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INTEGRATING EMBEDDED ZEROTREE AND SET PARTITIONING IN HIERARCHICAL TREES FOR WAVELET BASED IMAGE COMPRESSION

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ABSTRACT

The need of era in image compression is to minimize the number of bits needed to represent the image for ease of storage and transmission. The image compression algorithm includes iterative phases of quantization, coding and decoding the transform processing. Several methods have been proposed in the past for performing image compression. The basic idea of any compression method is to compress and decompress a grayscale and/or true-color image using some thresholding and encoding technique. The existing work in this paper is based on the use of various types of compression methods like EZW, SPIHIT, ASWDR, and WDR. The use of proposed progressive method starts with Embedded Zero tree Wavelet algorithm and Set partitioning in Hierarchical Trees algorithm using the Haar wavelet and the BIOR4.4 wavelet. The experimental results show that the efficiency of proposed system is higher than existing systems. The validation of the proposed method is done through quantitative metrics such as Peak Signal to Noise Ratio (PSNR), Compression Ratio (CR), Mean Square Error (MSE), Bit per pixels. The proposed algorithm yields high values for these metrics with better image quality.

KEYWORDS: Image Compression, Wavelets, Thresholding.

I. INTRODUCTION

The field of digital image processing refers to the processing of digital images by means of a digital computer. It encompasses processes whose inputs a and outputs are digital images and, in addition, it encompasses processes that extract element from images, up to and including the recognition of individual objects. Consider the area of automated analysis of image. The processes of acquiring an image of the area containing text, pre-processing that image, extracting (segmenting) the individual edge, describing the characters in a form suitable for computer processing, and recognizing these individual characters are in the scope of digital image processing.

The main processes encompassed by digital image processing are divided into two broad categories, i.e., the methods whose inputs and outputs are images and methods whose inputs are images but whose outputs may be attributes extracted from images. . The intention is to convey an idea of all the methodologies that can be applied to images for different purposes and possibly with different objectives. The basic operations performed in a digital image processing systems include acquisition, storage, processing, communication, and display. Knowledge about problem domain is coded into an image processing system in the form of a knowledge database and all the processing modules interact with the knowledge base to produce output. In addition to guiding the operation of each module, the knowledge base also controls the interaction between modules. Interest in digital image processing methods stems from two principal application areas: improvement of pictorial information for human interpretation, and processing of scene data for autonomous machine perception.

The digital image processing is used to perform image processing on digital images using following fundamental steps:

i. **Image acquisition**
ii. **Image pre-processing**
iii. **Image segmentation**
iv. **Image representation and description**
v. **Image recognition**

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vi. **Image interpretation**
vii. **Knowledge base**

Type of image
The array of class logical single, or double, unit8, unit16, int16, whose pixel values specify intensity values. For single or double arrays, value ranges from (0, 1). For unit8 value ranges from (0, 255). For unit16, values range from (0, 65535). For int16, values from (-32768, 32767).

II. LITERATURE REVIEW

While reviewing literature, it was found that a great deal of study has been done on Advanced imaging, thatrequires storage of large quantities of digitized data. Due to the constrained bandwidth and storage capacity, images must be compressed before transmission and storage. However the compression will reduce the image fidelity, especially when the images are compressed at lower bitrates. The reconstructed images suffer from blocking artifacts and the image quality will be severely degraded under the circumstance of high compression ratios. Medical imaging poses the great challenge of having compression algorithms that reduce the loss of fidelity as much as possible so as not to contribute to diagnostic errors and yet have high compression rates for reduced storage and transmission time. To meet this challenge several hybrid compression schemes have been developed in the field of image processing. This paper presents overview of various compression techniques based on DCT, DWT, ROI and Neural Networks for two dimensional (2D) images.

There are some literature available that explains implementation of a EZW&SPIHT Encoding Coder for Lossy virtual Images. Embedded Zero Tree Wavelet algorithm (EZW) used here is simple, specially designed for wavelet transform and effective image compression algorithm. This algorithm is devised by Shapiro and it has property that the bits in the bit stream are generated in order of importance, yielding a fully embedded code. SPIHT stands for Set Partitioning in Hierarchical Trees. The SPIHT coder is a highly refined version of the EZW algorithm and is a powerful image compression algorithm that produces an embedded bit stream from which the best reconstructed images. The SPIHT algorithm was powerful, efficient and simple image compression algorithm. By using these algorithms, the highest PSNR values for given compression ratios for a variety of images can be obtained. SPIHT was designed for optimal progressive transmission, as well as for compression. The important SPIHT feature is its use of embedded coding. The pixels of the original image can be transformed to wavelet coefficients by using wavelet filters.

Another group of researchers presented the performance difference of the discrete cosine transform (DCT) and the wavelet transform for gray scale images. Wide range of gray scale images were considered under seven different types of images. Image types considered in this work are standard test images, sceneries, faces, misc, textures, aerials and sequences. Performance analysis is carried out after implementing the techniques in Matlab. Reconstructed Image Quality values for every image type would be calculated over particular bit rate and would be displayed in the end to detect the quality and compression in the resulting image and resulting performance parameter would be indicated in terms of PSNR , i.e. Peak Signal to Noise Ratio. Testing is performed on seven types of images by evaluating average PSNR values.

In some of the works, analysis different wavelet techniques for image compression were seen. Both hand-designed and lifting based wavelets are considered. These wavelet transforms are used to compress the test images competitively by using Set Partitioning In Hierarchical Trees (SPIHT) algorithm and by incorporating lifting concepts. Set Partitioning In Hierarchical Trees is a new advanced algorithm based on wavelet transform which is gaining attention due to many potential commercial applications in the area of image compression. These algorithms resulted in practical advantages, such as, superior low bit rate performance, bit-level compression, progressive transmission by pixel, accuracy and resolution .The SPIHT coder is also a highly refined version of the EZW algorithm and is a powerful image compression algorithm, that produces an embedded bit stream form, in which the best reconstructed images shows a significant perceptual improvement as well as an increased PSNR.

III. METHODOLOGY

Wavelets compression is represent effective solutions for this problem. The complete process of compression is used iterative phases the wavelet itself.

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The purpose of decompose, compress, and decompress a grayscale or truecolor image using various wavelet compression methods. To illustrate these capabilities, it consider a grayscale image and a truecolor image.
A measure wavelet compression is given by the compression ratio (CR) and the Bit-Per-Pixel (BPP) ratio. CR and BPP represent equivalent information. CR indicates that the compressed image is stored using CR % of the initial storage size while BPP is the number of bits used to store one pixel of the image. For a grayscale image the initial BPP is 8. For a true color image the initial BPP is 24, because 8 bits are used to encode each of the three colors (RGB color space).

IV. PROPOSED WORK

The proposed algorithm will adopt for creating comparing image scale by wavelet in the image compression. The compression features of a given wavelet basis are primarily linked to the relative scarceness of the wavelet domain representation of the signal. The wavelet compression that the regular signal component can be accurately approximated using the following elements: a small number of approximation coefficients (at a suitably chosen level) and some of the detail coefficients. The compression procedure contains three steps:

Step1 Decompose: Choose a wavelet with compression choose a level N. Compute the wavelet decomposition of the signal s at level N.

Step2 image of threshold detail coefficients: For each level from 1 to N, a threshold is selected and hard thresholding is applied to the detail coefficients.

Step 3 Reconstruct: Compute wavelet reconstruction using the original approximation coefficients of level N and the modified detail coefficients of levels from 1 to N.
There are two compression approaches available. The wavelet expansion of the signal is keeping the largest absolute value coefficients. In this case, it can set a global threshold, a compression performance, or a relative square norm recovery performance.

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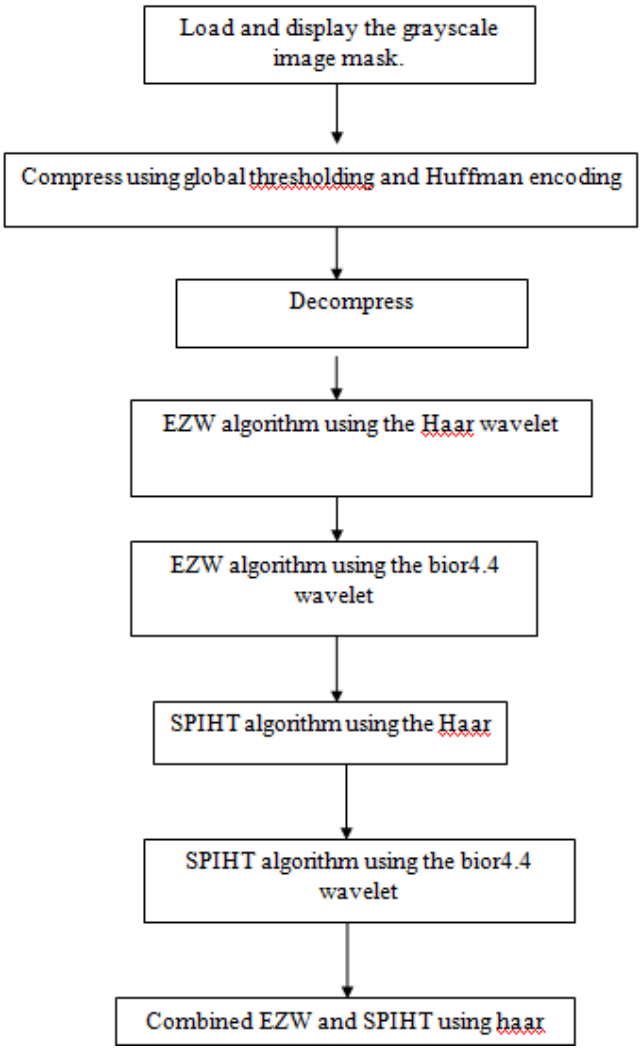

V. RESULTS AND DISCUSSIONS

The features of two-dimensional true compression using the Wavelet Toolbox software.For more information on the main function available when using command-line mode, the wcompressfunction..Starting from a given image, the goal of the true compression is to minimize the length of the sequence of bits needed to represent it, while preserving information of acceptable quality. Wavelets contribute to effective solutions for this problem.

IMAGE NAME	GREY SCALE IMAGE INPUT	GREY SCALE IMAGE OUTPUT
Leena		
Camerman		

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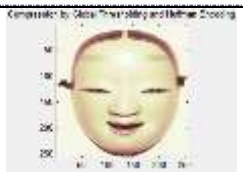
Mask		
Laure		
Cathine		
Bust		

Fig1: Test Images befor and after Compression by Global Thresholding and Huffman Encoding

Progressive methods are use of starting with the EZW algorithm. The key parameter is the number of loops. Increasing it leads to better recovery but worse compression ratio.

Compression by EZW using Haar Wavelet: 6 loops are the too small number of produces a very coarse compressed image. So let us examine a little better result for 11 steps and a satisfactory result for 12 steps.Compression ratio is a good perceptual result.

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Mask		
Laure		
Cathine		
Bust		

Fig2: TEST IMAGES Before and after Compression byEZW using HAAR Wavelet

Compare the CR value : The compression ratio is very satisfactory: compression ratio is low value compare to decompression and EZW with haar is high compared to EZW with bior4.4.SPIHT with haar is high compared to SPIHT with bior 4.4. Combine EZW with haar and SPIHT with haar is a very good perceptual result.

Table1: COMPRESSION RATIO Comparison between Grey Scale images.

Image	Compression	De-compression	EZW with haar	EZW with bior 4.4	SPIHT with Haar	SPIHT with BIOR4.4	Com-bine dSPIHT and EZW
Lena	5.42	6.81	7.16	3.10	1.24	0.93	0.52
Camer man	8.29	9.75	17.77	16.98	6.76	5.87	3.22
Mask	6.69	7.85	7.86	4.40	2.49	1.54	1.20
Laure	6.60	7.96	9.37	5.98	3.05	2.05	1.40
catherine	7.39	9.05	18.35	15.64	5.74	4.63	2.51
Bust	6.99	8.57	23.19	17.83	7.84	5.76	3.39

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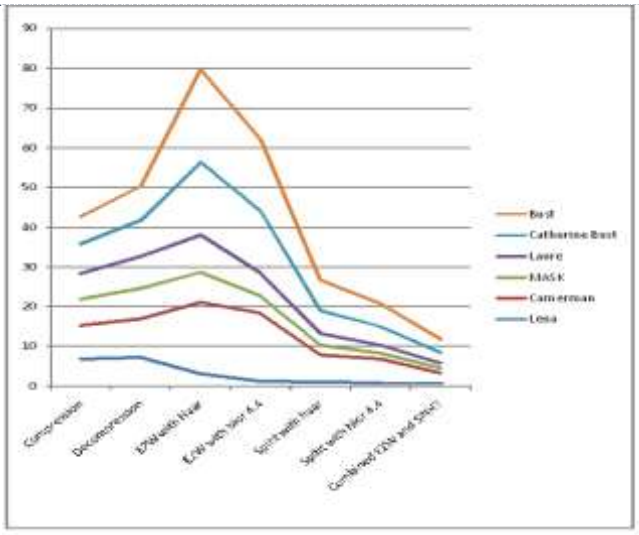

Fig3: COMPARISON BETWEEN CR VALUES OF GREY SCALE IMAGES

Compare the BPPvalue : The BPP ratio is very satisfactory: BPP ratio is the low value compared to decompression and EZW with haar is high compared to EZW with bior 4.4. SPIHT with haar is high compared to SPIHT with bior 4.4. Combine EZW with haar and SPIHT with haar is a very good perceptual result.

Table2: BPP Values Comparison between Grey Scale images.

Image	Com press -ion	De-com press -ion	EZ W with haar	EZW with bior 4.4	SPIHT with haar	SPI HT with bior 4.4	Com-bined SPIH T and EZW
Lena	0.43	0.54	0.33	0.25	0.10	0.07	0.04
camer man	0.66	0.78	1.42	1.36	0.54	0.47	0.26
Mask	0.53	0.63	0.55	0.35	0.20	0.12	0.10
Laure	0.52	0.64	0.75	0.48	0.24	0.16	0.11
catheri ne	0.59	0.72	1.47	1.25	0.46	0.37	0.20
Bust	0.55	0.69	1.86	1.43	0.63	0.46	0.27

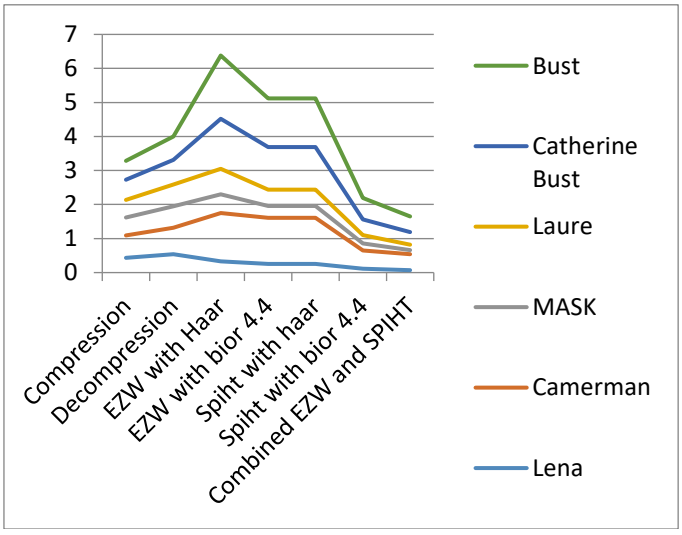

Fig4: COMPARISON BETWEEN BPP VALUES OF GREY SCALE IMAGES

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Compare the PSNRvalue : The PSNR ratio is very satisfactory: PSNR ratio is the low value compared to decompression and EZW with haar is high compared to EZW with bior4.4.SPIHT with haar is high compared to SPIHT with bior 4.4. Combine EZW with haar and SPIHT with haar is a very good perceptual result.

Table3: PSNR Comparison between Grey Scale images

image	Compress-ion	De-compress-ion	EZW with haar	EZW with bior 4.4	SPIHT with haar	SPIHT with bior 4.4	Com-bined SPIHT and EZW
Lena	30.59	29.48	32.11	33.18	28.64	29.39	26.04
camerman	29.74	29.74	34.90	35.28	31.51	29.06	29.24
Mask	34.19	33.29	33.02	33.82	27.89	29.11	24.27
Laure	35.37	34.87	35.57	36.84	31.42	33.13	28.41
catherine	29.52	29.87	32.48	32.87	28.31	28.65	25.80
bust	28.76	29.48	33.18	33.44	27.00	27.54	24.52

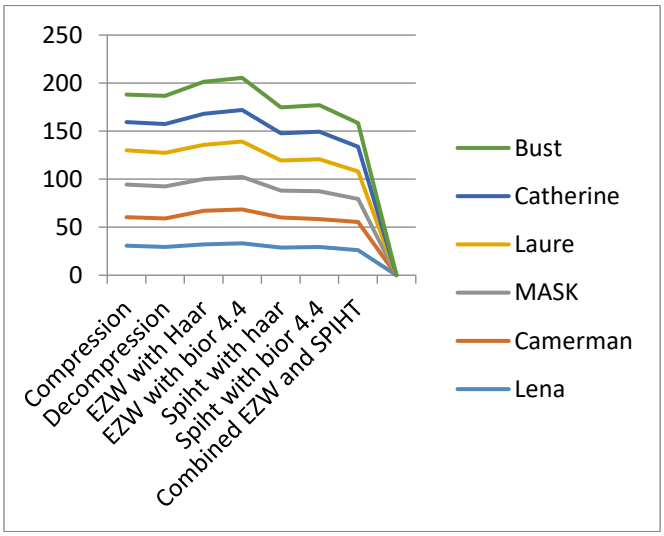

Fig5: COMPARISON BETWEEN PSNR VALUES OF GREY SCALE IMAGES

VI. CONCLUSIONS

The features of two-dimensional true compression are using the Wavelet Toolbox software. For more information on the main function available when using command-line mode, the w-compress function. Starting from a given image, the goal of the true compression is to minimize the length of the sequence of bits needed to represent it, while preserving information of acceptable quality. Wavelets contribute to effective solutions for this problem.
The complete chain of compression includes phases of quantization, coding, decoding in addition of Compression by Global Thresholding and Huffman Encoding the wavelet processing itself. The uses of progressive methods starting with EZW algorithm and SPIHT algorithm using the Haar wavelet and EZW algorithm and SPIHT algorithm using the bior4.4 wavelet. The key parameter is the number of loops. Increasing it leads to better recovery but worse compression ratio. This work, the various coding techniques with their description and highlights of their merits and demerits are discussed. This can provide an insight combined EZW and SPIHT with Haar wavelet and consider all the techniques and to choose the one based on the requirement in hand.

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