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Near lossless medical image compression using block BWT-MTF and Hybrid Fractal Compression Techniques

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Abstract: In medical field we come across huge amount of images in the forms of scans, reports and so on. Hence, we need to compress the data we come across due to the factor of storage space. Diagnosis of medical image requires detailed analysis of vital portion of the image. In medical image compression, a small loss in the vital portion leads to wrong interpretation. The proposed compression scheme will eliminate this problem by utilizing region based compression which results in the lossless compression of requisite area, where the salient details are stored and lossy compression in the remaining region. In this method, region which contains most required diagnostic features is separated and then encoded without significant loss in diagnostic quality using block based Burrows- Wheeler compression algorithm. Remaining regions are encoded using hybrid fractal encoding algorithm. Finally, both encoded regions are combined together to reconstruct the output image. The performance of the compressed scheme is evaluated in terms of PSNR (Peak Signal to Noise Ratio), CR (Compression Ratio), space saving and time consumption.

Keywords: PSNR, Hybrid fractal encoding, PSNR, MSE, CR, BWT-MTF.

1. INTRODUCTION

Image compression is minimizing the size in bytes of a graphics file without degrading the quality of the image to an unacceptable level. The reduction in file size allows more images to be stored in a given amount of disk or memory space. It also reduces the time required for images to be sent over the Internet. There are several different ways in which image files can be compressed. For Internet use, the two most common compressed graphic image formats are the JPEG format and the GIF format. The JPEG method is more often used for photographs, while the GIF method is commonly used for line art and other images in which geometric shapes are relatively simple. Other techniques for image compression include the use of fractals and wavelets. These methods have not gained widespread acceptance for use on the Internet as of this writing. However, both methods offer promise because they offer higher compression ratios than the JPEG or GIF methods for some types of images. Another new method that may in time replace the GIF format is the PNG format.

IMAGE COMPRESSION TECHNIQUES

- LOSSLESS COMPRESSION
- LOSSY COMPRESSION

LOSSELESS COMPRESSION

Lossless compression is a class of data compression algorithms that allows the original data to be perfectly reconstructed from the compressed data.

LOSSY IMAGE COMPRESSION

Lossy compression or irreversible compression is the class of data encoding methods that uses inexact approximations and partial data discarding to represent the content. These techniques are used to reduce data size for storing, handling, and transmitting content. The amount of data reduction possible using lossy compression is much higher than through lossless techniques.

2. PROBLEM STATEMENT

In medical applications, lossless compression is traditionally used for fear of losing critical information On the other hand, many in the medical image compression community argue that lossy compression of medical images is necessary and helpful in the long run. The “near-lossless” methods as a means of trading off between compression ratios and distortion so that higher compression ratios can be achieved with small enough distortion to ensure sufficient accuracy for specific purposes. The most popular definition of "near-lossless" is that no pixel is changed in magnitude by more than δ gray levels compared with the original, where δ is a nonnegative integer indicating the error tolerance.

3. LITERATURE SURVEY

Most of the application including remote sensing, medical etc., requires high quality image for analysis and interpretation. Especially medical diagnosis and analysis is generally based on magnetic resonance imaging, X-Ray, computer tomography, ultrasound imaging etc. The raw image data obtained from such techniques occupy several megabytes of disk space. These images should be stored in any health care center for at least two decades and in some cases, it is transmitted to the physician for future medical diagnosis or legal purposes. To speed up the electronic transmission and to minimize the computer storage space, generally medical images are compressed into smaller files. During compression and decompression, the medical images must maintain all original details at the time of reconstruction. Hence there is a challenging task to deal the transmission and storage of medical images with high diagnostic quality. There are several techniques used to compress the image and are generally categorized as lossy and lossless compression.

4. EXISTING SYSTEMS AND DRAWBACKS

The existing system is Haar wavelet transform. Each image is presented mathematically by a matrix of numbers. Haar wavelet uses a method for manipulating the matrices called averaging and differencing. Entire row of a image matrix is taken, then do the averaging and differencing process. After we treated entire each row of an image matrix, then do the averaging and different process for the entire each column of the image matrix. Then consider this matrix is known as semifinal matrix whose rows and columns have been treated. This process is called wavelet transform. Then compare the original matrix and semifinal matrix, the data has become smaller. It takes more time and space consuming. The Haar split compression technique gives less compression ratio and the process is somewhat a time-consuming process.

5. PROPOSED SYSTEM

The proposed system is near lossless medical image compression block based BWT-MTF and hybrid fractal image compression. The BWT-MTF is an lossless image compression technique which is applied to the region which are crucial in the medical image to get a better quality image. The hybrid fractal image compression is a lossy image compression technique which is applied to remaining part of the image as itis not considered as an important region. The proposed system eliminates the ringing effect and it provides the better PSNR and CR. This system is also time and space saving. The first stage of the proposed method consists of separation of ROI and NROI region using morphological segmentation. In the morphological segmentation the input brain image is transformed into gray scale image. Then structuring elements are assigned.The input image is combined with the assigned structuring element using the morphological operator such as Erosion and Dilation. In the resultant binary image, pixel having value equal to 1 are replaced with original pixel value in the input image which result in ROI portion of the image. To obtain the NROI portion, the binary image is inverted and then replaces the pixel having value equal to 0 with original pixel value in the input image. Cost for transmitting an image as data reduces at much extent as cost depends uponduration for which data is being transmitted. It saves computing power as execution of image transmission takes very less time ifthe size is lesser. It reduces the transmission errors since fewer bits are transferred. Secure level of transmission is possible due to encoding and compressing the image

5.1 CONTENT DIAGRAM

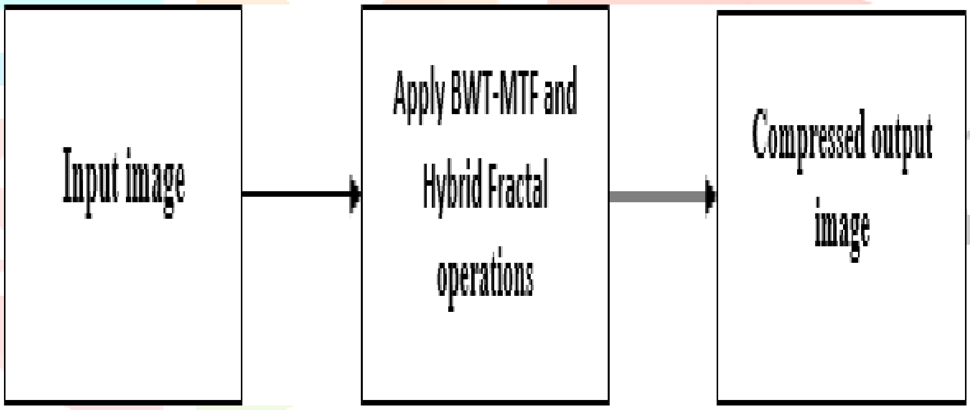

Fig 5.1 Content diagram of proposed system

5.2 FLOW CHART

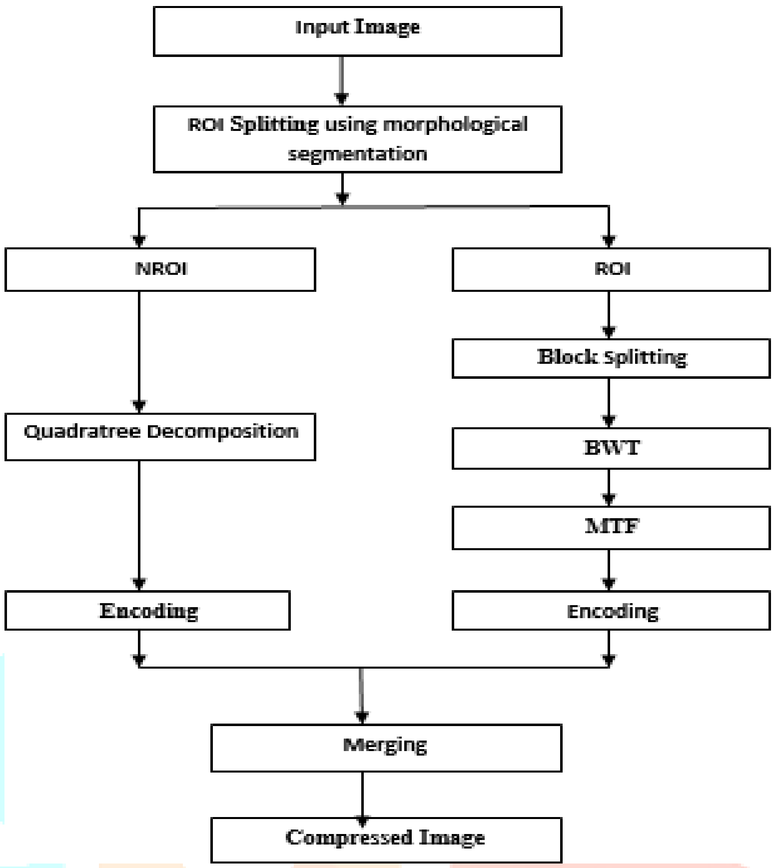

Fig 5.2 Flow chart of proposed system

6 METHODOLOGY

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus, it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work effectively. The implementation stage involves careful planning, investigation of the existing system and its constraints on implementation, designing of methods to achieve changeover and changeover methods. We have used different key functions in mat lab to get the accurate output. They are

imread( ): It reads the image from the file specified by filename, inferring the format of the file from its contents. If filename is a multi-image file, then imread reads the first image in the file.

Syntax: imread (‘filename.fmt’);

imshow( ): To display image data, use the imshow function. The following example reads an image into the MATLAB® workspace and then displays the image in a MATLAB figure window.

Syntax: imshow(N)

MORPHOLOGICAL SEGMENTATION

In the morphological segmentation the input brain image is transformed into gray scale image. Then structuring elements are assigned. The input image is combined with the assigned structuring element using the morphological operator such as Erosion and Dilation. In the resultant binary image, pixel having value equal to 1 are replaced with original pixel value in the input image which result in ROI portion of the image. To obtain the NROI portion, the binary image is inverted and then replaces the pixel having value equal to 0 with original pixel value in the input image.

7. RESULTS

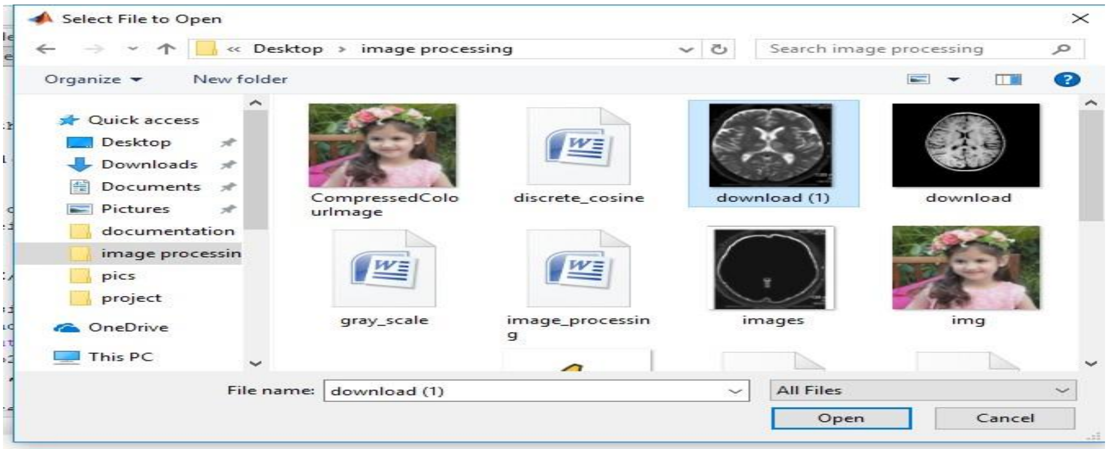

Fig (a) Selecting input image

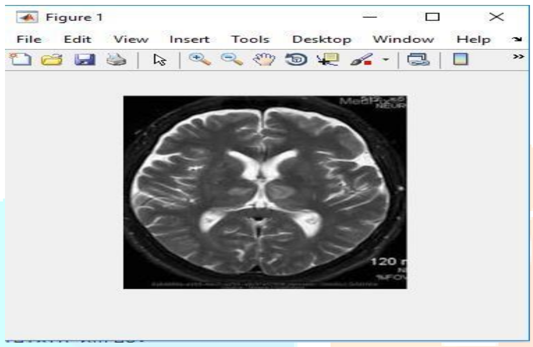

Fig (b) Input image

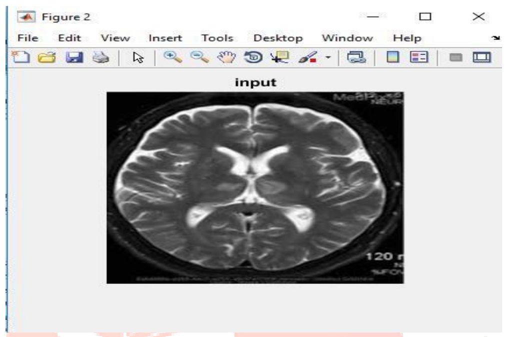

Fig (c) Resized input image

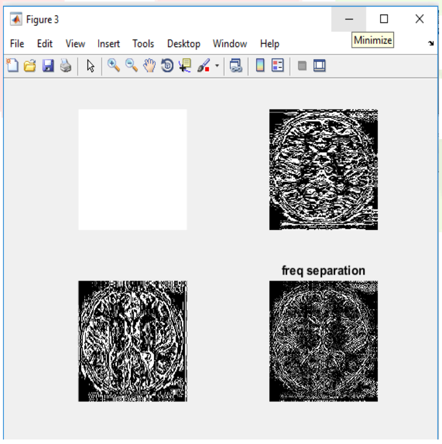

Fig (d) Frequency separation image

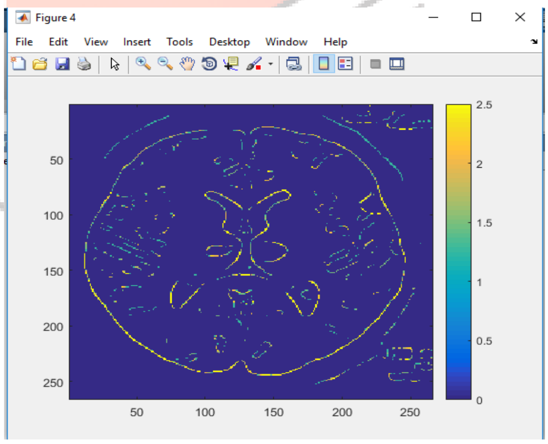

Fig (d) Edge detected image

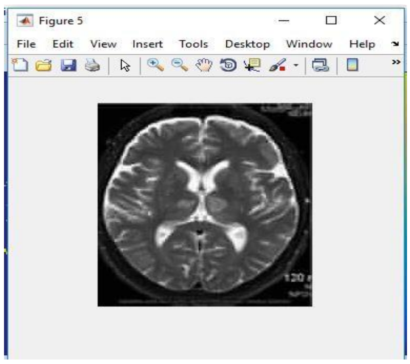

Fig (e) Compressed output image

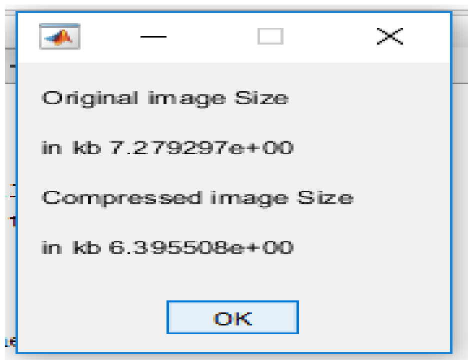

Fig (f) Size comparison image

CONCLUSION

Image compression plays a vital role when it comes to storage space. The medical image compression is a bit tedious task as a small change in quality of the image may impact the health condition. In this work near lossless ROI based medical image compression using block BWT–MTF and hybrid fractal compression techniques is proposed and tested for compression of medical images such as ultrasound, MRI, CT and X-Ray images with high quality. This method utilizes the features of hybrid fractal and BWCA algorithm. The hybrid fractal is implemented for compression for NROI region which overcomes longer encoding time of conventional fractal techniques. The block BWCA is implemented to compress the ROI region thereby ROI region is reconstructed accurately when compared with commonly used schemes in terms of PSNR by deliberately reducingthe mean square error and CR. Best result is obtained for ultrasound and MRI images.

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