Improved Hybrid Algorithm for Image Compression

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Abstract: The most important entity in various fields is Image compression. In many applications it plays vital role. Biomedical is one of the critical & vital application. Compression strategies are basically separated from lossy and lossless. In the lossless technique the image is compressed without any loss of data but some information may loss in the lossy technique.

In this research different compression approaches of these two categories are discussed and brain images for compression techniques are highlighted. Both lossy and lossless techniques are implemented by studying it's advantages and disadvantages. In this study two important quality parameters i.e. CR & PSNR are calculated. Here the existing strategies DCT, DFT, DWT and Fractal are used and introduced new strategies namely Oscillation Concept method, BTC-SPIHT and Hybrid method using flexible limit and Quasi Fractal Algorithm.

Index Terms— *Oscillation Concept, BTC-SPIHT, Quasi Fractal, Morphological Filter, Adaptive Threshold*

1. INTRODUCTION

This paper describes that for compression of an image lossy compression method is not that much useful. Required time for processing an image is more hence compression has special importance in compression medical images. By using compression algorithms, we can reduce processing time required. Different techniques are used i.e. lossy and lossless for compression. Most challenging part of research is to develop algorithm. Many algorithms developed for achieving better results.

Due to compression method there is possibility of loss in useful information, which has been used for researchers and practitioners. Some operations like enhancement may steer to further deterioration hence there is need of efficient method of image compression. Lossless compression as a better option as a remedy. Many lossless schemes are based on linear prediction and interpolation. Scientific art and better solution for saving high data and reducing size is to compress images. Oscillation Concept method, BTC-SPIHT & Hybrid technique using adaptive threshold & Quasi Fractal Algorithm used for the compression.

A) CR & PSNR: For this research some important quality parameters i.e. CR, PSNR are calculated. Here existing techniques DCT, DFT, DWT & Fractal are implemented. Out of which Fractal gives us better results.

By implementing Fractal image compression, got the values of CR & PSNR as 3.51 & 31.45 respectively. Also by using fractal, getting value of MSE which is quite large, indicating quality of image is not good. For improving CR and quality new method has been introduced. The new proposed methodology suggests that in every image there is variation in grey scale intensities, these variations are nothing but oscillations in an image.

This concept is utilized to find out the variations in biomedical images, appropriate oscillations are considered for image compression. By repeating the process we can obtain the Principal part from image. It is continued till better quality of Principal component. Here good quality is obtained by extracting Principal component. It gives better level of compression. It is explained as continuous signal just for understanding purpose. Finally achieved better results i.e. CR & PSNR are 4.32 & 32.56 respectively and value of MSE also reduced compared to existing Fractal technique.

Improving the Compression Ratio (CR) is essential and becomes big challenge in the field of medical. For improving results enhancement is used before image compression. Here an image enhancement technique is used. For enhancement of an image CLAHE and Decorrelation Stretch DCS algorithms are used. By Enhancement an image before compression better results are achieved i.e CR is 5.11 and PSNR is 32.77. These results are better than existing methods. Also achieved good image quality compared to Fractal & Oscillation concept used for compression of an image.

Oscillation concept is basically used as lossy image compression techniques. In the direction of

improving results hybrid techniques are developed. In the hybrid technique two different algorithms on ROI & Non-ROI are applied. On ROI Lossless & for Non-ROI Lossy image compression technique has been used. Here compared all existing techniques with implemented algorithms. Also taken literature review and concluded that there is need of new improved algorithm which will give us improved values of quality parameters (CR, PSNR, and MSE & MSSIM). Hence new hybrid algorithms are introduced.

Firstly hybrid algorithm is implemented using BTC & SPIHT. BTC is lossy compression technique and SPIHT is lossless. This hybrid algorithm is used after enhancement. Using this hybrid technique achieved better results than enhancing an image before compression. CR & PSNR are improved 5.65 & 33.01 respectively and also archived better image quality.

For refinement and reaching towards better quality of an image, developed improved hybrid coding algorithm for image compression and achieved better results i.e CR & PSNR are 24.98 & 36.21 respectively. [1-6]

B) Methodology

Lossy and Lossless are the two techniques of image compression. These compression techniques have their own pros and cons. Hybrid technique can be implemented to utilize advantages of both Lossy and Lossless techniques.

New approach may find maximum limit of compression up to which exact region of interest could be extracted. Residual part of biomedical images could be reutilized to obtain accurate result. Possible loss of useful clinical information in biomedical images could be avoided.

To reduce digital image we can use Lossless or, “reversible” compression which offers reduction in file size and Lossy or “irreversible” compression allows a far greater size reduction.

Here, we have selected brain image. By using biomedical compression we are applying different image compression algorithms on brain images and achieving better values of CR& PSNR. Brain image compression is well known as sub field in biomedical image compression. For analyzing & diagnosing brain images are compressed in an effective manner to reduce the storage space.

Here hybrid technique is proposed to get the benefits of lossy and lossless compression techniques for medical image compression.

An application that requires image compression are many, some of them are mentioned as below. Medical Imaging Internet Business Multimedia Satellite Imaging This thesis mainly explains following methods for compression of brain images.

Image Compression using Oscillation Concept. Oscillation Concept Method with Enhancement techniques. Image Compression using Hybrid Techniques. [6,10]

2. IMAGE COMPRESSION TECHNIQUES

A. Oscillation Concept

Theory “Oscillation concept” in images introduced by this method. An oscillation means vibrations and variations. In the pixel of an image vibrations are there w.r.t. x & y axis. These oscillations are used for compression of an image, For improving CR this is better method. We can achieve principal part of an image By repeating the process & it will continued till better quality obtained. By extracting PC better quality is achieved [10].

B. Hybrid Image Compressions

In this hybrid coding following Nobel techniques are used as hybrid image compression techniques for achieving better results. Here by combining of two techniques (Lossy & Lossless), developing hybrid model.

Here used lossy & lossless techniques for developing hybrid model, and will get good level of compression by using lossy technique and due to lossless technique our PSNR and MSE will go better than the old algorithms.[6-12,15]

C. BTC-SPIHT

Oscillation Concept & Quasi fractal method.
Block Truncation Coding (BTC). For digitized gray scale images BTC has used .BTC uses moment preserving quantization method. For retaining visual quality of the reconstructed image this method is used.

Set Partitioning In Hierarchical Trees (SPIHT): SPIHT is Wavelet-based image compression method. DWT block has used for sending information which outputs DWT

coefficients of the original image.

Data bit stream manner is output of SPIHT encoder which encodes the output. This bit stream send through SPIHT decoder & IDWT block, gives reconstructed image back.

3. HYBRID CODING USING QUASI FRACTAL & OSCILLATION CONCEPT

Lossless Fractal Image Compression (LFIC) And Morphological Filters

A. Detecting ROI & NON-ROI Portions.

At first we need to separate the brain portion from the whole image because most of the background pixels are black i.e. pixels with zero intensity. So excluded those pixels are also helpful to reduce the amount of bits during transmission and used for reasonable CR.

Bounding box is a technique used to separate the brain portion from background. Bounding box is also used to extract the ROI produced by watershed algorithm.

ROI is selected using bounding box is shown in Figure.

The extracted brain portion from the whole image is selected as ROI portion and is shown in Figure [161-8]

B. Methodology for ROI:

Input Image→ RGB to Gray Image→Demised Image→ Resize Image 256*256→ Morphological Filter→ Adaptive → Current ROI → Refinement → Final ROI

Figure 1. Brain image ROI & Non-ROI

3. Hybrid Method Flow :

1. Morphological filter & adaptive threshold are key factors of Hybrid Method.
2. Multilevel operations are used in the methodology.
3. Algorithm developed using ROI & Non-ROI techniques.

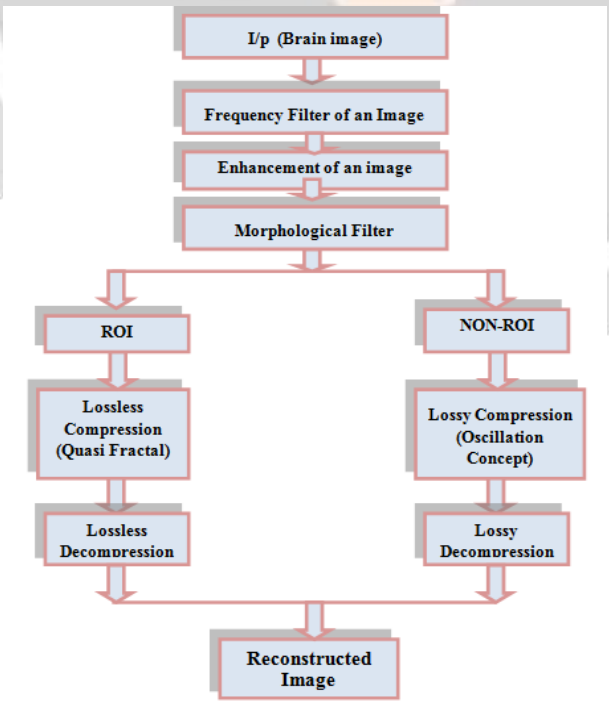

Figure 2. Improved Hybrid Method Flow

Adaptive Threshold: In image processing most commonly used operation is thresholding a grayscale image with a fixed value to get a binary image. Neighboring pixel intensities are important for deciding the threshold value at each pixel location. Adaptive thresholding is used for partitioning the original image into certain sub images and utilize global thresholding techniques for each sub image.

Algorithm for Improved Hybrid Method using Quasi Fractal & Oscillation Concept Method:

1. Read Input Image
2. Convert RGB to Gray
3. Image Filteration using Frequency filter
4. Denoise an image
5. Resize Image into 256*256
6. Filteration using Morphplogical Filter
7. Apply Adaptive Thresholding
8. Find Current ROI
9. Repeat Procedure by tuning Morphological filter for Refinement
10. Find final ROI
11. Apply Lossless Compression Technioque over final ROI.

4. RESULT AND DISCUSSION

A) Results of Improved Hybrid Method for various brain images from hospitals

Table.1 Statistical parameters CR & PSNR

Image/Parameters	CR	PSNR
IMG-1	24.77	34.31
IMG-2	24.65	33.25
IMG-3	26.56	41.58
IMG-4	23.56	34.64
IMG-5	25.63	37.86
IMG-6	26.30	41.81
IMG-7	22.50	35.12
IMG-8	29.12	37.86
IMG-9	23.95	33.09
IMG-10	25.74	33.58
IMG-11	22.05	36.31
Avg	**24.98**	**36.31**

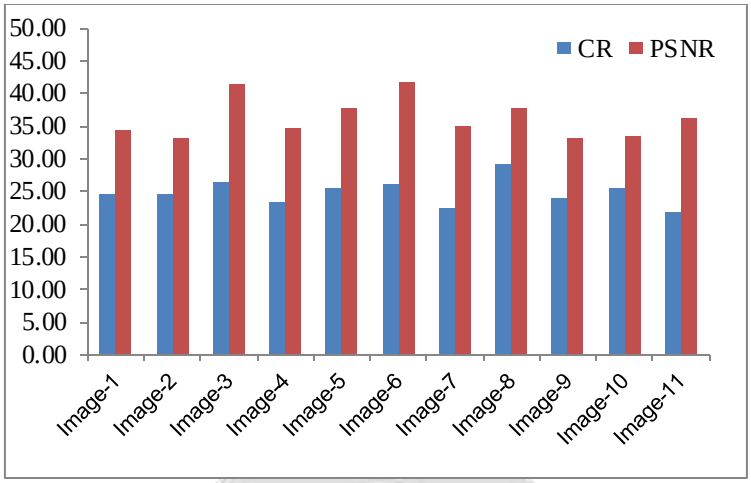

Figure 3. CR & PSNR for different brain images

B) Results of Hybrid Method for CR & PSNR

Table.2 Statistical parameters CR & PSNR for Hybrid Techniques

Sr. No	Technique used for Image Compression	Parameters	
		Average value of CR	Average value of PSNR
1	Improved Hybrid Coding using Oscillation Concept & Quasi Fractal	24.98	36.31
2	Hybrid Coding using Oscillation Concept & Quasi Fractal	24.61	33.51
3	Hybrid Coding using BTC-SPIHT	5.65	33.01

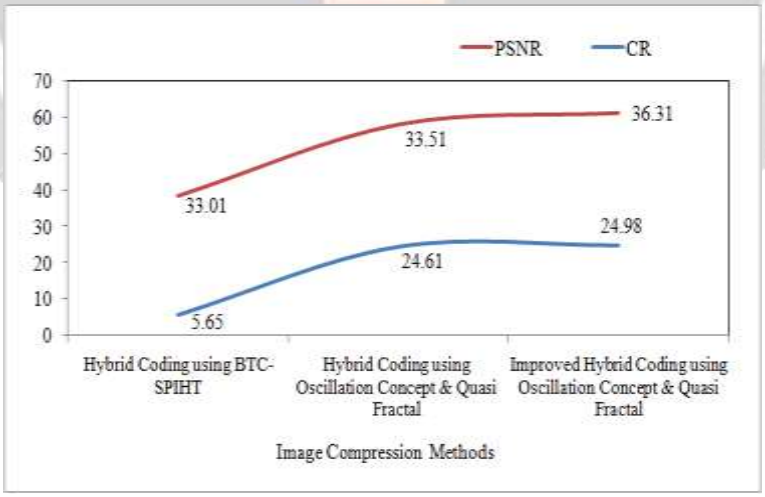

Figure 4. Statistical parameters CR & PSNR for various Image Compression Techniques

CONCLUSION

After comparing the results of existing hybrid techniques and improved hybrid method, we can conclude that the improved hybrid method algorithm has given good results. The existing techniques like DFT, DCT, DWT and fractal have given compression ratio in the range between 1 to 4. On the other hand the proposed works have increased the compression ratio to the range between 1.01to to 24.98. Similarly the PSNR which is measuring quality for the existing algorithms is in the range between 27.04 to 36.31 whereas the improved hybrid method algorithm have raise the image quality which is

comparatively very less proving that the proposed algorithm is providing better results.

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