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# A Review of Block based Image Compression Using Hybrid Techniques

[1] S.Narasimhulu, [2] Dr.T.Ramashri
[1] Lecturer Dept of ECE, SKU College of Engineering & Technology, S K University, Anantapuramu, India.
[2] Professor, Dept of ECE, S .V.U College of Engineering, S.V.U College of Engineering, Tirupati, India.

***Abstract:* -- This Paper gives review of different types of Images and the different techniques for Image Compression. Based on this Review we recommended general method for Image Compression. Image Compression is the technique of reducing the image size without degrading the quality of the image. Various types of images and different compression techniques are discussed here. Image Compression is the solution associated with transmission and storage of large amount of information for digital Image. SPIHT is computationally very fast and among the best image compression algorithms known today. According to statistic analysis of the output binary stream of SPIHT encoding, propose a simple and effective method combined with Huffman encode for further compression. In this paper the results from the SPHIT algorithm are compared with the existing methods for compression like discrete cosine transform (DCT) and discrete wavelet transform (DWT).**

***Keywords:* Encoding; Decoding; DCT; Mean Square Error (MSE), Peak Signal-to-Noise Ratio (PSNR).DWT; SPIHT; Huffman coding**

## I. INTRODUCTION

The image compression is the mechanism by which size of the image is reduced. In order to enhance, the image processing is used. The image compression and enhancement will go side by side. The image transfer process will take large amount of bandwidth. This bandwidth consumption has to be minimized. When image is compressed then same space can be used by other images on the disk drive. The image compression tools are available and are used using the simulator like MATLAB. There are number of mechanisms which can be used for the image compression. Those are divided into two categories.

1. Lossy Compression
2. Lossless Compression

Lossy compression is the one in which there is a chance that some of the pixels might be lost during the process of encoding and decoding. Lossless compression on the other hand ensures that the image will be compressed and decompressed without the loss of the pixels. In the proposed paper the analysis of lossless compression techniques is studied. Some of them are Huffman Encoding, Run Length Encoding etc. The encoding mechanism which is suggested will compress the image and also image dimensions are preserved after decryption.

The image is a 2 Dimensional signal representedby Digital system. Normally Image taken from the camera is in the analog form. However for processing, transmitting and storage, images are converted in to digital form. A Digital image is basically 2 – Dimensional array of pixels [1]. Basically compressing of image is different than compressing digital data. General purpose Data compression algorithm can be used for Image compression but the result is less than optimal. Different types of images are used in remote sensing, bio medical and video processing techniques which require compression for transmission and storage. [2].Compression is achieved by removing redundant or extra bits from the original image.

The discrete cosine transform (DCT) [1], is a technique for converting a signal into elementary frequency components. It is widely used in image compression. Here we develop some simple functions to compute the DCT and to compress images [2]. These functions illustrate the power of Mathematical in the prototyping of image processing algorithms. In recent years, wavelet transform [3],[4] as a branch of mathematics developed rapidly, which has a good localization property[5] in the time domain and frequency domain, can analyze the details of any scale and frequency. So, it superior to Fourier and DCT. It has been widely applied anddeveloped in image processing and compression.

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## II. RELATED WORK

The work has been done toward the lossy as well as lossless compression techniques. All of these techniques are discussed in this paper. [1] This paper will include the mechanism of enhancing the color image patterns. The image which is enhanced will be based upon the discrete cosine transformations. The transformation process will be lossless in nature. [2]In this paper, image compression will be used in order to reduce the size of the image. Block optimization and byte compression will be done within this paper. The compression technique which is used is lossless in nature [3].

Data compression is a common requirement for most of the computerized applications. There are number of data compression algorithms, which are dedicated to compress different data formats. Even for a single data type there are number of different compression algorithms, which use different approaches. This paper examines lossless data compression algorithms and compares their performance. A set of selected algorithms are examined and implemented to evaluate the performance in compressing text data. An experimental comparison of a number of different lossless data compression algorithms is presented in this paper. The article is concluded by stating which algorithm performs well for text data [4].

The image compression technique which is used in this paper is run length encoding technique. The image compression will be in the form of replacement of characters with the number indicating the number of occurrences of the characters. The stuffing is also used in this case in order to identify the beginning and ending of the bits of the image.

Digital image is basically array of various pixel values.[1] In the digital image Pixels of neighborhood are correlated and so that this pixels contain redundant bits. By using the compression algorithms redundant bits are removed from the image so that size image size is reduced and the image is compressed.

Image compression Have two main Components:redundancy reduction and irrelevant data reductionredundancy reduction is achieved by removing extrabits or repeated bits. While in irrelevant reduction thesmallest or less important information is omitted,which will not received by receiver. There are threetypes of redundancies.

Coding redundancy is present when less umber ofcode words required instead of larger symbol. Inter pixel redundancy results from correlated pixels of an image. In psycho visual redundancy data is ignored by the normal visual system. Image compression is applied to reduce the number of bits which represent the image.

## III. PERFROMANCE PARAMETERS

There are two performance parameters are used to measure the performance of the image compression algorithms. One is PSNR (peak signal to noise ratio) and second is Mean square error (MSE). PSNR is the measurement of the peak error between the compressed image and original image. The higher the PSNR contains better quality of image.

To compute the PSNR first of all MSE (mean square error) is computed. Mean Square Error (MSE) is the cumulative difference between the compressed image and original image. Small amount of MSE reduce the error and improves image quality. Normalized cross correlation is also calculated for compressed images

$$MSE = \frac{1}{MXN}\sum_{x=1}^{M}\sum_{y=1}^{N}[I(x,y) - \bar{I}(x,y)]^2$$

In the above equation, M and N are the number of rows and columns in the input images. The PSNR is computed from following equation.

$$PSNR = 20\log_{10}\left(\frac{MAX_i}{\sqrt{MSE}}\right)$$

$$NC = \frac{\sum_{i=1}^{i=n-1}\sum_{j=1}^{j=n-1} W(i,j).W'(i,j)}{\sqrt{\sum_{i=1}^{i=n-1}\sum_{j=1}^{j=n-1}(W(i,j))^2}.\sqrt{\sum_{i=1}^{i=n-1}\sum_{j=1}^{j=n-1}(W'(i,j))^2}}$$

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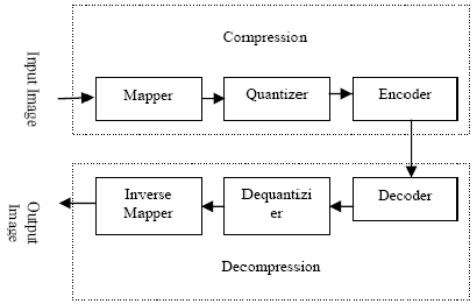


***Figure 1: General Compression and Decompression***

As shown in Figure 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 or Curvelet transform. Each has its own advantages and disadvantages.

An entropy encoder compressed the quantized values and improves the compression. The reverse Process Decoder, De-quantizer and inverse mapper is obtained to reconstruct the image and it is calleddecompression.

## IV. COMPARISON OF TECHNIQUES

The techniques which are used in the existing papers are listed and describe through the tabular structure as follows

| S No | Paper | Year | Characteristics |
|---|---|---|---|
| 1 | Review of The Image Compression And Enhancement Techniques | 2016 | 1 A combined approach using arithmetical coding and RLE is considered 2 Lossless compressions are considered. |
| 2 | A New Color Image Compression Based on Fractal and Discrete Cosine Transform | 2014 | 1 Color Images are considered in this case 2 Discrete Cosine Transformation is followed in this case. 3 Lossless Image compression is followed in this case |
| 3 | An Efficient Image ompression Algorithm Based on Block Optimization and Byte Compression | 2010 | 1 Block optimization is considered 2 Byte Compression is performed. 3 Lossless Image Compression is performed |

## V. COMPRESSION ALGORITHMS

There are Two types of compression algorithm: Lossless and Lossy. In the loss less compression the compressed image is totally replica of the original input image, there is not any amount of loss present in the image. While in Lossy compression the compressed image is not same as the input image, there is some amount of loss is present in the image.

### *A. Lossless compression Techniques*

In lossless compression scheme reconstructed image is same to the input image. Lossless image compression techniques first convert the images in to the image pixels. Then processing is done on each single pixel. The First step includes prediction of next image pixel value from the neighborhoodpixels. In the second stage the difference betweenthe predicted value and the actual intensity of thenext pixel is coded using different encodingmethods. Different Encoding and Decoding Methods for Lossless compression are discussed below:

### *B. 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.

### *C. Statistical Coding*

The following techniques are included. 1. Huffman Encoding, 2. Arithmetic Encoding 3.LZE Encoding. [9][10]

### *D. Huffman Encoding*

Huffman coding can reduce the file size by 10% to 50% by removing the irrelevant information. In this technique smaller bit code is given to the pixel values which occur frequently and the higher bit code for repeated pixel value. In order to encode images.

- First of all image is divided in to 8X8 blocks
- Then each block is coded with particularsymbols
- Huffman code is applied to the each block
- Encoding all the blocks.

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### *E. 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 anygiven input sequence of symbols.

### *F. 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.

### *G. Area coding*

It is an enhanced version of the RLE. Area coding is highly effective and it can give better compression ratio but it has certain limitation that it can be applied to non linear transformation

### *H. 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 figure 2.

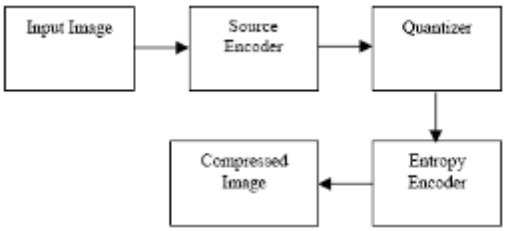


***Figure 2: Lossy Compression Techniques***

### *I. Transform Coding*

Transform Coding algorithm usually starts by partitioning the original image into small blocks of smaller size. Then for each block related transform coefficients are obtained based on their transform, DCT, wavelet and Curvelet are the example of the transform coding. The resulting coefficients are then computed by quantization techniques and then the output of the quantizer is used for symbol encoding technique to produce the output. At the decoder the reverse process is obtained and image is reconstructed.

### *J. Block Truncation coding*

In this the image is divided into non overlapping blocks of pixels. Then the quantizer is used to find mean of the pixel values of the all the non overlapping blocks. After that thresholding is done so that the image pixels above the threshold values are set to zero or one. Then for each segment in the bitmap the related reconstruction value is obtained. Larger block size gives greater compression ratio but it reduces the quality of an image.

### *K. Sub –band Coding*

The sub band coding split the frequency bands of a signal and then each sub band is coded by encoder and bit rate which is related to that particular band.[12]. SBC is generally used in speech coding and image coding. At the decoder the sub band signals are decoded and un sampled and passed through a synthesis filters. Then all the sub band coefficients are properly summed up to yield the compressed image.

### *L. Vector quantization*

Vector quantization (VQ) technique is the extensionof Scalar quantization in multiple dimensions. Thistechnique develops a dictionary of fixed-size vectorswhich are called code vectors. A given image againpartitioned into non-overlapping blocks called imagevectors. Then for each image vector, the closestmatching vector in the dictionary is determined andits index in the dictionary is used as the encoding ofthe original image vector [13]. Because of its fastlookup capabilities at the decoder side, VectorQuantization-based coding schemes are normallyused in multimedia applications.

## IV. CONCLUSION AND FUTURE WORK

In this paper a review of various techniques of image compression is followed. The image compression can be lossy as well as lossless in nature. The lossy techniques are considered in this case. The study of Run Length encoding is the prime objective of

this paper. The run length encoding is simple of all the encoding schemes available to be used. The stuffing is used in order to identify the beginning and ending of the bits. In the future we will propose the redundancy handling mechanisms to reduce the length of the image further.

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