ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 5, Issue 5, May 2016

HYBRID MEDICAL IMAGE COMPRESSION USING SPIHT AND DB WAVELET

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***Abstract*— Medical imaging produces digital form of human body pictures. There exists a need for compression of these images for storage and communication purposes. The hybrid technique provides efficient and accurate coding of the medical images. The amount of data might be a problem from a storage point of view or when the data is sent over a network. To overcome these problems data compression techniques is adapted by our method by combining 2 algorithms, SPIHT algorithm for ROI part and DB Wavelet transform for NROI part respectively**

Keywords—

***Index Terms*— Daubechies Wavelet, Image Compression, SPHIT.**

I. INTRODUCTION

Images play an vital role in the world of medical science and its transmission with storage has become really a big load as it occupy more space in memory [2][7]. Thus Data compression has become a necessity that will save bandwidth, power, storage space, etc. and it has turned out to be a part of research with so much manpower, time and money involved for its development. Image compression is the method of minimizing the size in bytes of a graphics files which does not degrading the quality of the image. It also reduces the time that is required for images to be sent or use over the Internet or downloaded from Web pages.

There are many 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 often used for photographs, while the GIF method is commonly used for line art and other images in which geometric shapes are relatively simple.

Image compression may be lossy or lossless. Lossless compression is preferred for archival purposes and often for medical imaging, technical drawings, clip art, or comics. Lossy compression methods, especially when used at low bit rates, introduce compression artifacts. Lossy methods are especially suitable for natural images such as photographs in applications where minor (sometimes imperceptible) loss of fidelity is acceptable to achieve a substantial reduction in bit rate. The lossy compression that producible differences may be called visually lossless.

Classification of Compression Methods

There have been many types of compression algorithms developed. These algorithms fall into two broad types, lossless algorithms and lossy algorithms. A lossless algorithm reproduces the original exactly. A lossy algorithm, as its name implies, loses some data. Data loss may be unacceptable in many applications.

Hybrid Medical Image Compression

Medical Image Compression cannot afford deficiency in diagnostically important regions (Region of Interest). An approach that brings high compression rate with good quality in region of interest (ROI) is required. A hybrid-coding scheme seems to be the only solution to this twofold problem. In other words, two different compression schemes should be used for ROI and non-ROI. The general theme is to preserve quality in diagnostically critical regions, while encoding the other regions so that the viewer can observe the position of the critical regions in the original image. Therefore, a very lossy compression scheme is suitable in non-ROI regions to give a global picture to the user while a lossless compression scheme is necessary for ROI regions.

II. PROBLEM IDENTIFICATION

A. PROBLEMS RELATED TO TRANSMISSION

1) Due to the large volume of images like X-Ray, Magnetic Resonance Imaging (MRI), Ultrasound, and Computed Tomography (CT), the transmission becomes slow via Internet.

2) Compression of medical images are necessary so that the images can be transmitted fast even through lower bandwidth and with high reliability for medical diagnosis at remote locations.

III. METHODOLOGY

SPIHT (Set Partition in Hierarchical Trees) [1] is one of the most advanced schemes, even outperforming the state-of the art JPEG 2000 in some situations. The basic principle is the algorithm in the area of image compression is the Set Partitioning in Hierarchical Trees (SPIHT).

Daubechies wavelets use overlapping windows, so the high frequency coefficient spectrum reflects all high frequency changes. Therefore Daubechies wavelets are useful in compression and noise removal of audio signal processing [5].

The implementation of medical image compression algorithm includes following steps:-

1. A medical image is taken as an input and then image is divided into ROI (Region of Interest) and NROI (Non – Region of Interest). ROI i.e. infected and to be diagnose regions. The Region of Interest may change according to the medical studies. NROI i.e. the regions being not infected by any disease alter other than ROI region or the background image and without any diagnostic value. The ROI having high priority means bit stream generated for this ROI will be appeared early in the whole image bit stream. The background area usually has lowest priority that is appeared in final part of whole image bit stream.

2. After choosing ROI's and NROI's portion, we compress the ROI portion with lossless method i.e. SPIHT algorithm to get good quality of image for maintaining diagnostic importance and compress the NROI portion with lossy method i.e DB Wavelet transform to achieve high compression ratio for efficient storage and swift transfer.

same; a progressive coding is applied, processing the image respectively to a lowering threshold [6]. The most efficient

3. Now, decompression is done of ROI part and NROI part by their respective inverse algorithms and integration of bits is done to reconstruct the original image.

The image quality is measured in terms of PSNR and MSE. For good quality image, PSNR value should be as high as possible & MSE value should be as low as possible.
It has been observed that PSNR is not always an indicator of the subjective quality of the reconstructed image, so that we can used MSE (Mean Square Error). PSNR (Peak Signal to Noise Ratio), SSIM (Structural Similarity Index) and Entropy as an objective quality measures.

IV. Result and Discussion:-

The image quality performance is evaluated using various image quality metrics like PSNR (Peak Signal to Noise Ratio) and SSIM (Structural Similarity).

We considered two images, Fig 1, Fig 2. Fig 1is an image of Brain and Fig 2 is image of Human Skull. We have compared our method's output with the hybrid compression method involving SPIHT algorithm and Block Truncation Coding [4] [3].Then we have considered three different images and performance evaluation is done on each and the values are shown in below table. The comparison of PSNR, CR and SSIM values are shown below:-

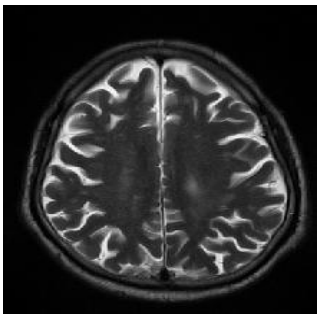


Fig 1: Brain Image

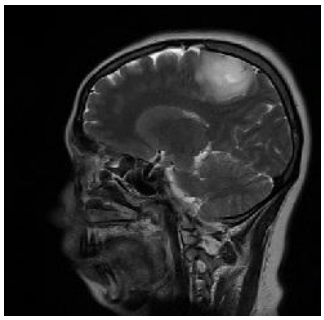


Fig 2: Image of Human Skull

(1) PSNR values:-

Image	Proposed Method SPIHT(ROI) and DB(NROI)	SPIHT + Block Truncation Coding
Brain Image	58.5063	49.4142
Image of Human Skull	59.0686	49.6854

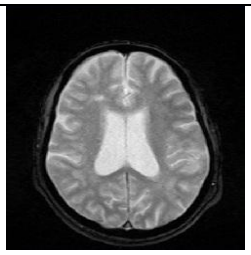
(2) SSIM values:-

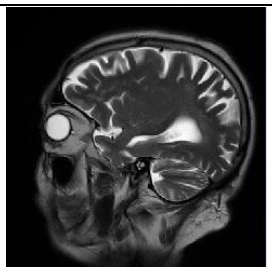
Image	SPIHT(ROI) and DB(NROI)	SPIHT + Block Truncation Coding
Brain Image	SSIM= 0.45413	SSIM= 0.16456
Image of Human Skull	SSIM= 0.47159	SSIM= 0.22901

(3) Comparison of CR for different images:-

S. N0.	Images	CR (Proposed Hybrid Method)	SPIHT + Block Truncation Coding
1	Brain Image	84.0172	64.6181
2	Image of Human Skull	99.642	79.687

(4) Performance evaluation for different images:-

S. No.	Images	Compression Ratio	PSNR	Entropy	SSIM
1		81.6244	56.5864	1.6235	0.33671

2		61.7462	58.0896	22669	0.45688
3		59.4706	56.6779	2.3351	0.52523

CONCLUSION AND FUTURE SCOPE:-

From the above comparison of PSNR, CR and SSIM values we came to a conclusion that our method combining 2 algorithms, SPIHT algorithm for ROI part and DB Wavelet transform for NROI part respectively is better that than the Hybrid method of Block truncation Coding and SPIHT algorithm.

In future we can apply our proposed algorithm for other images and videos and further:

4. More parameter can be evaluated for betterment of ROI Image quality.
5. Execution time of the proposed algorithm can also be minimized.
6. Selection of ROI and NROI portion from Medical Image can be done automatically.
7. It may possible for medical video compression.
8. It can also be used for satellite images.

Real time applications can be done in near future.

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