Review On Fractal Image Compression Techniques

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Abstract - *The image processing techniques plays an important role with the advancement of technology. It finds application in areas where efficient storage and transmission of image is necessary. Fractal coding is a potential image compression scheme which has the advantages of relatively high compression ratios and good reconstruction fidelity. Many methods are available to compress an image file like discrete cosine transform (DCT), discrete wavelet transform (DWT) and fractals. This paper presents different approaches of designing a fractal image compression based on different methods.*

Key Words*: *Image processing, discrete cosine transform (DCT), discrete wavelet transform (DWT), Fractal image compression.

1.INTRODUCTION

Images are very important documents nowadays to work with them in some applications they need to be compressed more or less depending on the purpose of the application. Due to limited bandwidth and storage capacity, images must be compressed before storing and transmitting. Image compression is an essential technology in multimedia and digital communication fields. Image compression is an application of data compression that encodes the original image with few bits. The objective of image compression is to reduce the redundancy of the image and to store or transmit it in an efficient form.

There are two types of image compression Lossy as well as Lossless. In lossless compression, the reconstructed image is numerically similar than that of the original image where as in lossy compression the reconstructed image contain some degradation. But this provides greater compression ratios than lossless technique.

Fractal Image Compression has generated much interest due to its promise of high compression ratios and also the advantages of very fast decompression. It is one of the lossy compression technique used in digital images. As the name indicates it is mainly based on the fractals. This approach is good for natural images and textures. In fractal coding, the image is divided into two sub-blocks with different size. One is called Range block (R) and the other is Domain block (D). R blocks do not overlap mutually covering the entire image while D blocks can overlap mutually and the length is twice of R blocks. This fractal image compression with wavelet transform can effectively solve the noise problem.

2. LITERATURE REVIEW

The research papers on the design of fractal image compression are published in various journals and presented in many conferences. Here the paper selected describes the design of fractal image compression based on DCT or DWT. Some of the papers are successful to give high compression ratio and some of these gave less encoding time.

Utpal Nandi and Jyotsna Kumar Mandal et. al.[1] designed an image compression based on the new fast classification strategy with quadtree partitioning technique. This classification strategy reduces the compression time significantly of the fractal image compression technique maintaining the same compression ratio and peak signal to noise ratio (PSNR). One is quadtree partitioning scheme where a range is broken up into four equal sized sub-ranges and another one is the classification strategy divides square block of image (range/domain) into 16 sub-block. For each block, a 64 bit ID is generated. The ID has row part and column part each of 32 bits. The row part has four 8 bit sub-ids- ID1, ID2, ID3 and ID4. To generate ID for each row, each sub-block are assigned a two bit code out of four possible codes 00, 01,10 and 11 that are termed as row code (RC). Similarly, to generate ID for each column, each sub-block B are assigned a two bit code out of four possible codes 00, 01, 10 and 11 that are termed as column code (CC). It reduces the compression time as compared to the other image compression techniques.

Chong Fu and Zhi-liang Zhu [2] designed a new block classification method based on the edge characteristic of an image block**.** There are total three steps for the

implementation of DCT-based fractal image compression. First one is image partition in which we partitioned image into a set of pixels range blocks which are non overlapping and set of pixels domain blocks which can be overlapping. Second one is image block classification in which the range and domain blocks are divided into three classes based on their DCT lower frequency coefficients and third one is best match exploiting in which only the domain blocks with the same class to the range block are calculated. The classification is based on the lower frequency horizontal and vertical DCT coefficients of an image block. The method proposed in this paper significantly improves the fractal encoding speed and also satisfied the fidelity of the reconstructed image.

Padmavati. S and Dr. Vaibhar Mesharam [3] designed an image compression on hybrid methodology. In this paper a new hybrid methodology is proposed by combining lossy and lossless compression methods. In this method, the given image is first compressed using DCT and to avoid compression on similar blocks of the image we are using fractal quadtree image compression. Finally the image is encoded effectively by using Huffman encoding. Huffman coding is used to improve the quality of the compressed image. Huffman coding when combined with DCT compresses the image to a very large extent.

The experimental results of the combined method using DCT and fractal quadtree decomposition was successful in terms of reducing the encoding time maintaining the quality of the image. This technique is also suitable for many real time applications such as medical images, satellite images, etc. The results also show an enhancement in compression ratio as compared to the traditional fractal compression using quadtree decomposition of image.

Mehdi Masoudi Chelehgahi and Mohsen Derakhshan Nia [4] designed an image compression based on high speed intelligent classification algorithm using DCT coefficients. This method specially used to reduce the encoding time. In this method, it reshape the given image into 1D array and calculate the DCT and standard deviation of each row. From the results it show that this method is faster than other standard ones to achieved high PSNR value.

Ahmad A. Nashat and N. M. Hussain Hassan [5] designed an image compression based upon Wavelet Transform and a Statistical Threshold. This compression algorithm based on the Haar Wavelet transform. The DWT of the image is generated by obtaining wavelet decomposition coefficients for the desired levels. The histogram for the selected level is calculated and a threshold for the decomposed image coefficient is selected which is based upon the statistics of the histogram.

Table -1: Overall analysis of different compression techniques

Comparison table shows the comparison of various approaches of designing an image compression. Analyzed the performance based on the parameter such as compression ratio, peak signal to noise ratio, encoding time.

PARAMETERS	REF. PAPER 1 2015	REF. PAPER 2 2009	REF. PAPER 3 2015	REF. PAPER 4 2011	REF. PAPER 5 2016
Compression Ratio	-	16.5	11.43	8.625	36.06
Peak Signal to Noise Ratio (dB)	28.87	31.34	25.48	28.60	31.63
Encoding Time(sec)	60	38.40	-	2.95	-
Transform	DCT	DCT	DCT	DCT	Haar Wavelet Transform
Method	FIC with Quadtree Partitioning	DCT	DCT combined with fractal quadtree decomposition & Huffman coding	High speed Intelligent classification algorithm using DCT coefficients	Wavelet transform & a Statistical Threshold
Image Type	Grayscale image	Grayscale image	Grayscale image	Grayscale image	Grayscale mage

3. PROPOSED METHODOLOGY

We propose a novel method which combines wavelets with fractal image in order to get the best results for image compression and decompression. Following block diagrams gives the perfect idea of propose methodology.

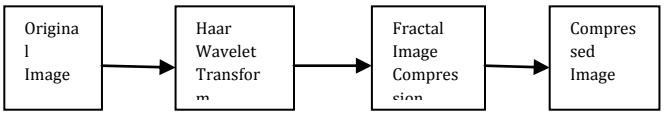

Fig. 1. Block diagram of Fractal image compression method using DWT

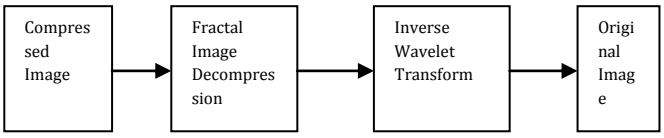

Fig. 2. Block diagram of Fractal image decompression method using DWT

4. CONCLUSIONS

The study of papers shows various approaches of designing the fractal image compression. It has been found that image compression is designed using discrete cosine transform (DCT), DCT combined with fractal coding and discrete wavelet transform (DWT). It is observed that the highest compression ratio achieved with wavelet transform & statistical threshold method is 36.06 [5]. In this case, the fractal image compression technique is not used with DWT. We are proposing a new approach for image compression where DWT is combined with fractal image compression which shall increase the compression ratio with low losses in the image.

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