Implementation And Performance Analysis of Bio-Medical Image Compression Based on Hybrid Techniques

Trisha Singh[1], Mrs. Jayshree Boaddh[2]
[2]Assistant Professor
[1, 2] Mittal Institute of Technology, Bhopal

Abstract- *Data compression is primarily used in transmission and storage of information. Image transmission applications are used in television broadcast, remote sensing via satellite, aircraft, radar, teleconferencing, computer communications, facsimile transmission, etc. In this paper, the researcher introduces hybrid compression technique using discrete wavelet transform. The performance of the simulation is measured in terms of normalized absolute error, mean square error, peak signal to noise ratio and computation time. The evaluated results are then compared with base paper, which shows the proposed technique has less computation time and greater peak signal to noise ratio as compared to previous techniques for medical images.*

Keywords- Image Processing, Data Compression, DWT, Hybrid techniques, JPEG.

I. INTRODUCTION

Magnetic resonance imaging (MRI) is exceptionally prominent in the restorative industry since they have low reactions in patients and in addition requiring cheap and generally little hardware as contrasted and different innovations. Consistently, an enormous number of MRI pictures are created by doctor's facilities and therapeutic consideration focuses; which numerous should be put away for later references or transmitted among medicinal professionals. For instance, in restorative data and correspondence frameworks, for example, PACS (Picture Archival and Communication System), HIS (Hospital Information System) and RIS (Radiology Information System), utilizing proficient high rate picture compression routines is unavoidable. These frameworks need different assets to transform the created data, so they have expanding requirement for capacity and transmission. This examination addresses these difficulties and the requirements for methods with as high compression proportion as could reasonably be expected while keeping up acceptable indicative quality.

There are many attempts to overcome the storage cost and transmission time challenges for MRI images including techniques based on the region of interest (ROI) coding. ROI based methods are able to compress the selected spatial regions of an image, instead of the entire image, to obtain higher output image quality as well as high compression ratio[1]. In medical domain, certain medical images such as MRI and CT necessitate lossless compression as even a negligible loss can lead to unfavorable effects. Moreover, attainment of high compression prediction is one of the methods so as to estimate current data from previously identified data. For example, in medical image compression applications, diagnosis is valuable only when compression techniques preserve the entire pertinent and significant image data required. In the past two decades, the frequently employed image compression technique for medical images is JPEG which integrates DCT transform with Huffman coding. During the last decade, on account of the necessity for enhancing the visual quality in compressed medical images, the wavelets (DWT) has continuously come out with flying colors in regard to image compression. The vital qualities of wavelet transforms like Multi-resolution representation, energy compaction, blocking artifacts and de-correlation, have enabled the discrete wavelet transform (DWT) emerge as one of the most imperative techniques for image compression during the period. Triggered by the immense success of wavelet in medical image compression, the familiar and the sophisticated image compression techniques for medical images are enlarged in accordance with integer wavelet transform with Embedded Block Coding with Optimized Truncation (EBCOT), called JPEG 2000 standard [2]. For the superior conservation of imperative image features and attainment of high compression ratios, simple DWT transform and fuzzy c-means clustering [3] are proficiently integrated. Of late, the hybrid model of image compression has become the cynosure of the researchers.

The procedure of speaking to the picture with less number of bits by expelling the redundancies from the picture is called compression which is determined as far as

Compression Ratio (CR) or number of bits per pixel (bpp) termed bit rate. Lossless and lossy compression are terms that describe whether or not, in the compression of a file, all original data can be recovered when the file is uncompressed.

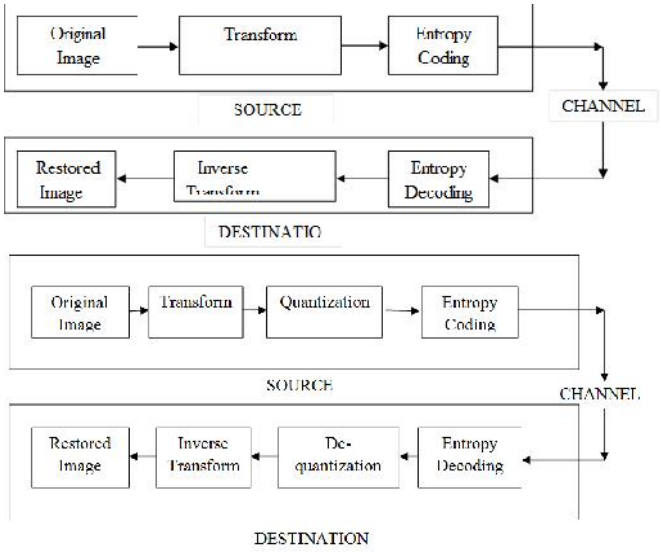


Figure 1: Lossless and Lossy Compression techniques

II. LITERATURE REVIEW

Dinu A J et al. [1], an enormous measure of therapeutic pictures is created through propelled therapeutic imaging in clinics. Restorative picture pressure assumes a key part in telemedicine to have high picture quality for therapeutic pictures with important demonstrative data and with less capacity necessities, with the goal that it can be effortlessly transmitted over a arrange and can be gotten to inside a restricted time. This paper examines about the execution examination of various picture pressures for the medicinal pictures their applications in telemedicine. The execution varieties of pressure calculation can be resolved utilizing target parameters, for example, MSE, PSNR furthermore, SNR at various piece rates.

Sanjith S et al. [2], the fast development of remote detecting innovation has an awesome preferred standpoint in delivering high determination pictures which are enormous in information volume. Because of the colossal volume it is monotonous to store and transmit the information. Keeping in mind the end goal to conquer this, a great pressure calculation ought to be utilized to pack the information before putting away are transmitting. In this paper we have picked seven diverse high determination satellite pictures to be specific Worldview 3, Worldview 2, GeoEye-1, Worldview 1, Pleiades, Quick Bird and IKONOS they are compacted utilizing three distinctive pressure strategies JPEG, SPIHT and JPEG2000. The Mean square Error, Signal to commotion Ratio and Peak Signal to Noise Ratio are figured to assess the nature of the pressure techniques in high determination satellite pictures.

Sanjith S et al. [3], the satellite picture in its crude shape requires a huge measure of capacity limit and a decent transfer speed for information transmission. Thinking about the significance of satellite symbolism, it is important to build up a framework that gives high level of pressure protecting basic picture information. In this paper, we exhibit a calculation which is the combination of both discrete cosine change and discrete wavelet change. In this the calculation plays out the discrete cosine change on the discrete wavelet change coefficients. A few satellite pictures has been reproduced and the outcomes were broke down, the dissected outcomes demonstrates that the proposed strategy increases higher PSNR esteem than the customary DCT and DWT. This proposed conspire is expected to use in on-board PC for pressure.

Sanjith S et al. [4], in this paper we introduce the trial comes about by looking at the nature of various satellite pictures (LANDSAT 7, MODIS, ASTER) after pressure utilizing four unique techniques to be specific Joint Photographic Expert Group (JPEG), Embedded Zero tree Wavelet (EZW), Set Partitioning in Hierarchical Tree (SPIHT), Joint Photographic Expert Group—2000 (JPEG 2000) are displayed. Pressure is performed with three unique kinds of satellite sensor pictures, having distinctive ghostly groups, picture bit-rate and level of subtle elements utilizing VC Demo programming bundle. The Mean Square Error (MSE), Signal to Noise Ratio (SNR) and Peak Signal to Noise Ratio (PSNR) values are ascertained to decide the nature of the picture after pressure. The qualities are portrayed in proper tables and figures. While looking at the got values we found that the pressure techniques have diverse effects in each satellite picture as per their photo bit-rate and level of subtle elements. The pressure techniques utilized as a part of this work have diverse calculations to play out the pressure which are appropriate for satellite pictures; we proposed to locate the best strategy for satellite picture pressure.

Literature exhibits a few works for medical image compression. Here, we survey a portion of the most recent strategies accessible. Many specialists in their studies have exhibited the new advances in the field of medical image compression in both lossless and lossy classifications. Lossless compression can perform a biggest compression proportion of 3:1 restoring the image without loss of data. As computerized image possess substantial measure of storage room, a large portion of the examination is centred on lossy

compression that uproots inconsequential data safeguarding all the significant and essential image data [8. 9].

III. PROPOSED SOLUTION & ALGORITHM

Transmission and storage of raw images require huge quantity of disk space. Hence, there is an urgent need to reduce the size of image before sending or storing. The best possible solution to the problem is to use compression methods where the compression of data on digital images are made to reduce irrelevance and redundancy of the image data to be able to efficiently store or transmit data. Most of the existing compression techniques employed have their negatives and an enhanced technique which is faster, effective and memory efficient can definitely satisfy the requirements of the user. Image compression thrives to store or transmit the data in a proficient mode as well as to offer a best image quality at a specified bit-rate. Image compression can be done in lossy or lossless mode. Lossless compression is preferred for archival objectives and mainly used in medical imaging, technical drawings, clip art, or comics. This is due to the introduction of compression artifacts, low bit rates and also because the resources cannot be considerably saved by using image compression method. Lossy methods are especially suitable for natural images such as photographs in applications where negligible loss of fidelity is tolerable to attain a considerable reduction in bit rate. Here conciliated ensuing image quality devoid of much perception by the viewer is achieved. Recently, studies on the wavelet theory and its application to the image compression field have been increasingly carried out. The subject is adequately novel and additional progression is needed to improve on the quality.

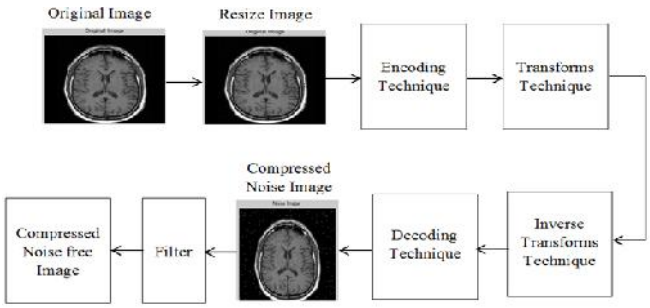
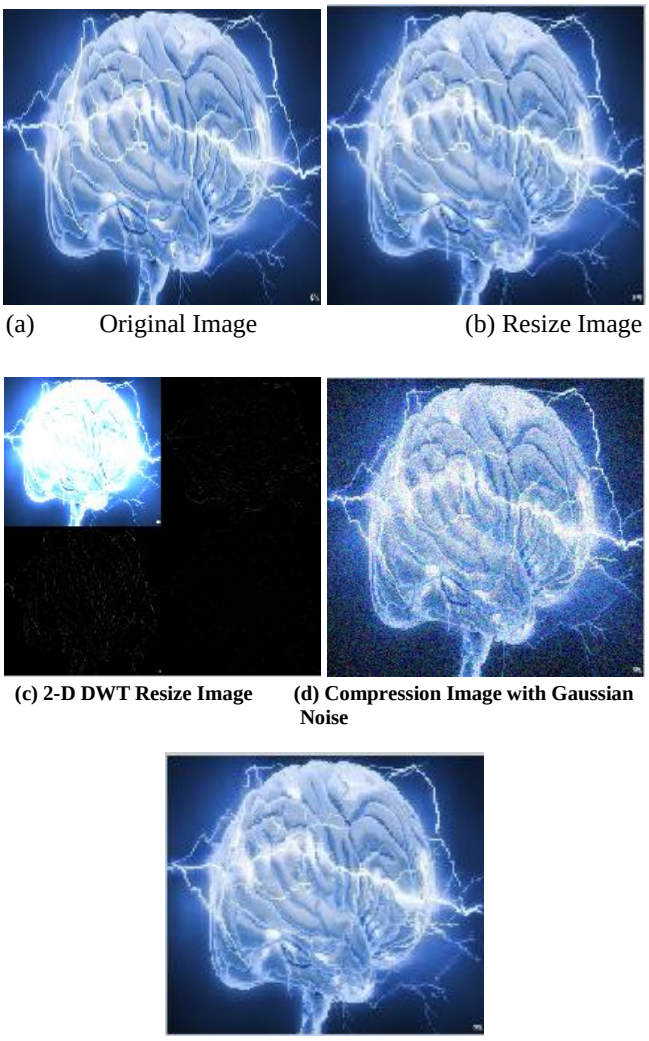


Figure 2: Block Diagram of Proposed Methodology

IV. SIMULATION RESULTS

The original MRI image of 512×512 pixel value is shown in figure 5.1. This figure divided into five parts. Original random MRI image is shown in first part, second part the original random image is resize of the 512×512, the resize image is passing through the 2-D discrete wavelet transform (DWT) and get low frequency image is shows in third part. Fourth part is shows the compressed image with Gaussian noise 512×512 pixel value and get noise free compressed MRI image is shows in fifth part.



(a) Original Image (b) Resize Image

(c) 2-D DWT Resize Image **(d) Compression Image with Gaussian Noise**

(e) Compressed Image with Noise Free

Figure 3: Hybrid Algorithm applied on MRI Image

As shown in table 1 the peak signal to noise ratio (PSNR) is obtained for the proposed hybrid encoding and discrete wavelet transform algorithm. From the analysis of the results, it is found that the proposed hybrid encoding and discrete wavelet transform gives a superior performance for MRI-III image.

Table 1: Experimental Results of Hybrid algorithm for PSNR

Image	Noise	PSNR (dB)	Time (sec)
MRI-I	Gaussian Noise	40.318	0.9016
MRI-II	Poisson Noise	40.773	1.2164
MRI-III	Salt and Pepper Noise	43.456	1.351
MRI-IV	Speckle Noise	42.406	1.532

Figure 4: PSNR for Hybrid Algorithm in different Noise

As shown in table 2 the PSNR is obtained for the proposed hybrid encoding and discrete wavelet transform algorithm and previous algorithm. From the analysis of the results, it is found that the proposed hybrid encoding and discrete wavelet transform gives a superior performance for previous algorithm.

Table 2: Comparison Result

Image	Peak Signal to Noise Ratio (dB)	
	Previous Algorithm	Proposed Algorithm
MRI-I	25.9	40.318
MRI-II	34.4	40.773
MRI-III	39.9	43.456

V. CONCLUSION

The objective of image compression is to reduce the redundancy of the image and to store or transmit data in an efficient form. As discussed earlier, there are many introduced approach regarding the importance of utilizing medical image for image compression procedure. In this research, a fulfillment approach of image compression approach on MRI images was proposed.

The present research has been carried out using MATLAB. Based on the performance metrics such as PSNR and MSE, the performances of the proposed approaches have been evaluated. It is observed from the empirical result that the proposed discrete wavelet transform (DWT) approach provides high PSNR values. Moreover, MSE value of the proposed approach is also much lower than that of the other proposed and the existing techniques.

On the basis of experimental results the compression ratio depends on the type of image and type of transforms because; there is no filter that performs the best for all images pertaining to different applications. Hence, there is always necessary to select the appropriate threshold value to get higher compression and the minimum loss of image contents. The performance of the compression and decompression generally depends on the image characteristics, type of image, and type of filter, order and level of the decomposition used. Multiwavelets are better approach for high compression ratio and to get better performance pertaining to Medical imaging applications; and it may be found suitable for enhancing the computability for compression of different areas of application.

REFERENCES

[1] Dinu A J, Ganesan R, Abraham Alem Kebede and Balaji Veerasamy, “Performance Analysis and Comparison of Medical Image Compression Techniques”, International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT), IEEE 2016.

[2] Sanjith S, Ganesan R, "Evaluating the Quality of Compression in Very High Resolution Satellite Images Using Different Compression Methods", International Journal of Engineering Research in Africa, Vol. 19, pp. 91-102, Mar. 2016.

[3] Sanjith S, Ganesan R, “Fusion of DWT-DCT Algorithm for Satellite Image Compression", International Journal of Applied Engineering Research, ISSN 0973-4562, Vol. 10,pp. 130-137, Jul 2015.

[4] Sanjith S, Ganesan R, Rimal Isaac R. S. "Experimental Analysis of Compacted Satellite Image Quality Using Different Compression Methods", Advance Science Engineering Med Vol. 7, pp. 17, Mar 2015.

[5] Sanjith Sathya Joseph, Ganesan Ramu, "Performance Evaluation of Basic Compression Methods for Different Satellite Imagery", Indian Journal of Science and Technology, Vol. 8 Issue 19, Aug. 2015.

[6] Ansari M.A., R.S. Anand "Comparative Analysis of Medical Image Compression Techniques and their Performance Evaluation for Telemedicine", Proceedings of the International Conference on Cognition and Recognition, pp. 670-677, 2014.

[7] Sanjith S, Ganesan R. "A Review on Hyperspectral Image Compression", Control, instrumentation, communication and computational technologies (ICCICCT). International Conference, Kanyakumari, India. , pp. 10-11, Jul 2014.

[8] Smitha Joyce Pinto, Prof. Jayanand P.Gawande "Performance analysis of medical image compression techniques”, Proceedings of the Institute of Electrical and Electronics Engineers IEEE, 2012.

[9] Jing-Ming Guo and Yun-Fu Liu, "High Capacity Data Hiding for Error-Diffused Block Truncation Coding," IEEE Transactions on Image Processing, Vol. 21, No.12, PP.4808-4817, December 2012.

[10] Yung-Chen Chou and Hon-Hang Chang, "A Data Hiding Scheme for Color Image Using BTC Compression Technique," Proc. 9th IEEE International Conference on Cognitive Informatics, PP.845-850, 2010 IEEE.