A REVIEW ON LATEST TECHNIQUES OF IMAGE COMPRESSION

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ABSTRACT : *With the growth of modern communication technologies, demand for data compression is increasing rapidly. This Paper gives review of compression principle, classes of compression and various algorithm of image compression. Image Compression is the solution of problems associated with transmission of digital image and storage of large amount of information for digital Image. Compression of Images includes different applications like remote sensing via satellite, broadcasting of Television, and other long distance Communication. Image storage is required for satellite images, medical images, documents and pictures. Image compression is essential for these types of applications. This paper attempts to help for selecting one of the best and popular image compression algorithm.*

KEYWORDS: Image, Image compression technique, DCT, DWT, BTC, Huffman Coding, LZW, Loss less and lossy image compression. Run Length Encoding, Transform Coding.

1. INTRODUCTION:

Image is basically a two Dimensional signal representation in Digital system. Normally Image which we take from the camera is in the analog form. However for further processing, storage and transmission, images should have to be converted in to its digital form. A Digital Image is 2- Dimensional array of pixels. Basically compression of image is different than compression of digital data. We can use Data compression algorithm for Image compression but the result obtain from that process is less than optimal. Different types of images are used in bio medical, remote sensing and in technique of video processing which require compression for transmission and storage. Compression could be achieved by removing some redundant or extra bits from the image.

1.1 Need of compression:

An Uncompressed image occupies large amount of memory in storage media, and it takes more time to transfer from one device to another. So if we want to transfer or store digital image then we have to compress it first for fast speed of transfer and to store in a less space. Hence compression is very essential for modern multi media application.

2. COMPRESSION TECHNIQUE:

In this paper we study different type of image compression techniques. The image compression techniques are classified into two categories.

A. Lossless compression technique.

B. Lossy compression technique

2.1. LOSSLESS COMPRESSION TECHNIQUE:

In lossless image compression algorithm, the original data can be recovered exactly from the compressed data. It is used for discrete data such as computer generated data, text and certain kinds of image and video information. It can achieve only a modest amount of compression of the data and hence it is not useful for sufficiently high compression ratios. Lossless compression is preferred for artificial images such as drawing, comics etc.

there are some techniques of lossless compression:

2.1.1 Run length encoding

2.1.2. LZW coding

2.1.3. Huffman coding

2.1.4. Area coding

2.1.1. Run length encoding:

Run length encoding is one of the simplest data compression method. This compression technique is useful in case of repetitive data. when we have sequence of same intensity pixel or symbols then this sequence is replaced by shorter symbols and it is represented by a sequence (Vi,Ri).where Vi is represented as the intensity of pixel and Ri is the no of consecutive pixel with same intensity as shown in fig.

50 50 50 50 97 97 120 120 120
(50, 4) (97, 2) (120, 3)

" Run length coding"

2.1.2. Lempel-Ziv-Welch (LZW) coding:

It is dictionary based coding, which is used in computer industries. LZW is basically of two type, Static and dynamic. in the static dictionary coding the dictionary is fixed during the encoding and decoding while in dynamic dictionary coding the dictionary is updated when new word is introduction.

2.1.3. Huffman coding:

Huffman coding is based on the statistical occurrence frequencies or probabilities. Huffman coding can reduce the file size by 10% to 50% by removing the irrelevant information. In this encoding each pixel are treated as a symbol. The symbols which have higher frequency are assigned a smaller number of bits while the symbol which has less frequency is assigned a relative large number of bits.

2.1.4. Area code :

Area coding is more enhanced form of run length coding of lossless compression. It is highly effective and can produce better compression ratio (CR) but it has some limitation that it cannot be implemented in hardware because of non-liner method.

2.2. LOSSY COMPRESSION TECHNIQUE : Lossy compression techniques refer to the loss of information when data is compressed, but because of this distortion, much higher compression ratios can be achieved as compared to the various lossless compression technique in reconstruction of the image. 'Lossy' compression technique sacrifices quality of data for better compression. It removes redundancy and creates an approximation which is near to the original image. This scheme is highly effective for compressing images.

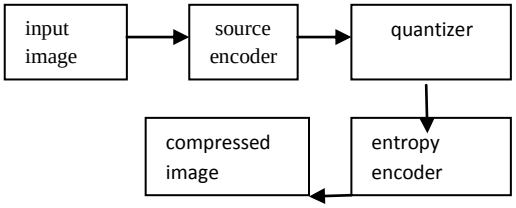

fig 1: " Lossy compression"

Here are some examples of lossy compression are given below:

2.2.1. Transform coding.

2.2.2. Block truncation coding.

2.2.3. Vector quantization.

2.2.4. Sub band coding.

2.2.5. fractal coding.

2.2.1. transform coding:

transformation coding is a lossy compression technique. It usually starts by dividing the original image into small blocks of smaller size. This technique is used for natural data like audio signal or biomedical image. Lesser bandwidth is required in this type of coding. Different transform such as DFT (discrete Fourier transform) and DCT (discrete coding transform) are used to change the pixel of the original image into frequency domain coefficients. Among all the transforms , DCT coding has been the most common technique of transform coding and also adopted in the JPEG image compression standard.

2.2.2. Block truncation coding:

Block truncation coding is well known technique for image compression, It (BTC) divides the original image into small sub blocks of size n x n pixels and after the division of image, it reduces the number of gray levels within each block. reduction of gray level is performed by a quantizer. Threshold and reconstruction values are calculated for each block and a bitmap of the block is obtained for that values. We replace all the pixels whose values are greater than or equal (less than) to the threshold by a 1 (0), in this bit map. Then for each segment (group of 1s and 0s) of the bitmap, reconstruction value is calculated.

2.2.3. Vector quantization:

VQ technique is nothing but the extension of Scalar quantization but with multiple dimensions. code vectors which is a dictionary of fixed-size vectors, needs to be develop,. A given image again divided into non-overlapping blocks, which are called image vectors. Then the closest matching vector in the dictionary is determined for each image vector and its index in the dictionary which is used to encode the original image vector. It is mostly used in multimedia application.

2.2.4. Sub band coding:

The sub band coding split the frequency bands of a signal and then each sub band is coded by encoder .decoder decodes the sub band signal, then it is sampled and passed through the synthesis filter. SBC is generally used in speech coding and image coding.

3. PERFORMANCE PARAMETER:

There are various parameters present which are used to measure the performance of different compression algorithm. Some examples of the performance parameters of image compression are given below:

3.1 Peak signal to noise ratio (PSNR):

PSNR is an important parameter for image compression. It is measurement of the peak error present between the compressed image and original image. For better quality of image PSNR should be as high as possible.

$$PSNR = 10\log_{10}\left(\frac{MAX^2 i}{MSE}\right)$$
$$= 20\log_{10}\left(\frac{MAX\ i}{MSE}\right)$$
$$= 20\log_{10}(MAX\ i) - 10\log_{10}(MSE)$$

3.2 compression ratio:

CR is the ratio of size of compressed image to the size of original image. Compression ratio should be as high as possible to achieve better compression.

$$\text{compression ratio} = \frac{\text{uncompressed size}}{\text{compressed size}}$$

3.3 Mean square error :

Mean Square Error (MSE) is cumulative difference between the original image and compressed image. MSE should be as minimum as possible for better quality of image.

4. LITERATURE SURVEY:

In 2010, Jau Ji Shen et al presents vector quantization based image compression technique [5]. In this paper encoding of the difference map between the original image and compressed image is adjusted and after that it is restored in VQ compressed version. Result of this experiment shows that although this scheme needs to provide extra data, it can improve the quality of Vector quantized compressed images, and further be adjusted according to the difference map from the lossy compression to lossless compression.

In 2011, Suresh Yerva, et al presents the approach of the lossless image compression using the novel concept of image folding [6]. This proposed method uses the property of adjacent neighbor redundancy for the prediction. In this method, column folding followed by row folding is applied iteratively on the image till the image size reduces to a smaller pre-defined value. This method is then compared with the existing lossless image compression algorithms and the obtained result shows a comparative performance of various methods. Data folding method is a simple technique for compression of images which provides good efficiency and offer lower computational complexity as compared to the SPIHT technique of lossless compression.

In 2012, Firas A. Jassim, et al presents a novel method for compressing the image named as Five module method (FMM). In this method they convert each pixel value in 8x8 blocks into a multiple of 5 for each of RGB array [7]. Then After that the value is divided by 5 to obtain new values which are known as bit length for each pixel and uses less storage space than the original values which is 8 bits. This paper shows the potential of the FMM based image compression techniques. The advantage of this method is, it provides high PSNR although it is low CR (compression ratio). This method is good for bi-level like black and white medical images where the pixel of the images is presented using one byte (8 bit). As a recommendation, a variable module method (X) MM, where X could be any number, may be constructed in latter research.

In 2013, C. Rengarajaswamy, et al presents a technique in which encryption and compression of an image is done. first, stream cipher is used to encrypt an image after that a compression technique named SPIHT [14] is used for compressing the image. In this paper stream cipher encryption is used to provide good encryption. SPIHT compression results better

compression ratio as the size of the larger images can be chosen and can be decompressed with the least or no loss in the original image. Thus confidential and high encryption and the best compression rate has been energized to provide better security, hence the main scope or aspiration of this paper is achieved.

In 2012, Yi-Fei Tan, et al presents a technique which utilizes the reference points coding with threshold values for image compression. This paper gives the idea of an image compression method which can be used to perform both lossy and lossless compression [12]. A threshold value is associated in the compression process, by varying this threshold values, different compression ratios can be achieved and if we set the threshold value to zero then lossless compression can be performed. quality of the decompressed image can be calculated during the process of compression. when the threshold value of a parameter assumes positive values, Lossy compression can be achieved. Further study can also be performed to determine the optimal threshold value T.

In 2013, S. Srikanth, et al presents a technique for image compression which uses different embedded Wavelet based image coding with Huffman-encoder for further compression. In this paper they implemented the EZW and SPIHT algorithms with Huffman encoding [15] which uses different wavelet families for compression and after that comparison of the PSNRs and bit rates of these families are made. These algorithms were performed on various images, and it is seen that the results have good quality and it also provides high compression ratio as compared to the previous existing lossless image compression techniques

5. EXPERIMENTAL COMPARISION:

Method	Advantage	Disadvantage
Wavelet	High Compression Ratio State-Of-The-Art	Coefficient Quantization Bit allocation
JPEG	Current Standard	Coefficient (dct) Quantization Bit allocation
VQ	Simple decoder No-coefficient quantization	Slow codebook Generation Small bpp
Fractal	Good Mathematical Encoding-frame	Slow Encoding

6. CONCLUSION:

Basic concept of image compression and various technologies used are discussed in this paper.. We have also discussed advantages and disadvantages of some lossy image compression techniques. This review paper also gives the idea about various image types and performance parameter of image compression. Based on review of different types of images and its Compression algorithms we conclude that the compression algorithm are useful in their related areas and basically depends on the three factors i.e. quality of image, amount of compression and speed of compression.

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