MEDICAL IMAGE COMPRESSION USING INTEGER MULTI WAVELETS TRANSFORM FOR TELEMEDICINE APPLICATIONS

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Abstract—In this paper we suggest an efficient compression and encoding coding performance based on Integer multi wavelet transform of medical application. This method reduces the Mean Square coefficients and increases the peak signal to noise ratio in the code block due to the transmission purpose. By using this coding technique the compressed data and encoded bit stream are all suited for progressive transmission. By the experimental results show that the proposed algorithm gives better quality, if the images using integer multi wavelets compared to that of the other wavelets transforms. The parameter of the system has been evaluated based on Compression Ratio (CR), peak signal to noise ratio (PSNR) and mean square error (MSE).

Index Terms—Medical image compression, Integer Multi wavelet Transform, Data security, Compression Ratio(CR),Peak Signal to noise ratio(PSNR),Mean Square Error(MSE).

1 INTRODUCTION

A compression of medical imagery is an important area of biomedical and telemedicine. For the medical application image study and data compression are quickly developing field with rising applications services are teleradiology, teleconsultation, Bio-medical, tele-medicine and medical data analysis[1]. For the above application, medical image compression and image analysis of data might be even more helpful and can play an main task for the diagnosis of more complicated and difficult images through consultation of experts[2]. In medical image compression diagnosis and analysis are doing well simply when compression techniques protect all the key image information needed for the storage and transmission. This is the case of lossless compression. On the other scheme is lossy compression is more efficient in terms of

storage and transmission needs but there is no guaranty to preserve the information in the characteristics needed in medical diagnosis [3].

To avoid the above problem, there may be third option that the diagnostically important is transmission and storage of the image is lossless compressed. ROI, a segmentation approach can be used to remove the region of interest(ROI). These regions of interest is very useful for diagnosis purpose. Hence, the ROI must be compressed by a Lossless or a near lossless compression algorithm. By this Wavelet based techniques are most recent growth in the area of medical image compression.

This paper is prepared as follows: section two proposed method, section three discrete wavelet transforms, section four multi wavelet and integer multi wavelet transform, section, section five Flow chart, section six experimental results, section seven describes conclusion and future

work.

2 FRAME WORK OF OUR PROPOSED METHOD

2.1 EXISTING METHOD

Region of interest is a important feature provided by the JPEG 2000 standard. The entire image is encoded as a single entity by heterogeneous fidelity constraints. This new method reduces the background coefficient but the algorithm complexity is high, the method gives a better image quality compared to the scalar wavelet.

2.2 PROPOSED METHOD

In the proposed method integer wavelet transform is used in compressing the image. The compressed image is decomposed by the multiwavelet transform. The encoding is done based on maximum value of image pixel, original value is reduced based on the neighboring pixel value. The final image obtained by this process is an encoded bit stream image which is in binary image (i.e 0's and1's). Receiver decodes the incoming bit stream value, decompress it and reconstructs the original image. Major advantage of this method is that the mean square error is reduced when compared to other transforms and the compression ratio is significantly increased.

3 DISCRETE WAVELET TRANSFORM

In the analysis of both numerical and functional methodologies, a Discrete Wavelet Transform (DWT) can be used. DWT is a kind of wavelet transform for which the wavelet functions are discretely sampled by the other wavelet transforms. A major advantage of discrete wavelet transform over the Fourier transform is the effect of temporal resolution. The temporal resolution is nothing but capturing both frequency (frequency in lamda) and location information (location in time).For image processing applications we need wavelets that are two-dimensional. This problem reduces down when it comes to the design of 2D filters. Focus on a particular class of 2D filters and separable filters can be directly designed from their 1D counterpart itself. Image contrast enhancement with wavelets is specially important in the field of medical imaging. The small coefficients are made smaller and the large coefficients are made larger. A nonlinear mapping function to the coefficients is then applied. By applying DWT, the coefficients in finer scales reduce the effect of noise and enhance features within a certain range using a nonlinear mapping function. Performance of IDWT is absolutely mandatory to reconstruct the image.
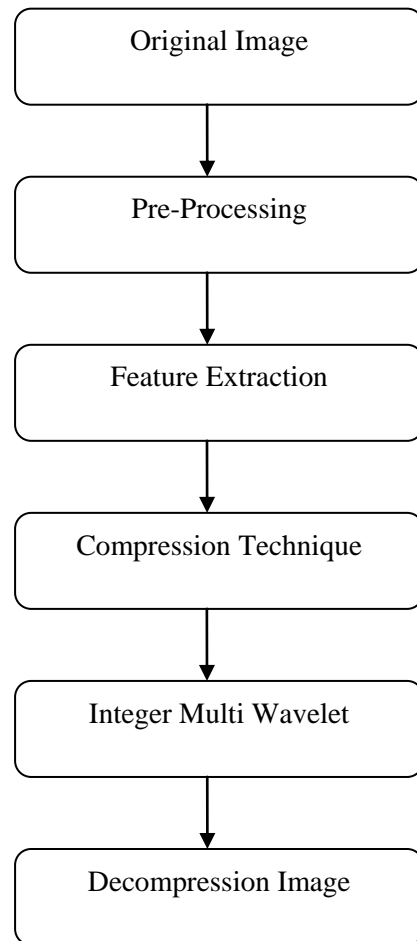
In the wavelet decomposition method it is widely based on the two types of filters, i.e low pass filter and high pass filter. The filter length is same in both the low pass and high pass filter. In this decomposition ,DWT image is split into several sub bands(LL,LH,HL,HH),for the further decomposition level we consider only LL sub band, because in this sub band only it has a low frequency and noise compare to other sub band levels[10].The wavelet transform (WT), in general, produces floating point coefficients. These floating point coefficients can be used to reconstruct an original image perfectly by using quantization results in a lossy scheme. Recently reversible integer wavelet transforms have been introduced.

4 MULTI WAVELET AND INTEGER MULTIWAVELET TRANSFORM

Multiwavelets are defined using wavelets with scaling functions. But in integer Multiwavelets, transform can be implemented using several wavelet functions and several scaling functions. So this transform is useful for multilevel decomposition. Integer multi wavelets have some advantages in comparison with other multi wavelets. The properties such as orthogonality, symmetry and then approximation are known to be important in the image processing domain. Integer multi wavelets are very similar to Multiwavelets but have some important differences.

In particular, Multi wavelets have an related to both scaling function and wavelet function whereas integer multi-wavelets have two or more several scaling and wavelet function depending up on their applications. The coefficients of wavelet is actually based on filtering and down sampling process. Integer multiwavelet transform can be efficiently implemented in the shift and the addition operations. The other advantages of this integer multiwavelet transform is to increase the higher order approximation and dynamic range of the coefficients.

5 FLOW CHAT FOR PROPOSED METHOD

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┌─────────────────────────────┐
│       Original Image        │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│       Pre-Processing        │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│      Feature Extraction     │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│     Compression Technique   │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│     Integer Multi Wavelet   │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│     Decompression Image     │
└─────────────────────────────┘
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Steps involved in the process:

Step 1: Consideration of Original Image

Initially the input image is fed to the system, the input image may be a highly non stationary one, hence we convert the size of the input image to 256 x 256. In gray scale coding even if the input image is a colour image it will be converted into gray scale image using RGB converter.

Step 2:Pre-Processing

After the input image is taken, in the Pre-processing step each and every neighborhood pixel of an input image should have a new brightness value corresponding to the output image. Such pre-processing operations are also known as filtration.Types are enhancement (image enhancement for shape detection), image restoration (aim to stem degradation using knowledge about its nature of an image; i.e. relative motion of camera image and object, wrong lens focus etc.), image compression (search for way to eliminate redundant information from images given to the pre processing)

Step 3: Feature Extraction

In the extraction process the input image data is segmented and then the input data will be transformed into a reduced represented set of features. It is useful on a selection of situations Where it helps to stem data information that is not important to the specific image processing task (i.e. background elimination).Transforming the input data into a particular set of features is called as feature extraction.

Step 4: Compression technique

Basically, there are two types of image compression techniques used with digital image and vedio, **lossy** and **lossless.** Lossy compression methods include DCT (Discrete Cosine Transform), Vector Quantization and Huffman coding. Lossless compression method include RLE scheme (Run Length Encoding), string-table compression and LZW (Lempel Ziv Welch) .In this proposed method we consider lossy compression scheme, because in the lossy compression technique provide better compression ratio compared to the lossless scheme.

Step 5: Integer Multi wavelet Transform

The integer multi wavelet transform is proposed for an integer implementation of a multi wavelet system, based on the simple multi –scalar function.

Step 6: Decompressed Image

In the decompression process, the encoded binary data and the data which is compressed can be easily extracted.

6 EXPERIMENTAL RESULTS

The original image is taken as a test images as shown in fig 1.Input image of size is 256 x 256
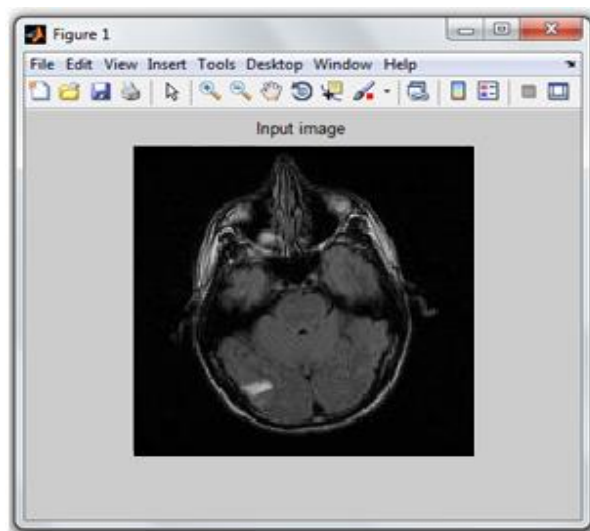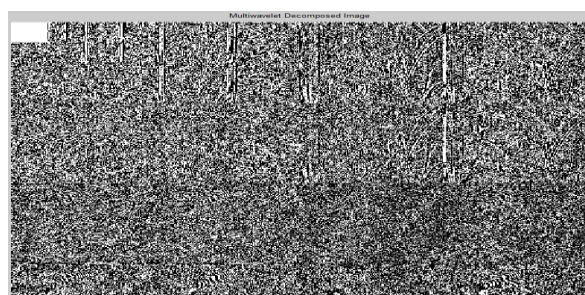

Fig1.Input Image

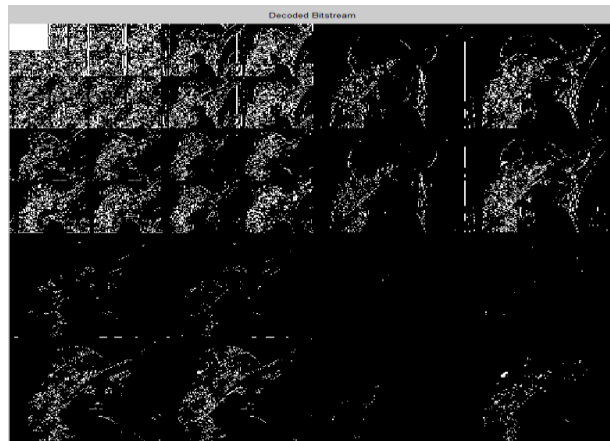**Fig 2.Multilevel decomposition image**

Fig 3.Encoded Bit stream data
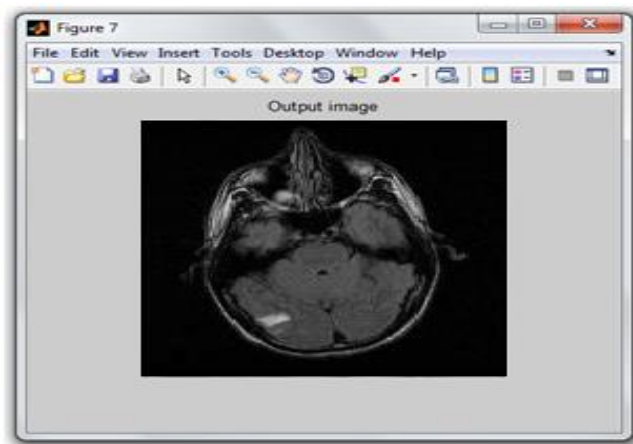
Fig 4.Decoded Bit stream data

Fig 5.Reconstructed Image

Table 1: Performance Metric Measurements of PSNR,MSE,CR

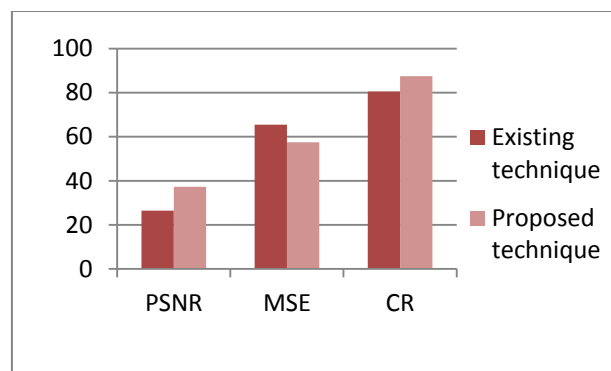| S.no	Technical parameter	Existing technique	Proposed technique
1	PSNR	26.50	37.32
2	MSE	65.50	57.50
3	CR	80.50	87.50

Fig. 1. Performance Comparison of the Existing technique to the Proposed Technique

7 CONCLUSION

In this paper focus is on the implementation of lossless image data codec, when the input image data is encrypted before using compression technique. Hence this is more suitable for the transmission of Medical images for Telemedicine application. We propose multiwavelet based compression for this problem, which has been shown to have much better coding efficiency and less computational complexity than existing approaches. The success of high PSNR is due to enabling partial access to the current source at the compression to improve the compression ratio. Our future work will focus on compression of color images and to be obtained high PSNR and Mean Square Error and correlation. We feel due to multiwavelet we can achieve better output for compression.

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