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JPEG Image Compression Using Various Algorithms: A Review

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ABSTRACT

The basic goal of image data compression is to reduce the bit rate for transmission and storage while either maintaining the original quality or providing an acceptable fidelity. JPEG is the one of the hottest topics in image compression technology. JPEG is different because it is primarily a lossy method of compression. It converts the spatial domain into frequency domain. It used DCT which provides the high compressed image. We will use DCT algorithm to implement the objectives. The proposed model focuses on reducing the size of image & time elapsed in compression with minimum distortion in reconstructed image and is practically implemented using MATLAB 7.5 environment. The aim of compression is to achieve good quality compressed image making the storage and transmission more efficient. The proposed method is implemented using some images. The implementation of the DCT based JPEG obtains the higher PSNR value. The higher the PSNR value higher the quality of an image. The higher PSNR is obtained for compressed image by DCT based JPEG compression as compared to JPEG Compression.

Keywords:- Image processing, image compression, DCT algorithm,

I. IMAGE COMPRESSION

Image compression is minimizing 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 given amount of disk or memory space. It also reduces the time required for images to be sent over the Internet or downloaded from Web pages.

There are several different ways in which image files can be compressed. For Internet use, the two most common compressed graphic image formats are the JPEG format and the GIF format. The JPEG method is more often used for photographs, while the GIF method is commonly used for line art and other images in which geometric shapes are relatively simple.

Other techniques for image compression include the use of fractals and wavelets. These methods have not gained widespread acceptance for use on the Internet as of this writing. However, both methods offer promise because they offer higher compression ratios than the JPEG or GIF methods for some types of images. Another new method that may in time replace the GIF format is the PNG format.

A text file or program can be compressed without the introduction of errors, but only up to a certain extent. This is called lossless compression. Beyond this point, errors are introduced. In text and program files, it is crucial that compression be lossless because a single error can seriously damage the meaning of a text file, or cause a program not to run. In image compression, a small loss in quality is usually not noticeable. There is no "critical point" up to which compression works perfectly, but beyond which it becomes impossible. When there is some tolerance for loss, the compression factor can be greater than it can when there is no loss tolerance. For this reason, graphic images can be compressed more than text files or programs.

II. RELATED WORK

In 2010 JAGADISH H. PUJAR et al analyzed that the need for an efficient technique for compression of Images ever increasing because the raw images need large amounts of disk space seems to be a big disadvantage during transmission & storage. Even though there are so many compression technique

already present a better technique which is faster, memory efficient and simple surely suits the requirements of the user. Sachin Dhawan (2011) concluded that Image compression is now essential for applications such as transmission and storage in data bases. In this paper the author review and discuss about the image compression, need of compression, its principles, and classes of compression and various algorithm of image compression. This paper attempts to give a recipe for selecting one of the popular image compression algorithms based on Wavelet, JPEG/DCT, VQ, and Fractal approaches. Prabhakar.Telagarapu et al (2012) stated that Image compression is a widely addressed researched area. Many compression standards are in place. But still here there is a scope for high compression with quality reconstruction. The JPEG standard makes use of Discrete Cosine Transform (DCT) for compression.

The introduction of the wavelets gave a different dimension to the compression. Rajesh K. Yadav et al (2012) presented comprehensive study with performance analysis of very recent Wavelet transform based image compression techniques. Image compression is one of the necessities for such communication. The goals of image compression are to minimize the storage requirement and communication bandwidth. Compression is achieved by the removal of redundant data. Discrete Wavelet Transform (DWT) is a recently developed compression technique in image compression. Dr.E.KANNAN et al (2012) concluded that to decrease the communication bandwidth and save the transmitting power in the wireless endoscopy capsule, this paper presents a new near-lossless image compression algorithm based on the Bayer format image suitable for hardware design. This algorithm can provide low average compression rate (2.12 bits/pixel) with high image quality (larger than 53.11 dB) for endoscopic images. K.Saraswathy et al (2013) introduces an orthogonal approximation for the 8 point Discrete Cosine Transform (DCT). The proposed transformation matrix contains only ones and zeros. Bit shift operations and multiplication operations are absent. The approximate transform of DCT is obtained to meet the low complexity requirements. The implied transformation and approximation are orthogonal and are based on polar decomposition methods. The low complexity introduced in DCT reduces power consumption. Gaurav Vijayvargiya et al (2013) addressed about various image compression techniques. On the basis of analyzing the various image compression techniques this paper presents a survey of existing research papers. In this paper we analyze different types of existing method of image compression. Compression of an image is significantly different then compression of binary raw data. To solve these use different types of techniques for image compression. Now there is question may be arise that how to image compress and which types of technique is used.

III. DCT ALGORITHM

The discrete cosine transform (DCT) is a technique for converting a signal into elementary frequency components. Like other transforms, the Discrete Cosine Transform (DCT) attempts to de correlate the image data. After de correlation each transform coefficient can be encoded independently without losing compression efficiency.

Proposed DCT Algorithm:

- The following is a general overview of the JPEG process.
- The image is broken into 8x8 blocks of pixels.
- Working from left to right, top to bottom, the DCT is applied to each block.
- Each block is compressed through quantization.
- The array of compressed blocks that constitute the image is stored in a drastically reduced amount of space.
- When desired, the image is reconstructed through decompression, a process that uses
- the inverse Discrete Cosine Transform (IDCT)

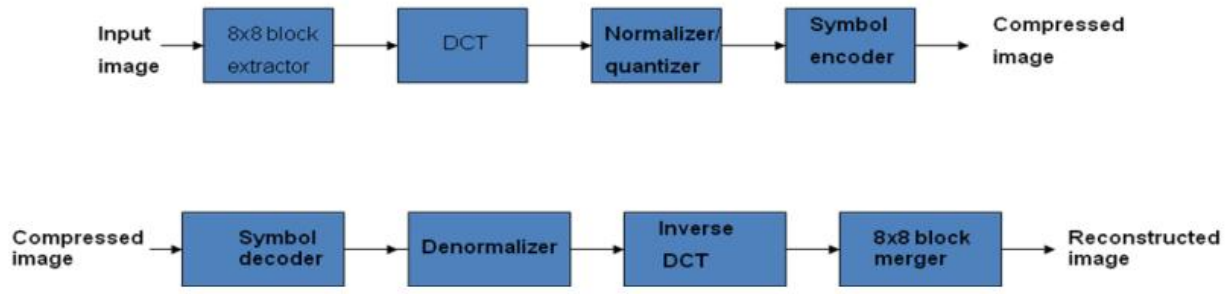

Figure 1: Image Compression using DCT

IV. WAVELET TRANSFORM

Wavelets are functions defied over a fiite interval and having an average value of zero. The basic idea of the wavelet transform is to represent any arbitrary function (t) as a superposition of a set of such wavelets or basis functions. These basis functions or baby wavelets are obtained from a single prototype wavelet called the mother wavelet, by dilations or contractions (scaling) and translations (shifts). The Discrete Wavelet Transform of a fiite length signal x(n) having N components, for example, is expressed by an N x N matrix.

Despite all the advantages of JPEG compression schemes based on DCT namely simplicity, satisfactory performance, and availability of special purpose hardware for implementation; these are not without their shortcomings. Since the input image needs to be ``blocked," correlation across the block boundaries is not eliminated. This results in noticeable and annoying ``blocking artifacts" particularly at low bit rates as shown in Fig.2. Lapped Orthogonal Transforms (LOT) [5] attempt to solve this problem by using smoothly overlapping blocks. Although blocking effects are reduced in LOT compressed images, increased computational complexity of such algorithms do not justify wide replacement of DCT by LOT.

Figure 2: Original Lena Image, and Reconstructed Lena with DC component only, to show blocking artifacts.

V. VQ COMPRESSION

A vector quantizer is composed of two operations. The fist is the encoder, and the second is the decoder. The encoder takes an input vector and outputs the index of the codeword that offers the lowest distortion. In this case the lowest distortion is found by evaluating the Euclidean distance between the input vector and each codeword in the codebook. Once the closest codeword is found, the index of that codeword is sent through a channel (the channel could be computer storage, communications channel, and so on). When the encoder receives the index of the codeword, it replaces the index with the associated codeword. The fundamental idea of VQ[4] for image compression is to establish a codebook consisting of code vectors such that each code vector can represent a group of image blocks of size m × m, (m=4 is always used). An image or a set of images is fist partitioned into m × m non overlapping blocks which are represented as m2-tuple vectors, called training vectors. The size of training vectors can be very large. For example, a 512 × 512 image contributes 16,384 training vectors.

VI. CONCLUSION

The goal of codebook design is to establish a few representative vectors, called code vectors of size 256 or 512, from a set of training vectors.

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