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A REVIEW PAPER ON COLOR IMAGE COMPRESSION TECHNIQUES

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Abstract: *In this paper we will study the concept of color image compression and the different techniques applied on the color Image Compression. ColorImage Compression is the technique of reducing the image size without degrading the quality of the image and also reducethe storage requirement area. Color Image Compression is the solution associated with transmission and storage of large amount of information for digital Image.Image Compression has become is an indispensable part of digitized image storage and transmission. Compression of an image is necessary before storing and transmitting it due to its limitation of storage and bandwidth capacity.Image compression makes the faster transmission process as well as provides larger bandwidth and also provides security for the data transmission. In this paper,two techniques of color image compression using DCT(Discrete Cosine Transform) and DWT(Discrete Wavelet transform).Image compression system between DCT and DWT using JPEG (Joint Photographic Experts Group) and PNG (Portable Network Graphics) color images.*

Keywords: *DCT, DWT, JPEG, Image Compression and Decompression, PNG, Lossless and LossyImage Compression.*

I. INTRODUCTION:

An image can be defined as a matrix of pixel orintensity values. Color Image compression is used to reducethe redundancy and randomness present in the image because to increase the storing capacity and efficiencylevel of the images. Therefore it is essential tocompress the images by storing only the requiredinformation needed to reconstruct the image. Tocompress any image, redundancy must be removed.Sometimes images having large areas of same colorwill have large redundancies and similarly images thathave frequent and large changes in color will be lessredundant and harder to compress[1-2].Image compression is the application of datacompression ondigital images. In effect, the objective is to reduce redundancyof the image data in order to be able to store or transmit data in an efficient form.The main objective of this paper 0.is to reduce irrelevance and redundancy of the JPEG and PNG image data in order to be able to store or transmit data in an efficient form using DCT and DWT [3].

II.COLORIMAGE COMPRESSIONAND DECOMPRSSION:

As shown in Fig.1, First of all the image is taken from the image dataset. The mapper converts the input image into inter pixel coefficients. Transformation for the mapper may be DCT, wavelet transform. Each has its own advantages and disadvantages.

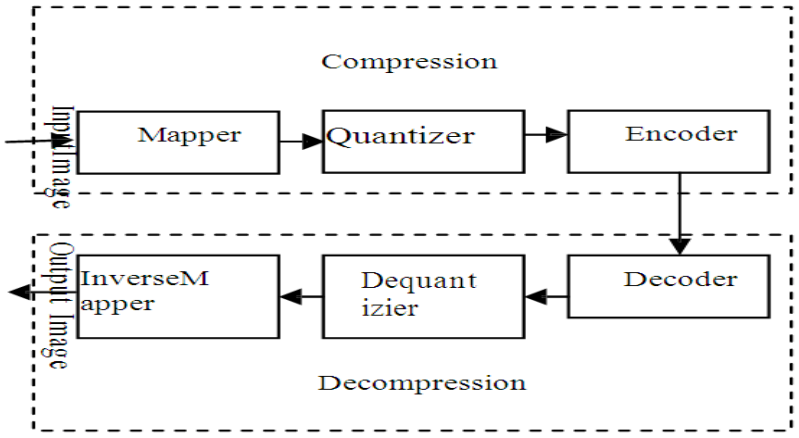

Fig. 1. Image Compression and Decompression

SecondstageistheQuantizerwhichsimplyreducesthenumberofbitsneededtostorethetransformedcoefficients.Itismanytoonemapinginwhichlargervaluesarequantizedintosmallervalue.Itisalossyprocessanditisthemainsourceofcompressioninanencoder.Quantizationreducedthenumberofbitssoitresultssomekindofinformationloss.Quantizercanbescalarorvectorquantization[4].InscalarQuantizerquantizationisperformedoneachcoefficientwhileinvectorquantizationitcanbeperformedon groups.
Anentropyencodercompressedthequantizedvaluesandimprovesthecompression.ThereverseProcessDecoder,Dequantizerandinversemapperisobtainedtoreconstructtheimageanditiscalleddecompression.

II.1PERFROMANCEPARAMETERS:

Therearetwoperformanceparametersareusedtomeasuretheperformanceoftheimagecompressionalgorithms.OneisPSNR(peaksignaltonoiseratio)andsecondisMeansquareerror(MSE).PSNRisthemeasurementofthepeakerrorbetweenthecompressedimageandoriginalimage.ThehigherthePSNR contains better quality ofimage[3-4].
TocomputethePSNRfirstofallMSE(meansquareerror)iscomputed.
MeanSquareError(MSE)isthecumulativedifferencebetweenthecompressedimageandoriginalimage.SmallamountofMSEreducetheerror andimprovesimagequality.

$$MSE = \frac{\sum_{M,N} [I_1(m,n) - I_2(m,n)]^2}{M * N} \quad \textbf{II.1}$$

In the previous quation,*M*and*N*arethenumberofrowsandcolumnsintheinput images.
The PSNR is computed from following equation

$$PSNR = 10\log_{10}\left(\frac{R^2}{MSE}\right) \quad \textbf{II.2}$$

III.COMPRESSION ALGORITHM:

There are Two types of compression algorithm: Loss less and Lossy.

A.Lossless compression Techniques:
In lossless compression scheme, shown in Fig.2 the reconstructed image, after compression, is numerically identical to the original image. However lossless compression can only achieve a modest amount of compression. Lossless compression can reduce it to about half that size, depending on the type of file being compressed. This makes lossless compression convenient for transferring files across the Internet, as smaller files transfer faster.

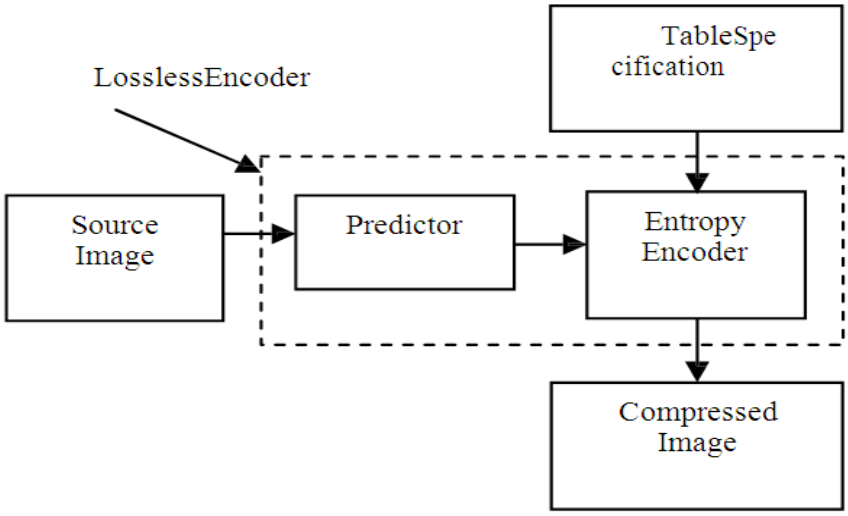

Fig. 2. Block Diagram for Lossless Compression

Different Encoding and Decoding Methods for Loss less compression are discussed below.

a.RLE (Run Length Encoding):

RLE is the simplest image compression technique in which sequence of identical symbols are replaced by a pair containing the symbol and the length at which the number is repeated.[8]. it is widely accepted compression technique in the fax standard.

b. *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]

c. Arithmetic Encoding:

Arithmetic encoding was introduced by Rissanen in which the last symbol is encoded and decoded first.[11]Arithmetic encoding is based on following principle.

- The symbol alphabet should not infinite.
- All possible symbol sequence of give length should not infinite
- The number of real number in the interval [0,1] can assign a unique subinterval for any given input sequence of symbols.

d. LZW coding:

It is dictionary based coding, 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 introduced.

B. Lossy Compression Techniques:

Lossy compression technique provides higher compression ratio compare to lossless compression. In this method, the compressed image is not same as the original image; there is some amount of information loss in the image. Lossy compression scheme is shown in fig. 3

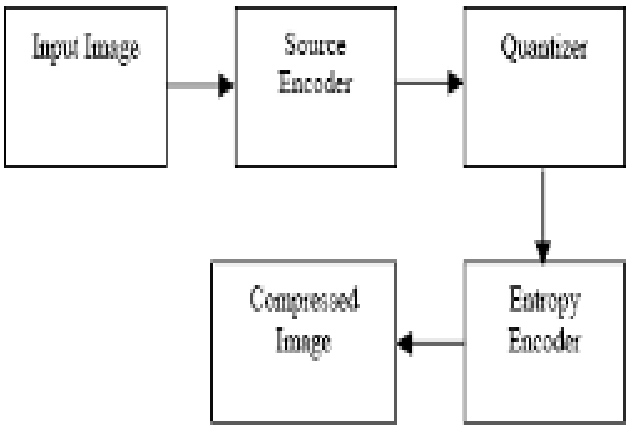

Fig.3.BlockDiagramforLossyCompression

a. Transform Coding:

TransformCodingalgorithmusuallystartsbypartitioningtheoriginalimageintosmallblocksofsmallersize.Thenforeachblockrelatedtransformcoefficientsareobtainedbasedontheirtransform,DCT,waveletandCurveletaretheexampleofthetransformcoding.Theresultingcoefficientsarethencomputedbyquantizationtechniquesandthentheoutputofthequantizerisusedforsymbolencodingtechniquetoproducetheoutput.Atthedecoderthereverseprocessisobtainedandimageisreconstructed.

b. 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.

c. 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.

IV. 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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