Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2925 - 2933
Received 25 April 2021; Accepted 08 May 2021.

A Review on Medical Image Compression Using Wavelet Transform in Medical Images

Dr.V.Anusuya[1],Dr.V.Srinivasa Raghavan[2]

Assistant Professor (Senior Grade), Ramco Institute of Technology, Rajapalayam,pgkrishanu@gmail.com

Principal, S.VeerasamyChettiar College of Engineering and Technology,Puliangudi,vsraghavan1965@gmail.com

Abstract

An increase in the volume of the informationto be put away calls for compression techniques. 3D medical images are progressivelyutilized in clinical and exploration applications.Due to the higher size of images, which requires a large amount of storage, there is a need to compress the image size. In telemedicine, compression is required for data preservation and usage of bandwidth is required, during transmission. This paper review the various wavelet transformation techniques used for compressing medical images.

Keywords: Wavelet Transform, Medical image Compression, Lifting Scheme, Compression Ratio, Peak Signal to Noise Ratio.

1. Introduction

Clinical image data such as Computed Tomography, Magnetic Resonance Imaging, etc.preoccupyextreme storage and usesgreatest data transfercapacity for transmission that frequentlybringsabout degradation of image quality. Because of these ingest issues in clinical images, compression is the solitary material method investigated in the proper way of earlier exploration work.

Presently, there exists ample research work on medical image compression considering lossy and lossless types, yet the requirement for medical images to be compressed effectively with optimal compression ratio is yet a question mark This system will perform an examination of various techniques explored and discusses some of the efficient techniques clearly among all the earlier work. However,studying the firstworks, it was found that granting medical image compression is an emerging need, it encounters higher dimensions of difficulties and intricacies for catering to the increasing demands of the medical science [1].

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2925 - 2933
Received 25 April 2021; Accepted 08 May 2021.

1.1 Compression

With the increasing use of Computed Tomography (CT), and Magnetic Resonance Imaging (MRI), the use of computers in facilitating their processing and analysis has become necessary. Medical Images incorporates information about the human body which is utilized for various purposes such as surgical and analytic plans. Medical image compression is used in applications such as summing up patient's information and IoT applications [4,18,19]. Concerning the significance of medical image information, lossless compression is preferred. Image compression may be lossy or lossless. Lossless compression is desired for storage purposes and often for medical imaging, specialized drawings, clip art, or comics.Lossless compression algorithms are the original data perfectly recreated from compressed data. In alossy compression, only the approximation of the original data is reconstructed.

1.2 Wavelet Transform

Fourier transform only gives what frequency component exists in a signal. Fourier transforms cannot tell what time; the frequency components occur. However, the time-frequency component is needed in most cases. The representation of a function of a wavelet transform is called the daughter wavelets. These daughter wavelets are scaled and interpretedduplicates of the central oscillating waveform called the mother wavelet.

The wavelet changes are more beneficial over the old Fourier transform. The wavelet transform describes the functions that have disconnection and sharp points, and for precisely deconstructing and recreating finite, nonperiodic, additionally nonstationary signals along with periodic or stationary signals.

The wavelet transforms can be categorized into two types such as Discrete Wavelet Transform (DWT) and a Continuous Wavelet Transform (CWT). Both of these wavelets transform to give the time and frequency of the signal and are called analog transforms. CWTs function on each scale and interpretation conceivable, through the DWTs utilizes anexact subset of scale and interpretation esteems.

1.3 Wavelet Transform in Image Compression

Wavelet Transform utilizes both the spatial and frequency correlation of data by dilations (or contractions) and translations of mother wavelet on the input data. Wavelet

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2925 - 2933
Received 25 April 2021; Accepted 08 May 2021.

Transform supports the multi-resolution analysis of data, it can be convenient to different levels according to the details required, which permitsreformist transmission and zooming of the image without the requirement for additional capacity. Another hopefulelement of wavelet change is its symmetric nature that is both the forward and the inverse transform has the similar intricacy, constructing fast compression and decompression routines.

Wavelet transform qualities are appropriate for image compression including the capacity to assess Human Visual System's (HVS) attributesawesome energy compaction capabilities, vigor under the transmission, high compression ratio, etc. In the subband coding plan, the signal is disintegrated using filter banks. The usage of the wavelet compression scheme is very related to that of sub band coding plan. The output of the filter banks is encoded, down-sampled, and quantized. The decoder interpretes the coded representation, up-samples, and recomposes the signal. The proposed a new filter designed based on a 9/7 wavelet lifting scheme. There are some advantages when compared to 5/3 wavelet filter relaxation in the design constraints that are implementing integer arithmetic without division it improves our compression performance. It gives better performance when compared to JPEG 2000 using a 5/3 wavelet lifting scheme[2].

Proposed a novel symmetry-based procedure for adaptable lossless compression of 3D medical image data. The strategyutilizes 2D wavelet-based compression of slices within a 3D medical image. It encodes slices by first applying a 2D integer wavelet transform, followed by a block-based intraband prediction of the resulting sub-bands. Remaininginformationcreatedby the intraband prediction method are then compressed using a modified version of the embedded block coder with optimized truncation (EBCOT) considered according to the characteristics of the residual data[3].

This system proposed compression of 3D clinical image data. The proposed method employs the 2D integer wavelet transform to decorrelate the information and an intrabandexpectationtechniques to reduce the energy of the subbands by exploiting the anatomical symmetries typically present in structural medical images. A changedadaptation of the Embedded Block Coder with Optimized Truncation (EBCOT), customizedby the to the attributes of the information, encodes the excess information created after forecast to give goal

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2925 - 2933
Received 25 April 2021; Accepted 08 May 2021.

and quality versatility encodes the excess information generated after prediction to provide resolution and quality scalability [23].

Proposed system medical image compression using bi-orthogonal wavelet with different decompositions. Making the reverse process the image is reconstructed. The proposed method is suitable for different images of various sizes. The reconstruction depends upon the number of decomposition[5].

Proposed a system in which ROI extracted using lifting wavelet and background extracted using the tiling process. The transformed coefficient is encoded by using Set Partitioning in Hierarchical Trees (SPIHT). It gives a high compression ratio and the reconstructed quality of the image is also high. Encoding is performed based on resolution[6].

The system proposes a method to improve the performance of the earlier work. Here compression is performed using bi-orthogonal wavelet transform CDF 9/7 coupled with SPIHT coding algorithm, it gives better performance when compared to partial EZW and SPIHT. In this proposed method the lifting design to improve the disadvantages of the bi-orthogonal wavelet transform. To improve the presentation of the compression algorithm, they have related the results obtained with wavelet based filters bank. Test results show that the proposed algorithm is better than the conventionalstrategies in both lossy and lossless compression for all tested images. They could detect that compression reduces to a slighteramount the image structure for a low compression bit-rate. However, for high compression bit-rate, their algorithm better safeguards the various image structures[7].

This system proposed a survey on the lifting scheme. The system proposed a lifting scheme combined with evolutionary computing shows better results [8].Proposed a system where the image is decomposed using DWT and then the coefficient coded using Quantization. This method gives high compression performance compared to the existing system.

Proposed a system with each source symbol divided into segments, each segment coded using adaptive arithmetic coding. They concentrate only on a smaller range of values to improve the efficiency of coding. It reduces up to 25% of bits per component[9].

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2925 - 2933
Received 25 April 2021; Accepted 08 May 2021.

Proposed a system that uses video compression. Here frames are decomposed and coded using SPIHT and also decomposed frames coded using Stationary wavelet transform techniques. Then the performance measured using CR, PSNR. The quality of the reconstructed frame is degraded[10].

This system proposes, in which different modalities of MRI images such as the brain, knee, spine used for compression, and the performance of compression measured in two ways subjective measure and objective measures [17]. The objective measures are RMSE, MAE, MSE, PSNR. Subjective measures are mean opinion scores used for diagnosing the perceived quality of an image.Bouklihacene*et al.* (2013) proposed a method used to compress color medical images. This system uses a Biorthogonal wavelet with SPIHT coding used for compression. This algorithm gives better performance when compared to other compression techniques[11].

Proposed a system that uses Graphics Processing Units (GPU) architecture to compress hyperspectral images. Experimental results for hyperspectral images with different spatial and spectral measurements are presented[12].

Proposed a system in which the image is divided into 8x8 blocks. These coefficients are quantized and then calculated Compression Ratio (CR) and Peak Signal to Noise Ratio (PSNR). The quality of the compressed image is better when using DWT than DCT, but PSNR is the same for both methods[13].

The proposed system that utilizes Sparse Steering Kernel Synthesis Coding (SSKSC), this strategy was executed as a pre and post-processor for JPEG performs nonuniform sampling based on the smoothness of an image, and the missing pixels reconstructed using adaptive kernel regression. The benefit of kernel regression is that it decreases the blocking artifacts. For the low-quality region, it achieves CR 50% is more than JPEG. The PSNR is low. If the image has lots of texture then the performance of compression is low[14].

Proposed a system in which the image is compressed using Modified Fast Haar wavelet transform and SPIHT. The performance compared with MFHWT and HWT. CR, PSNR better. It reduces memory requirements. This method is implemented using natural images. Korde&Gurjar (2014) proposed a system in which the input image is converted into 256x256.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2925 - 2933
Received 25 April 2021; Accepted 08 May 2021.

Region of interest image is extracted and compressed using run-length coding, Here NROI is not coded and the compression ratio is high[15].

Proposed a system in which the image is decomposed using Hand Designed wavelets such as Haar wavelet, Demeyer wavelet, Coiflet wavelet, and Symlet wavelets transform and then coded by Set Partitioning in Hierarchical Trees (SPIHT). The proposed method gives a high compression ratio[16].

The system proposes lossless medical image compression for teleradiology. In this system, NROI is extracted by using grow cut algorithm coefficients coded by using EZW coder, ROI extracted by using IWT, and coefficient coded by using arithmetic coding. The performance of the proposed system gives a better compression ratio and high peak signal to noise ratio[20].

Proposed a system in which the region of interest technique is applied to the input image to extract ROI then segment the image, the segmented image coded using Adaptive Multi wavelet Transform AMWT**),** non-region of interest encoded using Contextual Multidimensional Layered Zero Coding [21]. Image enhancement is performed by top hat filtering and histogram that pixels are taken by haar wavelet transform,the coefficients are encoded by DPCM encoder. The image is reconstructed by performing a reverse process[22].

2. CONCLUSION

This system provides a survey of existing wavelet-based compression and decompression techniques for compressing medical images. Though conventional wavelet transform methods are efficient for compressing medical images, this method assumes some subjective measures such as CR, PSNR for finding the efficiency of compression.

REFERENCES

1. Suma, V & Sridhar, V 2014, ‘A review of the effective techniques of compression in medical image processing’, International Journal of Computer Applications, vol. 97, no. 6, pp. 0975-8887.
2. Sanchez, V, Abugharbieh, R &Nasiopoulos, P 2009, ‘3D scalable lossless compression of medical images based on global and local symmetries’**,** 16th IEEE InternationalConference on Image Processing (ICIP), vol. 07, pp. 2525-2528.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2925 - 2933
Received 25 April 2021; Accepted 08 May 2021.

3. Sanchez, V, Abugharbieh, R &Nasiopoulos, P 2009, 'Symmetry-based scalable lossless compression of 3-D medical image data', IEEE Transactions on Medical Imaging., vol. 28, no. 7, pp. 1062-1072.
4. A.Prasanth, S.Jayachitra, A Novel Multi-Objective Optimization Strategy for Enhancing Quality of Service in IoT enabled WSN Applications, Peer-to-Peer Networking and Applications, Vol.13, 2020, pp.1905–1920
5. Loganathan, R &Kumaraswamy, YS 2010, 'Medical image compression using biorthogonal spline wavelet with different decomposition', International Journal on Computer Science and Engineering, vol. 02,no. 09, pp. 3003-3006.
6. Rajkumar, TMP &Mrityunjaya V Latte 2011, 'ROI based encoding of medical images: An effective scheme using lifting wavelets and SPIHT for telemedicine', International Journal of Computer Theory and Engineering, vol. 3, no. 3, pp. 338-346.
7. Bouklihacene, I, Beladghem, M &Bessard, A 2013, 'Lossy compression color medical image using CDF wavelet lifting scheme', International Journal of Image, Graphics, and Signal Processing, vol. 5, no. 11, pp. 53-60.
8. Nagaraja Rao, S &Giriprasad, MN 2011, 'The effective utilization of lifting schemes for constructing second generation wavelets: A survey on current state-of-the-art', International Journal of Signal Processing, Image Processing and Pattern Recognition vol. 4, no. 4, pp. 115-130.
9. Zhang, L, Wang, D & Zheng, D 2012, 'Segmentation of source symbols for adaptive arithmetic coding', IEEE Transactions on Broadcasting, vol. 58, no. 2, pp. 228-235.
10. MayankNema, Lalita Gupta & Trivedi, NR 2012, 'Video compression using SPIHT and SWT wavelet', International Journal of Electronics and Communication Engineering, vol. 5, no. 1, pp. 1-8.
11. Seddeq E Ghrare&Salahaddin M Shareef 2012, 'Quality evaluation of compressed MRI medical images for telemedicine applications', International Journal of Biomedical and Biological Engineering vol. 6, no. 12, pp. 641-643.
12. Lucana Santos, Enrico Magli, RaffaeleVitulli, José F López& Roberto Sarmiento 2013, 'Highly-parallel GPU architecture for lossy hyperspectral image compression', IEEE

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2925 - 2933
Received 25 April 2021; Accepted 08 May 2021.

Journalof Selected Topics in Applied Earth Observations and Remote Sensing, vol. 6, no. 2, pp. 670-681.

13. Gullanar M Hadi 2014, 'Medical image compression using DCT and DWT techniques', Advances in Image and video processing, vol. 2, no. 6, pp. 25-35.
14. Ruben Verhack, Andreas Krutz Peter Lambert, Rik Van de Walle& Thomas Sikora 2014, 'Lossy image coding in the pixel domain using a sparse steering kernel Synthesis approach', IEEE International Conference on Image Processing-ICIP, vol. 1, no. 1, pp. 4807-4811.
15. Kranthi, B, Ananda Krishna, B, Kamaraju, M &Rajasekhar, B 2014, 'Enhanced image compression algorithm for image processing applications', (IJCSIT) International Journal of Computer Science and Information Technologies, vol. 5, no. 2, pp. 1509-1515.
16. S.UshaKiruthika, S. Kanaga Suba Raja, V. Balaji, C.J.Raman, S. S. L. DuraiArumugam (2019) 'Detection of Tuberculosis in Chest X-rays using U-Net Architecture', International Journal of Innovative Technology and Exploring Engineering, ISSN: 2278–3075, Volume 9, Issue - 1, pp. 2514-2519
17. S.Jayachitra, A.Prasanth, Multi-Feature Analysis for Automated Brain Stroke Classification Using Weighted Gaussian Naïve Baye's Classifier, Journal of Circuits, Systems, and Computers, 2021.
18. A.Prasanth, S.Pavalarajan, 'Zone-Based Sink Mobility in Wireless Sensor Networks', Sensor Review, Vol.39, pp.874–880, 2019.
19. A.Prasanth, Certain Investigations on Energy-Efficient Fault Detection and Recovery Management in Underwater Wireless Sensor Networks, Journal of Circuits, Systems, and Computers, Vol. 30, 2020.
20. Moorthi, M &Amutha, R 2015, 'Region-based medical image compression in teleradiology', International Journal of Telemedicine and Clinical Practices, vol. 1, no. 1, pp. 47-63.
21. Sumalatha, R &Subramanyam, MV 2015, 'Hierarchical lossless image compression for telemedicine applications', Eleventh International Multi-Conference on Information Processing (IMCIP-2015), vol. 54, no. 11, pp. 838-848.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2925 - 2933
Received 25 April 2021; Accepted 08 May 2021.

22. ReemKord, HebaAfify, and Manal Abdel Wahed, “Towards Improved Lossless Compression for Mammogram Images using Differential Pulse Code Modulation”, Current Medical Imaging Reviews, 2018, 14, 969-975.
23. Victor Sanchez, RafeefAbugharbieh, and PanosNasiopoulos, 3-D Scalable Medical Image Compression With Optimized Volume of Interest Coding, IEEE Transactions On Medical Imaging, VOL. 29, NO. 10, OCTOBER 2010.