ISSN 2348 – 8034
Impact Factor- 3.155

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

DENTAL X-RAY IMAGE COMPRESSION USING BIORTHOGONAL WAVELET TRANSFORM

Kumar Rajan[*1] and Pappu Kumar[2]

[*1]Research Scholar, EEE Department, BIT, Mesra, Ranchi

[2]Lecturer, EE Department, Government Women's Polytechnic, Ranchi

ABSTRACT

Images require substantial digitization of data. With increase in number of data, most of the image data in hospitals are stored in digital form using picture archiving and communication systems. The need for data storage disks and bandwidth requirements is increasing day by day. Wavelet compression techniques have become a necessary tool for same. The successful use of the wavelet transform in the field of image compression has been extensively studied in Joint Photographic Experts Group (jpeg) format of medical image(teeth).The main objective is to investigate the still image compression and de-noising of a gray scale image using wavelet theory at different decomposition and threshold levels. The wavelet analysis is the most recent analyzing tool. The medical image compression (dental x-ray image) using biorthogonal wavelet family is implemented in software using MATLAB7.5 version Wavelet Toolbox technique.

Keywords- *Digital X-ray image (Dental), Image compression, Wavelet Transform, PSNR Values, Compression Ratio.*

I. INTRODUCTION

Nowadays hospitals and clinics diagnose x-ray image (teeth) and store or transmit the dental x-ray image which requires large memory size. So, there is a need of image compression system to reduce of the large size image (Dental x-ray image). Image compression is a method through which we can reduce the storage space of images, videos which will be helpful to increase the storage and transmission process's performance. In image compression, we do not only concentrate on reducing size but also concentrate on doing it without losing quality and information of image.

In this paper, we present the performance of the compression through wavelet transform. Biorthogonal Wavelet had been used for implementation in a still image. Dental x-ray image analysis is major area of digital image processing. Dental caries and periodontal disease are the most common dental diseases in the world. Dental caries has affected human being widely in modern times. Dental caries is an infectious microbiological disease that results in localized dissolution and destruction of the calcified tissues of the teeth. If untreated the caries results in the progressive distraction of the tooth and infection of the dental pulp takes place. Compression is the techniques for reducing the storage required for saving a medical image, or the bandwidth required to transmit it. Although storage technology has improved significantly over the past decade, the same cannot be said for transmission capacity. This is true particularly in uses of the internet, which are characterized by significant pictorial content. Medical Image compression is familiar to the computers in the form of image file extensions, such as the jpg file extension used in the JPEG (Joint Photographic Experts Group) image compression standard.

Compared with other compression technique, wavelets are better, because the wavelet transform are global transform, which is better in locality characters in time and frequency. Furthermore, consider the human vision characteristic wavelet transform is better from many compressive algorithms.

II. DIGITAL X-RAY IMAGE

Radiographs are images produced on a radiosensitive surface, such as a photographic film, by radiation other than visible light, especially by x-rays passed through an object. These images, commonly referred to as x-rays, are usually used in medical diagnosis, particularly to investigate bones, dental structures, and foreign objects within the body.

X-rays are the second most commonly used medical tests, after laboratory tests. Recently, teleradiology, which is one of the most used clinical aspects of telemedicine, has received much attention. Teleradiology attempts to

ISSN 2348 – 8034
Impact Factor- 3.155

transfer medical images of various modalities, like computerized tomography (CT) scans, magnetic imaging (MRI), ultrasonography (US), and x-rays from one location to another such as in hospitals, imaging centers or a physician's desk. The radiological images are needed to be compressed before transmission to a distant location or due to the bandwidth or storage limitations. There has been a rapid development in compression methods to compress large data files such as images where data compression in various applications has lately became more vital [6].

III. IMAGE COMPRESSION

The purpose of Compression techniques is playing an important role in the world of Telecommunication and multimedia systems where bandwidth is still a valuable commodity. Hence, image compression techniques are of prime importance for reducing the amount of information needed for the picture without losing much of its quality, judged by human viewers. Transformation is applied to transmit or to store the image. In the receiver side, decompression is applied to get the original image. Now-a-days, Image compression is used to increase the spatial resolution of image sensors.

IV. LITERATURE RVIEW

A large number of data compression algorithms have been developed and used throughout the years. Some of which are of general use, i.e., can be used to compress files of different types (e.g., text files, image files, video files, etc.). Others are developed to compress efficiently a particular type of files. It has been realized that, according to the representation form of the data at which the compression process is performed, below is reviewing some of the paper in this field.

J. H. Pujar et.al [1] used a lossless method of image compression and decompression. It uses a simple coding technique called Huffman coding. A software algorithm has been developed and implemented to compress and decompress the given image using Huff-man coding techniques in a MATLAB platform. They concern with compressing images by reducing the number of bits per pixel required to represent it, and to decrease the transmission time for images transmission. The image is reconstructed back by decoding it using Huffman codes [1].

A. Alarabyyat et.al [2], present a Lossless Image Compression Technique Using Combination method. This approach works as follows: first, we apply the well known Lempel-Ziv-Welch (LZW) algorithm on the image in hand. What comes out of the first step is forward to the second step where the Bose, Chaudhuri and Hocquenghem (BCH) error correction and detected algorithm is used. To improve the compression ratio, the proposed approach applies the BCH algorithms repeatedly until "inflation" is detected. The experimental results show that the proposed algorithm could achieve a compression ratio without losing data when compared to the standard compression algorithms.[2]

Ranbeer Tyagi, D.K.Sharma,[3], the presented an algorithm where DPCM and LMS may be used to remove the unused bit in the image for image compression. In this paper we compare the compressed image results for 1 and 3 bits DPCM Quantization and DPCM with LMS Algorithm and also compare the histogram, prediction mean square using DPCM Quantization and DPCM with LMS Algorithm for approximately same distortion levels. The LMS may provide almost 2 bits per pixel reduction in transmitted bit rate compared to DPCM when distortion levels are approximately the same for both methods. The LMS Algorithm may be used to adapt the coefficients of an adaptive prediction filter for image source coding. In the method used in this paper we decrease the compressed image size, distortion and also the estimation error.[3]

N.Senthilkumarn [4], presented an algorithm of image compression as a process which minimizes the size of an image file without degrading the quality of the image to an unacceptable level. It also reduces the time required for images to be sent over the internet or downloaded from web pages. This paper proposes an Improved Backpropagation Neural Network Technique, for lossless image compression.

A Fidler, et.al [5], used lossy JPEG compression which does not affect the measurements of no change areas by DSR. Image as undergoing subtraction should be registered before compression and if so, J90 compression with a compression ratio of 1:7 can be used to detect and measure 4 mg and larger bone gain.

V. QUALITY MEASURES

ISSN 2348 – 8034
Impact Factor- 3.155

The performances of image compression techniques are mainly analyzed on the basis of two measures: Compression Ratio (CR) and Peak Signal to noise ratio (PSNR). The compression ratio is defined as ratio of the size of original data set to the size of the compressed data set.

PSNR provides a measurement of the amount of distortion in a signal, with a higher value indicating less distortion. For n-bits per pixel image, PSNR is defined as:

where, RMSE is the root mean square difference between two images. The Mean Square Error (MSE) is defined as follows:

where x(m,n), y(m,n) are respectively the original and recovered pixel values at the m^{th} row and n^{th} column for MxN size image. The PSNR is given in decibel units (Db), which measures the ratio of the peak signal and the error signal (difference between two images). The PSNR value provides the quality objectively. While, visual quality of image is considered as subjective quality measures.

VI. BIORTHOGONAL WAVELET TRANSFORM

Wavelets are useful for compressing signals but they also have far more extensive uses. They can be used to process and improve signals, in fields such as medical imaging (dental x-ray image). Where image degradation is not tolerated they are of particular use. They can be used to remove noise in an image. This family of wavelets exhibits the property of linear phase, which is needed for signal and image reconstruction. By using two wavelets, one for decomposition (on the left side) and the other for reconstruction (on the right side) instead of the same single one, interesting properties are derived in Figure.1 which also illustrates commonly used wavelet function in our experiments.

Algorithm

Step 1: Start Load the source image data from a file into an array.
Step 2: Choose a Biorthogonal Wavelet.
Step 3: Decompose choose a level N, compute the wavelet decomposition of signals at level N.
Step 4: Threshold detail coefficients, for each level from 1 to N, a threshold is selected and hard thresholding is applied to the detail coefficients.
Step 5: Remove (set to zero) all coefficients
Step6: Reconstruct, Compute wavelet reconstruction using the original approximation Coefficients of level N and the modified detail coefficients of levels from 1 to N.
Step7: Compare the resulting reconstruction of the compressed image to the original image.
Step 8:End.

ISSN 2348 – 8034
Impact Factor- 3.155

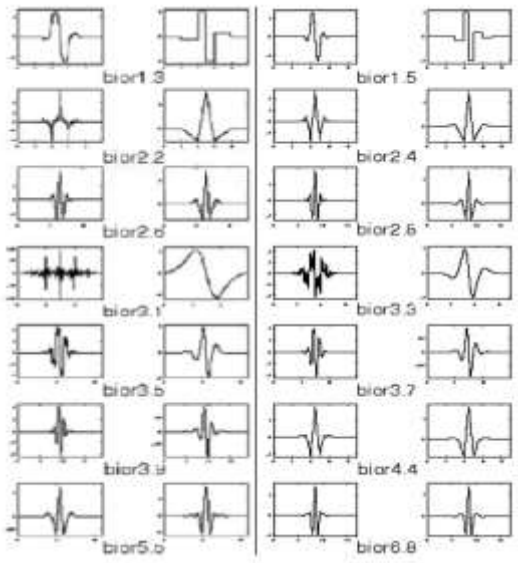

Fig.1 Biorthogonal Wavelet Family

VII. RESULT & DISCUSSION

In this study we have examined in the Biorthogonal wavelet family. We have analyzed Dental X-ray image range from 194kb. Results are measured in terms of compression ratio, retained energy, PSNR values and visual quality of compression image. Table 1 shows the different values in PSNR values and compression ratio for Biorthogonal family wavelet. Figure 2 shows the original image and Figure 3 shows the compressed image.

- Retained Energy = 99.9
- Decomposition Levels = 8
- Compressed range = 32kb

TABLE 1: PSNR values in biorthogonal wavelet family

S.No	Biorthogonal family	PSNR Values (db)	Compression Ratio (%)
1	Bior 1.1	32.04	4.94
2	Bior 1.3	32.29	5.38
3	Bior 1.5	32.29	5.38
4	Bior 2.2	34.74	3.96
5	Bior 2.4	35.56	4.19
6	Bior 2.6	35.79	4.31
7	Bior 2.8	35.87	4.41
8	Bior 3.1	31.28	3.07
9	Bior 3.3	35.81	4.98
10	Bior 3.5	36.2	4.99
11	Bior 3.7	36.45	5.05
12	Bior 3.9	36.49	5.08
13	Bior 4.4	34.31	3.19
14	Bior 5.5	32.77	2.71
15	Bior 6.8	34.86	3.47

ISSN 2348 – 8034
Impact Factor- 3.155

Figure 2 Original Image

Figure 3 Compressed Image

VIII. CONCLUSION

Biomedical image search and mining is becoming an increasingly important topic in biomedical informatics. Accessing the bio-medical literature via image content is complementary to image compression based search and retrieval. The major goal of this research is to provide practical ways of exploring compression & decomposition of wavelet transform technique within the context of MATLAB7.5 software. An experimental results compare the efficiency of medical image compression using biorthogonal wavelet was implemented. The output of the various PSNR values and a stable compression ratio and retained energy are obtained.

IX. FUTURE SCOPE

The wavelets theory is new advanced topic for research which can be used in enormous field of different image formats and is also very interesting. Hence, wavelet theory can be implemented as applications to provide better results in digital signal processing and digital image processing. We can also send the compressed image (dental x-ray image) through electronic medium to the address of networking communication.

REFERENCES

[1] J. H. Pujar and L. M. Kadlaskar, "A New Lossless Method of Image Compression and Decompression Using Huffman Coding Technique," Journal of Theoretical and Applied Information Technology, Vol. 15, No. 1, 2010.
[2] S.Al-Hashemi,T .khdour,M.Hjoiy Btoush,S.Bani-Ahmad,R.Hashemi, "Lossless Image Compression Technique Using Combination method," Journal of Software Engineering and Applications, 2012, 5, pp752-763 doi:10.4236/jsea.2012.510088
[3] Ranbeer Tyagi, D.K.Sharma, "Digital Image Compression Comparisons Using DPCM and DPCM With LMS Algorithm", International A.Alarabyyat Journal of Computer Applications & Information Technology Vol. I, Issue II, September 2012 (ISSN: 2278-7720)
[4] N.Senthilkumarn, Member IACSIT and Dr.J.Suguna,"Neural Network Technique For Lossless Image Compression Using X-ray Image", International Journal of Computer and Electrical Engineering, Vol.3, No.1, February, 2011 1793-8163.

[5] A Fidler,B Likar, F Pernus and U Skaleric,"Impact of JPEG Lossy Image Compression on Quantitative Digital Subtraction Radiography", Dentomaxillofacial Radiology (2002) 31, pp106 - 112. DOI : 10.103 8/sj/dm fr/4600670
[6] Puneet Sagar Ashok Kumar, "Best-Wavelet Based X-Ray Image Compression Using Neural Network", International Journal of Research in Engineering, IT and Social, Volume1, Issue 2 ISSN: 2250-0588.
[7] Rafael C. Gonzalez and Richard E.Woods Digital Image Processing (Pearson Education, Second Edition).
[8] Prabhakar. Telagarapu, V.JaganNaveen, A.Lakshmi. Prasanthi, G.Vijaya Santhi "Image Compression Using DCT and Wavelet Transformations" International Journal of Signal Processing, Image Processing and Pattern Recognition Vol. 4, No. 3, September, 2011.
[9] Albertus Joko Santoso, Dr. Lukito Edi Nugroho, Dr. Gede Bayu Suparta, Dr. Risanuri Hidayat," Compression Ratio and Peak Signal to Noise Ratio in Grayscale Image Compression using Wavelet", ISSN : 2229-4333(Print) | ISSN : 0976-8491(Online), IJCST Vol 2, ISSUE 2,June 2011.
[10] Talukder, K.,H., dan Harada, K., "Haar Wavelet Based Approach for Image Compression and Quality Assessment of Compresed Image", IAENG International Journal of Applied Mathematics, 36:1, IJAM_36_1_9, 2007.