Analysis of Lossless Image Compression Technique Using Fractal Wavelet Transform Function and Improved Genetic Algorithm

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ABSTRACT

Image compression is an important task in image processing, use of wavelet transform function and genetic algorithm improves the quality of an image. Image compression is an important step for any complicated algorithms, in information security and image compression. In this paper we proposed a block based fractal image compression technique using genetic algorithm and HCC code matrix. The HCC code matrix compressed into two different set redundant and non-redundant here generate similar pattern of block coefficient. The similar block coefficient generated by particle of swarm optimization. The process of particle of swarm optimization is select the optimal block of fractal transform function. The proposed algorithm implemented in MATLAB software. This software is well known application for image processing. The process of implementation also used two different algorithm such as FICGA and JPEG. The experimental result shows that our proposed algorithm produces better result in compression of FICGA and JPEG. For the experimental purpose used some standard image such as Lena, Barbara and cameraman image. The size of resolution of this image is 512*512.

Keywords: - Image compression, Genetic algorithm, JPEG, PSNR.

INTRODUCTION

The digital image compression is vital research field in the area of communication and storage. The size of multimedia data acquired more space and more bandwidth during transmission and storage. In the process of size reduction and utilization of bandwidth used various image compression technique. Some compression technique based on lossy technique and some compression technique based on lossless technique [1]. The process of lossless technique is very slow instead of data the loosy compression is very fast and high compression ratio. The compression ratio basically depends on searching technique of similar block during compression process. In general the compression process used sequential search technique. The sequential search technique acquired more time and process are very slow [4]. So various authors used heuristic searching technique for the efficient searching process in image compression. A compression method consist definitions of two complex processes compression and decompression. Compression is a transformation of original data representation into different representation characterized by smaller number of bits. Opposite process reconstruction of the original data set is called decompression. There can be distinguished two types of compression: lossless and lossy [9]. In lossless compression methods, the data set reconstructed during decompression is identical as the original data set. In lossy methods, the compression is irreversible the reconstructed data set is only an approximation of the original image. At the cost of lower conformity between reconstructed and original data, better effectiveness of compression can be achieved. A lossy compression method is called “visually lossless” when the loss of information caused by compression-decompression is invisible for an observer (during presentation of image in normal conditions). However, the assessment, if a compression of an image is visually lossless, is highly subjective. Besides that, the visual difference between the original and decompressed images can become visible when observation circumstances change. Two classes of digital images can be distinguished analog and digital images. Both types fall into non temporal multimedia type [13]. Analog images are painted or created through photographic process. During this process, the image is captured by a camera on a film that becomes a negative. We have a positive when the film is developed no processing is possible from this moment. When the photography is made on a transparent medium then we are dealing with a dispositive (slide). Analog images are characterized by continuous, smooth transition of tones [15]. Digital images are characterized by multiple parameters. The first feature of a digital image is its color mode. A digital image can have one of three modes: binary, grayscale or color. A binary (bi level) image is an image in which only two possible values for each pixel. A grayscale image means that its each pixel can contain only a tint of gray color. As it was already mentioned, a digital image is a set of pixels. Each pixel has a value that defines color of the pixel [2]. All the pixels are composed into one array. The resolution of a digital image is the number of pixel within a unit of measure. Several Lossless image compression algorithms were evaluated for compressing medical images. There are several lossless image compression algorithms like Lossless

JPEG,JPEG 2000,PNG,CALIC and JPEG-LS.JPEG-LS has excellent coding and best possible compression efficiency [11].But the Super-Spatial Structure Prediction algorithm proposed has outperformed the JPEG-LS algorithm. This algorithm divides the image into two regions, structure regions (SRs) and non-structure regions (NSRs). Section II discusses about image compression techniques, Section III discusses about the proposed methodology. Section IV discusses comparative result analysis. Finally, concluded in section V.

II IMAGE COMPRESSION TECHNIQUES

FUNDAMENTALS OF IMAGE COMPRESSION

A compression method consists of definitions of two complex processes compression and decompression. Compression is a transformation of original data representation into different representation characterized by smaller number of bits. Opposite process reconstruction of the original data set is called decompression. There can be distinguished two types of compression: lossless and lossy [14]. In lossless compression methods, the data set reconstructed during decompression is identical as the original data set. In lossy methods, the compression is irreversible the reconstructed data set is only an approximation of the original image. At the cost of lower conformity between reconstructed and original data, better effectiveness of compression can be achieved. A lossy compression method is called "visually lossless" when the loss of information caused by compression-decompression is invisible for an observer (during presentation of image in normal conditions). However, the assessment, if a compression of an image is visually lossless, is highly subjective [11]. Besides that, the visual difference between the original and decompressed images can become visible when observation circumstances change. In addition, the processing of the image, like image analysis, noise elimination, may reveal that the compression actually was not lossless. There are many ways to calculate the effectiveness of the compression.

LOSSY COMPRESSION

The limitation of the effectiveness of lossless compression techniques brought about demand for different approach to compression, which will give better compression ratios [8]. Better effectiveness can be achieved only by disposing of the reversible character of the encoding process. The lossy compression methods reduce the information of the image to be encoded up to some level that is acceptable by a particular application field. This means that, apart from characteristics of a compression method known from lossless techniques compression ratio and time needed for encoding and decoding, in lossy methods occurs one more distortion rate. By distortion rate, one should understand the distance between original image and the image reconstructed in decoding process [9].

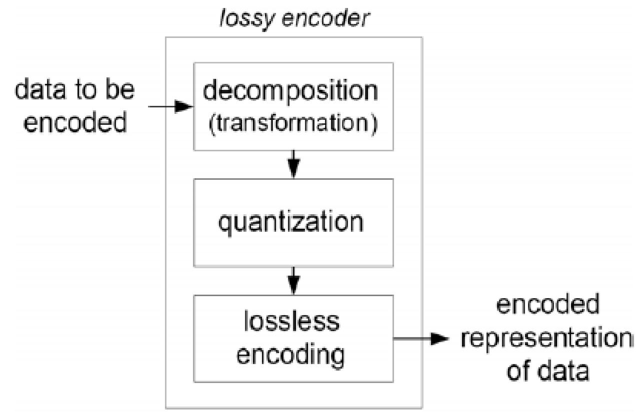

Figure 1: General scheme for lossy compression.

In lossy compression algorithms, two obligatory phases can be distinguished quantization and lossless compression. This means that the quantization is the key issue for lossy methods.

QUANTIZATION

Two types of quantization are used n lossy compression methods Scalar Quantization and Vector Quantization. Difference between these two types is what the elementary unit of symbols for processing is. In scalar quantization, this unit is equivalent of single symbol. While in vector quantization, it consists of some number of successive symbols a vector of symbols [10]. Both of these methods can employ regular or irregular length of intervals.

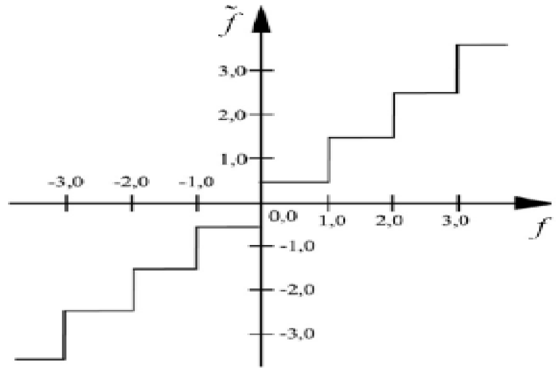

Figure 2: Regular scalar quantization.

The quantization can be executed in an adaptive manner. The adaptation can go forward or backward. In forward adaptation, the input stream is divided into pieces, which have similar statistical characteristics, e.g. variance. For each one of these pieces a quantization is being built separately. This method results in better quantization of the entire input stream with cost of greater computing complexity and enlargement of the size of description of the quantization attached to the encoded stream. The backward method of adaptive quantization builds the quantization based on data already processed during the quantization process. This method does not require any additional information about the quantization to be attached to the encoded stream [6]. The last phase of lossy compression methods is de facto a complete lossless compression method to which the output of quantization is passed as the input stream to be encoded. A large variety of lossless methods is used in different lossy compression methods. Any type of lossless method can be used here, but it must be chosen with respect to the decomposition and quantization techniques. Any phase of above-described scheme can be static or adaptive. Adaptive version usually leads to increased effectiveness with the cost of higher complexity of the algorithm.

III 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 value 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 search the block coefficient for passes of code matrix HCC. The proposed algorithm discuss in three section. 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 process 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 coefficient in terms of agent in search space
4. define the velocity parameter by difference of structure 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
4. find PSNR value
5. **exit**

PROPOSED MODEL

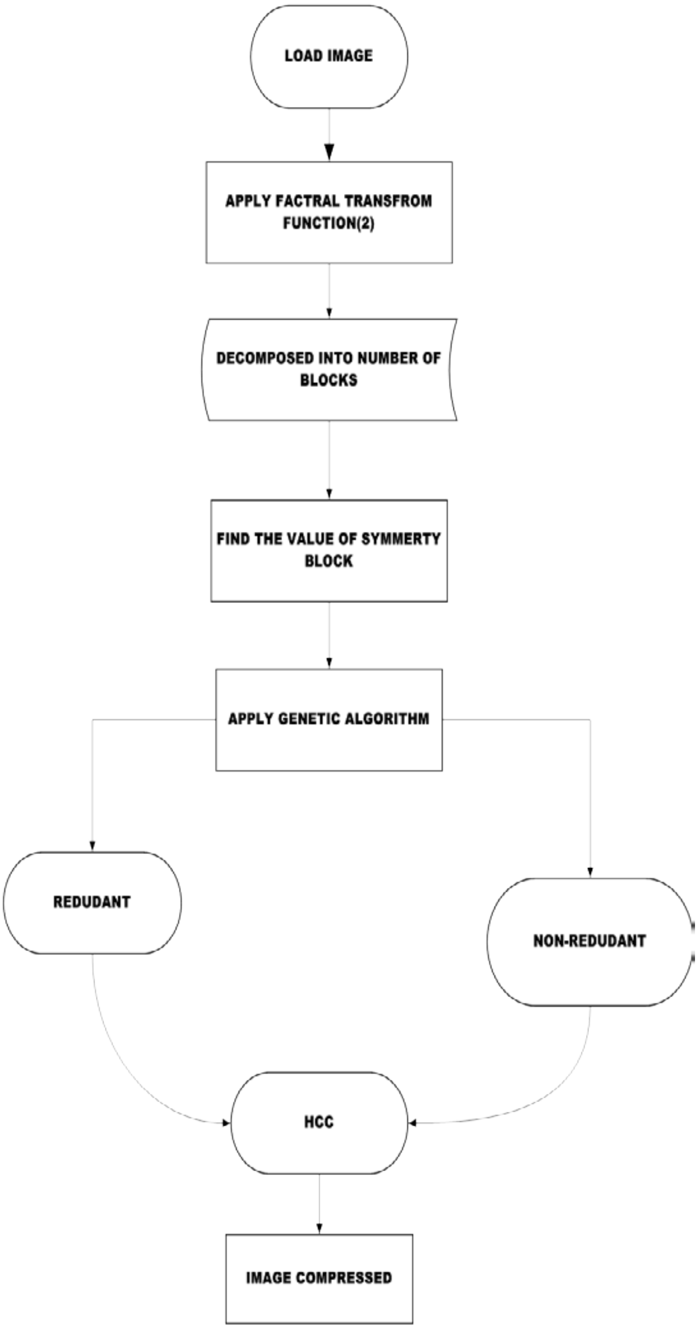

Figure 3: proposed Model of our Algorithm.

V EXPERIMENTAL RESULT ANALYSIS

In this section discuss the comparative result analysis of previous algorithm used for the performance evaluation of in the form of elapsed time, compression ratio and PSNR value for the JPEG, FICGA and proposed GA methods for Cameraman, Barbara image and Lena image. This all image is gray scale image size is 512 * 512 resolution is basic method for image compression techniques. The performance measuring parameter is PSNR.

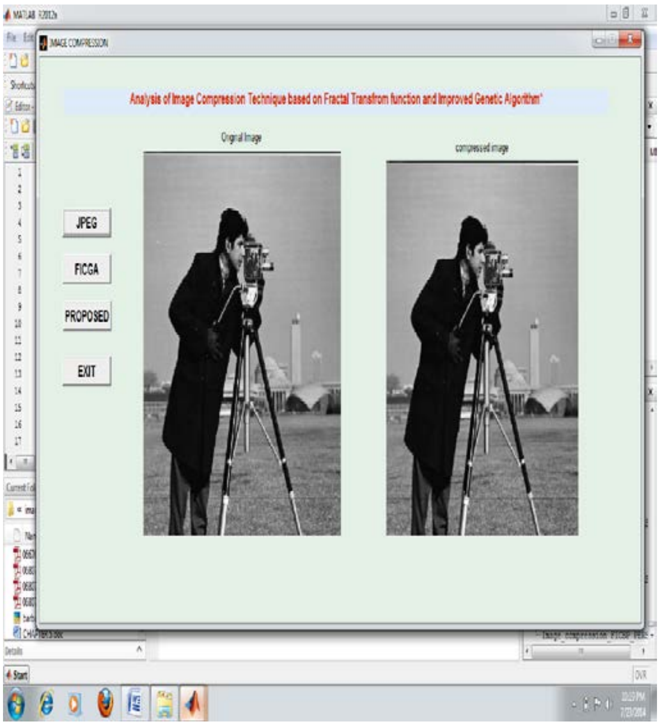

Figure 4: Shows that original image and compressed image of camera man based on JPEG method.

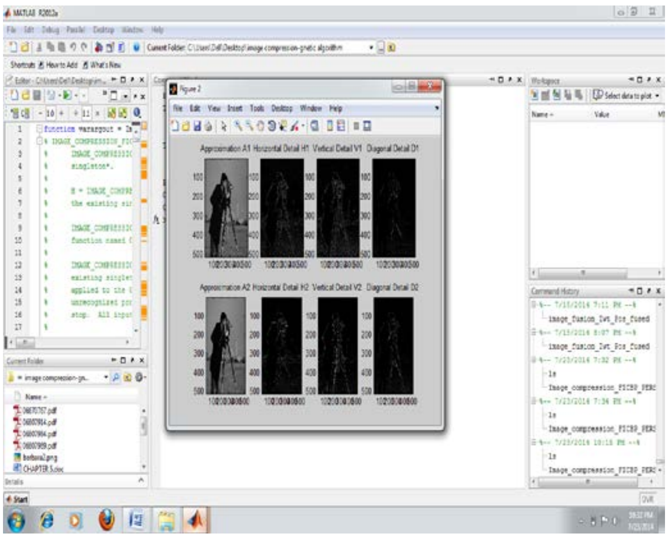

Figure 5: Shows that compressed image of camera man based on FICGA method the elapsed time of image is 5.4618 and compression ratio is 1.4834 and psnr value is 21.5604.

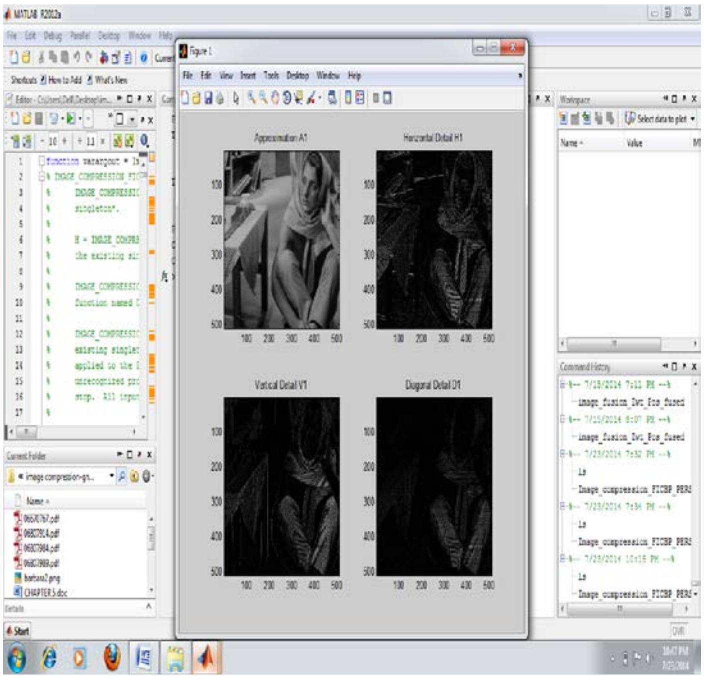

Figure 6: Shows that compressed image of barbara based on proposed method the elapsed time of image is 6.5333 and compression ratio is 2.1586 and psnr value is 18.1333.

Barbara image size 512*512

Method	PSNR	Compression Ratio	Elapsed Time
JPEG	8.1333	0.45864	6.5610
FICGA	16.1333	1.7586	6.5585
Proposed	18.1333	2.1586	6.5333

Table 1: Comparative result of Barbara image for their PSNR, Compression Rate and Compression Ratio.

Camera man image size 512*512

Method	PSNR	Compression Ratio	Elapsed Time
JPEG	13.5604	0.1833	6.8585
FICGA	21.5604	1.4834	5.4618
Proposed	23.5604	1.8834	5.7017

Table 2: Comparative result of Camera man image for their PSNR, Compression Rate and Compression Ratio.

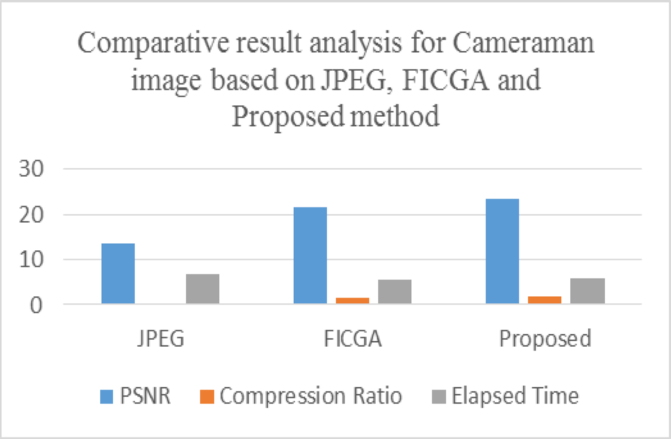

Figure 7: Shows that compressed image of camera man based on Proposed method the PSNR value of the image is 23.5604, compression ratio is 1.8834 and elapsed time is 5.7017.

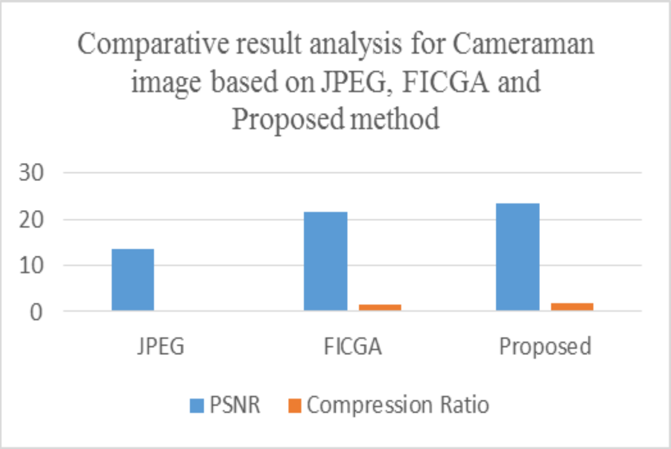

Figure 8: Shows that compressed image of camera man based on Proposed method the compression ratio is 1.8834 and PSNR value is 5.7017.

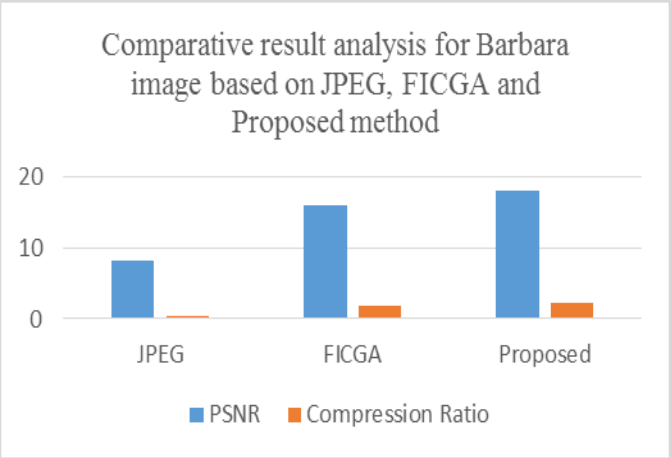

Figure 9: Shows that compressed image of Barbara based on Proposed method the compression ratio is 2.1586 and PSNR value is 18.1333.

V CONCLUSION AND FUTURE WORK

In this paper an image compression technique using JPEG, FICGA and GA method. 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 measure 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. 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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