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Improved Image compression Techniques using Median Filter DWT-SPIHT based on Huffman coding

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Abstract
In present paper we proposed a simple and effective method to compress an image. Here we found success in size reduction of an image without much compromising with its quality. Here we used Medain filter on original image after Discrete Wavelet Transform with SPIHT, Huffman coding method is used to compress the image.
Keywords- *DWT, SPIHT, Huffman coding, Medain filter.*

INTRODUCTION

Image compression is the application of data compression on digital images. In effect, the objective of compression is to reduce redundancy of the image data in order to be able to store or transmit data in an efficient form [1].
Compression is carried out for the following reasons as to reduce, the storage requirement, processing time and transmission duration. Image compression is minimizing the size in bytes of a graphics file without degrading the quality of image.
Uncompressed multimedia (graphics, audio and video) data requires considerable storage capacity and transmission bandwidth. Despite rapid progress in mass-storage density, processor speeds, and digital communication system performance, demand for data storage capacity and data transmission bandwidth continues to outstrip the capabilities of available technologies. The recent growth of data intensive multimedia-based web applications have not only sustained the need for more efficient ways to encode signals and images but have made compression of such signals central to storage and communication technology.

Image compression can be categorized in two ways-

1. Lossy compression and
2. lossless compression

In first compressed image is same as original and in second we remove the noise from image. In this paper we used improved image compression approach for gray scale images. If we remove the all redundancies from the image, we can compress the image efficiently Here psycho visual redundancy is remove using DWT-SPIHT, and coding redundancy is removed by Huffman coding.
The paper is organised as follows. Section 2 introduce the process of compression. Section 3 explain Experimental results and discussion. Finally. The conclusion is given in section 4.

PROPOSED METHOD

The block diagram given below describes the process of compression and each block is discussed accordingly.

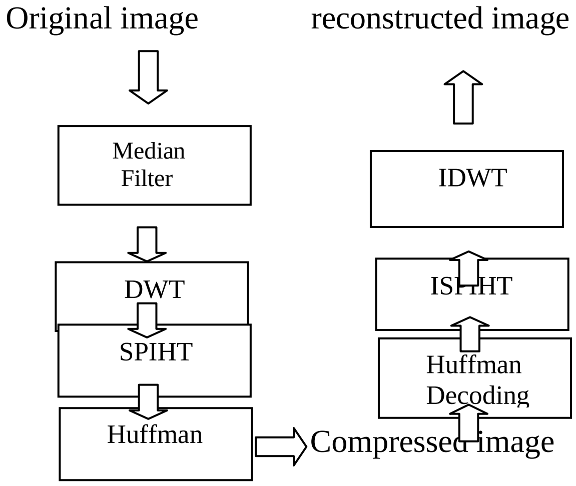

Fig. 1 Block Diagram of Propoesd Method

A. Median Filter

Median filters can be used to reduce impulse noise level from corrupted images. Median filters are used to remove the salt-and-pepper noise. The median filter is a simpler nonlinear smoothing operation that takes a median value of the data inside a moving window of finite length. Median filter can be used to evaluate the averaging value of filter.

B. DWT Process

The Discrete Wavelet Transform (DWT), which is based on sub-band coding.

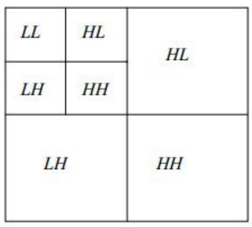

Fig. 2 Image Decomposing Using Wavelets

In DWT image is decomposed into four sub-bands; LL,LH, HL and HH bands,(L= Low, H=High). The LL-sub band contains an approximation of the original image while the other sub band contain the missing details. The LL-sub band output from any stage can be decomposed further. The decomposition of the DWT image is shown in fig.2

C. SPIHT Image Compression

Set-Partitioning in Hierarchical Trees (SPIHT) coding operates by exploiting the relationships among the wavelet coefficients across the different scales at the same spatial location in the wavelet sub bands. In general, SPIHT coding involves the coding of the position of significant wavelet coefficients and the coding of the position of zero trees in the wavelet sub bands [6].

The SPIHT coder exploits the following image characteristics:

1) The majority of an image's energy is concentrated in the low frequency components and a decrease in variance is observed as we move from the highest to the lowest levels of the sub band pyramid

It has been observed that there is a spatial self-similarity among the sub bands, and the coefficients are likely to be better magnitude-ordered if we move downward in the pyramid along the same spatial orientation.

A tree structure, termed spatial orientation tree, clearly describes the spatial relationship on the hierarchical pyramid.

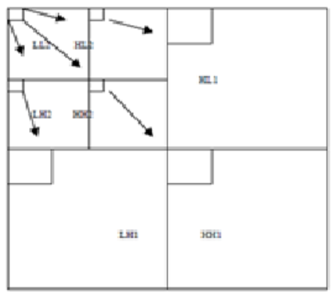

Figure 3. Image Decomposing Using

SPIHT

The tree is defined in such a manner that each node has either no offspring (the leaves) or four offspring's, which at all times form a group of 2 x 2 adjacent pixels. In Fig. 2, the arrows are directed from the parent node to its four offspring's. The pixels in the highest level of the pyramid are the tree roots and are also grouped in 2 x 2 adjacent pixels. Nevertheless, their offspring branching rule is different, and in each group, one of them has no descendants.

D. Huffman Encoding

This is a general technique for coding symbols based on their statistical occurrence frequencies (probabilities). The pixels in the image are treated as symbols. The symbols that occur more frequently are assigned a smaller number of bits, while the symbols that occur less frequently are assigned a relatively larger number of bits. Huffman code is a prefix code. This means that the (binary) code of any symbol is not the prefix of the code of any other symbol.

RESULT ANALYSIS

The experimental results are shown for three different grayscale images with different compression technique

For this we consider three parameters that is compression ratio, peak signal to noise ratio and mean square error are calculated as :

$$MSE = 1/MN \sum_{I=1}^{M} \sum_{J=1}^{N} [\{f'i,j\} - \{fi,j\}]^2$$

Here f(i, j) = original image

f'(i, j) = output compressed image

MXN = rows and columns matrix of image

$$PSNR = (db) = 10log10(255 * 255)/MSE$$

$$\text{Compression Ratio} = \frac{\text{Uncompressed Size}}{\text{Compressed Size}}$$

TABLE 1: Comparison With Existing Method of Lena image

Lena image	PSNR	MSE	CR
DWT	33.8172	5.786	2.322
DWT+SPIHT	40.8219	3.6598	5.6721

TABLE 2: Comparison With Existing Method of peppers image

peppers image	PSNR	MSE	CR
DWT	29.8791	7.672	1.563
DWT+SPIHT	39.8981	4.7671	6.8921

TABLE 3: Comparison With Existing Method of zelda image

zelda image	PSNR	MSE	CR
DWT	29.8762	7.871	5.761
DWT+SPIHT	38.9087	5.9878	6.9870

Fig 4: original and reconstructed 'Lena'image

Fig 5: original and reconstructed 'Peppers'image

Fig 6: original and reconstructed 'Zelda'image

Here table 1, table 2 and table 3 reveal the results for proposed method are in competence with results for existing methods. Figure 4, Figure5 & Figure 6 reveal results of proposed method using Lena, Peppers and Zelda image.

CONCLUSION

The SPIHT method with Huffman encoding method is simple & effective for image compression. it provide better image quality in terms of PSNR, MSE and CR.

The proposed method shows better performance than DWT+Huffman alone. In future work may extended using different format and size of image.

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