Parallel Approaches for Implementing Fractal Image Compression Based on multi-objective Genetic Algorithm

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ABSTRACT
Now a day's increasing size of multi-media data decrease the performance of internet browsing and waste of transmission bandwidth. Now increase the browsing capacity and proper utilization of dedicated bandwidth required compression technique. The compression technique gives the verity of algorithm such as loss less compression and lossy compression. The process of loss less image compression is very complex and slow. How can improve the compression ratio is a major challenge in digital image compression technique. For the improvement of compression rate various algorithm and transform based method are used. In consequence of this process one researcher used genetic based image compression technique. In this technique used the parallel algorithm concept for image compression. But certain limitation is there. In this paper modified the genetic based image compression technique using multi-objective genetic algorithm for the image compression technique. The multi-objective genetic algorithm gives the two fitness constraints function one is selection of symmetry block and another is removal of redundant block of information.

Keywords: - Image Compression, HCC, Lossy image compression, Lossless image compression, JPEG, ACO.

INTRODUCTION

The digital multimedia is popular nowadays because of their highly perceptual effects. However, it often requires a large amount of data to store these multimedia contents due to the complex information they may encounter [8][10]. Besides, the requirement of resolution is much higher than before, such that the data size of the image is surprisingly large. Hence, image compression has proved to be a valuable technique as one solution. Presently, terms of digital image large amount of information is available. The solution for the storage of this information and transmission of this information is compression of image. There are various applications of image transmission such as long distance communication, television broadcasting, remote sensing using satellite etc [13]. Still image is a sensory signal. This sensory signal consists of information in significant amount which is redundant information. This redundant information is in canonical form. Compression of image data is the technique of reducing the redundancies in image data required to maintain a given quantity of information. Therefore, how to improve image compression becomes an important question. Great progress has been made in applying digital signal processing or wavelet transform techniques in this area [13][18]. There are two different technique groups including lossy compression and lossless compression depending on if the information can be recovered after compression. In lossless type, the original image and the reconstructed image generated after compression is numerically similar [14]. If the reconstructed image using loosy and original image is compared then it will found that reconstructed image contains degradation. Many times this happens due to completely discard of redundant information by compression technique. Higher compression is possible to achieve using lossy techniques of compression. A signal processed by visual system of human and which in 2-dimension is called an image. This signal is normally in analog form and it is converted into digital form. The purpose of this conversion of this image signal from analog to digital is the storage processing and transmission from one place to another place. A image in digital form is represented as 2 dimensional pixel array. Images play important role in many application such as video conferencing, health care, remote sensing etc. Presently, everything is getting computerized. This means use of computer in all areas is increasing very fast. So we need efficient ways for transmission and storage of large amount information in form of images [14]. The digital image is composed of many single points. This single point is called as pixel. Pixel is also called as smallest unit of picture. It is controllable. Below given Figure 1.1 displays the smallest addressable picture element of screen. Each pixel has its own address. The coordinates of pixel can be obtained using pixel address. 2-D grid representation is used to arrange pixels. For representing pixels, squares or dots are used. Every pixel is sample of an original image. Every pixel have different intensity. 3 or 4 component intensities like red, green and blue are used to display color in color image system. Uncompressed images can occupy large amount of memory space in RAM and in storage media, and they can take more time to transfer from one device to another. Data given in following table clearly shows need for sufficient storage space and more bandwidth because long transmission time is required for uncompressed image. So there is only one solution and that is to compress the image [13].

Rest of this paper is organizes as follows In Section II describe the image compression techniques. Section III gives the problem statement and formulation. In section IV discusses proposed methodology. In section V discuss

performance evaluation and result analysis followed by a conclusion in Section VI.

II IMAGE COMPRESSION TECHNIQUES

Digital image is represented by various pixel values in form of array [13]. Image contains redundant data because neighboring pixels are correlated. This is common property of most of the images [14]. In the digital image pixels of neighborhood are correlated and so that this pixels contain redundant bits [13]. Image compression system take an advantage of redundancies. Bits needed to represent an image are minimized. Compressed data is provided as an input to the inverse process. This process is called as decoding. The output of this process in reconstructed image [13][14]. The goal of compression system to minimize possible number of bits while maintaining reconstructed image quality and resolution as much as close to original image. Image compressions have two main components: redundancy reduction and irrelevant data reduction. Redundancy reduction is achieved by removing extra bits or repeated bits in image.

LOSSY IMAGE COMPRESSION

The compression ratio of lossy compression techniques is much high than lossless compression techniques. In many applications, the image quality is compromised, so that lossy compression techniques are used widely. In this technique original image and reconstructed image is not identical but reasonably similar and close to it. Prediction, transformation and then decomposition is totally reversible process in lossy compression. Loss of data is resulted in quantization. The next step is entropy coding and it is loss less. Then next process is of decoding which is reverse process. Here, in first step, compressed data is provided to entropy decoding and then from this quantized data is obtained. In second step, quantized data is provided foe de-quantization and then in third step inverse transformation is applied to get the reconstructed image. The performance of lossy compression techniques can be measure using Compression ratio, Signal-to-Noise ratio and Speed of encoding [12]. Below given are the various types of lossy compression techniques.

1. Transform Coding
2. Vector Quantization
3. Fractal Coding
4. Block Truncation Coding
5. Sub band Coding

LOSSLESS IMAGE COMPRESSION

The original image can be obtained perfectly from the compressed image in lossless compression techniques. As these techniques don't add error (noise) to the signal, these are called noise free or noiseless techniques of image compression. As it uses the technique of decomposition to reduce redundancy, it is also known by another name that is entropy coding [13, 15]. In many applications these techniques are used. The examples of this lossless image compression techniques can be found in areas such as healthcare, manufacturing industries, radiographic images etc. whose minute details means intricate details are very important. Similarly, another example where zero loss is required is circuit diagram images in electronics and electrical engineering. It is also used in ZIP file format application, executable programs, text documents etc. Some of the image file formats such as PNG and GIF are used only in lossless compression.

Following techniques are included in lossless compression [17]:

1. Run length encoding
2. Entropy Encoding
3. Huffman encoding
4. Arithmetic Coding
5. LZW coding
6. Lossless Predictive Coding
7. Multi resolution Coding

III PROBLEM STATEMENT

The problem is even more severe when a block crosses an image boundary. Here, they actually destroy valuable image information and the infamous blocky artifacts of the FIC compression appear. A logical consequence in improving such algorithms is to be less blind. Therefore one uses semantic image information, the so called image features, like edges or corners, to decide which are the vital information contents of the image one wants to preserve in the compression step. The problem of image compression based on FIC is mentioned in following step.

- The selection of block and index has same fitness function.
- Complex quantization process of zero trees.
- The bit of compression process is very slow.
- Difficult to design adaptable size of coded blocks according to the level FIC decomposition.

IV PROPOSED METHODOLOGY

In this section discuss the proposed algorithm for image compression. The proposed algorithm is composition of fractal wavelet transform function, genetic algorithm and HCC matrix. The fractal wavelet transform generates the symmetrical block coefficient, the symmetrical wavelet coefficient decomposed into number of layers. The decomposed layers computes in fashion of horizontal vertical and diagonal transform. The values of transform combined and make block matrix. The block matrix process for motion estimation process of structure reference process. The structure reference process set the block value of similar and dissimilar. For the finding the position the value of equal coefficient used improved genetic algorithm. The improved genetic algorithm searches the block coefficient for passes of code matrix HCC. The proposed algorithm discuss in three sections. Section first discuss the process of fractal transform function and in second section discuss structure reference section for allocation of block coefficient. And finally discuss the process of code matrix.

➢ SECTION FIRST

1. Input the image
2. Apply 2D fractal transform function and decomposed the image into number of layer in terms of details and approximate.
3. The processes of property of symmetry of fractal transform function.

4. compute the value of symmetry in the form of transform value
5. The block coefficient value of transform form a series of coefficients a1……an.
6. these coefficient passes through genetic algorithm and find optimal set of structure

➢ **SECTION TWO**

1. in this phase initialized the population set N=512;
2. define the fitness constrains selection for similar structure and dissimilar structure

$$fitness = V(r1,r2)/M(ri)$$

3. load the selected coefficient block for the process of encoding
4. define the correlation coefficient parameter is r1-r2=x
5. for every coefficient Ri in V
   x=0;
6. for every coefficient in Ri in V
   xij=x(ri,rj)
7. if(x=1) then coefficient is non- redundant
8. else
9. coefficient is redundant
10. two block code are generate one is redundant and another is non redundant

➢ **SECTION THREE**

1. the sorted coefficient of redundant and non-redundant input the HCC matrix
2. image compressed
3. find C.R value

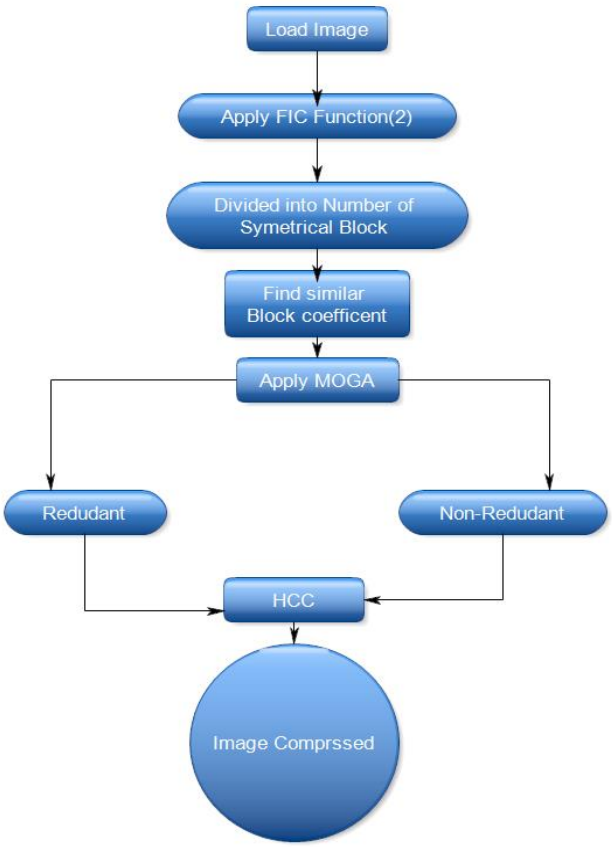

Figure 1: Shows the proposed model of image compression.

V IMPLEMENTATION DETAILS AND RESULT ANALYSIS

In this section, experimental process of image compression is performed. This process of image compression is done by using three methods that are JPEG, FICGA and FICIGA. The proposed method implemented in MATLAB 7.8.0. Here we are using three different image. They are having different sizes. Following table gives the details of images used as input dataset for this application. All these input images are of same dimension and that is 512 x 512.

Image Description:

Sr. No.	Name of Image	Size	Dimensions
01	Cameraman.jpeg	23.3 KB	512 X 512
02	Leena.bmp	256 KB	512 X 512
03	Barbara.png	181 KB	512 X 512

Table 1: Shows that the description of different images used in experimental process.

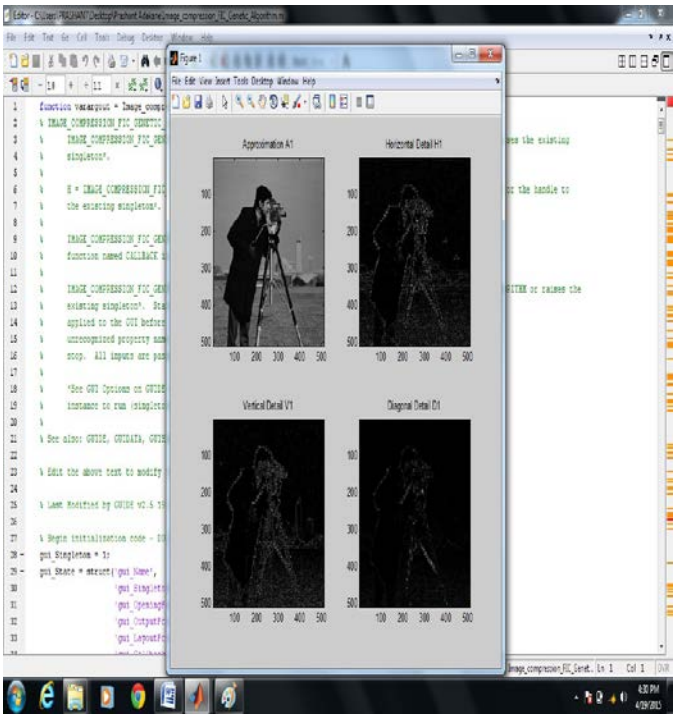

Figure 2: Shows Cameraman image details for Approximation A1 using JPEG compression method.

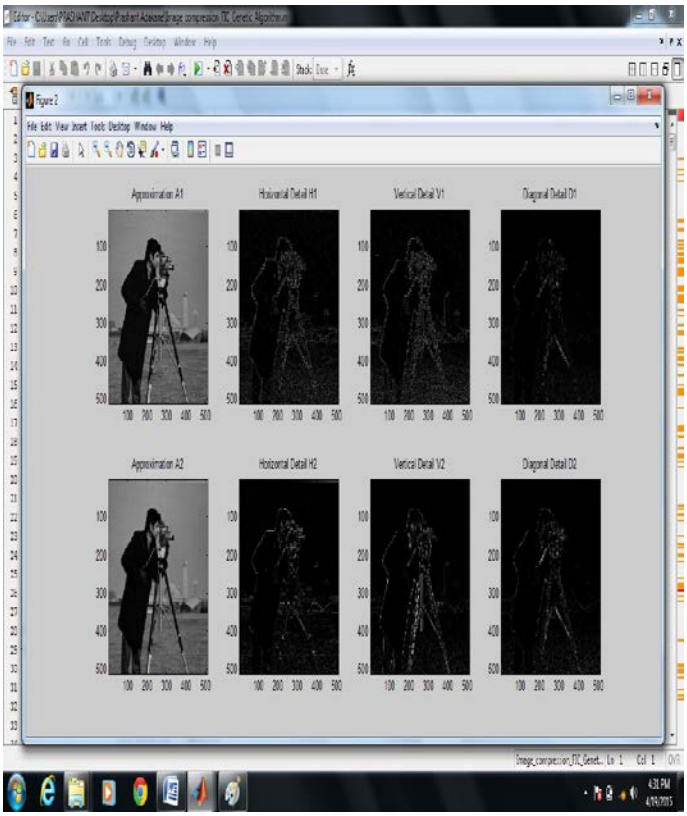

Figure 3: Shows Cameraman image details for Approximation A1 and Approximation A2 using JPEG compression method.

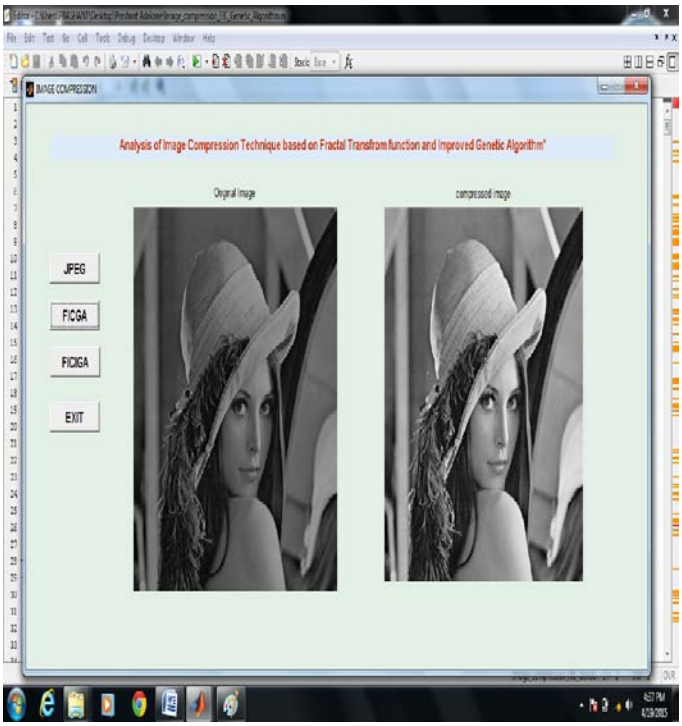

Figure 4: Shows that the Leena image in original and compressed form using FICGA image compression method.

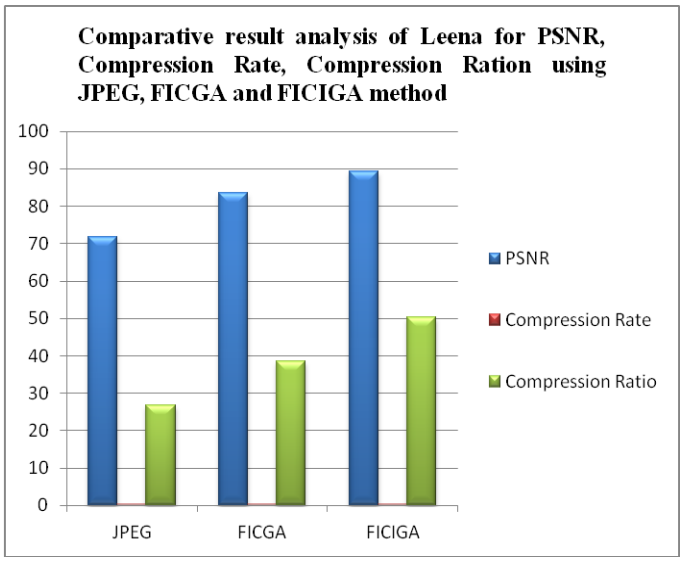

Figure 5: Shows comparative result analysis of Leena for PSNR, Compression Rate and Compression Ratio using JPEG, FICGA and FICIGA method and we found that our proposed FICIGA method gives better PSNR and Compression Ratio values than existing methods.

VI CONCLUSION AND FUTURE WORK

In this paper proposed a hybrid method of image compression. The hybrid method is a combination of fractal wavelet transform, genetic algorithm and HCC code matrix. The proposed algorithm improved the compression ratio and PSNR value. The increased PSNR value shows that the proposed algorithm is efficient in compression of JPEG and FICBGA algorithm. The fractal wavelet transform function provides the facility of block symmetry property for the selection of block coefficient. The improved genetic algorithm provide the searching process for block coefficient for finding similar and dissimilar block coefficient for the processing of searching technique. The similar block passes through HCC code matrix and HCC code matrix compressed the image. The compressed image measures the performance of image compression. Results indicate wavelet fractal transforms can decor relate gray data efficiently. Simple coefficients shuffling makes data to satisfy zero tree features. Classical encoding algorithm fractal in wavelet field is used to generate embedded data flow. Wavelet, a new thing developed from scalar wavelet has good characteristics. In this work, two algorithms, Particle Swarm Optimization and wavelet transform, were applied to solve a structural optimization problem which deals with the design of the wavelet packets. Both the DWT and genetic algorithms produced reasonable results in terms of PSNR and the compression scores. For the problems of which the feasible region was not narrow, that is when the lower bound of PSNR was low, genetic algorithm was successful. However, when the feasible region was shrieked, the performance of the genetic algorithm was not as good as in the former case. Suggestion of future in proposed image compression we used genetic algorithm for adaptive block coding. But genetic

algorithm is iterative process the computational time of method is increase and also some visual effect of image is degraded. Now in future we minimized computational time and improve the visual quality of compressed image. Also used another structure optimizations algorithm such as ACO ABC and another biological inspired function for compression of image for reduction of packet tree.

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