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RESEARCH ARTICLE

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COMPARISON OF HYBRID AND SPIHT IMAGE COMPRESSION TECHNIQUE

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ABSTRACT
Image compression concerned with reduction of the number of bits required to store or transmit images without any appreciable loss of information. The goal of image compression is to reduce the image file size without affecting the quality of an image. In this paper, a hybrid image compression coding technique using the discrete cosine transform (DCT) and the discrete wavelet transform (DWT) and Huffman encoding is used for medical images. The aim is to achieve higher compression rates by applying different quantization factor of DCT and DWT. we are comparing it with SPIHT encoding scheme and comparing the final results in terms of compression ratio and peak signal to noise ratio.

Keywords- Cosine transform, Huffman Coding, Wavelet, Image compression, quantization, SPIHT.

INTRODUCTION

Now a day in medical field employment of image became more significant for diagnosis of patients and stored for future reference so use of medical image increase every day. Basically image embrace large amount of data that requires extra storage space, high transmission bandwidths and times required to transmission long. To reduce storage size and also for high transmission image compression is required. Compression of image represent an important role in medical field for efficient storage [1] and transmission. There are many category of medical image compression techniques are available. Different techniques uses indifferent image like magnetic resonance image (MRI), X-ray angiograms (XA), sonogram etc... Image compression classified into lossy and lossless. Lossless compression was mainly used in medical imaging. Transforms based compression techniques have become more popular because they provide good image quality at high image compression JPEG was developed in 1992, using the DCT [2] is simple and it is the widely used technique for compression, but results in blocking artifacts, ringing effects and false contouring appreciably for high compression ratio [3]. Discrete Wavelet Transform (DWT) based coding, is another efficient technique used for image compression [5-6]. The ability to display image at different resolutions like low frequencies and high frequencies simultaneously makes it a better method compared to others. Utilizing the benefits of both (DCT-DWT) popular coding techniques a new technique known as hybrid transform technique has been introduced where these two coding schemes are implemented together. A few efforts are devoted to such hybrid implementation in research area nowadays. In [4], a hybrid transformation scheme for video coding is presented, which

minimizes prediction error. In [7], Yu and Mitra introduced another form of hybrid transformation technique. In [8], Singh et al. used a hybrid algorithm for medical images that uses 5- level DWT decomposition. But higher level schemes require large computational resources and are not suitable for use in modern coding standards. In this paper, an efficient hybrid DWTDCT technique for image compression is presented in which the 2-level 2-D DWT is taken followed by applying the 8-point 2-D DCT. The DCT is applied only to the DWT low-frequency components that results in higher compression ratio (CR) preserving important information. Three cases have been taken in account in which each case depends upon the consideration of different sub images of DWT output. The result shows performance improvement with least false contouring and a higher compression ratio is achieved compared to the other standard stand alone schemes. Wavelet based image coding as SPIHT proposed by Said and Pearlman in 1996 is widely used in the field of image compression than other techniques because of its high compression efficiency and many other features [9]. These algorithms have embedded coding property enabling easy bit rate control with progressive transmission of information for a wavelet transformed image. Also it's a fully embedded codec , provides good image quality, high PSNR , optimized for progressive image transmission, efficient combination with error protection, sort information on demand and hence requirement of powerful error correction decreases from beginning to end.

Proposed Image Compression technique

The flow diagram of the hybrid image compression technique are shown in figure1.

In our proposed image compression algorithm various steps are performed to apply image compression. The steps are given below with the flowchart of the proposed algorithm:

Step1: The image in an YCbCr color space is passed through 2D DWT operation.

Step2: LL, HL, LH and LL sub bands taken as DWT output (are of low significance).

Step3: HL and LH do not occupy much information are passed through the 2D DCT block processing.

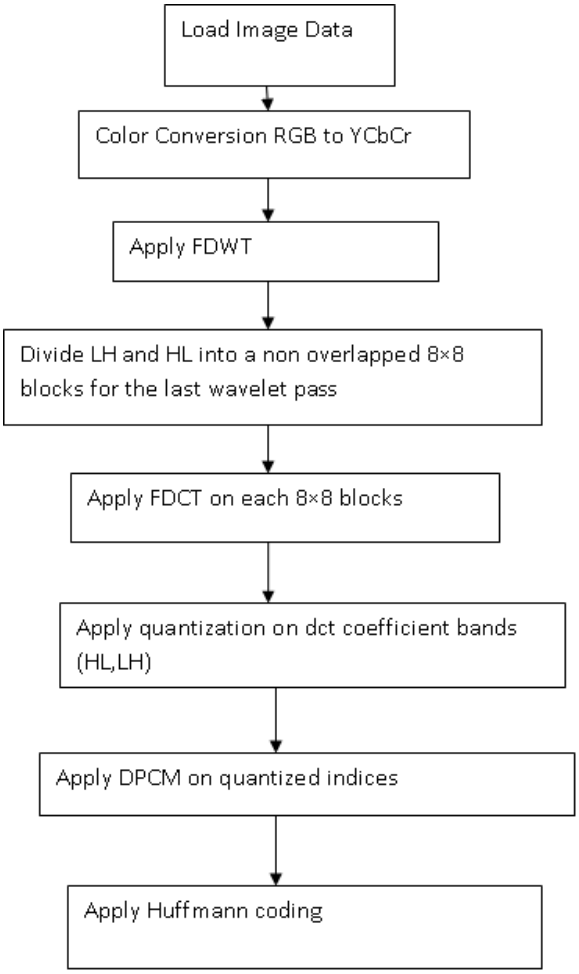

Figure1.proposed algorithm

Step4: The approximated component LL and HH represents high amount of data size and further compressed second time by 2d DWT decomposition (2 level of DWT) see figure. (2) DWT and DCT coefficients are further quantized.

Step5: Quantized coefficients are passed through Huffman coding algorithm to produce the compressed image data in encoded form.

The detailed steps for proposed image compression are as follows:

- RGB to YCbCr Color space conversion: YCbCr refers to the color resolution of digital components. In order to compress bandwidth, Cb and Cr are sampled at a lower rate than Y, which is technically known as "chroma subsampling."
- Discrete Wavelet Transform: Wavelets are defined over all and have an average value equal to zero. The basis function is obtained from a single prototype wavelet called the

mother wavelet. The basic functions include scaling function and wavelet function. The image is first divided into blocks and each block is then passed through the two filters: scaling filter (basically a low pass filter) and wavelet filter (basically a high pass filter). Four subimages are formed after doing the first level of decomposition namely LL, LH, HL, and HH coefficients. The filter which is used for this. Transformation is a nonreversible filter.

- Discrete Cosine transformation: The discrete cosine transform (DCT) is a technique for converting a signal into elementary frequency components. One of the advantages of DCT is the fact that it is a real transform, whereas DFT is complex.
- DCT Quantization: The DCT transformed coefficients are then quantized with the help of quantization tables separately for Y, Cb and Cr components. Each value of transformed coefficients are divided by the corresponding elements in the Q table and they are rounded off to the nearest integer
- DWT Quantization: The LL, HH coefficients must be quantized using adaptive quantization. The luminance component Y requires the small step of quantization while Cb and Cr need a large step. After this step, a large sequence of zeros is obtained especially in HH part of the image.
- DPCM and Mapping to Positive: The forward differential pulse code modulation is applied on the quantized (LL band) wavelet coefficients and quantized DC coefficients of DCT transform. And then all the coefficients must be converted into positive values by mapping to positive technique.
- Huffmann Coding: Huffman coding is based on the frequency of occurrence of each data item (pixel in images) [15]. The principle is to use a short codeword (lower number of bits) to encode the data that occurs more frequently. Codeword are stored in a codebook, which may be constructed for each image or a set of images. In all cases the codebook plus encoded data must be transmitted to enable decoding.

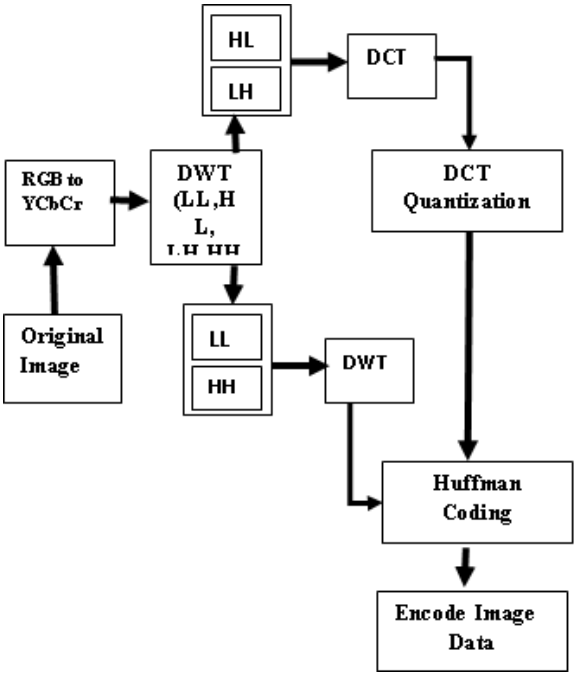

Figure .2 Coding Process

SPIHT IMAGE COMPRESSION TECHNIQUE

SPIHT is a very powerful image compression technique introduced in 1996. SPIHT is a fully embedded wavelet coding algorithm that progressively refines the most significant coefficients in order of decreasing energy levels. It is an advanced version of Embedded Zero Tree Wavelet (EZW) coder based on construction of coefficient trees and successive approximations that can be implemented as bit plane processing. Due to its successive-approximation nature, it is SNR scalable, although at the expense of sacrificing spatial scalability. SPIHT incorporates two concepts: ordering the coefficients by magnitude and transmitting the most significant bits first. SPIHT consist of three passes: insignificant pixel pass (IPP), insignificant set pass (ISP), significant pixel pass (SPP) and accordingly maintain three lists: LIP. LIS, LSP [9]. LIP is list of insignificant pixels which stores those pixels which are insignificant when compared to certain threshold. LIS is list of insignificant sets having those sets whose each pixel is below some certain threshold. LSP is list of significant pixels containing those pixels which are significant when compared with Scalar Quantization certain threshold. A pixel is significant if its value is greater than or equal to certain threshold.

SPIHT Algorithm Steps

Step 1 : *Initialization :* Initialization with n set the LSP as empty list and add the coordinates H to the LIP which leads to highest level nodes by image decomposition as LL,LH,HL,HH and only those with descendents to the LIS as sub trees i,e obtaining different levels and sub band of an image. Such as Sub band labeling Scheme for a Three Level, 2-D Wavelet transform.

Step 2: *Sorting Pass :* The threshold value obtained by encoding algorithm and that value is in terms of pixel value i ,e List of insignificant pixels and List of significant pixels as it will be low or high for each entry sorting as true and false and move to further step if LIP > LSP i.e to process entire LIP .If true then move to the further to process entire LIP otherwise to the LSP

Step 3: Refinement Pass : After processing the it will lead to Refinement pass for processing bit coding for obtaining resulting bit stream .The resulting bit stream will gives an original image .

Step 4: *Quantization Step Update:* Decrement n i ,e the pixel value with an set as List of insignificant sets (LIS) by 1 and go to step 2 . By using this method set of coordinates of all tree roots in the highest level of the pyramid is determined for an image by using the SPIHT Algorithm to give an decomposed image and that will be processed in bits format resulting bit stream .So here the process is for converting pixels of an image into bits by initialization, sorting, refinement and quantization steps.

In this section the image being transformed using one level, 2-D Wavelet Transform. The1-D wavelet transform can be extended to a two-dimensional (2-D) wavelet transform using separable wavelet filters. With separable filters the 2-D transform can be computed by applying a 1-D transform to all the rows of the input, and then repeating on all of the columns. The image is being transformed as low-pass then another low pass (LL), low pass then high pass (LH), and high and low pass (HL) and finally high pass then another high pass(HH). The resulting LL version is again decomposed to give a decomposed image. The decomposition is mainly based on the factors as levels and the sub band that is being used for the image.

SIMULATION RESULT

The proposed approach and SPIHT technique perform on the sonogram medical image (256X256) and compare the result on the parameter of compression ratio (CR) and PSNR.

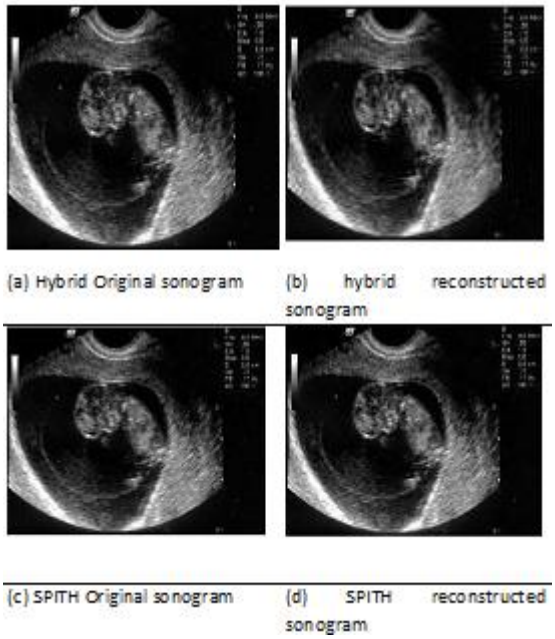

Figure3.Comparison of hybrid and SPITH Algorithm

Table :Resulting parameters

Image(256x256)	Techniques	Compression ratio	PSNR
Fetal sonogram	hybrid	12.5604	34.1143
	SPIHT	8	37.0171

CONCLUSION

We have compared the hybrid approach with the SPITH approach using two performance parameters, peak signal to noise ratio and compression ratio. Hybrid algorithm is giving the better compression ratio in compare to the SPITH algorithm. In case of PSNR SPIHT is better. Increasing the decomposition level increasing the MSE and Compression Ratio and lower the PSNR.

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