RESULT:Wavelet Transform Along with SPIHT Algorithm used for Image Compression

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Abstract - *The medical image processing process is one of the most important areas of research in medical applications in digitized medical information. A medical images have a large sizes. Since the coming of digital medical information, the important challenge is to care for the conduction and requirements of huge data, including medical images. Compression is considered as one of the necessary algorithm to explain this problem. A large amount of medical images must be compressed using lossless compression. This paper proposes a new medical image compression algorithm founded on lifting wavelet transform CDF 9/7 joined with SPIHT coding algorithm, this algorithm applied the lifting composition to confirm the benefit of the wavelet transform. To develop the proposed algorithm, the outcomes compared with other compression algorithm like JPEG codec. Experimental results proves that the anticipated algorithm is superior to another algorithm in both lossy and lossless compression for all medical images tested. The Wavelet-SPIHT algorithm provides PSNR very important values for MRI images.*

***Key Words*: Medical image, Compression, Biorthgonal wavelets, CDF9/7, Lifting scheme, SPIHT**

1. INTRODUCTION:

While transferring the medical images from one place to another place, reducing memory space and the speed of transmission are the two vital factors. Medical images are generally larger in size and the main challenge is to deal with the storage and transmission requirements of huge data Compression is the technique to overcome this challenge. In medical image compression we needs to preserve the exact data of the original image as much as possible. Hence, an efficient, high-speed/high resolution image compression technique became the focus in the research field of medical image compression [5].In case of remote diagnosis and treatment of patients by means of telecommunication technology such as medicine where the images of patients acquired are to be transmitted in compressed form on a constant bit rate channel from one site to the other the accuracy becomes very much important because tumours in the CT scan, fractures in X-rays if wrongly diagnosed may result in the adverse effect on the patients health. In such cases, the need for rapid and precise diagnosis and the drawbacks of bandwidth of the communications medium may need the use of efficient compression technique [4]. Compression is of two types, one is the **Lossless compression** that has the ability to reconstruct the exact original data from the data that is compressed and the image quality is not much decreased and the other is the **Lossy compression** where the exact original image cannot be obtained back from the compressed data and the image quality is somewhat decreased. Some of the Lossless compression techniques are: Huffman coding, Arithmetic coding, Run Length Encoding, Dictionary coders etc., and some of the Lossy compression techniques are: JPEG coding, DCT coding, KLT coding etc., HWT is a simplest transform that is hand calculative. It is considered to be a prototype for studying more sophisticated wavelets that divides a image into sub-bands through averaging and deducting method. Compression techniques like EZW and SPIHT are considered to be the benchmark techniques in the field of compression. Besides, better compression and better image quality, the bit stream can be truncated at any point [3]. In SPIHT algorithm aspect many researchers proposed various modifications to improve performance of SPIHT. In this algorithm it mainly aims for better PSNR values [2]. Hybridizing the compression techniques provides still good results. HWT and SPIHT algorithm techniques are the most efficient algorithms in the field of image compression. The proposed paper describes algorithm for implementation of techniques like HWT and Modified Stripe logic based Parallel SPIHT.

1.1 Wavelet Transforms:

The wavelet transform (WT), in general, produces floating point coefficients. Although these coefficients are used to reconstruct an original image perfectly in theory, the use of finite precision arithmetic and quantization result a lossy scheme.

1.2 Lifting Scheme of Wavelet Transform: The Wim Sweldens76 developed the lifting scheme for the construction of biorthogonal wavelets. The main feature of the lifting scheme is that all constructions are derived in the spatial domain. It does not require complex mathematical calculations that are required in traditional methods. Lifting scheme is simplest and efficient algorithm to calculate wavelet transforms. It does not depend on Fourier transforms. Lifting scheme is used to generate second-generation wavelets, which are not necessarily translation and dilation of one particular function. It was started as a method to improve a given discrete wavelet transforms to obtain specific properties. Later it became an efficient algorithm to calculate any wavelet transform as a sequence of simple lifting steps.

1.3 Introduction to SPIHT: This page presents the powerful wavelet-based image compression method called *Set Partitioning in Hierarchical Trees* (SPIHT). This award-winning method has received worldwide acclaim and attention since its introduction in 1995. Thousands of people, researchers and consumers alike, have now tested and used SPIHT. It has become the benchmark state-of-the-art algorithm for image compression. The SPIHT method is not a simple extension of traditional methods for image compression, and represents an important advance in the field. The method deserves special attention because it provides the following:

Highest Image Quality

Progressive image transmission

Fully embedded coded file

Simple quantization algorithm

Fast coding/decoding

Completely adaptive

Lossless compression

Exact bit rate coding

Error protection

Each of these properties is discussed below. Note that different compression methods were developed specifically

to achieve at least one of those objectives. What makes SPIHT really outstanding is that it yields all those qualities **simultaneously**. So, if in the future you find one method that claims to be superior to SPIHT in one evaluation parameter (like PSNR), remember to see who wins in the remaining criteria.

Software use:

MATLAB R2016a

2. SPIHT ALGORITHM

A. *DESCRIPTION OF THE PROPOSED ALGORITHM:*Aim of the proposed algorithm is to obtain high peak signal to noise ratio.The SPIHT image coding algorithm was developed by Said and Pearlman in 1996. SPIHT algorithm is another more efficient implementation of the embedded zero tree wavelet (EZW) algorithm by Shapiro. SPIHT achieves better performance by exploiting the spatial dependencies of the wavelet coefficients in different sub bands. SPIHT captures the current bit-plane information of all the wavelet coefficients and organizes them into three ordered lists:

1. List of significant coefficients (LSC).

2. List of insignificant coefficients (LIC).

3. List of insignificant sets of coefficients (LIS).

LSC constitutes the coordinates of all coefficients which are significant. LIS contains the roots of insignificant sets of coefficient. They can be two different types; the first type known as TYPE A has all the descendants insignificant within a given bit-plane, the second type known as TYPE B excludes the four children of the root node. Finally, LIC contains a list of all the coefficients that do not belong to either LIS or LSC and are insignificant. The operation of SPIHT can be grouped into three sequential steps: initialization, sorting pass (SP) and refinement pass (RP) & threshold update. 1) Initialization: The initial threshold is set to 2^log2(max(|Ci,j|), where max(|Ci,j|) is the largest wavelet coefficient. The algorithm starts at the coarsest band in the sub band pyramid. All the coefficients in the sub band are added to the LIC and the coefficients with descendants (tree roots) are added as to LIS as TYPE A. Thus, during initialization, every coefficient is initialized to an insignificant state. 2) Sorting pass: At each threshold level, the LIC is coded first, followed by the entries in LIS. A given entry in LIC is tested and moved to LSC if found significant. The sign bit of the significant coefficient is also immediately coded. The LIS entries are coded quite differently. For a TYPE A LIS entries, if any member in the hierarchical tree is found to be significant, the immediate children are tested and are added to either LIC or LSC. The parent is added to the end of LISas a TYPE B entry or removed from the LIS if it does not have any grandchildren. For TYPE B entries, if any member in the hierarchical tree is found to be significant, the immediate children are removed and added as TYPE A entries to the end of LIS. Processing continues till the end of LIS is reached. SP also records the position of the coefficients that are found significant during the current pass. 3) Refinement pass and threshold update: Refinement pass adds precision to the LSP entries obtained before the current sorting pass by outputting the most significant bit corresponding to the existing threshold. On completion of the refinement, the threshold is halved and the cycle is repeated starting from step 2.

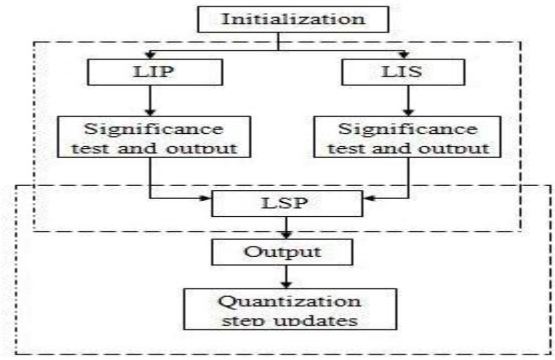

Fig.1:SPIHT ALGORITHM

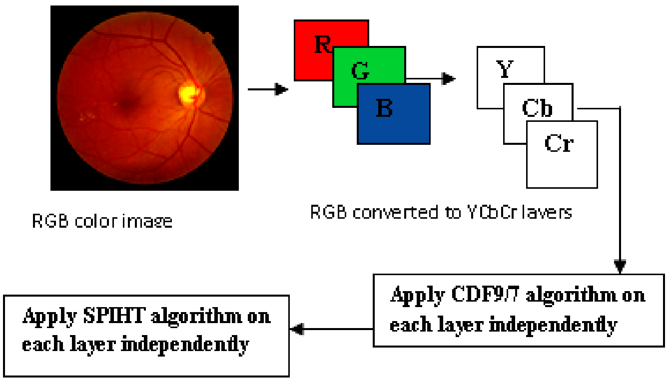

Fig2: Complete steps image compression Technique using CDF97 coupled with SPIHT

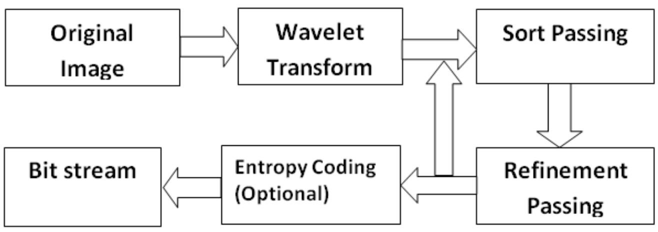

Fig -3: Flow Diagram of SPIHT

SPIHT algorithm is used and at a given bit-rate, the subjective visual first-rate is advanced to a certain volume. At the identical time, because of the ignoring of unimportant information scanning, simplest 25% data changed into handled. The reminiscence has been saved and the coding efficiency is been improved. In conclusion, the set of rules may be broadly used within the memory-restricted and real time situations. In addition, DWT and Lifting Wavelet rework are in comparison via the usage of SPIHT algorithm for Compression Ratio (CR), Peak Signal-to-Noise Ratio (PSNR) and encoding and decoding time. Higher PSNR is performed in Lifting scheme in comparison to DWT. This SPIHT algorithm performs fast compression and decompression, saves lot of bandwidth, enables rapid transmission and requires less storage memory. The SPIHT algorithm can be carried out to warm research fields such as scientific discipline, communication area and so on. In which speedy transmission of photograph file from one vicinity to any other can be achieved through preserving fine of photograph identical.

3. Result and Comparison:

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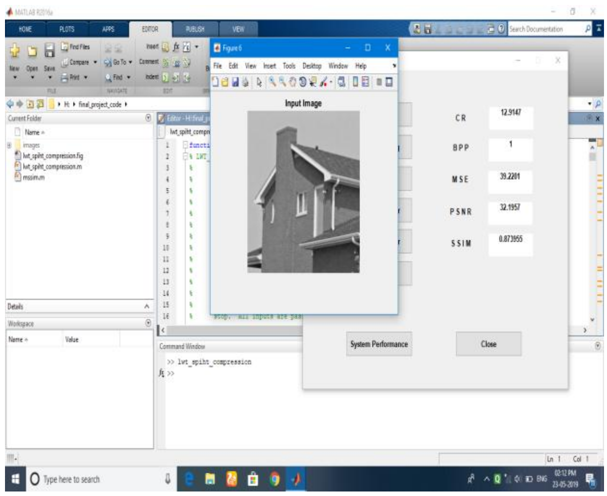

Fig.3 Input image

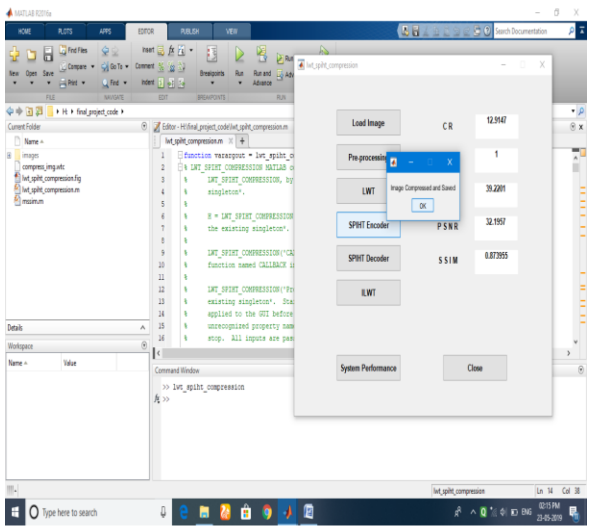

Fig.4 comressive image size

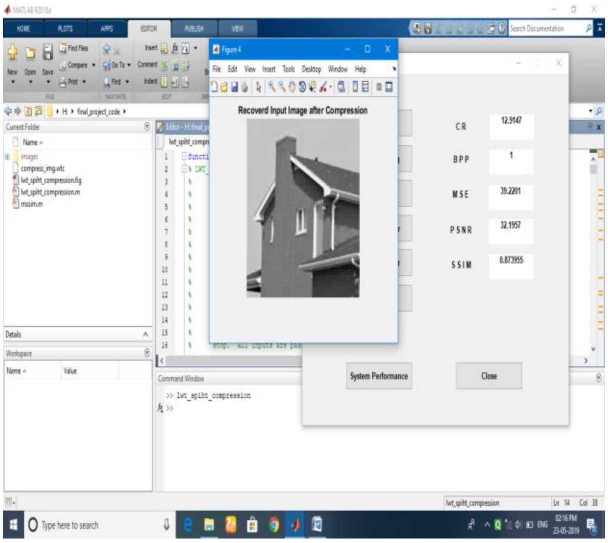

Fig.5: parameter analysis

4. Conclusion: We have demonstrated the outstanding efficiency of the LWT-SPIHT image compression solution. Our simulations confirm the proposed ideas of proper wavelet filters usage. The fact that LWT were able to perform best results among all tested wavelet families and types has been expected. It is interesting to observe how the decomposition depth influences the final image quality. We have also measured algorithm complexity in terms of elapsed compression time and we found that SPIHT coding results are very unpredictable in that sense. In the future much more effort must be emerged in order to make the codec more resilient against bit or synchronization errors, which should be quite a challenging task in order to keep the embedded character of the bit stream together with the progressive behavior.

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