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Experimental Comparison of Medical Image Compression Techniques

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***Abstract**: This paper represents the comparison technique of Image compression (using HAAR wavelet, Daubechies Wavelet, Coiflets Wavelet, Biorthogonal Wavelet).The testing have done in different image mode like medical images, JPG images etc. which reduce the image sizes on their storage requirements while maintaining relevant diagnostic information. The amount of data produced by these techniques is vast and this might be a problem when sending the data over a network. To overcome this problem image compression has been introduced in the field of medical. Medical image compression plays a key role as hospitals, move towards film- less imaging and go completely digital compression. The techniques can be categorized as, focusing on just a lossless compression method, on just a lossy compression method, or focusing on both. The time complexity curve and performance curve shows the comparison between all wavelet function and represents the reliable compression ratio with time comparison complex city*

Keywords: X-ray image, compression techniques, wavelet compression ratio

I. INTRODUCTION

Medical images are one of the most important data about patients. Image compression is the process of encoding information using fewer bits (or other information-bearing units) than an un-encoded representation would use through use of specific encoding schemes.Compression is useful because it helps to reduce the consumption of expensive resources, such as hard disk space or transmission bandwidth (computing). The reduction in file size allows more images to be stored in a given amount of disk or memory space. It also reduces the time required for images to be sent over the Internet or downloaded from Web pages.

There are several different ways in which image files can be compressed. For Internet use, the two most common compressed graphic image formats are the *JPEG* format and the GIF format. The *JPEG* method is more often used for photographs, while the GIF method is commonly used for line art and other images in which geometric shapes are relatively simple. Other techniques for image compression include the use of fractals and wavelets. These methods have not gained widespread acceptance for use on the Internet as of this writing. However, both methods offer promise because they offer higher compression ratios than the JPEG or GIF methods for some types of images. Another new method that may in time replace the GIF format is the PNG format.

II. BACKGROUND LITERATURE REVIEW

Classification of dental caries is important for the diagnosis and treatment planning of the dental disease, which has been affecting a very large population throughout the globe. It is also helpful for conducting detailed study and investigations about the nature of the dental disease. Classification of dental diseases is decided on the basis of certain criteria, such as based on whether the lesion is within the enamel, dentin or whether it touches the pulp. Dental caries are, clearly visible in the x-ray changes and it can be detected from the caries lesion present in the radiographs. [16]

MATLAB and the Image Processing Toolbox provide a wide range of advanced image processing functions and interactive tools for enhancing and analyzing digital images. The interactive tools allowed us to perform spatial image transformations, morphological operations such as edge detection and noise removal, region-of-interest processing, filtering, basic statistics, curve fitting, FFT, DCT and Radon Transform. Making graphics objects semitransparent is a useful technique in 3-D visualization which furnishes more information about spatial relationships of different structures. [1]

III. EXPERIMENTAL OBSERVATION TESTING

(A) With HAAR wavelet function on first level decomposition

Firstly we will take the sample image. After that we will convert that image in 245*245

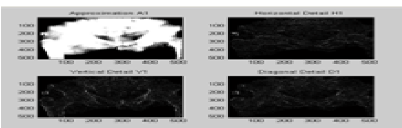

Figure1: First level decomposition of x-ray

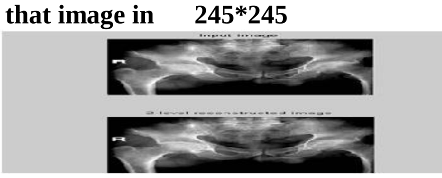

Figure2: First level decomposition result image

(B) Daubechies Wavelet function on first level decomposition

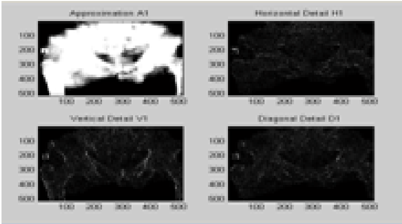

Figure3: First level decomposition of x-ray

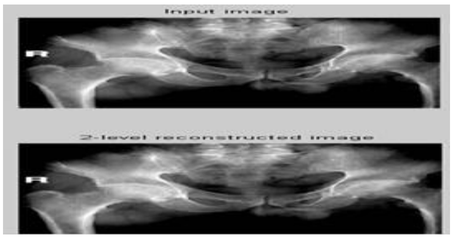

Figure4: First level decomposition result image

(C)With Coiflets Wavelet function on first level decomposition

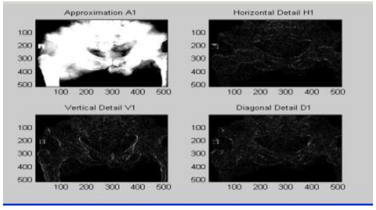

Fig5: First level decomposition of x-ray

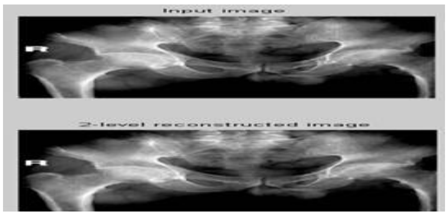

Fig6: First level decomposition result image

(D)With Biorthogonal Wavelet function on first level decomposition

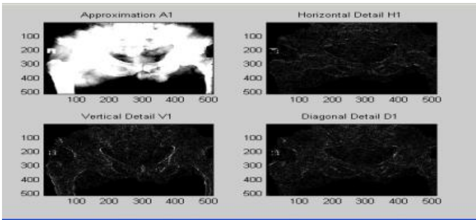

Fig7: First level decomposition of x-ray

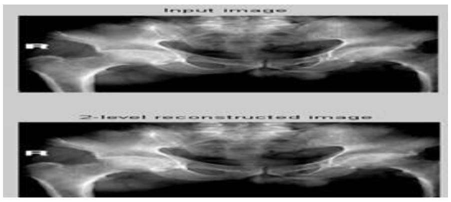

Fig8: First level decomposition result image

Table1. Compression ratio of x-ray images for different wavelet functions

Type of Wavelet function	**Compression Ratio**
Haar Wavelet	**3.1491**
Coiflets Wavelet (coif4)	**2.6399**
Daubechies Wavelet (dB4)	**3.0591**
Biorthogonal Wavelet - bior5.8	**2.5914**

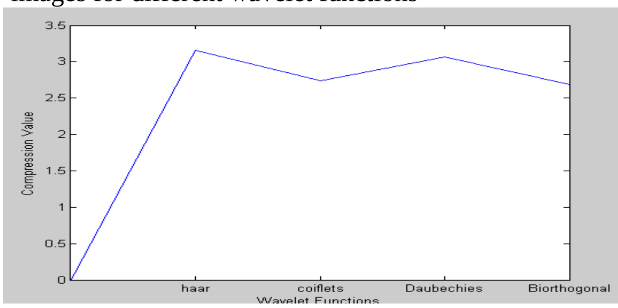

Fig9: Graph b/w wavelet functions and compression ratio

Table 2: Compression ratio of ultrasound images for different wavelet functions

Type of Wavelet function	Compression Ratio
Haar Wavelet	3.0063
Coiflets Wavelet (coif5)	2.8208
Daubechies Wavelet (dB4)	3.4008
Biorthogonal Wavelet - bior6.8	2.7560

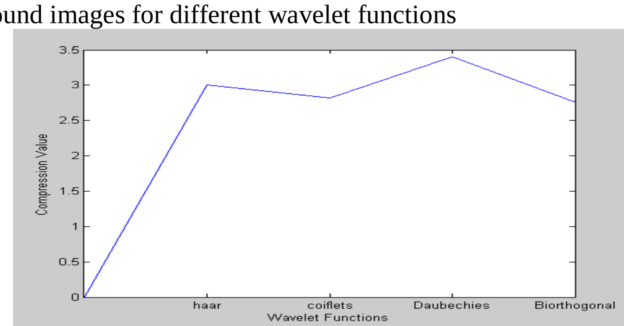

Fig10: Graph b/w wavelet functions and compression ratio

Table 3: Compression ratio of ultrasound images for different wavelet functions

Image	ultrasound.jpg	
Decomposition level	1	
Algo	**Time Complexity**	**Compression Per**
Haar	1.78	66.36
Daubechies	1.26	74.1

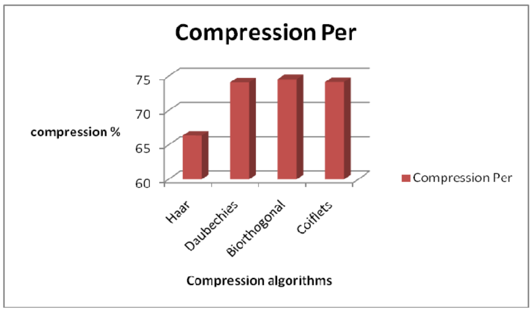

Fig11.A Graph b/w compression performance

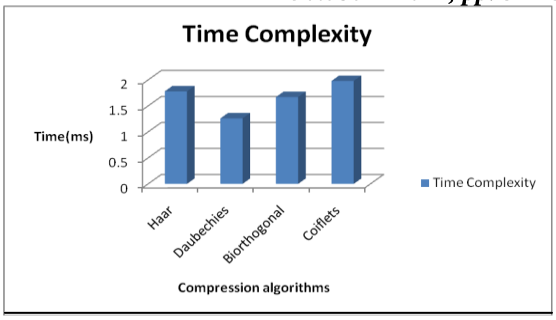

Fig 11.B Graph b/w time complexity

Table 4: Compression ratio of ultrasound images (other image .jpg) for compression

Image	Xray.jpg	
Decomposition level		2
Algo	**Time Complexity**	**Compression Per**
Haar	4.22	66.36
Daubechies	2.56	74.1
Biorthogonal	3.19	74.56
Coiflets	3.5	74.14

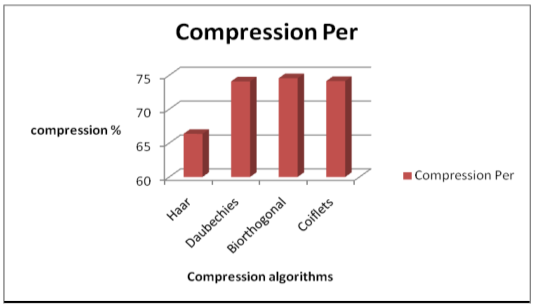

Fig12.A Graph b/w compression performance

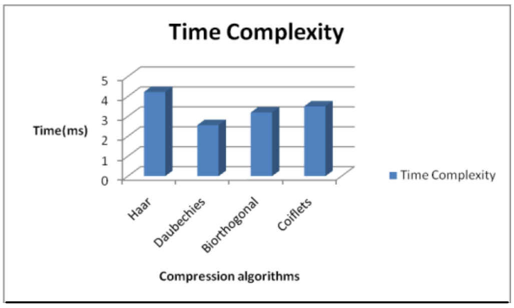

Fig. 12.B Graph b/w time complexity

IV. RESULT ANALYSIS

For Ultrasound Images we have analyses the compression ratio with different wavelet functions for PSNR = 5.9866. By this analysis we have observed that for MRI Images 'Daubechies' wavelet can perform relatively better time complexity than other Wavelet functions. By using 'haar' Wavelet we can achieve better compression ratio up to 3.4008

V. CONCLUSION AND FUTURE SCOPE

In our study we have applied different Wavelet functions on different type of biomedical images for a fix PSNR value and calculated the compression ratio.

After analysis we have found that, for X-Ray Images 'Haar' can provide the best result as its compression ratio is 3.1591.For MRI Images 'Haar' gives better result in comparison to other Wavelet functions it provide compression ratio approximately 3.5227.For Ultrasound Images 'Daubechies' provides the better result and its compression ratio is 3.4008. For Mammography Images 'Coiflets' perform the most compression as it can provide compression ratio up to 3.3726. This result is outcomes of the analysis given below. In this analysis we fix the threshold and PSNR of the image compression and use different type of wavelets to compress each image at the given Threshold and PSNR value.

We analyzed that the compression ratio obtained after each compression and decides which wavelet function can provide maximum compression ratio for a particular biomedical image.In this thesis, we have considered the methods only for best compression but, the choice of optimal wavelet depends on the method, which is used for picture quality evaluation. We have done compression ratio measures. But should also use objective and subjective picture quality measures. The objective measures such as PSNR and MSE do not correlate well with subjective quality measures. Therefore, we should PQS as an objective measure that has good correlation to subjective measurements. After this we will have an optimal system having best compression ratio with best image quality.

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