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A NEW APPROACH OF FRACTAL COMPRESSION USING COLOR IMAGE

Indrani Dalui [*1], SurajitGoon [2], Avisek Chatterjee [3]
[*1, 2] Computer Application Department, Eminent College of Management & Technology, India
[3] Computer Application Department, BCDA Collage of Pharmacy & Technology, India

Abstract:
Fractal image compression depends on self-similarity, where one segment of a image is like the other one segment of a similar picture. Fractal coding is constantly connected to grey level images. The simplest technique to encode a color image by gray- scale fractal image coding algorithm is to part the RGB color image into three Channels - red, green and blue, and compress them independently by regarding each color segment as a specific gray-scale image. The colorimetric association of RGB color pictures is examined through the calculation of the relationship essential of their three-dimensional histogram. For normal color images, as a typical conduct, the connection necessary is found to pursue a power law, with a non- integer exponent type of a given image. This conduct recognizes a fractal or multiscale self-comparable sharing of the colors contained, in average characteristic pictures. This finding of a conceivable fractal structure in the colorimetric association of regular images complement other fractal properties recently saw in their spatial association. Such fractal colorimetric properties might be useful to the characterization and demonstrating of natural images, and may add to advance in vision. The outcomes got demonstrate that the fractal-based compression for the color image fills in similarly with respect to the color image.

Keywords: Image Compression; Iterated Function System (IFS); Self-Similarity; Histogram; Encoding Time.

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1. Introduction

Fractal Compression was first advanced by M. Barnsley, who established an organization dependent on fractal image compression methodology yet who has not discharged subtleties of his scheme [1]. A doctoral student of Barnsley's, A. Jacquin, was the first to distribute an equivalent fractal image compression method [2]. Fractal picture compression is another compression strategy which depends on self-similarity inside the diverse bits of the image [3]. The first open plan was because of E. Jacobs and R.Boss of the Naval Ocean Systems Center in San Diego who used standard partitioning and classification of curve segments so as to compress arbitrary fractal curves, (for example, political limits) in two dimensions [4]. It may be progressive in the realm of data compression due to its high compression rate contrasted and different strategies; in any case,

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it experiences a few issues, for example, the time taken for encoding. A fractal is a structure that is comprised of comparable structures and examples that happen in a wide scope of sizes.

The term fractal was first used to depict rehashing designs that he watched happening in a wide scope of structures. These patterns appeared almost indistinguishable in structure at any size and happened normally no matter what Mandelbrot likewise found that these fractals could be portrayed in mathematical terms and could be made utilizing extremely little and limited calculations and information [5].

Fractal encoding is to a great extent used to change over bitmap image to fractal codes.Fractal decoding is only the invert, in which a lot of fractal codes are changed over to a bitmap .The encoding process is incredibly computationally concentrated. Millions or billions of emphasis required to discover the fractal patterns in an image. Contingent the resolution and substance of the input bitmap data, and outcome quality, compression time, and report estimate parameters picked, compressing a single image could take wherever from a couple of minutes to a few hours (or more) on even a fast PC.

Decoding a fractal image is an a lot more straightforward procedure. The diligent work was performed discovering all the fractals amid the encoding procedure. The decoding procedure should simply to decipher the fractal codes and make an interpretation of them into a bitmap image. There are two primary groups of fractals: linear and nonlinear. The last are encapsulated by the famous Mandelbrot set and Julia sets, which are fractals of the unpredictable plane [6].

However, the fractals utilized in image compression are linear, and of the genuine plane. In this way, the fractals utilized are not chaotic; at other end, they are not delicate to initial conditions. They are the fractals from Iterated Function Theory. An Iterated Function system (IFS) is just a lot of contractive affine transformations [7]. IFSs may productively create shapes, for example, greeneries, leaves and trees. This introduced an interesting possibility; since fractal arithmetic is useful for producing normal looking images, would it be able to not, in the reverse direction, be used to compress images? The likelihood of utilizing fractals for image encoding lays on two suppositions:

1) Numerous natural scenes have this detail inside detail structure (for example mists);
2) An IFS can be discovered that creates a nearby guess of a scene using only a few transformations. Until now, a lot of work has been done on fractal gray scale image compression, albeit sadly not all that much exertion has been committed to fractal color image compression. In this paper the improvement of color images utilizing fractal-based image compression, since little work has been finished already here. Taking all things together, the fractal coding is constantly connected to grey level images. The utmost upright strategy to encode a color image by gray-scale fractal image coding calculation is to part the RGB color picture into three Channels, red, green and blue, and compress the system independently by regarding each color segment as a solitary gray-scale image. The colorimetric association is researched through the figuring of the correlation integral of their three-dimensional RGB color histogram. For normal scenes, As a typical conduct, the correlation integral is found to seek after a power law, with a non-integer exponent of a given picture. The most critical properties distinguishes the natural images lies in their multiscale self-similar dissemination or fractal conduct. This conduct finding of a

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conceivable structure in the colorimetric association of natural images supplement other fractal properties recently saw in their spatial association. Fractal colorimetric properties may supportive to the image portrayal and demonstrating can add to the comprehension of the visual system and may add to advance in vision. The outcomes got demonstrate that the fractal-based compression for the color images fills in just as for the gray-scale images.

Nevertheless, the encoding of the color images takes additional time than the gray-scale images. The Rest of the paper is sorted out as follows. In the following Section II. We referenced some related works about fractal image compression and decompression techniques. After that in the Section III. We proposed our model and in see IV. and V. we discussed and the result of our experiment and see the conclusion with future scope.

2. Related Works

As we know that all compression technique belongs to two type of compression, one called lossless and another is lossy compression. Fractal image compression is lossy type compression; there is a loss in some data, but high compression rate is achieved The French mathematician Benoit B. Mandelbrot previously begat the term fractal in 1975 [5]. He got the word from the Latin 'fractus', which signifies "broken", or "irregular and fragmented". In fact, the introduction of fractal geometry is normally followed to Mandelbrot and the 1977 production of his original book The Fractal Geometry of Nature [5]. Mandelbrot asserted that classical Euclidean geometry was lacking at depicting numerous natural objects, for example, mists, mountains, coastlines and trees.

So, he imagined and created fractal geometry. A fractal is a structure that is comprised of similar forms and patterns that happen in a wide scope of sizes. The term fractal was first used to depict rehashing patterns that he watched happening in a wide scope of structures. These patterns showed up about indistinguishable in structure at any size and happened normally no matter what.

Mandelbrot in like manner found that these fractals could be depicted in scientific terms and could be made using exceptionally little and finite algorithms and data [5]. Fractal encoding is commonly used to change over bitmap pictures to fractal codes [8][9][10]. Fractal decoding is just the reverse, Fractal decoding is just the reverse, in which a lot of fractal codes are changed over to a bitmap [8][9]. The encoding procedure is very computationally serious. A fractal image compression algorithm dependent on spatial correlation and half and half molecule swarm improvement with genetic algorithm (SCPSOGA), was proposed to diminish the searching space.

There are two phases for the algorithm: (1) Make utilization of spatial connection in images for both range and domain pool to abuse neighborhood optima.(2) Adopt hybrid particle swarm optimization with genetic algorithm (PSO-GA), to investigate the worldwide optima if the nearby optima are not fulfilled. At the reason of good quality of the recreated image, the algorithm spared the encoding time and got high compression proportion. According to GoharVahdati in [11].

Shiguolina et al have talked about Security of fractal encoded images in their paper [12]. They have straightforwardly worked a safe fractal image coding schema, which encrypts a portion of the fractal parameter amid the fractal encoding and delivered encrypted and encoded image. The

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properties of different fractal parameters, including parameter space, distribution and parameter sensitivity.

The encryption procedure helps to keep the document remain same format, keeps secure in observation, and costs brief period or computational resources. Chakrapani et al proposed a back engendering based neural system for fractal picture compression [13]. [13]. In order to improve the computational time and compression ratio, artificial intelligence system like neural network has been utilized.

Feature extraction diminishes the dimensionality of the issue and empowers the neural network to be prepared on a picture separate from the test picture consequently lessening the computational time. Bringing down the dimensionality of the issue lessens the calculations required amid the search. The fundamental favored point of view of neural network is that it can adjust from the preparation information.

The network adjusts as indicated by the conveyance of feature space observed during training. Computer simulations uncover that the network has been legitimately prepared and classifies the areas effectively with least deviation which helps in encoding the image utilizing FIC. Ali et al proposed Intelligent fuzzy approach for fractal image compression in there literature [14]. they have two phase algorithm to perform fractal picture compression which decreases the MSE computations.

In first phase, all picture pieces were partitioned into three classes as indicated by picture squares edge property utilizing DCT coefficients. From the spatial domain, a square of picture could be changed to the recurrence domain by method for DCT transformation. Within the recurrence domain, the DCT coefficients that is arranged in the upper left of the picture piece implies the picture piece's low recurrence data and it's harsh shape whereas the DCT that is arranged in the lower right of the picture piece means the picture piece's high recurrence data and it's fine texture.

Therefore, they explore the class of picture square by thinking of its lower-higher recurrence DCT coefficients. In second phase, the ICA algorithm found the reasonable domain pieces utilizing the outcome acquired as a part of the principal phase.

3. Proposed Model

With the rapid increase in the utilization of PCs and internet, the demand for higher transmission and better storage is increasing as well.

One approach to take care of this issue is by using compression, in which a small amount of data can speak to a lot bigger amount of original data. This paper depicts new compression technique called Fractal Image Compression. Fractal Image Compression depends on self-similarity, where one part of an image is like the other part of a similar image.

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3.1. Compression Algorithm

This program takes an image in a matrix and determines an array. Array lists which searches for the best transformed domains that guide to ranges, which each are submatrices of matrix. The areas are gotten from subdomains of size 2nx2n which have been arrived at the midpoint of to measure nxn. The data that is spared in the output files are a compressed versions of the image. This data alongside the block size is required Fractural decompress file to reconstruct the image.
Input: User insert a image file desired

Output: This batch program saves 5 different versions (based on allowable error) of the compressed image (held in array) along with the variables: save, resize and time which will be used by Fractural decompress file to decompress the image, and to create time charts. The above process presented in Figure 1.

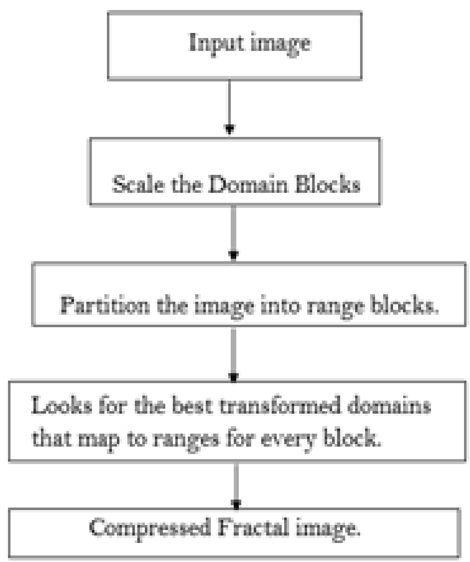

Figure 1: Process of compression algorithm

3.2. Decompression Algorithm

Decodes the fractal image compression data form the Fractural Compression file routine. This routine needs rotates a matrix by 90 degrees Counter clockwise by using file, flip the matrix about its central row and flip the matrix about its central column.

Input: The user must designate in the load statement what mat data file should be loaded. This data file should have been created by the previous program 'compress'. Also, the user should designate the desired number of iterations.

Output: This program outputs the attractor image after the specified number of iterations. The above process presented in Figure 2.

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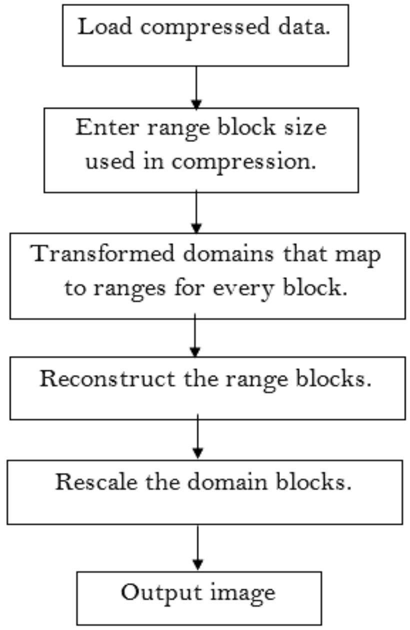

Figure 2: Process of decompression algorithm

4. Observation and Results

The accompanying table-I demonstrates the Original image and fractal image, and there with its histogram images, its execution test characteristics like PSNR, MSE and SSIM. The histogram image exhibits how the image pixels are dismembered in the image, moreover gives the contrast between the first image and last image in the wake of applying the proposed methodology for the compressed image.

Through images, the proposed methodology is associated with the image and yielded image are shown by their PSNR values. PSNR is utilized to quantify the nature of remaking of lossy and lossless compression. Normal qualities for the PSNR in lossy image compression are between in the range of 30 and 50 dB, gave the bit depth is 8 bits, where higher is better.

The proposed strategy is recovering the image with the minimum noise and its PSNR esteem is almost 41.21 dB. So it is most extreme recover the data with the minimum distortion. The equation is follows:

$$\mathbf{PSNR = 20 * \log_{10} (255/\sqrt{MSE})} \ \ldots\ldots\ldots\ldots\ldots\ldots \quad \textbf{(I)}$$

Where, MSE is the mean square error value of the image.

The MSE esteems and SSIM values are additionally appeared table-I. From the MSE esteems, it gives the actual image and fractal image contrasts. Here, the MSE values are nearly 405.556 and it gives the actual image remains unchanged in fractal image after the proposed techniques.

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The equation is follows:

$$MSE = \frac{1}{W*L}\left(\sum_{p=1}^{p}\sum_{q=1}^{q}\left(OI_{pq} - EI_{pq}\right)^2\right)\ldots\ldots\ldots\ldots\ldots\ldots \quad \textbf{(II)}$$

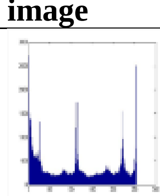
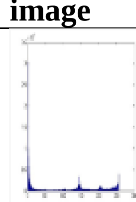
SSIM is the quality appraisal of an image based on the debasement of structural information.

The SSIM adopts a strategy that the HSV is adjusted to extricate auxiliary data from images. In this manner, it is critical to hold the structural signal for image fidelity estimation. The equation as follows:

$$SIM(x, y) = \frac{(2\mu_x\mu_y + 1)(2\sigma_{xy} + C_2)}{(\mu_x^2 + \mu_y^2 + C_1)(\sigma_x^2 + \sigma_y^2 + C_2)}\ldots\ldots\ldots\ldots\ldots\ldots \quad \textbf{(III)}$$

Where C1 and C2 are consistent and equivalent to solidarity. Right when the two images are same, SSIM is 1 so a Value closer to 1 would normally demonstrate high reproduction quality. In the proposed model SSIM shows the value is nearer to 1(**0.9964**). Therefore it evident that reconstruction image quality is high.

Table 1: proposed model with experimental results

Original image	**Histogram**		**Final output**	**PSNR value**	**MSE**	**SSIM**
	Original image	**Fractal image**				
				**41.21**	**405.556**	**0.9964**

5. Conclusion and Future Scope

In this paper, the new compression technique called fractal color image compression investigated; through this investigation the following was found. All compression techniques belong to two types of compression, one called lossless compression and the other called lossy compression. with lossless compression, no data is lost but it is hard to achieve a high compression rate. Fractal image compression is a lossy kind of compression dependent on self-similarity inside the image and mainly works well with natural type of images.

It can accomplish high compression rates, be that as it may, with high compression rates it begins losing quality. Though fractal compression works very well with gray-scale just as it takes a shot at color images, but it suffers from one main weakness. Fractal compression is computationally over the top expensive. The proposed implementation is more suitable because of time for a lot lesser than the fractal encoding.

In this paper we get the base encoding time for a color image and as well as the minimum decoding time. But this is not so efficient. It would be nice to try to implement a more efficient algorithm

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based on fractal compression for color images. In which we try to get much less encoding and decoding time. Which will worked on color images as well as gray scale images

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*Corresponding author.
E-mail address: indrani@ ecmt.in