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Analysis of Medical Image using image Compression Techniques

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Abstract- *In this paper we present the image compression scheme for the medical science image compression used in the field of health care industry through various methods like neural network and evolutionary techniques, here we shows the comparative study for the image compression in the area of medical science, and our proposed method gives the better results than existing techniques. The results are measured in the terms of some performance parameter evaluation.*

Keywords:- Genetic Approach, Mean Square Error, Peak Signal to Noise Ratio, Computed Tomography, Compression Ratio, Image Compression.

Introduction

Image compression is a form of signal processing, and a type of data compression applied to an image to reduce its cost for storage or transmission. Image compression is an extremely important part of modern computing. By having the ability to compress images from their original size, the required storage space in computer memory space of images can be reduced [4]. The image compression technology in the past decade has revolutionized the field of data communication. Today's high-definition photograph accessing/editing, live video display and multimedia messaging are easy and instantaneous because of compression techniques. The compression technique helps in representing the source image with a reduced number of bits. Time–frequency-based compression algorithms have the property of multi scale characterization, which gives high quality of image reconstruction. Popular compression algorithm JPEG 2000 uses discrete wavelet transform that splits the image into a small number of tiles. The wavelet transform is applied to each tile individually to enhance the quality of the reconstructed image. However, the increase in the number of tiles leads to aliasing effect, which is a limitation of this technique. However, discrete fractional Fourier transform is a simple coding technique which elucidates the characteristics of signals, gradually by changing them from a time domain to the frequency domain with an order from 0 to 1 [11].

Image compression gives a compact representation of digital images by exploiting the redundancy in the original data. Mainly, it results in reduction of bit rate to represent an image. Most of the internet applications require high bandwidth for voluminous data transfer. So, image compression plays a vital role in effective image storage and transmission. Though the recent developments in technology have resulted in reduction of data transmission and storage costs, massive data generation due to exponentially growing digital online applications still poses a challenge for their effective storage and transmission. Image compression becomes a unique solution for many imaging applications such as, document imaging management systems, facsimile transmission, image archiving, remote sensing, medical imaging,

entertainment, HDTV, broadcasting, education and video teleconferencing. Specifically, medical field has witnessed tremendous growth with state of the art imaging technologies for accurate diagnosis, which in turn demands efficient storage of medical images. Image compression technique is widely classified into two types such as, lossy and lossless compression. Various methods have been proposed for image compression based on Vector Quantization, Image Transforms and Evolutionary computation techniques for improving the quality of an image with a reduced storage space [12].

Image compression addresses the problem of reducing the amount of information required to represent a digital image. It is a process intended to yield a compact representation of an image, thereby reducing the image storage transmission requirements. Every image will have redundant data. Redundancy means the duplication of data in the image. Either it may be repeating pixel across the image or pattern, which is repeated more frequently in the image. The image compression occurs by taking benefit of redundant information of in the image. Reduction of redundancy provides helps to achieve a saving of storage space of an image. Image compression is achieved when one or more of these redundancies are reduced or eliminated. In image compression, three basic data redundancies can be identified and exploited. Compression is achieved by the removal of one or more of the three basic data redundancies [17].

II. Predictive Coding

A general paradigm in data compression is the concept of prediction. Prediction allows a compact representation of data by encoding the error between the data itself and the information predicted from past observations. If the predictor works well, predicted samples are similar to the actual input and the prediction error is small or negligible. Pixels in images show a high degree of correlation among their neighbouring samples. This means that there exists a mutual redundancy in the raw data. Predictive coding is used to remove the mutual redundancy. Removing the mutual redundancy by de correlating the data, much more efficient and better compressed coding of the signal can be obtained. Predictive coding predicts the next pixel value based on a sequence of reproduced pixels values (previous values) obtained during the scanning of the image and encodes (quantises) the difference between predictive and actual value (the error signal). The better the prediction, the smaller the transmitted error, hence the better the coding process. If the current reproduced pixel is taken as the sum of the predicted pixel value and the quantised error value between the current pixel and the predicted pixel, the prediction method is called differential pulse code modulation (DPCM).

III. Discrete Wavelet Transform

Wavelets compression is very popular compression approach in mathematics and digital image processing area because of their ability to effective represent and analysis of data. Image compression algorithms based on Discrete Wavelet Transform (DWT), such as Embedded Zero Wavelet (EZW) which capable of excellent compression performance, both in terms of statistical peak signal to noise ratio (PSNR) and subjective human perception of the reconstructed image. The current wavelet approach applies a wavelet transform on images in a pyramid fashion up to the desired scale using the theory of multi resolution signal decomposition with the wavelet representation and the concept of embedded zerotree wavelet (EZW) based on the decaying spectrum hypothesis . In a pyramidal structure after a certain scale of wavelet transforms on an image, an algorithm successively determines if a coefficient is significant in the spatial-frequency domain to form a significance map consisting of the sign (+ or −) of a significant coefficient, an insignificant symbol, and a zerotree symbol. It assumes that wavelet coefficients of an image in the finer resolutions corresponding to a zerotree mark have smaller magnitudes than the one marked as zerotree in a coarser resolution for this image according to a practical, but false decaying spectrum hypothesis. An algorithm has been widely tested with desirable results and shown to be very effective. SPIHT is also a wavelet

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transform method, this is the best algorithms in terms of the peak signal-to-noise ratio (PSNR) and its execution time. Set partitioning in hierarchical trees provide excellent rate distortion performance with low encoding complexity and with higher degree of compression performance. Internet teleconferencing, High Definition Television (HDTV), satellite communications and digital storage of images will not be feasible without a high degree of compression [18].

IV. Experimental Work

In this section discuss the present techniques methodology of image compression technique based on wavelet transform function and evolutionary techniques. In our present work, we propose a novel approach to compress the image using wavelet level with neural network and the proposed method i.e. genetic algorithm. Here, we first decompose image using wavelet method. Then, we use genetic algorithm to choose the most informative wavelet coefficients that can contribute to accurate verification of individuals from image. We also compare the proposed method with the existing state of the art methods such as wavelet based image compression approaches. Further, we also compare the performance of proposed image compression approach with more robust compression approach based on match scores using weighted sum rule.

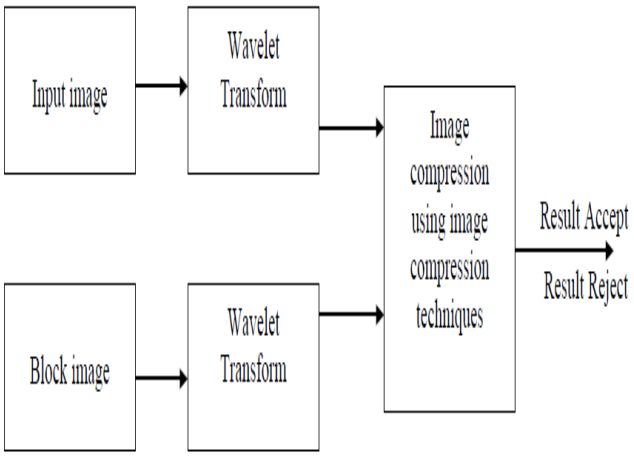

Fig 1: Proposed method block diagram.

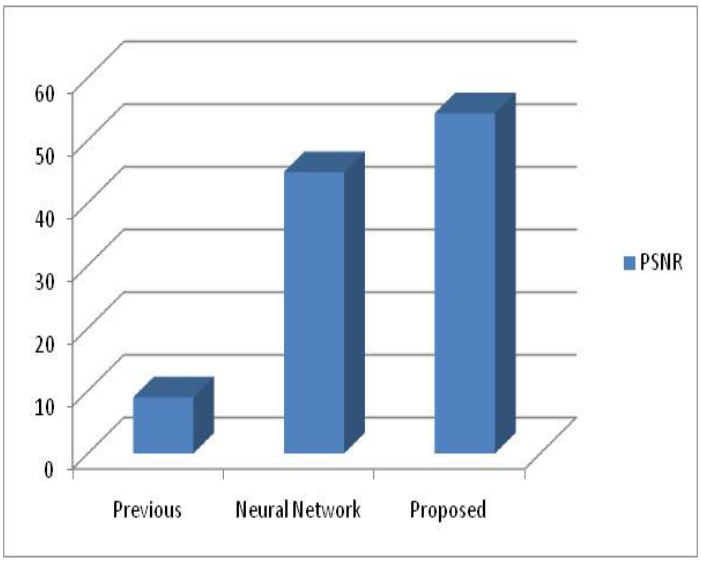

Fig 5: The above picture shows the comparative result graph for medical science image-1 using previous and proposed techniques, here we found the value of peak signal noise ratio.

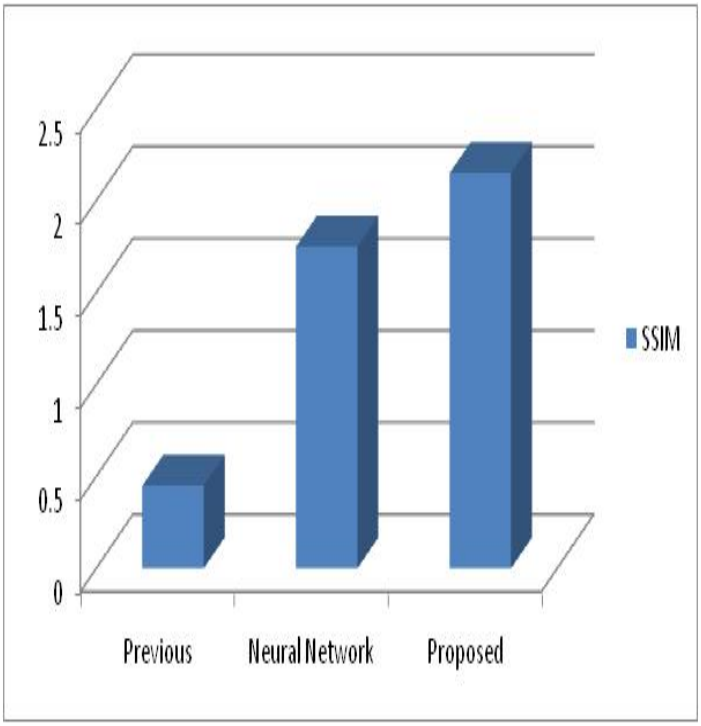

Fig 3: The above picture shows the comparative result graph for medical science image-1 using previous and proposed techniques, here we found the value of structure similarity index.

V. Conclusion

Image compression is the techniques of to reduce the data size without any loss of information or data, the image is available in many forms such as digital images, grey scale images, x-ray image etc. image compression is done by using two techniques lossless image compression techniques and lossy image compression techniques. Here present the image compression scheme for the medical science image compression used in the field of health care industry through various methods like neural network and evolutionary techniques, here we shows the comparative study for the image compression in the area of medical science, and our proposed method gives the better results than existing techniques. The results are measured in the terms of some performance parameter evaluation.

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