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A Review on Image Compression Techniques

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Abstract: ***Many techniques are now existing for the image compression and much effort is being expended in determining the optimum compression transforms. Various techniques of data compressions are available but mostly compression is done using Cosine and Wavelet Transforms. In this paper also focused on the two technologies of image compression are highlighted and they are lossy compression ,lossless compression and various technology included in them. Compression of the digital image data is the image compression process. Out of the compression data, Huffman code is the one. Huffman made considerable contributions in several areas. Mostly information theory and coding signal design procedures. For asynchronous logical circuits, the information theory and coding technology procedure mostly used and design for radar and communication.***

Keywords: DCT, DWT, Decompression, Image compression technique, Huffman Coding, Lossless and lossy image compression

I. INTRODUCTION

The utilize of Digital Images is growing rapidly. In the today's world increased the use of digital images comes the severe issue of storing and transferring the huge volume of data presenting the images because the uncompressed multimedia (Audio,Video and Graphics) data requires considerable storage capacity and transmission bandwidth. The latest growth of data intensive multimedia based web application has put much pressure on the researchers to find the way of using the images in the web applications additional effectively, internet teleconferencing, high definition television (HDTV), satellite communication, medical imaging and digital storage of movies are not feasible without a high degree of compression. Compression[1][2] is helpful because it helps decrease the utilization of expensive resources such as hard disk space or transmission bandwidth. When redundancies are condensed or eliminated, the Image compression[1][2] is achieved. An images file size can be condensed among or exclusive of a loss in quality of the image; these are called lossy compression and lossless compression, respectively. For the reduction the amount of data required the represent the digital image the image compression address. By removing one or more of the three basic data redundancies[3][4] from the given data the compression is achieved.

a. *Coding Redundancy:* present when less than optimal(i.e. the smallest length) code words are used.
b. *Interpixel redundancy:* Results from correlations between the pixels of an image.
c. *Psycho visual redundancy:* Happens due to data that is uncared for by the human visual system(i.e. visually nonessential information).

Huffman codes include the fewest possible number of code symbols (e.g., bits) per source symbol (e.g., grey level value) subject to the limitation that the source symbols are coded one at a time. So, Huffman coding when join with technique of sinking the image redundancies using Discrete Cosine Transform (DCT)& DWT helps in compressing the image data to a very high-quality point. The intention of image compression is to shrink the redundancy of an image. Where loss of in the least Information is not acceptable and data are essential then Lossless Compression method[1][2] is useful. Lossless compression method is in the base of compression of medical images. For recognition of disease and surgical preparation medical imaging is being worn, and enduring storage space is necessary for profiling patients data. To keep away from loss of critical medical in sequence, lossless compressions of the medical images are crucial. In the earlier few years, the production of medical images in hospitals has been greater than before considerably. In a typical hospital, great amount of medical data are generated every year. Compression[1][2] has two catalogues. There are two techniques namely lossless and lossy techniques can be in employment, it depends on the scheme desires. Whole data reliability is ensured after reconstruction by lossless compression, but in wide-ranging compression ratios is limited between 2:1 to 3:1. However, only usual drop is provided in file size used by lossless techniques. The production of digital images at a range of health care conveniences is vast and rising, and desires of storage space surpass the existing archival ability.

II. METHODS

Lossless and Lossy compression[1][2] are the two main categories of the compression. The reconstructed image after compression is numerically matching to the original image,is in the lossless compression. The reformed image contains degradation relative to the original in the lossy compression technique and whereas lossy technique[5] causes image quality humiliation degradation in each compression or decompression step[5].

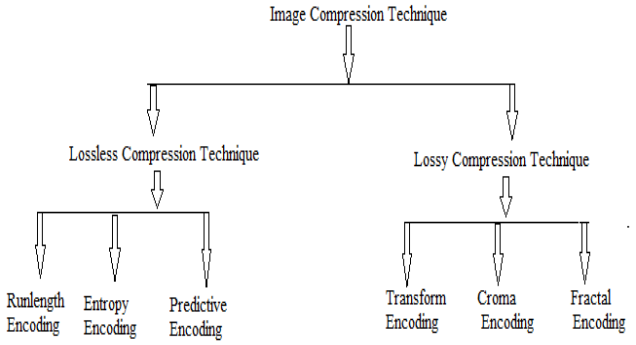

Fig.1 Image Compression Technique

Lossy image compression:

Lossy methods are particularly appropriate for natural images such as photographs in applications where slight failure of fidelity is satisfactory to attain a considerable decrease in bit rate[2][6].

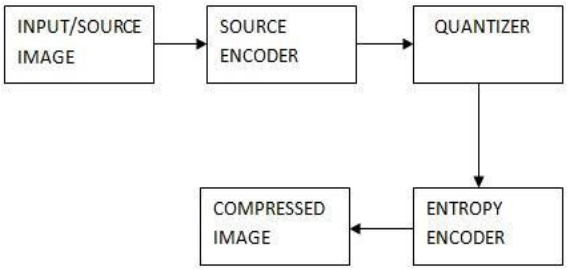

Fig 2. Lossy Image Compression

To eliminate certain information permanently especially redundant information by the file,the lossy compression used. Only a part of the original information is still there (mainly not noticed by user) happens when the file is uncompressed. Lossy compression[1][2] is usually worn for video and sound, where a sure quantity of information loss will not be detected by mainly users. The JPEG image file, normally old for photographs and previous multifaceted still images on the Web, is an image that has lossy compression. Using JPEG compression, the originator can choose how much loss to set up and make a trade-off between file size and image quality.

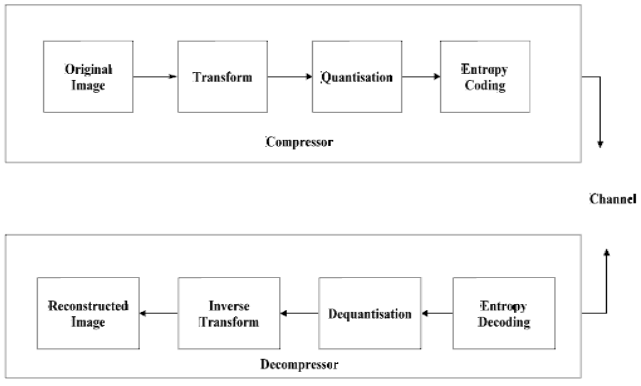

Fig 3. Lossy Compression Technique

In general mainly lossy compressors (Fig. 2) are three-step algorithms, each one of this is in agreement by three kind of redundancy mentioned beyond. The first stage is a convert to get rid of the interpixel redundancy to bunch information efficiently. Then a quantizer[11] is useful to take away psycho-visual redundancy to stand for the filled information with as few bits as achievable. The quantized bits are afterwards powerfully encoded to get more compression from the coding redundancy.

Next is the lossy image compression[6] coding which used

a. Transform Coding
b. Croma Coding
c. Fractal Coding
d. Vector quantization

Lossless Image Compression:

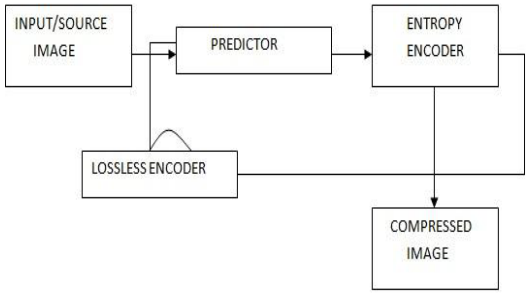

Fig 4. Lossless Image Compression

Lossless compressions are favoured for archival purposes and often for medical imaging, clip art scientific drawings.

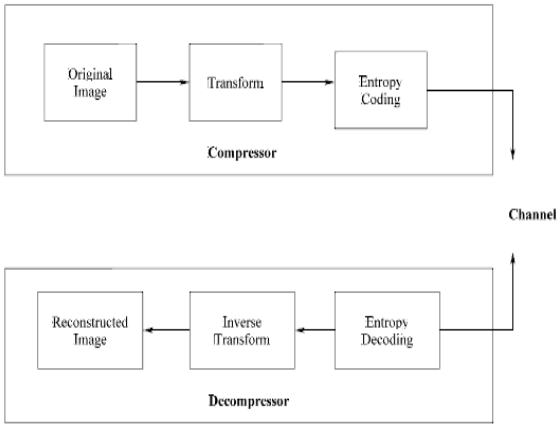

Fig 5. Lossless Compression Technique

Among lossless compression[1][2], each lone bit of data that was initially in the file remains after the file is not compressed. Each and every one of the information is wholly restored. This is normally the technique of selection for text or spreadsheet files, anywhere losing words or financial data could pretence a trouble. Lossless compressors (Fig. 5) are typically two-step algorithms. The first step transforms the innovative

image to a number of other format in which the inter-pixel redundancy is condensed. The second step uses an entropy encoder to eliminate the coding redundancy. The lossless decompressor is a just right opposite process of the lossless compressor.

III. DWT , DCT , HUFFMAN CODING

A. DWT(Discrete Wavelet Transform)

Data reduction capability which has grow to be a standard tool in image[11] compression applications is because of Discrete Wavelet Transform[13][14]. As in a Discrete Cosine Transform based compression system, the entire image is transformed with compressed as a single data object rather than block by block in Discrete Wavelet Transform. Wavelet examination[14] be able to be used to separate the information of an image into estimate and comprehensive sub signal. Compared with Fourier transform, the wavelet transform is space (time) and frequency of local transform, so it can effectively extract information from signal. An image keen on a lower resolution approximation image (LL) as well as horizontal (HL), diagonal (HH) and vertical (LH) detail components by the separation of Discrete Wavelet Transform[14]. Wavelets are having an average value equal to zero and they are defined over all. The wavelet called mother wavelet is the basis function which is obtained from a single prototype wavelet[13]. The basic functions include wavelet function and scaling function. The image is first divided into blocks and each block is then passed through the two filters:

a. *wavelet filter* (basically a high pass filter): high frequency information is kept, low frequency information is lost.
b. *scaling filter* (basically a low pass filter) : low frequency information is kept, high frequency information is lost.

After doing the first level of decomposition, four sub images are formed namely LL, LH, HL, and HH coefficients. The nonreversible filter used in this transformation so that signal is effectively decomposed into two parts, a complete division (high frequency) and estimate division (low frequency).

B. DCT(Discrete Cosine Transform)

Discrete Cosine Transform[9] is a lossy Compression technique which is widely used in area of image and audio compression. Example: JPEG Images[11]. Discrete Cosine Transforms are used to convert data into the summation of series of cosine waves is oscillating at different frequencies[9]. These are very similar to Fourier Transforms, but Discrete Cosine Transform[11] involves use of cosine functions and real coefficients, Fourier Transforms use both sine and cosine and cosine functions are a large amount extra competent as fewer functions are needed to approximate a signal. Both Fourier and Discrete Cosine Transform[9] convert data from a spatial domain into a frequency domain and their respective functions converting thing back. In the Discrete Cosine Transform[14], the images are separated into different parts of varying importance. Discrete Cosine Transform expresses a sequence of finitely several data points oscillating at different frequencies in terms of sum of cosine functions[11]. Similarly as the discrete Fourier transform (DFT), a Discrete Cosine Transform is also a Fourier-related transform, but using only real numbers. The inversion of Discrete Cosine Transform can be accomplished hence the Discrete Cosine Transform is a unitary transform .The Discrete Cosine Transform helps to separate the image into spectral subbands of differing importance with respect to the visual quality of images.

C. Huffman Coding

Huffman code is method intended for compressing data[15]. Huffman completed significant contributions in several areas. Mostly information theory and coding signal design procedures for asynchronous logical circuits and design for radar and communication. Huffman coding[16] is a appearance of statistical coding which effort to reduce the amounts of bits required representing the string of symbols to vary in length. Shorter codes be assigned to the majority often used symbols & longer codes to the symbol which appear less frequently in the series. Code word length is no longer fixed similar to ASCII[15]. In the early on 1980s, individual computers had hard disks that were no bigger than 10MB; nowadays, the puniest of disks are still deliberate in hundreds of gigabytes[15]. Even though hard drives are getting bigger, the files we want to store up (funny pictures of cats, music ,videos and so on) appear to keep speed with that expansion which makes even today's gargantuan disk seem too tiny to hold the whole thing. Single technique to utilize our storage space extra optimally is to condense the files[17]. By taking benefit of redundancy or patterns, we might be able to "abbreviate" the contents in such a method to get up less space yet maintain the ability to rebuild a complete version of the innovative when desirable. Such compression[16] could be useful when trying to stuff extra things on a disk or to condense the time desirable to copy/send a file in excess of a network.

IV. CONCLUSION

In this paper we have focused on images compression scheme based on DWT, DCT and Huffman coding techniques. The algorithm based on Discrete Cosine Transform offers a robust method of images with minimum distortion. The Discrete Wavelet Transform has advantage to decomposition of images which is

necessary criteria for it. The Huffman encoding reduces the average codeword length by assigning shorter codeword's to highly frequent symbols and longer codeword's to rarely occurring symbols. Thus these desirable properties have been utilized to create a new robust compression technique.

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