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IMPROVED STRUCTURE SIMILARITY IN FRACTAL IMAGE COMPRESSION WITH QUAD TREE

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ABSTRACT

Fractal Image compression uses different fractals is lossy compression technique. Textures and natural images are compressed & decompressed using fractal image compression. As there is repeation in the other parts of the same image. In proposed methodology, complete image is converted into mathematical equations. These equations are used to convert images into fractal codes. After reception these code may encoded with useful information. On the other hand fractal image compression is pixel based scheme such as JPEG, GIF and MPEG. After apply different Fractal image algorithm, peak signal to noise ratio is improved up to 25.83505of mandril standard image.

KEYWORDS: Fractal Image, Encoding, Decoding, PSNR.

Compression ratio of an image can be calculated using standard fractal image compression techniques. An image can be represented in form of pixels to store an image, memory ratio is required. These images are store in compressed form. A no. of transform takes place that are in repeation form. A no. of implications is used for reconstruction of an image. There are different levels of transformations, first level of transformation is known as fern. In this level there is no natural size of decoded image. From this point of view it is clear that this technique can decode any size of image (Wang Jing, 2010).

In many cases, this technique have low magnification rate. But it is very useful method for data transfer. In fractal image compression technique, images are encoded with magnification of the original image. Pixels of image represent the magnifications. If there is more no. of dots in the image, there is more magnification. For visible images, dots should be maximum. With the help of local repetition of the pixels, images are magnified by a factor 4. Pixelazationdoes not appear in decoded image. For example, 768 bits data is used to store 65,536 in form of pixels (Ching-Hung , 2012).Fractal image compression can decode an image at any level. In image compression technique, the image can be divided into various range blocks. These range blocks are 4×4 , 8×8 and 16×16 depending upon the pixels of an image. For each range block, there are two transformation are required. One transformation is geometrical transformation and another one is relative transformation. The geometrical transformation is used to change the mapping of an image. On the other hand, relative transformation is used to change the intensity of an image up to an extent. The various portion schemes are used for compression of an image. These schemes are used to improve the peak signal to noise ratio. Compression ratio is also improved by this scheme.

The remaining of paper is organized as follows. The overall past work is describe in Section II. Methodology used for proposed work is described in Section III. Result analysis describe in section IV. Finally, Section V describes the conclusion of paper.

LITERATURE REVIEW

Wang Jing et al 2010 the authors describe Strong cryptographic security, short encryption time, and robustness against noise are three goals of cryptosystem. Theoretical analysis and simulation results show that the proposed algorithm has a good robustness against noise, and can effectively resist chosen-plaintext attack, statistical attack and differential attack.

Ching-Hung Yuen et al, 2012 describe a chaos-based cryptosystem with compression capability is proposed for lossy image compression. Simulation results show that the compression performance of their approach is encouraging.

Yepin Lu et al, 2012 focuses on the production, coding, transfer and receiving display of 3D video technology and mainly describes the mainstream and hot issue of disparity estimation of two way light signals.

Roberto Kawakam et al, 2013 describe a Successive Projections Algorithm (SPA) enables the construction of multiple linear regression (MLR) models which can efficiently determine the compression ratio. It

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has applicable to experimental results generated by either time domain transient spectrometers or continuous-wave instruments.

Amir Anees et al, 2013 describe the problems of robustness and quantity of compression of digital independent spatial and frequency domains have been analyzed. In addition, few security statistical analyses such as correlation, entropy, energy, contrast, homogeneity, mean square error and peak signal to noise ratio have also been carried out.

Jin-Gang Yu et al, 2014 propose a novel bottom-up saliency model for detecting salient objects in natural images. In the proposed framework, the input image is first over segmented into super pixels, which are taken as the primary units for subsequent procedures and regional features are extracted. Then, saliency is measured according to two principles, i.e., uniqueness and visual organization, both implemented in a unified approach, i.e., the MERW model based on graph representation.

Luhong Liang et al, 2014 describe Example-based super-resolution (SR) approaches mostly reconstruct and optimize the high-resolution (HR) image according to objective criteria such as imaging model. Experimental results show the proposed approach has competitive quality and lower computational complexity compared with several state-of-the-art SR approaches.

TruptiMemane et al, 2014 describe the Discrete Wavelet Transform (DWT) ,offer the optimal results for image compression. The purpose of this paper is to selection of wavelet by comparing various wavelet functions like Haar, Daubechies, Symlets, Coiflets, Biorthogonal, Reverse-Biorthogonal and Discrete Meyer wavelet for satellite image compression.

R. Praisline Jasmi et al., 2015 describe Image compression, one of the advantageous techniques in different types of multi-media services. In this paper the proposal of image compression using simple coding techniques called Huffman; Discrete Wavelet Transform (DWT) coding and fractal algorithm is done. By using the above algorithms the calculation of Peak signal to noise ratio (PSNR), Mean Square error (MSE) and compression ratio (CR) and Bits per pixel (BPP) of the compressed image by giving 512512 input images.

Kiichi Fukuma et al., 2016 describe Computer aided diagnosis (CAD) systems are important in obtaining precision medicine and patient driven solutions for various diseases. The Cancer Genome Atlas (TCGA) and check for classification accuracy using support vector machine (SVM), Random Forests (RF). Our results indicate that they obtain classification accuracy 98.9% and 99.6% respectively.

Wenhan Yang et al, in 2016 describe the autoregressive (AR) model is widely used in image interpolations. In the objective quality evaluation, their method achieves the best results in terms of both PSNR and SSIM for both simple size doubling (2) and for arbitrary scale enlargements.

METHODOLOGY

The image decomposes into different blocks. Entropy coding is used for encoding and decoding. It is applied on the compressed image to decrease the encoding time and improve the compression quality.

The algorithm steps are as follows:

1. Read the input (color /gray) image, if color converts to gray.
2. Determine the image dimension; if the image is not square, convert to nearest square size.
3. The input is quantized to approximate the continuous set of values in the image data with a finite nearest set of allowed values.
4. Setting domain data.
5. Partition the image using quad-tree decomposition of threshold is 0.2, minimum dimension and maximum dimension is 2 and 64 respectively.
6. Domain, Range classification and matching.
7. Record the fractal coding information.
8. Applying Entropy encoding to complete image encoding and calculate the compression ratio (CR), encoding time (ET).
9. Applying Entropy decoding to reconstruct the image and quad tree partitioning method.
10. Calculate decoding time (DT), MSE and PSNR.

Fig 1 represents the encoding technique & fig 2 gives the decoding technique algorithm for fractal image compression. The procedure of proposed fractal image compression can be explained as follows: A brief account of the partitioning scheme (quad tree partitioning), procedure involved in computing the transformations for a given image (encoding algorithm) and steps to reconstruct the image (decoding algorithm) are presented.

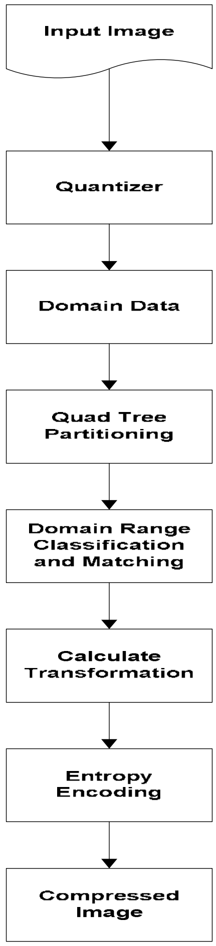

Figure 1: Proposed Fractal Image Compression Encoding Technique

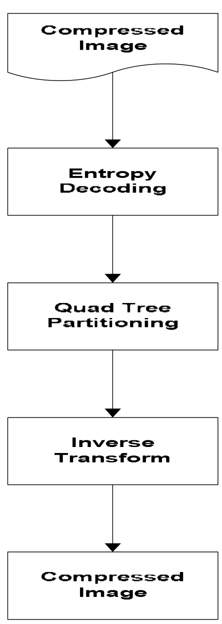

Figure 2: Proposed Fractal Image Compression Decoding Technique

RESULT ANALYSIS

Encoding is the process of putting a sequence of characters into a special format for transmission or storage purposes. Fig 3 shows that original image for fractal image compression. Fig 4 represents that quad tree decomposition of input image. There are different images used Mandrill, Barbara, Lena, Cameraman and Peppers Fig 5 gives the Huffman directory table of input image. Huffman directory of the input gives the vector probability of the compressed image. Fig 6 gives the comparison of input image with compressed image using PSNR.

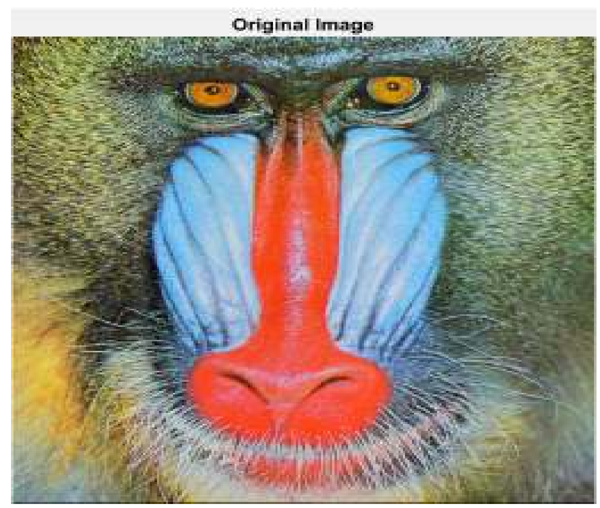

Figure 3: Original Image Taken for Fractal Compression

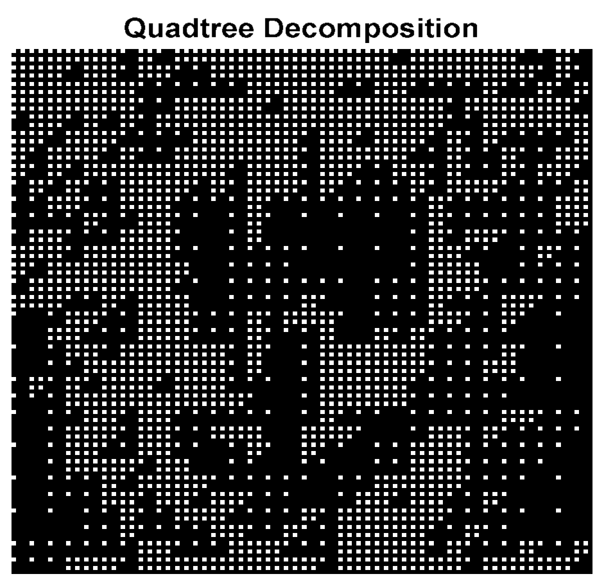

Figure 4: Quadtree Decomposition of input image

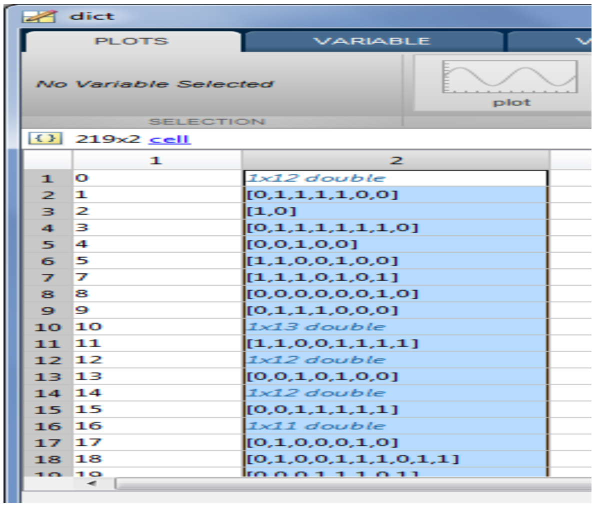

Figure 5: Huffman Dictionary of the input image

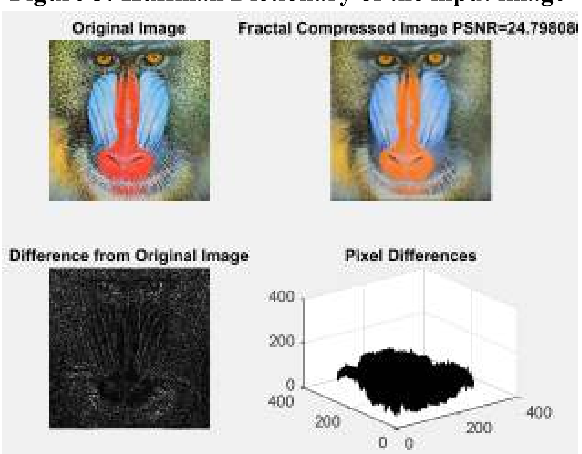

Figure 6: Comparison of input image with compressed image using PSNR, differences achieved and Pixel wise differences

Experimental results suggest the most images such as: trees, faces, houses, clouds etc. have similar portions within themselves and these features can be easily compressed by fractal compression and Quad-tree decomposition. The higher compression ratios for fractal images can be explained in terms of the occurrence of fractals due to repetition features at regular intervals. Hierarchical Quantized quad-tree decomposition and entropy coding are applied on images of different types and sizes. The results showed significant improvement in compression ratios, PSNR and better encoding time .These results are derived from the fractal compression with range block and iterations technique, the results are shown in Table belowFig 7 shows the comparison of different images for encoding time for the compression. As compression time is different for each image depending upon the size of image. For cameraman image compression is very less as compare to other images. Fig 8 shows the compression ratio for the various images. Mandrill image have very less compression ratio as compared to other. Fig 9 shows the peak signal to noise ratio of an image. Barbara has very high PSNR value.

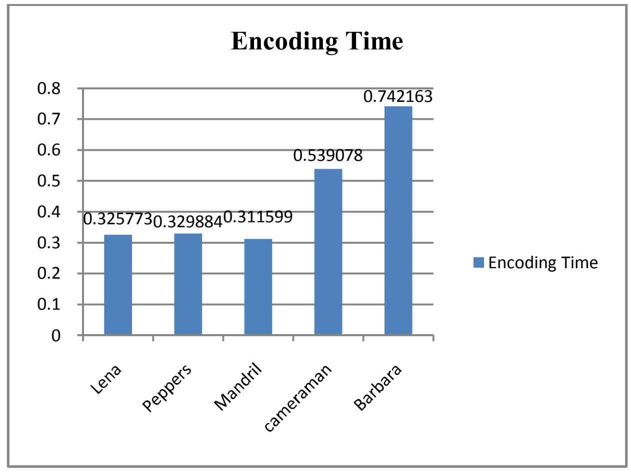

Figure 7: Encoding time for Various Images

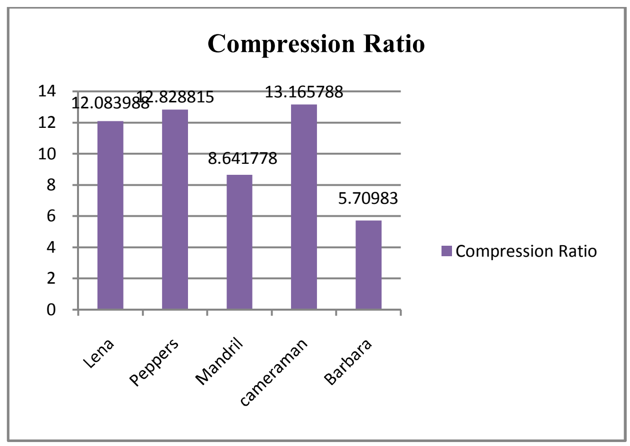

Figure 8: Compression Ratio for Various Images

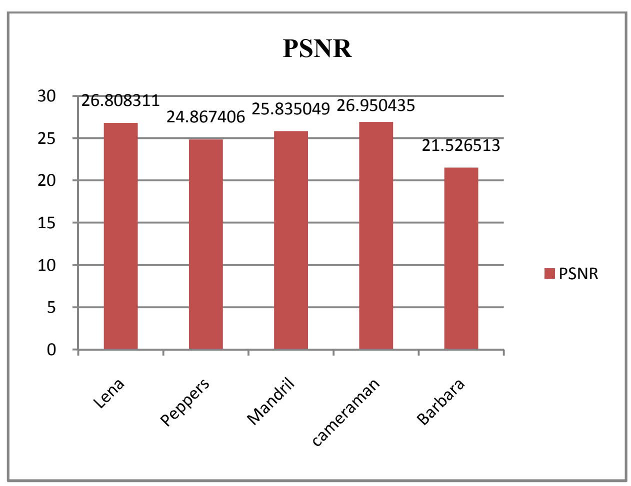

Figure 9: PSNR values for Various Images

Table 1: Fractal Image Compression Comparison

Image	Encoding Time	Compression Ratio	PSNR
Lena	0.325773	12.083988	26.80831
Peppers	0.329884	12.828815	24.86741
Mandril	0.311599	8.641778	25.83505
cameraman	0.539078	13.165788	26.95044
Barbara	0.742163	5.70983	21.52651

CONCLUSION

From the analysis carried out in the paper the following conclusions can be drawn. The quantized quad-tree decomposition and Entropy coding can be applied for improving the recovered image's quality and compression ratio significantly on different types of images. Perform scalar uniform quantization affected in the image quality, compression rate and encoding time. Fractal images can be easily compressed by fractal compression and Quad-tree decomposition. Decreasing images sizes making less encoding time, but decrease image quality.

REFERENCES

Wang Jing et.al., 2010. "Irrational-Based Cryptosystem", Coll. of Computation , Nanjing Univ. of Posts & Telecommunication., Nanjing, China, pp, 139-143.

Ching-Hung Yuen et.al., 2012. "Application of chaotic maps for simultaneous lossy image compression and encryption", Department of Electronic Engineering, City University of Hong Kong, 83 Tat Chee Avenue, Kowloon Tong.

Yepin Lu et.al., 2012. "A review on developing status of stereo video technology", Electronic and information engineering and electrical automation institute, Chaohu College, Chaohu China, pp715-718.

Roberto Kawakami et.al., 2013. "Multivariate analysis of the dielectric response of materials modeled using networks of resistors and capacitors", Instituto Tecnologico de Aeronautica Department of Electronics Engineering, pp995-1008.

Amir Anees et.al., 2013. "A technique for digital watermarking in combined spatial and transform domains using chaotic maps", Dept. of Electr. Eng., NUST, Rawalpindi, Pakistan, pp119-124.

Marios C.A. and Harry A., 2014. "Index", 10.1002/9781118796443.index.

Jin-Gang Yu, Ji Zhao, Jinwen Tian, Yihua Tan, "Maximal Entropy Random Walk for Region-Based Visual Saliency", Sch. of Autom., Huazhong Univ. of Sci. & Technol., Wuhan, China.

Luhong Liang et.al "Fast single frame super-resolution using perceptual visibility optimization", Hong Kong Appl. Sci. & Technol. Res. Inst., Hong Kong, China.

Trupti Memane et.al., 2014. "Selection of wavelet for satellite image compression using picture quality measures", Department of Electronics and Telecommunication, Sinhgad Academy of Engineering, Pune, India, pp1003-1006.

Jasmi R.P., Perumal B. and Rajasekaran M.P., 2015. "Comparison of image compression techniques using huffman coding, DWT and fractal algorithm", journal of image processing, pp 1-5.

Kiichi Fukuma et.al., 2016. "A study on feature extraction and disease stage classification for Glioma pathology images", pp 2150-2156.

Wenhan Yang et.al., 2016. "Isophote-Constrained Autoregressive Model with Adaptive Window Extension for Image Interpolation", IEEE Conference of biomedical image processing, 1-6.