IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified

Vol. 3, Issue 11, November 2016

Improved Firefly Algorithm for Fastest Encoding in Fractal Image Compression

S. Keerthika[1], S. Vidhya[2]

Research Scholar, Department of Computer Science, KG College of Arts and Science, Coimbatore, India[1]

Head of the Department, Department of Information Technology, KG College of Arts and Science, Coimbatore, India[2]

Abstract: The researchers are advanced in doing lots of work in the area of image compression. Fractal image compression needs lots of mathematical computation to compress an image. It is a lossy compression method with asymmetric process in which it takes more time in compression of an image than decompression. In this paper new technique is implemented to increase the speed of fractal image compression. The method using fast search strategies using proposed modified Firefly Algorithm with parallel sorting of blocks for fractal image compression is implemented. The purpose of the work is to overcome the drawback of fractal image compression which is the increased encoding time, the various speed up terms like compression ratio (CR), peak signal to noise ratio (PSNR), and encoding time. The test outcome on color and RGB images indicates a definite reduction in computational time and also achieving a faster encoding process. The experimental work done in this work proves that the proposed improved Firefly algorithm gives the best performance.

Keywords: Encoding, Firefly, Fractal image compression, Compression ratio.

I. IMAGE COMPRESSION

Image compression is useful to gain an image representation while reducing the quantity of memory wanted as much as achievable to encode the image. Compression methods try to eliminate repetitiveness, thus producing an extra dense code that preserves the essential and accurate information restricted in the original image. If all pixel value represents an exclusive and important part of information, it would be composite to compress an image. The data compressing a digital image or series of images are regularly redundant and irrelevant [1]. Redundancy relates to the numerical properties of images, while irrelevancy relates to the observer viewing an image. Redundancy can be divided into three types

- Spatial redundancy is suitable to the correlation between neighboring pixels in an image.
- Spectral redundancy is due to the correlation between planes or spectral bands.

Temporal redundancy is due to the correlation connecting neighboring frames in a sequence of images [1][2].

II. BASICS OF FRACTAL IMAGE COMPRESSION

Fractal image compression is a lossy compression method for digital images, based on fractals. The process is best matched for textures and natural images, relying on the information that parts of an image often be similar to other parts of the similar image. Fractal algorithms change these parts into numerical data called "fractal codes" which are used to rebuild the encoded image.
The word fractal was first used by Benoit B. Manderlbrot to assign objects that are self-similar at different scales as shown in Figure 1.1 Fractals. Such objects have information at every scale. Unfortunately, a good definition of the term fractal is indefinable. It is greatest to observe a fractal as a set that has a property such as those listed below, rather than to look for an accurate definition.

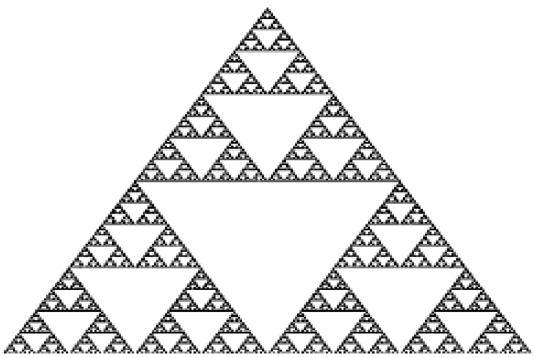

Fig.1 Fractals

If we consider a set F to be fractal, it will have some of the following properties:

1. F has aspect at every scale.
2. F is (exactly, roughly, or statistically) self-similar.
3. The 'fractal dimension' of F is better than its topological dimension.
4. There is a simple algorithmic explanation of F.

III. INTRODUCTION OF FIREFLY ALGORITHM

Firefly is an insect that typically produces short and rhythmic flashes that shaped by a process of bioluminescence. The function of the flashing light is to attract partners (communication) or attract possible prey

DOI 10.17148/IARJSET.2016.31135

IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified

Vol. 3, Issue 11, November 2016

and as a protective caution toward the predator. Thus, this intensity of light is the issue of the other fireflies to move toward the other firefly. The light intensity is diverse at the distance from the eyes of the beholder. It is safe to say that the light intensity is decreased as the distance increase [9].

The light intensity also the influence of the air absorb by the surroundings, thus the intensity becomes less attractive as the reserve increase. Firefly algorithm was followed three idealize rules,

1) Fireflies are worried toward each other's despite of gender.
2) The attractiveness of the fireflies is correlative by means of the intensity of the fireflies, thus the less attractive firefly will move onward to the extra attractive firefly.
3) The intensity of fireflies is depending on the reason function.

In firefly algorithm, there are two significant variables, which is the light intensity and attractiveness. Firefly is concerned toward the other firefly that has brighter flash than itself. The attractiveness depended with the light intensity.

IV. PROPOSED MODIFIED FIREFLY ALGORITHM WITH PARALLEL SORTING OF BLOCKS IN FIC

The fast search strategies using optimization in fractal image compression is proposed modified firefly algorithm with parallel sorting. The domain blocks and range blocks are initialized as population. The following steps are proposed to reduce the encoding time.

Step 1: Consider the objective function f(x), x=(x1,x2,x3...xd) as in domain and range blocks.
Step 2: Generate an initial population of fireflies in blocks x_i (i=1,2,...n).
Step 3: Formulate block intensity I so that it is associated with f(x).
Step 4: Define absorption coefficient γ in the image.
Step 5: check t is less than MaxGeneration for i = 1 : n (all n fireflies) and also for j = 1 : n (n fireflies).
Step 6: Vary attractiveness with distance r through move firefly i towards j.
Step 7: Evaluate new solutions and update light intensity.
Step 8: Rank fireflies and find the current best.
Step 9: Parallel sort of the fireflies based on range blocks and domain blocks.

V. PERFORMANCE METRICS

A. Compression ratio:

Data compression ratio is defined as the ratio stuck between the uncompressed size and compressed size. The data compression ratio can serve as a compute of the complexity of a data set or signal; in particular it is used to estimate the algorithmic complexity.

B. Peak signal-to-noise ratio:

The PSNR block computes the peak signal-to-noise ratio, in decibels, between two images. This ratio is often used as a quality between the original and a compressed image. Advanced the PSNR value the improved the quality of the compressed or reconstructed image.

The Mean Square Error (MSE) and the Peak Signal to Noise Ratio (PSNR) are the two error metrics used to compare image compression quality. The MSE represents the increasing squared error between the compressed and the unique image, whereas PSNR represents a measure of the peak error. Lower the value of MSE, the lower the error.

VI. RESULTS AND DISCUSSION

In this section we compare the encoding time, PSNR value, Compression ratio in terms for the existing and proposed scenario by using MATLAB R2013a. The results are described that the proposed scenario yields superior result for encoding of images.

Fig. 2 Boat image

Fig.3 Outcome of Boat Image

IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
ISO 3297:2007 Certified
Vol. 3, Issue 11, November 2016

The Experimental results executed in MATLAB R2013a on Intel (R) Core (TM) 2Duo CPU @ 2.00 GH_Z with 3.00 GB RAM along with 32 bit Windows 10 Pro Operating System. The test images used in the experiments is Boat image and Lena image.

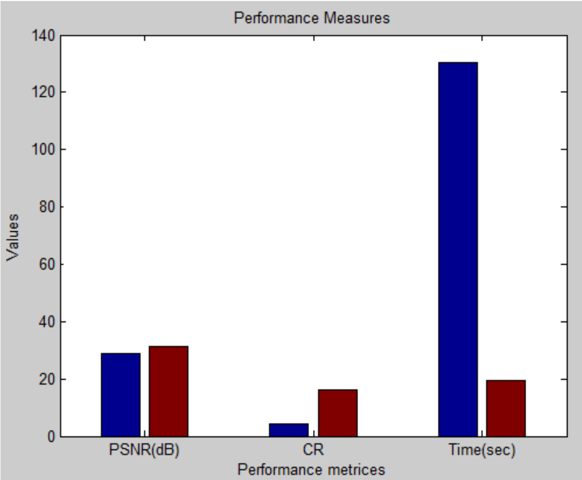

Fig.4 Performance of Boat image

Fig.5 Lena Image

Fig.6 Outcome of Lena Image

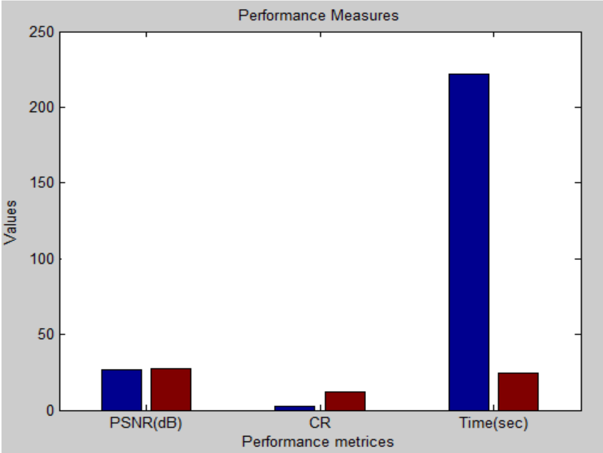

Fig.7 Performance of Lena Image

VII. CONCLUSION

Fractal image compression is an asymmetric lossy compression method which includes lot of computations in it. The proposed modified firefly algorithm with parallel sorting outcome on images indicates a definite reduction in computational time and also achieving a faster encoding process. The experimental work done in this work proves that the proposed improved Firefly algorithm gives the best performance.

REFERENCES

[1] Edward R. Dougherty (Editor), "Digital Image Processing Methods", Marcel Dekker, Inc., New York, 1994.
[2] Anil K. Jain, "Fundamentals of Digital Image Processing", PHI, New Delhi, 1995
[3] Yuval Fisher (Ed.), "Fractal image Compression Theory and Applications", Springer-Verlag, New york, 1995.
[4] M.F. Barnsley,"Fractals Every Where", Academic Press, San Diego, California, 1988.
[5] Mohammed Omari, Nasreddine Karour, and Souleymane Ouled Jaafri, “Fractal Image Compression based on Polynomial Interpolation”, IEEE 2016.
[6] Utpal Nandi, Jyotsna Kumar Mandal, Sahadeb Santra, Suman Nandi, “Fractal Image Compression with Quadtree Partitioning and a new Fast Classification Strategy”, IEEE 2016.
[7] A.E. Jacquin, "Image Coding Based On A Fractal Theory of Iterated Contractive Image Transformations", IEEE Transactions on Image Processing, IP- 1(1), pp. 18- 30, 1992
[8] Lester Thomas and Farzin Deravi, "Region Based Fractal Image Compression using Heuristic Search", IEEE Transactions on Image Processing, Vo1.4, No.6, pp.832-838, June 1995.
[9] Yang, X. S. Nature-Inspired Metaheuristic Algorithms. Luniver Press. ISBN 1-905986-10-6, 2008.