained to encode on image, alternate condition is that the redundant generated blocks from the block D, are useless each range block is also classified with the same method and its matching domain block is searched in the same class the total domain block number in the three domain classes is only one eight of the domain block number in fractal image compression, which can be greatly reduce the pair wise comparisons between the range blocks and domain blocks that all the domain and range blocks ate classified into three classes to reduce the pair wise comparisons further and we get the better reconstructed image quality because the fishers 3 classes method is APCC based [12].

SORTING DOMAIN BLOCK WITH APCC

To reduce more time complexity then use the sort the domain block with respect to APCC. If APCC of a pair of R, D and B equal to 1, then the domain block D is a high quality matching block B with non-zero variance APCC between R and B is close to APCC between D and B. A preset block B is used to sort the domain blocks by APCC, computed between each domain block and the preset block R its corresponding domain block in which the APCC of these domain blocks ate close to APCC between R and B. domain pool has been simplified and classified into three classes by fishers three classes method therefore we require only sort each domain class to which R, computed because of APCC is an absolute, both the blocks R and –R need to be taken into consideration. The fig show that the block R is transformed into R* to match one class defined in equation (II) as well as –R is transform into (-R)* to match the same class, means R* and (-R)* always match the same class but the transformation from R and R*, the transformation form –R to (-R)* are generally different.

Fig.1 show that If acc is APCC between R* and the preset block B then a set of domain block is chosen for R* to search its matching domain block. The set of domain block is chosen in the ordered domain class to make APCC between the preset block B and these blocks in this set all around acc. These block in this set are selected from an acc in this ordered domain class. Then the pair wise comparison are perform between R* and the entire block in the set to search the corresponding domain block for R*. The (-R)* also needs to be consider because APCC is an absolute value. The final matching block for k should be chosen from both the matching blocks for R* and (-R)* for the block R*, a set of domain blocks is required to search its marching block in the corresponding domain cross . The set of used for each block R* has in the ordered domain class then k block meat the block ate selected for the final comparison.

A preset block B is required to compute APCC with other blocks. We ate using the preset blocks ate trained offline and then they ate directly applied in the encoding process as auxiliary blocks when preset blocks are used then we get two option one is the preset block to get away from the berycentre of the domains class and other is for taking the berycentre as the preset block but preset block B by training is well because the classes in equation (II) are absolute independent in the search process their preset block can be trained independent. [12]

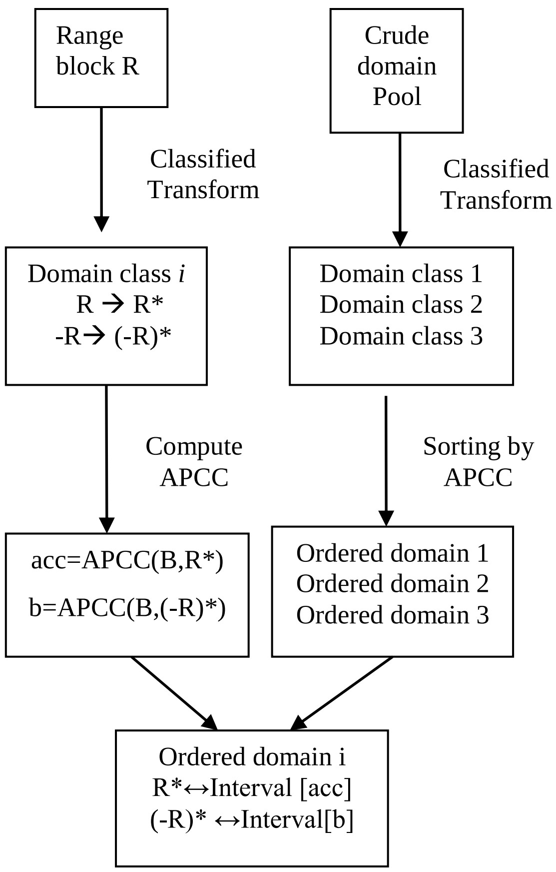

Fig 1. The FIC scheme with classification and sorting based on APCC

FRACTAL IMAGE COMPRESSION GENERAL PROCEDURE

Fractal encoding relies on the fact that all natural, and most artificial, objects contain redundant information in the form of similar, repeating patterns called fractals. Following are general procedure of fractal image compression.

Encoding:
Step 1: Initially we get a image and divide it into small and non-overlapping, square blocks. This is called as a "parent blocks"
Step 2: Divide each parent block into 4 each blocks, or "child blocks."
Step 3: Compare each child block against a subset of all possible overlapping blocks of parent block size.
Step 4: Need to reduce the size of the parent to allow the comparison to work.
Step 5: Determine which larger block has the lowest difference, according to some measure, between it and the child block.
Step 6: Calculate a grayscale transform to match intensity levels between large block and child block precisely. Typically an affine transform is used (w*x = a*x + b) to match grayscale levels.

Decoding:
Step 1: Read in child block and transform block position, transform, and size information.
Step 2: Use any blank starting image of same size as original image

Step 3: For each child block apply stored transforms against specified transform block
Step 4: Overwrite child block pixel values with transform block pixel values
Step 5: Repeat until acceptable image quality is reached

FRACTAL IMAGE COMPRESSION USING PEARSON CORRELATION COEFFICIENT GENERAL PROCEDURE

Encoding:
Step 1: Initially we get a image and divide it into small and non-overlapping, square blocks. This is called as a "parent blocks"
Step 2: Divide each parent block into 4 each blocks, or "child blocks." And generate Domain Blocks and Range Blocks
Step 3: Calculate APCC of each individual domain block, and then sort the domain blocks depending upon the APCC value
Step 4: Categories the domain blocks in 3 classes having the respective Range of APCC value to each class of domain block set.
Step 5: For Each Range block calculate its APCC value and check in which class of domain block set it comes.
Step 6: pick the class in which the APCC of range block lies and the compare it with the domain blocks.
Step 7: Determine which larger block has the lowest difference, according to some measure, between it and the child block.
Step 8: Calculate a grayscale transform to match intensity levels between large block and child block precisely. Typically an affine transform is used ($w*x = a*x + b$) to match grayscale levels.

Decoding:
Step 1: Read in child block and transform block position, transform, and size information.
Step 2: Use any blank starting image of same size as original image
Step 3: For each child block apply stored transforms against specified transform block
Step 4: Overwrite child block pixel values with transform block pixel values
Step 5: Repeat until acceptable image quality is reached

CONCLUSION

The field of fractal compression is relatively new, as is the study of fractals, and as such there is no standardized approach to this technique. The main concept in this compression scheme is to use Iterated Function Systems (IFS) to reproduce images. These Iterated Function System can be further optimized using Pearson Correlation Coefficient. the affine similarity between two image blocks in FIC is equivalent to the absolute value of Pearson's correlation coefficient between them. The main advantage it reduces the iteration and number of comparisons that can be helpful to increase the performance of the compression algorithm as well as image fidelity.

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