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Comparative study of 'Biomedical Image compression' using Wavelet (on X-rays)

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Abstract- A lot of hospitals handles their medical image data with computers. The use of computers and a network makes it possible to distribute the image data among the staff efficiently. As the health care is computerized new techniques and applications are developed, among them are the MR, X-rays and CT techniques. X-rays produce sequence of images (image stacks) each along the cross-section of an object. 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. Image compression will allow Picture Archiving and Communication Systems (PACS) to reduce the file sizes on their storage requirements while maintaining relevant diagnostic information. There have been numerous compression research studies, examining the use of compression as applied to medical images. The techniques can be categorized as, focusing on just a lossless compression method, on just a lossy compression method, or focusing on both. Most have focused on lossless algorithms since the medical community has been reluctant to adopt lossy techniques owing to the legal and regulatory issues that are raised, but this situation may start to change as more lossy research is performed. To achieve higher degree of compression we have to choose lossy compression technique. This thesis will propose an approach to improve the performance of medical image compression while satisfying both the medical team who need to use it, and the legal team

who need to defend the hospital against any malpractice resulting from misdiagnosis owing to faulty compression of medical images. There are several types of lossy image compressions available but in case of biomedical images the loss of diagnostability of the image is not tolerable and hence to achieve higher degree of compression without any significant loss in the diagnostability of the image we choose different type of wavelet function to compress biomedical images. A typical still image contains a large amount of spatial redundancy in plain areas where adjacent picture elements (pixels) have almost the same values. It means that the pixel values are highly correlated. However we have several types of biomedical images with us and there pixel correlativity might not be in same fashion therefore any specific wavelet function cannot give optimum result for each type of biomedical image.
This thesis is focused on selecting the most appropriate wavelet function for a given type of biomedical image compression. In this thesis we studied the behavior of different type of wavelet function with different type of biomedical images and suggested the most appropriate wavelet function that can perform optimum compression for a given type of biomedical image. To analyze the performance of the wavelet function with the biomedical images we fixed the loss amount of the data in the compressed image (Quality of the compressed image will be same for each wavelet function) and calculated their respective compression ratio. The wavelet function that gives the maximum compression for a specific type of biomedical image will be the most appropriate wavelet for that type of biomedical image compression.

Keyword- Comparative study on Biomedical images compression using harr-wavelet

Introduction- medical images are one of the most impotent data about patient. As a result have high volume of image and require huge hard disk space and transmission bw. to store these images. Images compression is the processor encoding information using fewer bit and than an un encoded represent would use of specific encoding scheme.

Wavelet properties- Wavelet means small wave the smallness implies to a window function0f

Finite length. The wavelet transforms was developed an alternative to the STFT. Wavelet are localized in both time and frequency domain. Wavelet support multi resolution. The regularity which is nice feature like smoothness and reconstruction signal.

Wavelet family- There are many members in the wave family.

1. Haar-wavelet- Haar wavelet is discontinues and resemble a step function.

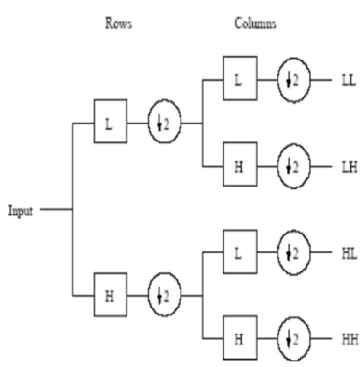
2. Daubechies- Daubechies are compactly supported orthogonal wave and found application in DWT.

3. Biorthogonal-these properties of linear phase which is needed for signal and image reconstruction.

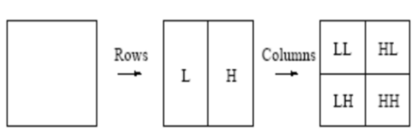
4. Coiflets-the wavelet function has2N moments equals to 0 and scaling function has 2N-1 moments equal to 0.

Types of wavelet transform-decomposition process-the images are high and low pass filter.

Along the row .result of each filter are down sampled by two. One deco potion step of the two dimension **image**

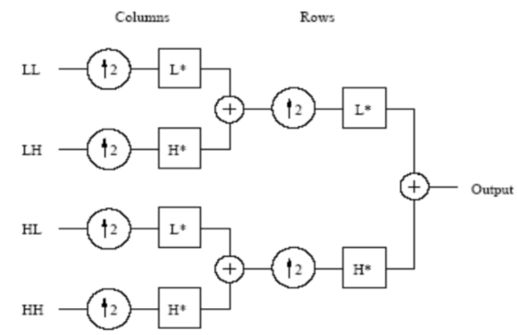


One DWT decomposition step



2- Compensation process-the four sub band are up sampled and filtered with corresponding inverse filter along the Colum .the result of the last steps is added together &we have the original images.

Wavelet based image compressionm



Methodology-evolution parameter

Compression-ratio=un-compression size/compressed size

Space saving= [1-compressedsize/un compressed size]

Peak signal to noise ratio

$$PSNR = 10\log_{10}\left(\frac{MAX_I^2}{MSE}\right) = 20\log_{10}\left(\frac{MAX_I}{\sqrt{MSE}}\right)$$

Signal to noise ratio

$$SNR = \frac{P_{Signal}}{P_{Noise}} = \left(\frac{A_{Signal}}{A_{Sinal}}\right)^2$$

Mean Squared Error The MSE of an estimator θ′with respect to the estimated parameter θ is defined parameter θ is defined as

$$MSE(\theta) = \frac{1}{n}\sum_{j=1}^{n}(\theta_j - \theta)^2$$

Resultant images

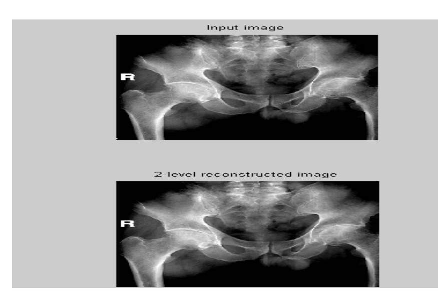


Fig-Resultant of x-ray images using HAAR WT

Whose PSNR value is 5.9866

Compression ratio achieved is =84.5082

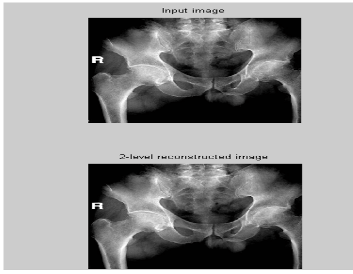


Fig-resultant image of x-ray image using daubechies WT

Whose PSNR value is 5.9866.

The compression ratio achieved =83.9761

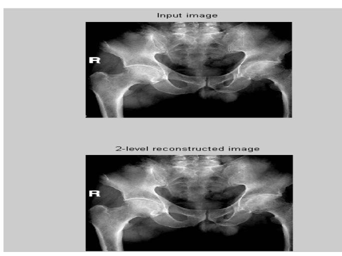


Fig-Resultant of x-ray images using Coiflet WT

Whose PSNR value is 5.9866.

The compression ratio achieved=82.2208

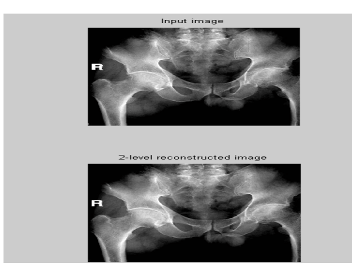


Fig-Resultant of x-ray images using Biorthogonal WT

Whose PSNR value is 5.9866.

The compression ratio achieved=83.1664

With the using above method we can compare the result and it can conclude that Haar-wavelet compression ratio is best compare to all methode.

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