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Edge Based Compression Using Embedded Zero Wavelet Tree (EBC –EZWT) for Lung Cancer CT Scan Medical Image

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ABSTRACT

The main objective of the research is to improve the accuracy through edge based EZW transform and compression algorithms for lung cancer medical image. The research objective also includes the development of the Discrete Cosine Transform (DCT) compression Algorithm and Discrete Wavelet Transform (DWT) Compression to enhance the Predictive Accuracy for Lung cancer CT scan reconstructed medical image. The objective of this work is to implement an innovative image compression system for the detection of lung cancer. Compression images obtained from CT scan image can accurately access the reconstructed cancer cells. Proposed edge detection transform coding by employing embedded zero-tree based compression which facilitates attaining significant compression efficiency.

Keywords: EZW, DCT, DWT,Edge Detection CT Scan and Lung Cancer

I. INTRODUCTION

The volume of medical image data produced every day in health care is ever growing, particularly in grouping with the improved scanning resolutions and the importance of volumetric medical image data sets. Lung cancer is the most common cause of cancer death in the world. Tobacco smoking cause's etiology breath and lung cancer. Patients at highly effected by the lung cancer[1]. The lungs are two large organs made of spongy tissue, which lie above the diaphragm and under the rib cage. When you breathe in, your lungs absorb oxygen and deliver it to the bloodstream where it's pumped throughout the body. When you exhale, the lungs remove carbon dioxide, a waste gas, from the bloodstream. Lung cancer interferes with this vital process and can make breathing more difficult. Lung cancer is the second most common non-skin cancer among men and women, after prostate cancer in men and breast cancer in women. Smoking significantly increases a person's chance of developing the disease, but people who have never smoked may develop lung cancer, too. According to the American Cancer Society, the lifetime risk of developing lung cancer is about 1 in 13 for men and 1 in 16 for women. In 2016, an estimated 224,390 people will be diagnosed with lung cancer in the United States[2].It's could present with a variety of indications and is regularly screened by more common sicknesses. Several patients report no indications what so always, so it is vital that exact questions be enquired to try to produce information about symptoms they may not reflect abnormal[3]. In the case of an abnormal chest x-ray, the patient should directly undergo a chest CT scan for further evaluation. Image compression is process to remove the redundant information from the image so that only essential information can be stored to reduce the storage size, transmission bandwidth and transmission time. The essential information is extracted by various transforms techniques such that it can be reconstructed without losing quality and

information of the image. In this work, comparative analysis of image compression is done by seven transform methods, which are Karhunen-Loève Transform (KLT), Walsh-Hadamard Transform (WHT), Fast Fourier Transform (FFT), proposed Sparse Fast Fourier Transform (SFFT), Discrete Cosine Transform (DCT), Discrete Wavelet Transform and Proposed EBC-EZWT.

II. LITERATURE SURVEY

A region based approach for the near lossless coding of images has been described by Pinho. Scalar quantisation is used to quantise the images. This quantisation process is the only source of error in the image. The constant intensity regions were then identified, and the regions were encoded using the context modelling. Qian et al proposed two near–lossless approaches called multi-stage vector quantization and hierarchical- self organizing cluster vector quantisation for the near-lossless compression of hyper spectral satellite data[4].This technique is tailor-made for the compression of satellite data, where the original data is always noisy and is not applicable for medical images. It was shown by Ferreira &Pinho [5] that, by packing the sparse image histograms, the compression performance of a lossless image coder can be improved. This method was extended to the near-lossless compression of images by Nasr-Esfahani et al. The pixel values were changed after deciding the near-lossless error. A high-performance implementation of the JPEG-LS encoder was studied by Markos et al (2008)[6]. An adaptive approach for lossless and near-lossless scalable compression of medical images was presented by Taquet&Labit[7]. It is a DPCM based approach, where a Hierarchical Oriented Predictor (HOP) was used to provide the resolution scalability.

scope of the research

The techniques used in this work are made general and can be used for other applications, other than considered in the research work. Transformation and compression accuracy to assess the quality of the reconstructed images. Lung cancer images was investigated throughout this work using various image processing compression algorithms like Karhunen-Loève Transform (KLT), Walsh-Hadamard Transform (WHT), Fast Fourier Transform (FFT), proposed Sparse Fast Fourier Transform (SFFT), Discrete Cosine Transform (DCT), Discrete Wavelet Transform and Proposed Edge based compression algorithm using Embedded Zero Wavelet Tree (EBC –EZWT)[8][9][10].

Compressing an image is significantly different than compressing raw binary data. of course, general purpose compression programs can be used to compress images, but the result is less than optimal. This is because images have certain statistical properties which can be exploited by encoders specifically designed for them. Also, some of the finer details in the image can be sacrificed for the sake of saving a little more bandwidth or storage space. This also means that lossy compression techniques can be used in this area. Uncompressed multimedia (graphics, audio and video) data requires considerable storage capacity and transmission bandwidth[11][12][13]. Despite rapid progress in mass-storage density, processor speeds, and digital communication system performance, demand for data storage capacity and data-transmission bandwidth continues to outstrip the capabilities of available technologies. The recent growth of data intensive multimedia-based web applications has not only sustained the need for more efficient ways to encode signals and images but have made compression of such signals central to storage and communication technology. For still image compression, the `Joint Photographic Experts Group' or JPEG standard has been established by ISO (International Standards Organization) and IEC (International Electro-Technical Commission).

Figure 3.1. Medical image compression

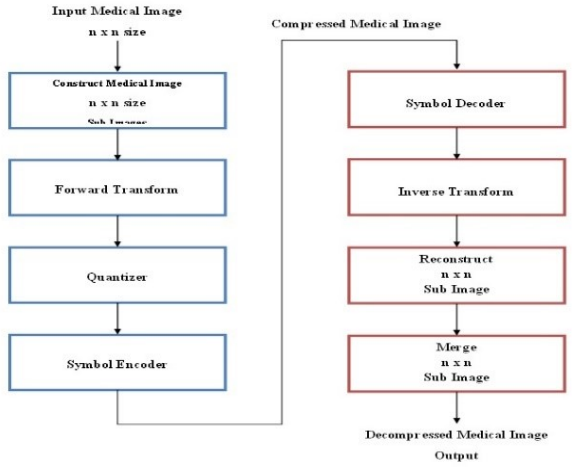

Figure 1

Many approaches have been proposed for image compression most of them still suffer from the problems of stagnation in local optima and high computational cost due mainly to the large storage space[14][15][16]. Therefore, an efficient compression technique is needed to address lossless tasks. In this work, various image processing compression algorithms like Karhunen-Loève Transform (KLT), Walsh-Hadamard Transform (WHT), Fast Fourier Transform (FFT), Sparse Fast Fourier Transform (SFFT), Discrete Cosine Transform (DCT), Discrete Wavelet Transform and Proposed EBC-EZWT algorithms are used[17][18][19]. This work has presented a wavelet transformation-based approach to compression and demonstrated how it can be applied to image compression problems for medical images.

research contribution and methodology

The sample medical images is taken from the Hospital medical image and the image have undergone a lossy and the lossless compression. Various image processing compression algorithms like Karhunen-Loève Transform (KLT), Walsh-Hadamard Transform (WHT), Fast Fourier Transform (FFT), proposed Sparse Fast Fourier Transform (SFFT), Discrete Cosine Transform (DCT), Discrete Wavelet Transform and Proposed edge based EZW transform algorithm have been applied to the lung cancer CT scan medical image data set[20][21][22].

Fast Foruier(FF) and sparse fast fourier transform (SFFT) based for easy optimization compression for *the Predictive Accuracy*

The first work, FFT is an algorithm which is used to compute Discrete Fourier Transform (DFT) in a very effective way[8]. It splits the larger size M = NxN matrix into smaller N's of DFT in time domain. Although there are several forms are available to implement this algorithm, but Radix-2 Decimation in Time (DIT) FFT is the simplest and effective method. This method is used to compute 2n point DFT. It splits the points into odd and even sequences by their indexes. After that both the sequence are combined to attain the whole DFT sequence.

sFFT computes *k* – sparse approximation, whose runtime depends upon k, the larger coefficient in the signal. This algorithm works in the process of identifying these k values by a filter *G*. G concentrates in both time and frequency. G is zero for all values except at a small number of time co-ordinates, and the Fourier Transform of G is negligible except at a small fraction value which is about *k*of the frequency co-ordinates. Gaussian or Dolph-Chebyshev function convolved with a box-car function is used to identify the large coefficients in sFFT.

Discrete cosine transforms (DCT) Algorithm based image compression for CT Scan image

The second work deals with Discrete Cosine Transform (DCT) exploits cosine functions, it transforms a signal from spatial representation into frequency domain[9]. The DCT represents an image as a sum of sinusoids of varying magnitudes and frequencies. DCT has the property that, for a typical image most of the visually significant information about an image is concentrated in just few coefficients of DCT. After the computation of DCT coefficients, they are normalized according to a quantization table with different scales provided by the JPEG standard computed by psycho visual evidence. Selection of quantization table affects the

entropy and compression ratio. The value of quantization is inversely proportional to quality of reconstructed image, better mean square error and better compression ratio. In a lossy compression technique, during a step called Quantization, the less important frequencies are discarded, and then the most important frequencies that remain are used to retrieve the image in decomposition process. After quantization, quantized coefficients are rearranged in a zigzag order for further compressed by an efficient lossy coding algorithm[23][24][25].

Discrete Wavelet transform Algorithm to Enhance the performance Evaluation for medical image

The Third work Wavelets are useful for compressing signals. They can be used to process and improve signals, in fields such as medical imaging where image degradation is not tolerated. Wavelets can be used to remove noise in an image. Wavelets are mathematical functions that can be used to transform one function representation into another. Wavelet transform performs multi-resolution image analysis. Multi-resolution means simultaneous representation of image on different resolution levels [10]. Wavelet transform represent an image as a sum of wavelets functions, with different location and scales.

Edge based Embedded Zero tree Wavelet (EZW) Algorithm for lossless image compression to transform medical images

The proposed new approaches for compression of the images. In the first approach, the input image is initially visually quantized to generate a pre-quantised image. An edge-based wavelet transform is proposed for image compression. In the encoder, first the dominant edges of an image are detected and coded as side information. Then, the EZW wavelet transform (WT) is carried out in such a way that no filtering over previously detected edges is performed. Compression examples show that the edge-based EZW- WT achieves good reproduction of sharp edges even at very low bit rates. Because of the additional side information, the PSNR is typically slightly lower than for standard wavelet coders. But the picture quality scale, an objective quality measure that better reflects the subjective impression, shows superior results for the proposed coder.

experimental results

The experiment is carried out in MATLAB environment. In this research, the images deployed here for compression are all 128 X 128, 256 X 256 and 512 X 512 medical images. Basically, meaning that images comprise of 128 X 128 = 16,384 pixels, 256 X 256 = 65536 pixels and 512 X 512 =262144 pixels, wherein each pixel is represented by 8 bits or 1 byte. KLT, WHT, FFT, SFFT, DCT, DWT and edge based EZW transform algorithm implementation has been carried out on MATLAB software and several different parameters have been ascertained with respect to the three medical images; comparison of reconstructed and original images PSNR, MSE, CR, SC values have been estimated.

In Table 1 we have taken 128X128 size CT scan medical images and simulated images using KLT, WHT, FFT, SFFT, DCT, DWT and Proposed EBC-EZWT compression techniques. In CT Image the proposed EBC-EZWT compression produce better result in PSNR value is 29.6817 less than KLT, WHT, FFT, SFFT, DCT and DWT value is 43.3436, 41.0181, 40.7637, 39.7656, 38.9746 and 36.9746respectively.In CT Image the proposed EBC-EZWT compression produce better result in MSE value is 22.148higher than KLT, WHT, FFT, SFFT, DCT and DWT value is 2.342, 3.165, 8.437, 10.373, 14.424 and 15.342 respectively. In CT Image the proposed EBC-EZWT compression produce better result in CR value is 10.2989 higher than KLT, WHT, FFT, SFFT, DCT and DWT value is 2.342, 3.7365, 4.4844, 5.3433, 5.9784 and 7.7642 respectively. In CT Image the proposed EBC-EZWT compression produce better result in SC value is 1.006higher than KLT, WHT, FFT, SFFT, DCT and DWT value is 3.984, 3.098, 2.965, 2.615, 2.105 and 1.987 respectively. Also in this research we have taken 256X256 and 512X512 size

medical images, the proposed EBC-EZWT given better output than other compression technique.

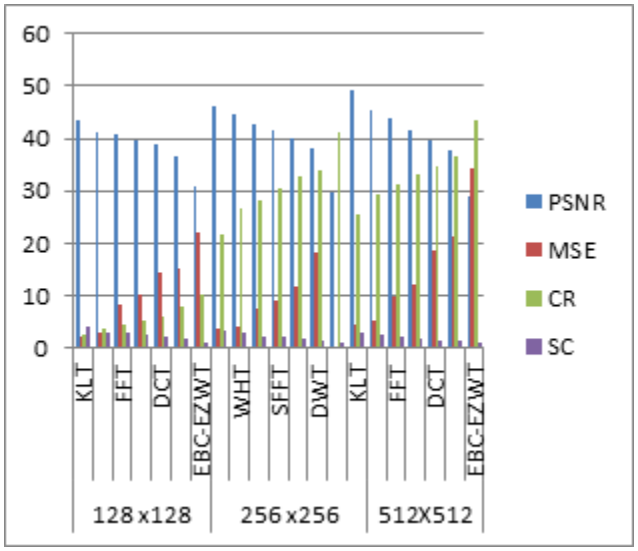

Figure 2

III. CONCLUSION

This work is concentrated on the comparison among six main KLT, WHT, FFT, SFFT, DCT DWT and EBC-EZWT methods of image compression. In this work, analysis of various Image compression approaches for different images is done based on parameters, mean square error (MSE), compression ratio(CR), Structural Content (SC) and peak signal to noise ratio (PSNR). The comparison of KLT, WHT, FFT, SFFT, DCT,DWT and proposed EBC-EZWT after compression the parameters like PSNR values, MSE, CR and SC values were good outcome in proposed EBC-EZWT work. From the above study, Proposed EBC-EZWT take less PSNR ,SC value than KLT, WHT, FFT, SFFT, DCT and DWT. The Proposed EBC-EZWT method has more MSE value than KLT, WHT, FFT, SFFT, DCT and DWT. The experimental result shows that we can achieve higher compression ratio using EBC-EZWT compression technique. EBC-EZWT gives higher compression ratio and getting good clarity of reconstructed images. It is more suitable for regular applications as it is having a good compression ratio along with preserving most of the information.

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