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Application of hybrid technique in medical image compression based on SVM and clustering method.

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Abstract

The Project proposes the region based Image compression technique based on clustering model and hybrid compression technique. The primary and secondary region of interest will be selected automatically by clustering algorithm. The lifting based discrete wavelet and NSCT is used to decorrelate the pixels into fine as well as redundant or noisy data and edge details. The regions are encoded by lossless and lossy technique to increase the compression ratio and preserve the image quality. These methods are useful to compress data for transmission and telemedicine application.

Key Terms— Medical Image, Image compression technique, clustering model, hybrid compression technique, clustering algorithm, discrete wavelet, data transmission

1. Introduction

A large amount of image data is produced in the field of medical imaging, in the form of computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET) and ultrasound images, which can be stored in picture archiving and communication system (PACS) or hospital information system (HIS). A medium scale hospital with the above facilities produces on an average 5–15 GB of data per day. So, it is very difficult for hospitals to manage the storing facilities for the same. Moreover such high data demands a high-end network, especially for transmitting the mages over the network such as in telemedicine. This is a very significant to the limitations of the transmission media in information and communication technology (ICT), especially for rural areas. Image compression is useful in reducing the storage and transmission and width requirements of medical images. If the image is compressed by 8:1 compression without any perceptual distortion, the capacity of storage increases eight times. Compression methods are classified into lossless and lossy methods. In the medical imaging scenario, lossy compression schemes, even though it gives up to 10% compression ratio, are not generally used. This is due to the possible loss of useful clinical information that may influence diagnosis. In addition to these reasons, there can be legal issues. Storage of medical images is generally problematic because of the requirement to preserve the best possible . Image quality which is usually interpreted as a need for lossless compression. Three-dimensional magnetic resonance imaging (MRI) contains multiple slices representing a part of a body, requires all information of that part.The storage size for such 3D images is huge**.**

2. Review of Related Research

A handful of researches are available in the literature for encoding an image based on ROI. Recently, utilization of wavelets and techniques like SPIHT and AT-SPIHT for encoding of ROI has received a great deal of attention among the researchers. A brief review of some of the recent research works is presented here.

V.K. Bairagi and A.M. Sapkal[1] *et* al. This paper proposes an automated, efficient and low complexity, lossless, scalable RBC for Digital Imaging and Communications in Medicine (DICOM) images using SPIHT coding. Region Based Coding (RBC) technique is significant for medical image compression and transmission. Lossless compression in these 'regions' and lossy compression for rest of image can helps to achieve high efficiency and performance in telemedicine applications. For the medical images, only a small portion of the image might be diagnostically useful, but the cost of a wrong interpretation is high.

Abdul Sattar[2] *et* al. This paper proposes the multi-iteration algorithm and particularly the two iteration EZW for a given image quality produce lower bit rate. It is applied for medical images and here, the thorax radiology is chosen as a sample image and the good performance is codified. The embedded zerotree wavelet algorithm (EZW) is used for image coding. It is designed to optimize the combination of zerotree coding and Huffman coding.

Calderbank, A.R., Daubechies, I., Sweldens, W., Yeo, B.L[8] *et* al. This paper describes the Use of lattice vector quantizers in conjunction with a quadtree-based sorting algorithm for the compression of multidimensional data sets, as encountered, for example, when dealing with hyperspectral imagery.The SPECK algorithm is presented that deals with vector samples and i used to encode a group of successive spectral bands extracted from the hyperspectral image original block. Finally provide comparison against state-of-the-art encoders, both 2D and 3D ones, showing the proposed encoding method is very competitive, especially at small bit rates.

Eva Cavero, A´ lvaro Alesanco, Lena Castro, Jose´ Montoya, Isaac Lacambra and Jose´ Garc *et* al[3]. The paper deals with an echocardiogram coding method that takes into account the visualization modes in order to compress efficiently the echocardiogram, a methodology to evaluate compressed echocardiograms, and the evaluation of the compression method using the proposed evaluation methodology. The evaluation of the echo cardiograms compressed with the proposed method has been carried out. The recommended transmission rates have been established as follows: 200 kb/s for the 2-D and the color Doppler modes, and 40 kb/s for theMand the pulsed/continuous Doppler modes. These rates, especially the latter, are very low to previous results. These recommendations are valid for all devices and images compressed with the proposed method. The evaluation process can be applied to any compression method.

Jamuna.M, A.M.Vijaya Prakash, J.Pushpanjali[13] *et* al. This paper presents implementation of 2 methods of DWT, one is conventional method and the other one is lifting scheme. Since conventional method requires more memory, area and power, lifting scheme is used as an enhanced method. DWT is the most widely used image compression technique and it is the most efficient algorithm used in JPEG image compression. The Inverse Discrete Wavelet Transform (IDWT) is also obtained in a similar way to get back the image matrix. This architecture enjoys reduced memory referencing.

3. Proposed Method

Automated Region based Image compression technique based on clustering model, lossless and lossy coding algorithms for efficient medical image transmission in telemedicine applications. Region based hybrid image compression through, Clustering model for region selection, Non-Sub sampled Contour let Transformation (NSCT), Entropy coder-Adaptive arithmetic coder (AAC), Lifting wavelet with SPECK Coding for Lossy compression and Parameter Analysis(MSE, PSNR, CR, Correlation and Elapsed Time).

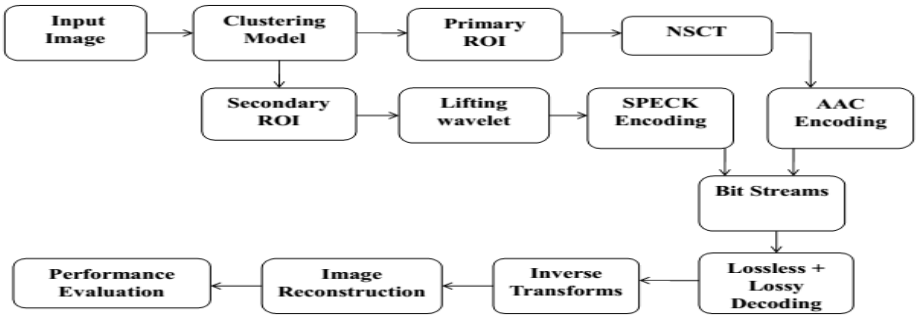

Figure.1: Block diagram of proposed method

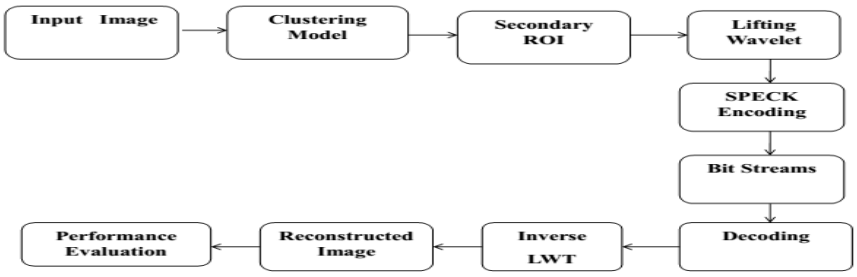

Figure2:flow of lossy compression

3.1 Region Selection

The first step is to select the desired regions from input automatically based on identifying an intensity variations. Here, grouping of similar region will be performed by Kmeans clustering algorithm. Here grouping of similar region will be performed by Kmeans clustering algorithm. It is an unsupervised clustering algorithm that classifies the input data points into multiple classes based on their inherent distance from each other. The algorithm assumes that the data features form a vector space and tries to find natural clustering in them. It is a well suited method for this process on MRI brain samples and it consumes less time and provides better result for better contrast image.

3. 2 Clustering algorithm

The K-means algorithm is an iterative technique that is used to partition an image into K clusters. The basic algorithm is Pick K cluster centres, either randomly or based on some heuristic. Assign each pixel in the image to the cluster that minimizes the distance between the pixel and the cluster centre. Re-compute the cluster centres by averaging all of the pixels in the cluster. Repeat steps 2 and 3 until convergence is attained (e.g. no pixels change clusters).

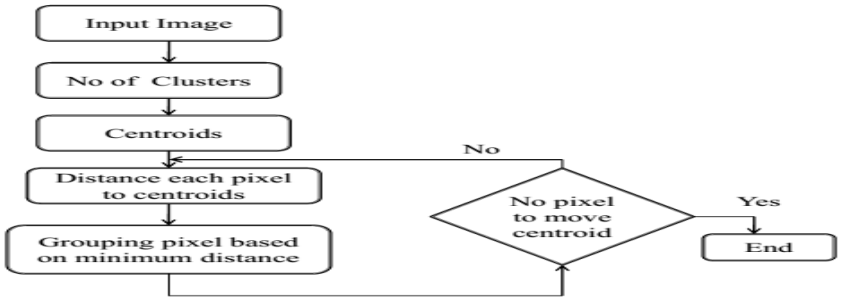

Figure3: Process Flow –kmeans algorithm

3.3. Orginal And Region Splitted Images

Figure4: Process Flow

4. Lifting Wavelet Transform

LWT decomposes the image into different subband images,namely, LL, LH, HL, and HH for getting pixel coefficients of images. LL subbands contains the significant part of the spatial domain image. High-frequency subband contains the edge information of input image. Integer wavelet transform can be obtained through lifting scheme. Liftin scheme is a technique to convert DWT coeff icient to Integer coefficients without losing information.

This will be used to provide unique values for quantization and encoding proces

4.1 Wavelet Computation

Forward Lifting in IWT

Step1: Column wise processing to get H and L

$$H = (Co-Ce) \text{ and } L = (Ce-[H/2]) \quad (1)$$

Where Co and Ce is the odd column and even column wise pixel values,

Step 2: Row wise processing to get LL,LH,HL and HH,

Separate odd and even rows of H and L,Namely, Hodd – odd row of H, Lodd- odd row of L Heven- even row of H, Leven- even row of L,

LH = Lodd-Leven ,LL = Leven – [LH / 2] (2)

HL = Hod –Heven ,HH = Heven–[HL / 2] (3)

4.2 Reverse Lifting Scheme In Iwt

Set partitioning in embedded coder is based on multiscale 2D DWT and exploits the self-similarity across scales by using set partitioning. After transformation, the coefficients are ordered into a tree structure, called spatial orientation tree (SOT). The SOT is defined by each wavelet coefficient (parent) in a certain decomposition scale has either no child (i.e., tree leave) or four children in the next finer scale and the coefficients in the low-frequency subband are the tree roots. The coefficients are quantized by partitioning them into different set likes significant information and insignificant informations and performs the priority based transmission.

5. SPECK Algorithm

SPECK algorithm is based on 3 concepts

- Ordered bit plane progressive transmission.
- Set partitioning sorting algorithm.
- Spatial orientation trees

In a practical implementation the significance information is stored in three ordered lists

- LIS-list of insignificant sets
- LIP-list of insignificant pixels
- LSP-list of significant pixels

5.1 spatial orientation trees

The following sets of coordinates are used to present the new coding method

◦ O (i, j) : Set of coordinates of all offspring of node (i, j);

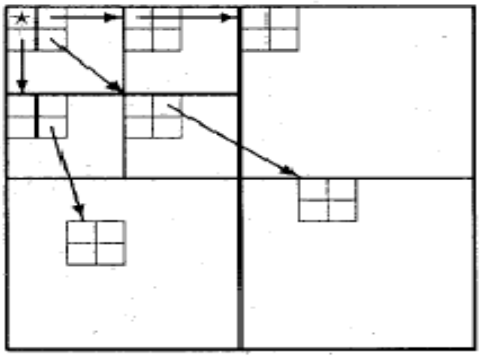

Figure4: splitting into child co-ordinates

5.2. Set partioning algorithm

The sorting algorithm divides the set of pixels into partitioning subsets T_m and performs the significance test by using the function

$$S_n(T) = \begin{cases} 1, \max(i.j)\text{€}T|Ci,j|> 2 \\ 0, \text{otherwise,} \quad n \text{ is the \# of pass} \end{cases}$$

6. Experimental Analysis

The test image of 69kb is used as input image here in the experiment. This image will be converted into frequency domain and then it will be compressed by using SPECK Algorithm. The input test image is of the size 822*446 dimension. after applying lifting wavelength algorithm the image split into different frequency range. This will help to identify where the effected part is and where the normal part in the image is. Then we can locate the exact tumour region(effected region)by using k-means algorithm.it will split into clusters.

SPECK Algorithm help us to perform lossy compression which have a good compression region. When i take the image of 69kb ,got a compression ratio of 1.7360.image size reduced to 24kb.And got 47.6602 as PSNR value.

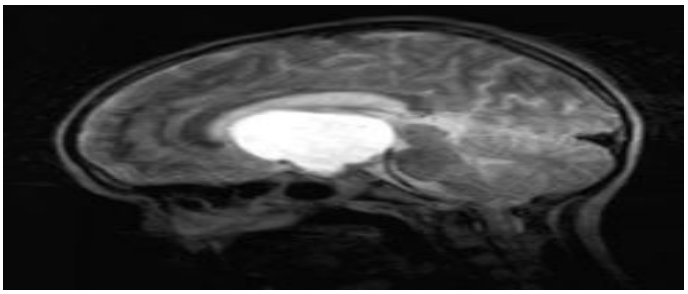

Figure.5: input image

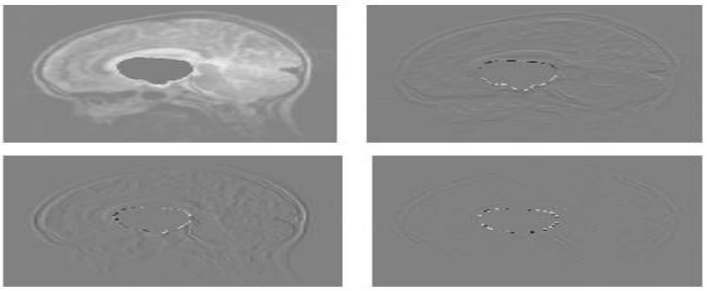

Figure 6:after applying lwt algorithm

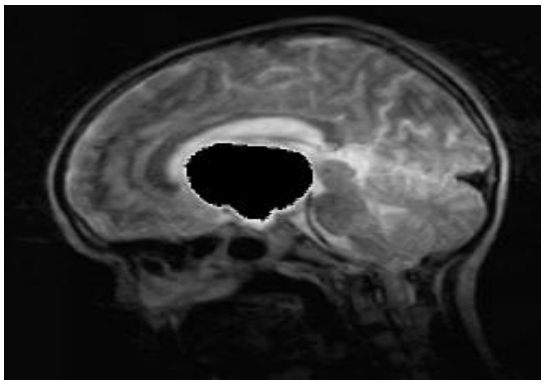

Figure7: Reconstructed image

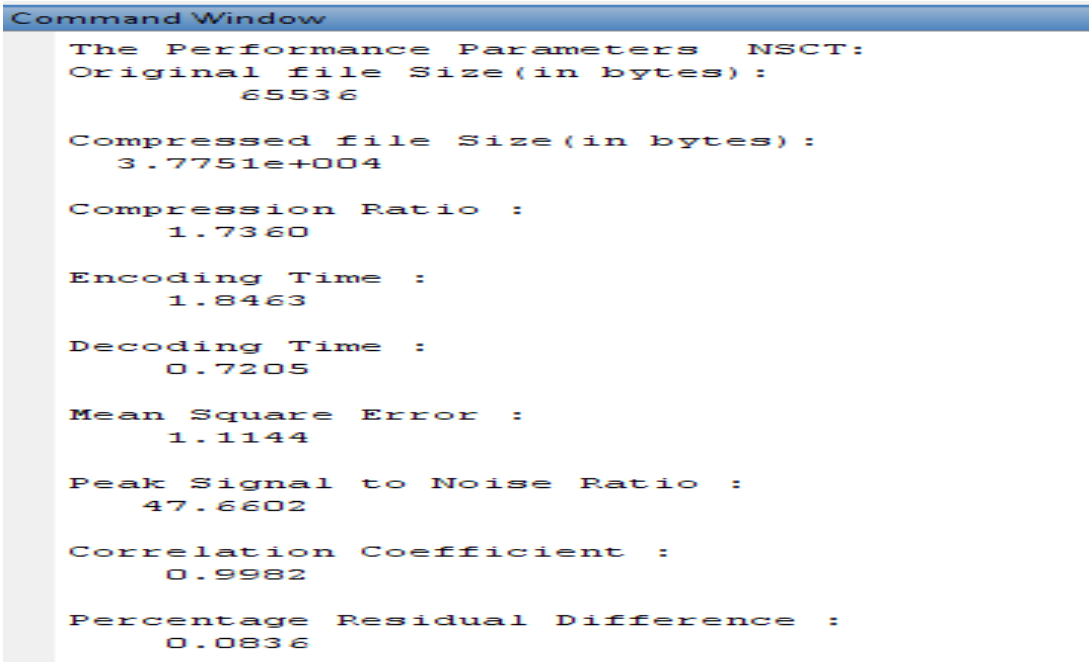

Figure.8: parameter analysis

After compression we got a good compression ratio and MSE value. A good PSNR value, correlation coefficient value could achieve. After combining with lossless compression for tumour affected area by using AAC Algorithm with NSCT technique we can make a detailed comparison with existing methods.

7. Conclusion

This paper presented to provide solutions for efficient region based image compression for increasing the compression ratio with less mean square error at minimum processing time based on NSCT transform with adaptive arithmetic coding, Lifting wavelet transform with set partitioning embedded block coding. This paper heavily utilized for compressing medical images to transmit for telemedicine application. To minimize the information loss, arithmetic entropy coding was used effectively. It will be enhanced by combining speck coding for compressing the secondary region and this hybrid approach was increased the CR and reduce the information loss. Here performance will be analysed through determining the image quality after decompression, compression ratio, correlation and execution time.

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9. References

[1]V.K.Bairagi A.M.Sapkal ,Automated region based hybrid for imaging and communications in medicine magnetic resonance imaging images for telemedicine applications,2012 january.

[2]Abdul Sattar, The medical image compression with embedded zerotree wavelet,2013 February
[3] Calderbank, A.R., Daubechies, I., Sweldens, W., Yeo, B.L.: 'Wavelet transforms that map integers to integers', Appl. Comput. Harmon. Anal., 2006, 5, pp. 332–369
[4] Eva Cavero, A´ lvaro Alesanco, Lena Castro, Jose´ Montoya, Isaac Lacambra, and Jose´ Garc´ıa SPIHT-Based Echocardiogram Compression: Clinical Evaluation and reccomendations of Use, ieee journal of biomedical and health informatics, vol. 17, no. 1, january 2013

[5]Jamuna.M, A.M.Vijaya Prakash, J.Pushpanjali, Low Power VLSI Architecture for Image Compression System Using Discrete Wavelet Transform,2012 june
[6]Mrs. S. Sujatha and Mrs. A. Shanthi Sona, New Fast K-Means Clustering Algorithm using Modified Centroid Selection Method,2013 February

[7] Sayood, K.: 'Introduction to data compression' (Elsevier Publication, 2010, 3rd edn.), pp. 473–512

[8] Zhang, Q., Xiaio, X.: 'Extracting regions of interest in biomedical images'. Int. Seminar on Future BioMedical Information Engineering, 2011, pp. 3–6

[9] Yu, Y., Wang, B.: 'Saliency based compressive sampling for image signals', IEEE Signal Process. Lett., 2010, 17, (11), pp. 973–976 [10] Doukas, C., Maglogiannis, I.: 'Region of interest coding techniques for medical image compression', IEEE Eng. Med. Biol. Mag., 2007, 26, (5), pp. 29–35

[11]Deepak.S.Thomas, M.Moorthi and R.Muthalagu, medical image compression based on automated roi selection for telemedicine application,2014 january.

[12] t. celine therese jenny and g. muthulakshm,

a modified embedded zero-tree wavelet method for medical image compression,2010 november

[14] Zdenek Prusa and Pavel Rajmic, Real-Time lifting wavelet transform algorithm,2011 september.

[15] Zdenek Prusa and Pavel Rajmic, Real-Time lifting wavelet transform algorithm, 2011 september.

[16] Jignesh Sarvaiya, Suprava Patnaik & Hemant Goklani, Image Registration using NSCT and Invariant Moment

[17] Arthur L. da Cunha, Jianping Zhou, Minh N. Do

The Non sub sampled Contourlet Transform: Theory, Design, and Applications, 2006 October

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