A New Method of Image Compression Using Multi wavelet Technique with MFHWT and ROI in SPIHT

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Abstract: In medical field the images produce by the modality is in the form of large file, in order to get the opinion from other doctors images are send using electronic media. As the file of images is very large to send, we require to have compression for images but with compression there is loss of information in the image. To minimize the loss and to increase the quality of image and requires compression is also to be done, wavelet transformation technology plays a vital role. So, in this paper we consider that multi wavelet with Region of Interest (ROI) selecting portion will not only give the quality but also reduce the loss of information from image. And we are going to implement the multi wavelet transformation with Modified Fast Haar Wavelet Transform (MFHWT) in Set Partitioning in Hierarchical Trees algorithm.

Keywords: Medical Image, MFHWT, Multi wavelet, ROI, SPIHT.

I. INTRODUCTION

Image compression is the process of encoding information using fewer bits. Compression is useful because it helps to reduce the consumption of expensive resources, such as hard disk space or transmission bandwidth. It also reduces the time required for images to be sent over the Internet or download from web pages. It also helps in accelerating transmission speed [1]. Data compression methods are usually classified as either lossless or lossy methods [1].

A. Wavelet Transform

When the signal in time for its frequency content is analyzed then in that wavelet functions are used. Multi resolution hierarchical characteristics are provided by wavelet based compression. Hence image can be compressed at different levels of resolution. It can be sequentially processed from low resolution to high resolution [1]. It has excellent energy compaction property which suitable for exploiting redundancy in an image to achieve compression [2]. Wavelets are localized in the both time and frequency domains. Hence it is easy to capture local features in a signal [1]. A newer alternative to the wavelet transform is the multi wavelet transform. Multi wavelets are similar to wavelets but have some important differences. In particular, whereas wavelets have an associated scaling function and wavelet function, multi wavelets have two or more scaling and wavelet functions [3].

Fig. 1 (a) Wavelet (b) multi wavelets [3]

B. Haar Transform

The Haar wavelet transformation is a simple form of compression involved in averaging and differencing term, sorting detail coefficients, eliminate data and reconstructing the matrix such that the resulting matrix is similar to initial matrix [4].

C. Modified Fast Haar Wavelet Transform (MFHWT)

MFHWT can be done by just taking $(w+x+y+z)/4$ instead of $(x+y)/2$ for approximation and $(w+x-y-z)/4$ instead of $(x-y)/2$ for differencing process. 4 nodes are considered at a time [1]. Also, it is used to reduce the memory requirements and the amount of inefficient movement of Haar coefficients [5]. Thus MFHWT reduce the calculation work of Haar transform.

D. SPIHT

SPIHT algorithm is one of the powerful algorithm for the compression. After wavelet transform SPIHT algorithm is used to encode the coefficients of wavelet. In SPIHT sorting is done by comparing two elements at a time and results in yes/no states. In this sorting pass coefficients are categorizes into 3 lists:

LIS List of Insignificant sets are the set of coefficients having magnitude smaller than the threshold.

LIP List of Insignificant Pixels are the coefficients having magnitude smaller than the threshold.

LSP List of significant pixels are the pixels those magnitude is larger than that of threshold.

In this pass, only bits related to the LSP entries and binary outcomes of the magnitude tests are transmitted to the decoder. In implementation, we grouped together the entries in the LIP and LIS which have the same parent into an entry element. For each entry element in LIP, we estimated a pattern in both encoder and decoder to describe the significance status of each entry in the current sorting pass. If the result of the significance test of the entry item is the same as the specified pattern, we can use one bit to represent the status of the whole entry atom which otherwise had two entries and representation of significance by two bits. If the significance test result does not match the pattern, we transmitted the result of the significance test for each entry in the atom.

In Refinement pass for each entry in the LSP, except those included in the last sorting pass , output nth bit of the entry [6]. There are two passes in SPIHT one is sorting pass which is initial step and other is refinement pass. In sorting pass sorting is done by comparing two elements at a time, and each comparison results in yes/no. it checks the significance of coefficients present in LIS. If the coefficients are significant then it results in yes and move to LSP. If they are not significant it results in no. In refinement pass it is performed after sorting pass the significant coefficients which we get from sorting pass are send to decoder.
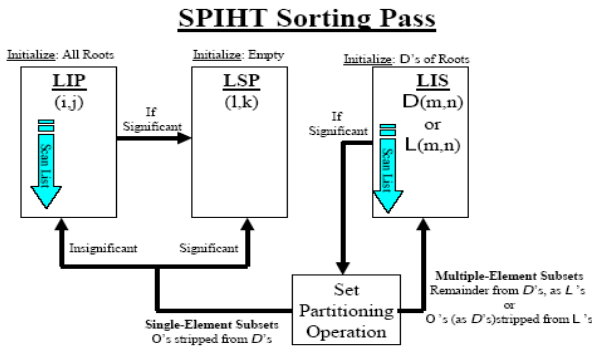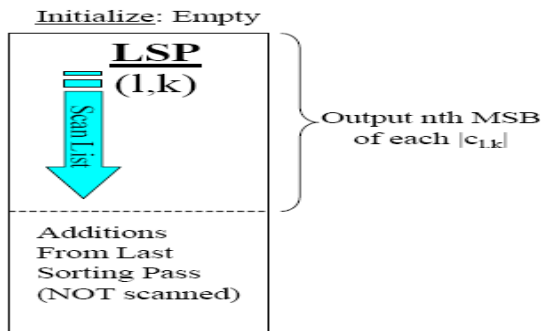

Fig. 2 SPIHT sorting pass [6]

Fig. 3 SPIHT refinement pass [6]

E. Region of Interest (ROI)

Region of interest is the selected portion of the image which is needed to be compressed. ROI is a feature introduced to overcome the loss of information in parts of an image which are more important than others [7]. ROI can be defined by a user and they are encoded with better quality than the rest of the image.

F. Medical Images

Medical science grows very fast and hence each hospital needs to store high volume of data about the patients. And medical images are one of the most important data about patients. Medical images are important as they are used by doctors in order to keep record of patients for long term. In order to keep the record of patients for long terms they are compressed using compression techniques so that large amount of data can be store. There are many types of medical images that are used to detect disease of patients. MRI is magnetic resonance image which is used to get information about tissues , organs in human body. Other types are X-ray, CT(computer tomography) , ECG(electrocardiogram).

II. PROPOSED SCHEME

Purposed algorithm modifies the existing SPIHT algorithm with multi wavelet transformation and multi wavelet decomposition will be performed with MFHWT.
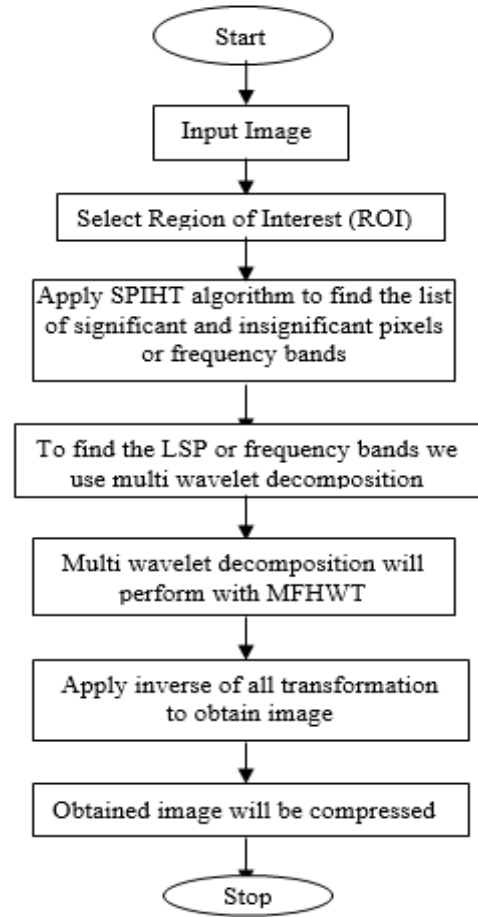

Fig. 4 Flow chart of proposed scheme

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