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Performance analysis of DCT Based Image Compression Techniques

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ABSTRACT

With the increasing growth of technology and the entrance into the digital age, we have to handle a vast amount of information every time which often presents difficulties. So, the digital information must be stored and retrieved in an efficient and effective manner, in order for it to be put to practical use. Wavelets provide a mathematical way of encoding information in such a way that it is layered according to level of detail. In this paper we used the image compression techniques for the general images, the 2D discrete wavelet transform (DWT) has been applied and the detail matrices from the information matrix of the image have been estimated. The reconstructed image is synthesized using the estimated detail matrices and information matrix provided by the Wavelet transform. The quality of the compressed images has been evaluated using some factors like Compression Ratio (CR), Peak Signal to Noise Ratio (PSNR), etc.

Keywords: DCT (discrete cosine transform), DWT (discrete wavelet transform), MSE (mean square error), PSNR (peak signal to noise ratio).

INTRODUCTION

Today's communication system is depend on multimedia way to send the information or data from the source to destination or one place to another, here the multimedia means a combination of more than one media such as image, audio, text, video, sound etc. so here we stored the large number or amount of information in the form of any media. Such media is also playing a great role in the field of security analysis as using in the form of bio-metric identification. When we stored the large number of information in the form of image and send form one place to another here our main aim is to sending the information as reduce the size of a data or an image data without loss in the resultant data or at the end of another. For the image data awe used the terms image compression and decompression, image compression is the process of transmit the image from one end with reduce the image size or reduce the bit's and forward to another end, at this end receiver decompressed the image without the any loss in data or information.

There are mostly two types of an image compression one is lossless image compression and the other is lossy image compression, all the techniques used for the image compressions are follow the properties of both category. In the lossless image compression we strictly send and receive the data without any loss of information while in the case of lossy image compression we can receive the data at the receiver end with some loss of information or in the form of acceptable limit of loss data or information. Image compression and decompression is used in the various field such as medical science, security system, bio-metric identification system etc. The good compression system should be able to reconstruct the compressed image source or an

approximation of it with good quality. It is an important branch of image processing that is still a very active research field and attractive to industry.

The image is actually a kind of redundant data i.e. it contains the same information from certain perspective of view. By using data compression techniques, it is possible to remove some of the redundant information contained in images. Image compression minimizes the size in bytes of a graphics file without degrading the quality of the image to an unacceptable level. The reduction in file size allows more images to be stored in a certain amount of disk or memory space. It also reduces the time necessary for images to be sent over the Internet or downloaded from web pages.

The scheme of image compression is not new at all. The discovery of Discrete Cosine Transform (DCT) in 1974 [4] is really an important achievement for those who work on image compression. The DCT can be regarded as a discrete time version of the Fourier Cosine series. It is a close relative of Discrete Fourier Transform (DFT), a technique for converting a signal into elementary frequency components. Thus DCT can be computed with a Fast Fourier Transform (FFT) like algorithm of complexity *O*(*nlog2 n*). Unlike DFT, DCT is real valued and provides a better approximation of a signal with fewer coefficients [4].

The rest of this paper is organized as follows in the first section we describe an introduction of about image compression and their types and techniques. In section II we discuss about the quantization techniques in image compression, in section III we discuss about the experimental work. And finally in section IV we conclude and discuss the future scope.

II QUANTIZATION

Based on the two techniques, quantizing the image's DCT coefficients and entropy coding the quantized coefficients, DCT-based image compression minimizes the data required to represent an image. Quantization process minimizes the number of bits required to represent a quantity by minimizing the number of possible values of the quantity. A range of values are compressed to a single quantum value to achieve quantization. The stream becomes more compressible as the number of discrete symbols in a specified stream is reduced. Transformation is performed by using a quantization matrix in combination with a DCT coefficient matrix.

According to the quantization matrix, the DCT coefficients are normalized by different scales, for high compression [11]. The transformed image matrix is divided by the employed quantization matrix to achieve quantization. Then the values of the resultant matrix are rounded off. The coefficients located near the upper left corner in the resultant matrix have lower frequencies. Human eye is more sensitive to lower frequencies. So, higher frequencies are eliminated and the image is reconstructed by using the lower frequencies.

III EXPERIMENTAL WORK

In this section we proposed a comparative model for the image compression methods for the general images. The comparative model is a combination of discrete wavelet transform function, and particle of swarm optimization. The wavelet transform function used 2D transform for the decomposition of input image, after the decomposition of an any image we used the respective methods for the particular input image and getting the result value in the form for performance parameter and finally compare the whole model on the basis of their respective performance parameter value, and our proposed methods shows better results than other existing methods.

PROPOSED ALGORITHM

1. begin
2. t=0;
3. initialize particles p (t);
4. evaluate particles p (t);
5. while (termination conditions are unsatisfied)

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6. begin
7. t=t+1;
8. update weights
9. select pbest for each particle
10. select gbest from p (t-1);
11. calculate particle velocity p(t)
12. calculate particle position p(t)
13. evaluate particles p(t)
14. end
15. end

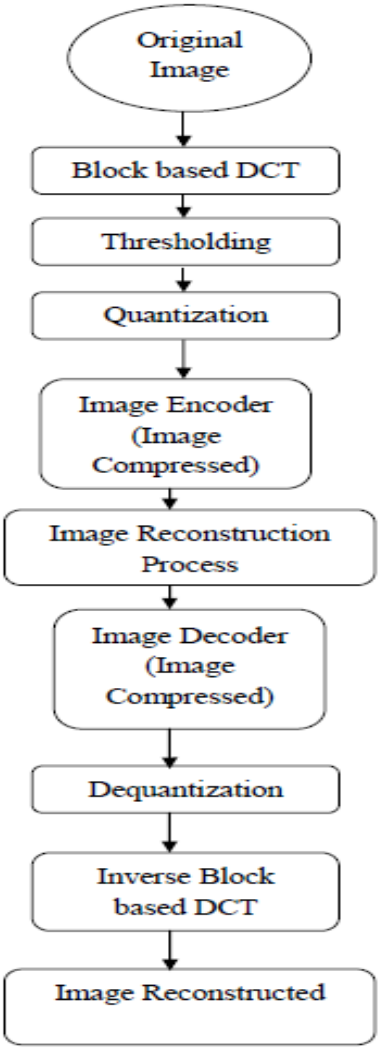

Fig 1: Proposed Image compression and decompression flow graph.

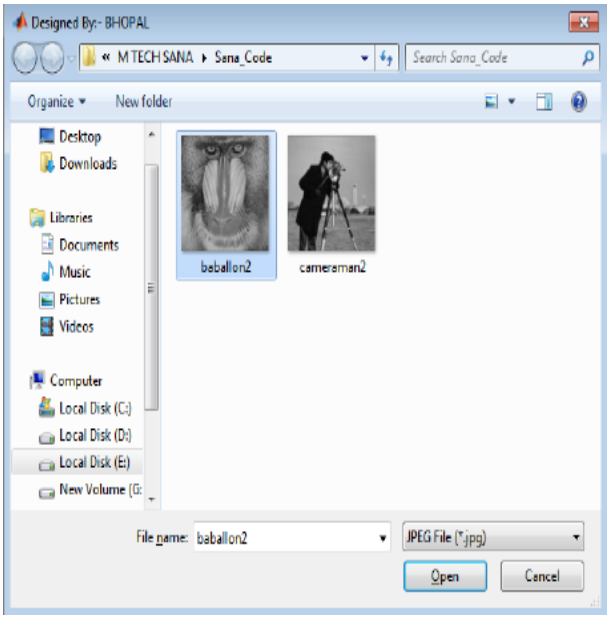

Fig 2: Windows show that the input Image for compression.

Fig 3: Windows show that the original Image of baballon2 for compression.

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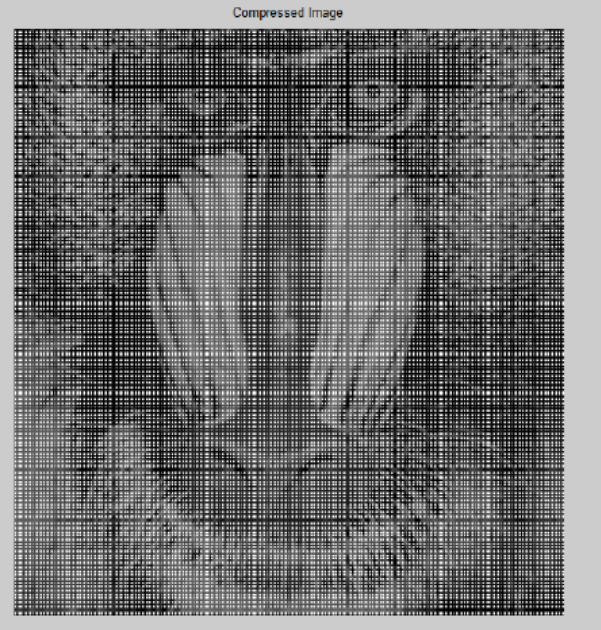

Fig 4: Windows show that the compressed Image of baballon2 after compression.

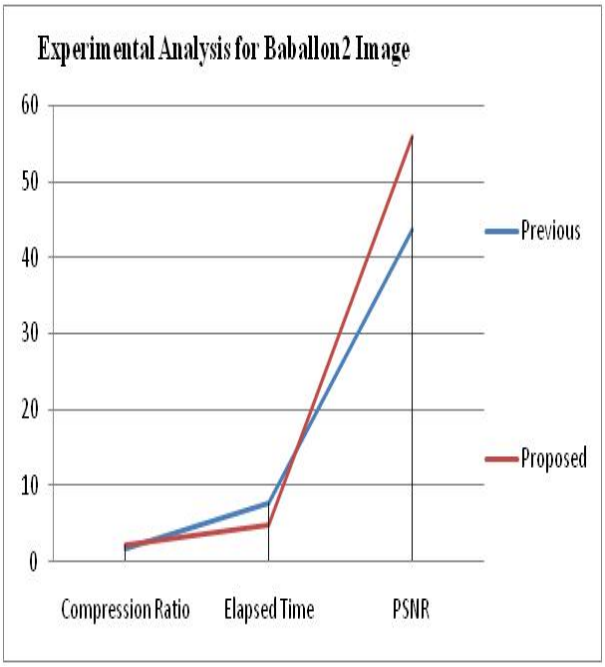

Fig 5: Comparative experimental study for the Baballon2 image using previous and proposed method.

IV CONCLUSION AND FUTURE SCOPE

Digital images in their uncompressed form require an enormous amount of storage capacity. Such uncompressed data needs large transmission bandwidth for the transmission over the network. Discrete Cosine Transform (DCT) is one of the widely used image compression method and the Discrete Wavelet Transform (DWT) provides substantial improvements in the quality of picture because of multi resolution nature. Image compression reduces the storage space of image and also maintains the quality information of the image. In this paper we present the comparative performance evaluation for the image compression techniques for the general images and this comparison basis on the some performance value, the proposed method gives better results in terms of PSNR and compression ratio etc.

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