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Wavelet Based Medical Image Compression For Telemedicine Application

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Abstract: - In this paper, we discuss about a simple and lossless compression method for compression of medical images. Method is based on wavelet transform of medical application. Wavelets provide a mathematical way of encoding information in such a way that it is layered according to level of detail. These approximations can be stored using a lot less space than the original data. Here a low complex 2D image compression method using wavelets as the basis functions and the approach to measure the quality of the compressed image are presented. By using this coding method the compressed bit stream are all embedded and suited for progressive transmission. The reconstructed image is synthesized using the estimated detail matrices and information matrix provided by the Wavelet transform. In this paper, different wavelets have been used to perform the transform of a test image. The compressed image can be accessed and sent over telemedicine network.

Keywords: **-** *Medical Images, Progressive Transmission, Telemedicine Network, Wavelet Transform, 2D Image Compression.*

I. INTRODUCTION

Medical images are very important in the field of medicine. Every year, terabytes of medical image data are generated through advance imaging modalities such as magnetic resonance imaging (MRI), computed tomography (CT), digital subtraction angiography (DSA), positron emission tomography (PET), X-rays and many more recent techniques of medical imaging. But storing and transferring these huge voluminous data could be a tedious job. some of the medical images are shown in fig. 3.

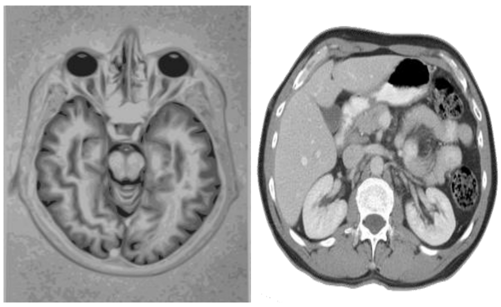

Fig 1. MRI IMAGE OF BRAIN CT IMAGE OF ABDOMEN

A compression of medical imagery is an important area of biomedical and telemedicine. 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. As in telemedicine, videos and the medical images are transmitted through advanced telecommunication links, so the help of medical image compression to compress the data without any loss of useful information is immense importance for the faster transfer of the information. There are many medical image compression techniques are available. Technically, all image data compression schemes can be broadly categorized into two types. One is reversible compression, also referred to as “lossless.” A reversible scheme achieves modest compression ratios of the order of two, but will allow exact recovery of the original image from the compressed version. An irrreversible scheme**,** or a “lossy” scheme, will not allow exact recovery after compression, but can achieve much higher compression ratios. To avoid the above problem, there may be third option that the diagnostically important is transmission and storage of the image is lossless compressed. This is the case of lossless compression.

Telemedicine is the use of telecommunication and information technologies in order to provide clinical health care at a distance. It is the use of medical information exchanged from one site to another via electronic communications. Telemedicine includes a growing variety of applications and services using two-way video, email, smart phones, wireless tools and other forms of telecommunications technology. The other popular technology is the two-way interactive television (IATV). This is used when a 'face-to-face' consultation between the health expert and the patients become mandatory. It is usually between the patients and their provider in one location and a specialist in another location.

II. FRAME WORK OF OUR PROPOSED METHOD

2.1 EXISTING METHODS

2.1.1. Medical Image Compression Using Integer Multi Wavelets Transform

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 and 1’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.

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

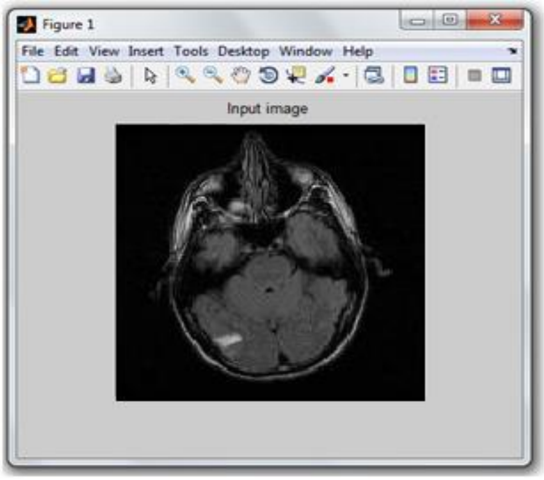

Fig 2.Input Image

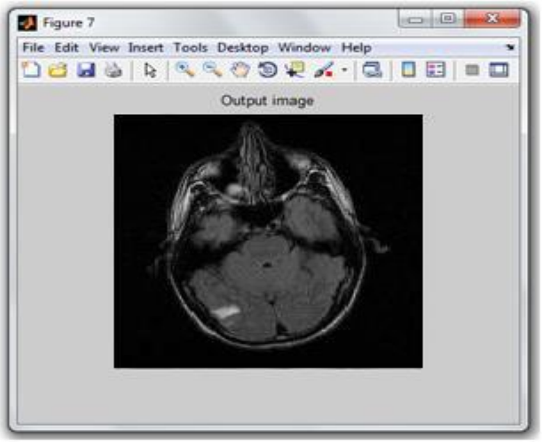

Fig 3.Reconstructed Image

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

2.1.2. ROI-based DICOM image compression for telemedicine

Many classes of images contain spatial regions which are more important than other regions. For medical images, only a small portion of the image might be diagnostically useful, but the cost of a wrong interpretation is high. Hence, Region Based Coding (RBC) technique is significant for medical image compression and transmission. A CT or MRI image contains three parts, ROI (the diagnostically important part), Non-ROI image part, and the background (part other than image contents) .The ROI is selected by expert radiologists. Depending on the selected part ROI-mask is generated in such a way that the foreground is totally included and the pixel values in the background are made zero. The background regions though they appear to be black in colour, they do not have zero grey level values.

Algorithm is implemented on a group of MR DICOM images. SPIHT is proved to be the best. But for ROI-based compression computational complexity is also one of the important issues to be considered, while addressing real time applications. A new and simple algorithm as explained above is used to encode the image. Original image formatted in DICOM format of size 256 X 256 with 8 bit resolution is input to software. The 'compressed image' is the image which is generated at the decoder side after reconstruction process. The output of encoder is a bit stream of numbers arranged in a manner so as to support the progressive transmission, with initial part as a ROI compressed with run length encoding. This bit stream is transmitted over the telemedicine network using GSM mobile device.

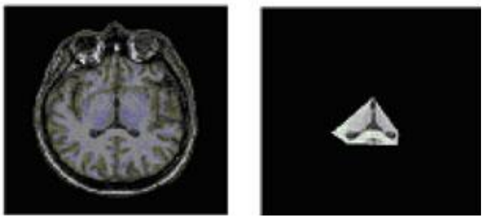

Fig 4. Original image   Region of interest

2.1.3. Medical Image Compression using Wavelet Decomposition for Prediction Method

Method is based on wavelet decomposition of the medical images followed by the correlation analysis of coefficients. The correlation analyses are the basis of prediction equation for each sub band. Predictor variable selection is performed through coefficient graphic method to avoid multicolinearity problem and to achieve high prediction accuracy and compression rate. The method is applied on MRI and CT images.

Two MRI and two CT gray scale standard test images as shown in figure 2 of size128*128 have been taken from world wide web for experiments and comparisons. MATLAB 7.0 has been used for the implementation of the proposed approach and results have been conducted on Pentium-1V, 3.20 GHz processor with a memory of 512 MB. BPP (Bits Per Pixel) metric is evaluated to compile compression result. Every image was decomposed into three scales with 10 wavelet sub bands.

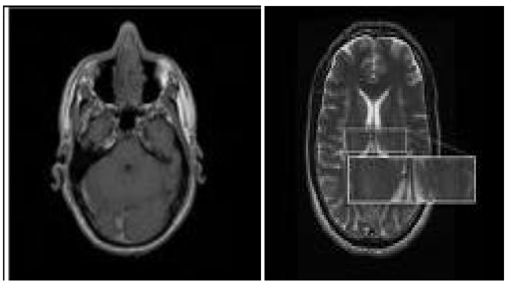

Fig 5. MRI 1   MRI 2

Table 2: Comparison of Compression Rate In Bits/Pixel Of Different Methods With Proposed Method

Type	Method		
	SPHIT	JPEG 2000	Proposed
MRI -1	2.53	2.42	1.45
MRI -2	3.11	3.12	1.51
MRI Average	2.82	2.77	1.48

2.2 PROPOSED METHOD

In the proposed work wavelet transform is the tool which we are going to use for medical image compression Wavelet transform has some of the advantages over the traditional transforms like

1. More robust under transmission and decoding errors.
2. Better matched to the HVS characteristics.
3. Good frequency resolution at lower frequencies, good time resolution at higher frequencies – good for natural images.

2.2.1 Basics Of Wavelet Transform

The wave is an infinite length continuous function in time. In contrast, wavelets are localized waves. A wavelet is a waveform of an effectively limited duration that has an average value of zero. Wavelet transform of a function is the improved version of Fourier transform. It provides the time-frequency representation. . The fundamental idea of wavelet transforms is that the transformation should allow only changes in time extension, but not shape. This is effected by choosing suitable basis functions that allow for this Changes in the time extension are expected to be conform to the corresponding analysis frequency of the basis function. Wavelet transforms are based on small wavelets with limited duration.

The Continuous Wavelet Transform or CWT formally it is written as:

$$\gamma(s,r)=\int f(t)\,\psi^*_{s,r}(t)dt \quad (1)$$

where * denotes complex conjugation. This equation shows how a function *f*(*t*) is decomposed into a set of basis functions ψs,-(*t*), called the wavelets. The variables *s* and - are the new dimensions, scale and translation, after the wavelet transform. equation (2) gives the inverse wavelet transform

$$f(t)=\int\int\gamma(s,r)\psi s,r(t)drds \quad (2)$$

The wavelets are generated from a single basic wavelet *ψ(t)*, the so-called mother wavelet, by scaling and translation:

$$\Psi_{s,r}(t)=1/\sqrt{s}\ \psi(t-r/s) \quad (3)$$

In (3) *s* is the scale factor, - is the translation factor and the factor *s*-1/2 is for energy normalization across the different scales.

2.2.2 DISCRETE WAVELET TRANSFORM

Discrete wavelets are not continuously scalable and translatable but can only be scaled and translated in discrete steps. This is achieved by modifying the wavelet representation (3) to create

$$\Psi_{j,k}(t)=1/\sqrt{s_0^j}\psi(t-kr_0s_0/s_0^j) \quad (4)$$

Although it is called a discrete wavelet, it normally is a (piecewise) continuous function. In (10) *j* and *k* are integers and *s*0 > 1 is a fixed dilation step. The translation factor -0 depends on the dilation step. The effect of discretizing the wavelet is that the time-scale space is now sampled at discrete intervals. We usually choose *s*0 = 2 so that the sampling of the frequency axis corresponds to dyadic sampling. This is a very natural choice for computers, the human ear and music for instance. For the translation factor we usually choose -0 = 1 so that we also have dyadic sampling of the time axis. 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.

Different types of wavelets are given below these all types of wavelets are used for image compression for telemedicin application

1. Harr wavelet
2. BNC wavelet
3. Coiflet wavelet
4. Daubechies wavelet
5. Bionomial wavelet
6. Mathieu wavelet
7. Legendre wavelet
8. Beta wavelet
9. Hermitian wavelet
10. Hermitian Hat wavelet
11. Meyer wavelet
12. Maxican Hat wavelet
13. Shannon wavele

3. FIGURE

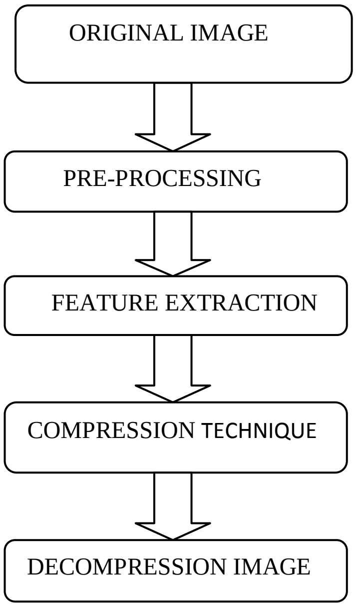

Fig 6.Flow Diagram of The Proposed Method.

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

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). Here we will use wavelet transform for compress the medical image.

Step 5: Decompressed Image

In the decompression process, the original image is extract.

III. CONCLUSION

Medical image compression is the current research area of interest. In this paper focus is on the implementation of lossless image data code, 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 are using different types of wavelet based compression which has much better coding efficiency and less computational complexity.

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REFERENCES

Journal Papers:

[1] Mr. E. PraveenKumar, Dr. M. G. Sumithra, Medical Image Compression Using Integer Multi Wavelets Transform For Telemedicine Applications, *International Journal Of Engineering And Computer Science ISSN:2319-7242 Volume 2 Issue 5 May, 2013.*

[2] S. M. Ramesh, Dr. A. Shanmugam, Medical Image Compression using Wavelet Decomposition for Prediction Method, *International Journal of Computer Science and Information Security,Vol. 7, No. 1, 2010.*

[3] Anuja P Parameshwaran, Manisha Gaonkar, DCT And DWT In Medical Image Compression, *International Journal on Advanced Computer Theory and Engineering, Volume-2, Issue-3, 2013.*

[4] Zixiang Xiong, Kannan Ramchandran, Michael T. Orchard, and Ya-Qin Zhang, A Comparative Study of DCT- and Wavelet-Based Image Coding, *Ieee Transactions On Circuits And Systems For Video Technology, Vol. 9, No. 5, August 1999.*

[5] Karen Lees " Image Compression Using Wavelets" *May 2002.*