LITERATURE REVIEW OF IMAGE COMPRESSION TECHNIQUE

D.Meenakshi
Assisant Professor
Department of IT and Applications
Shrimati Indira Gandhi College Trichy
d.meenakshi2310@gmail.com

V.Karthika Devi
Assisant Professor
Department of IT and Applications
Shrimati Indira Gandhi College Trichy
Saikarthika2002@gmail.com

Abstract - Image compression is an efficient technique to reduce the size of graphical file and also reduce the storage requirement area. Image compression makes the faster transmission process as well as provides larger bandwidth and also provides security for the data transmission. In this paper provides basic information about image compression techniques and its types and also give the benefits related to these compression techniques. In addition to reduces the instant time necessary used for images to be send in excess of the Internet otherwise downloaded as of Web pages.

Keywords - Lossless technique; Lossy technique; Block truncation coding; Huffman coding; Sub band coding

I. INTRODUCTION

Image compression is a method with the purpose of to reducing the quantity of data necessary to symbolize a digital image by removing the redundant data. It is also be used to decrease the size in bytes of a graphics file devoid of corrupting the value of the illustration to an intolerable level. The decrease in file size allows extra images to be stored in a specified quantity of disk or memory space [1].

Image compression in addition to coding techniques tends to remove three types of redundancies: coding redundancy, inter pixel(spatial) redundancy, and psychovisual redundancy.

a. Coding redundancy:

In this type of redundancy less code terms are used. In this type of coding with the aim of is for eternity reversible as well as typically implemented by lookup tables (LUTs) [3] Examples of image coding schemes that look at coding redundancy are the Huffman codes and the arithmetic coding technique.

b. Inter pixel redundancy:

This kind of redundancy is also called as inter frame redundancy or geometric redundancy, spatial redundancy. This type based on image contains sturdily interrelated pixels, in other words, large regions whose pixel values are the same or almost the same. It can be expressed in several ways; one is by predicting a pixel value based on the values of its neighboring pixels. In order to do so, the original 2-D array of pixels is usually mapped into a different format, e.g., an array of differences between adjacent pixels. If the original image pixels can be reconstructed from the transformed data set the mapping is said to be reversible.

c. Psychovisual redundancy:

Psychophysical aspects of person vision have proven that the human eye is incapable to react with equal compassion to all inward visual in sequence; some pieces of information are more important than others. The knowledge of which particular types of information are more or less relevant to the final human user have led to image and video compression techniques that aim at eliminating or reducing any amount of data that is psychovisually redundant. The end result of applying these techniques is a compressed image file, whose size and quality are smaller than the original information, but whose resulting quality is still acceptable for the application at hand[2]

II. IMAGE COMPRESSION TECHNIQUES

Compression techniques come up to in two general types: lossless and lossy. The name incites, when lossless data is decompressed, the resultant image is one and the same to the original. Lossy compression techniques result in loss of data and the decompressed image is not accurately the identical of the original.[5]

a. Lossless Compression

In lossless compression scheme the reconstructed image, after compression, is numerically identical to the original image. It is used in many applications such as ZIP file format & in UNIX tool gzip. It is important when the original & the decompressed data be identical. Some image file formats like PNG or GIF use only lossless compression. Most lossless compression programs do two things in sequence: the first step generates a statistical model for the input data, and the second step uses this model to map input data to bit sequences in such a way that "probable" (e.g. frequently encountered) data will produce shorter output than "improbable" data.

b. Lossy Compression

Lossy compression method provides superior compression ratio than lossless compression. The compression ratio is high in this method; the decompressed image is not accurately the same to the original image, but close to it. Different types of lossy compression techniques are widely used; it is characterized by the quality of the reconstructed images and its adequacy for application.[9]

III. LOSSLESS COMPRESSION TECHNIQUE

1. Run length encoding
2. Entropy encoding
3. Huffman encoding
4. Arithmetic coding
5. LZW coding

1. Run Length Encoding (RLE)

It is used in lossless data compression.RLE is a simplest type of data compression technique. In this technique data is in the form of runs. Runs are in the form of sequences in which the identical data value occurs in a lot of successive data elements; it is stored as a particular data value in addition to count, moderately than as the unique run. [4]

RLE can be used as a graphics file format. It does not suit for work continuous-tone images such as photographs, even though JPEG it quite successfully on the coefficients that stay after transforming in addition to quantizing image blocks.

2. Entropy encoding

Entropy encoding, is a coding format that involve transfer codes to cryptogram so as to go with system lengths with the probability of the symbols. Obviously, entropy encoders are used to compress data by replace cryptogram represented by the same length codes by means of symbols represented by codes proportional to the negative logarithm of the probability. Therefore, the most common symbols use the shortest codes.[10]

3. Huffman coding

The Huffman‟s algorithm is used to generating minimum redundancy codes compared to further algorithms. This coding has successfully used in text, image, video compression, as well as conferencing system such as, JPEG, MPEg-2, MPEG-4, H.263 etc... This coding method collected the unique cryptogram from the basis image as well as calculates its probability value for each symbol with sorts the symbols based on its probability value. In this coding the probability of symbol value arranged from lowest value to highest value symbol. After that these two values are combined to form a binary tree. [5]

4. Arithmetic Encoding (AC)

It is the mainly authoritative method for statically lossless encoding. It provides extra flexibility plus better competence than the Huffman coding. The main aim of AC is to provide code words with a perfect length.

AC is the most efficient method to code symbols according to the probability of their occurrence. The average code length is very close to the possible minimum given by information theory. The AC assigns an interval to each symbol whose size reflects the probability for the appearance of this symbol. The code word of a symbol is an arbitrary rational number belonging to the corresponding interval.

5. LZW Coding

LZW algorithm is operational based on the happening multiplicity of character sequences in the string to be encoded. In training process the algorithm goes over the flow of information, coding it; if a string is never smaller than the longest word in the dictionary then it s transmitted. In decoding process, the algorithm rebuilds the dictionary in the opposite direction; it thus does not need to be stored. [3]

IV. LOSSY CODING TECHNIQUES

1. Transform coding
2. DCT
3. DWT

1. Transform Coding

Transform coding algorithm typically initiate by partitioning the original image addicted to sub images (blocks)of small size (usually 8 x 8). For each block the change coefficients are calculated, successfully converting the original 8 x 8array of pixel values into an array of coefficients closer to the top left corner usually contain most of the information needed to quantize with encode the image with little perceptual distortion .The resultant coefficients are then quantized and the output of the quantizer is used by a symbol encoding technique(s) to produce the output bit stream representing the encoded image. [6] At the decoder‟s side, the reverse process takes place, with the obvious difference that the „dequantization‟ stage will only generate an approximated version of the original coefficient values; in other words, whatever loss is introduced by the quantizer in the encoder stage is not reversible.

2. Discrete Cosine Transform (DCT)

The DCT process is applied on blocks of 8 * 8 or 16 * 16 pixels, which will convert into series of coefficients, which define spectral composition of the block. The Transformer transforms the input data into a format to reduce inter pixel redundancies in the input image. Transform coding techniques use a reversible, linear mathematical transform to map the pixel values onto a set of coefficients, which are then quantized and encoded [8]. The key factor behind the success of transform-based coding schemes is that many of the resulting coefficients for most natural images have small magnitudes and can be quantized without causing significant distortion in the decoded image..

3. Discrete Wavelet Transform (Dwt)

The DWT represents an image as a sum of wavelet functions, known as wavelets, with different location and scale. The DWT represents the image data into a set of high pass (detail) and low pass (approximate) coefficients. The image is first divided into blocks of 32×32. Each block is then passed through the two filters: the first level decomposition is performed to decompose the input data into an approximation and detail coefficients.[14] After obtaining the transformed matrix, the detail and approximate coefficients are separated as LL, HL, LH, and HH coefficients[7]. All the coefficients are discarded except the LL coefficients that are transformed into the second level. The coefficients are then passed through a constant scaling factor to achieve the desired compression ratio.

V. BENEFITS OF COMPRESSION

- Storage Space compressing data files allows one to store more files in the storage space that is available
- Bandwidth and Transfer Speed Compressed files contain fewer "bits" of data than uncompressed files, and, as a consequence, use less bandwidth when we download them.
- Cost of storing the data are reduced by compressing the files for storage because more files can be stored in available storage space when they are compressed. [10]
- Accuracy also reduces the chance of transmission errors since fewer bits are transferred [11].
- Security also provides a level of security against illegitimate monitoring [11].

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