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Review Paper on Image Compression Using Lossless and Lossy Technique

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Abstract*— As we know today to store data is a big issue that's why we are shifting towards cloud computing which is very advanced technology. Besides this if we compress our data that means which can take less space as compared to original data. There are lots of techniques to compress data and in our research we will implement some of them. Basically compression is of two type lossy and lossless. Compressing an image is significantly different than compressing raw binary data. If we used general or outdated technique to compression images then result would be not optimal as it should be. This is because images have definitely statistical properties which can be triggered or exploited by encoders which are implemented or design for them. In image we have to give up some fine details for the sake of saving a little more bandwidth or storage space. So we can say that lossy compression technology. In this dissertation compression of digital images are done with the help of DCT. Several encoding technique have also been used together with DCT to improve the performance of compression. A computational analysis of picture quality is also made with respect to compression ratio and PSNR

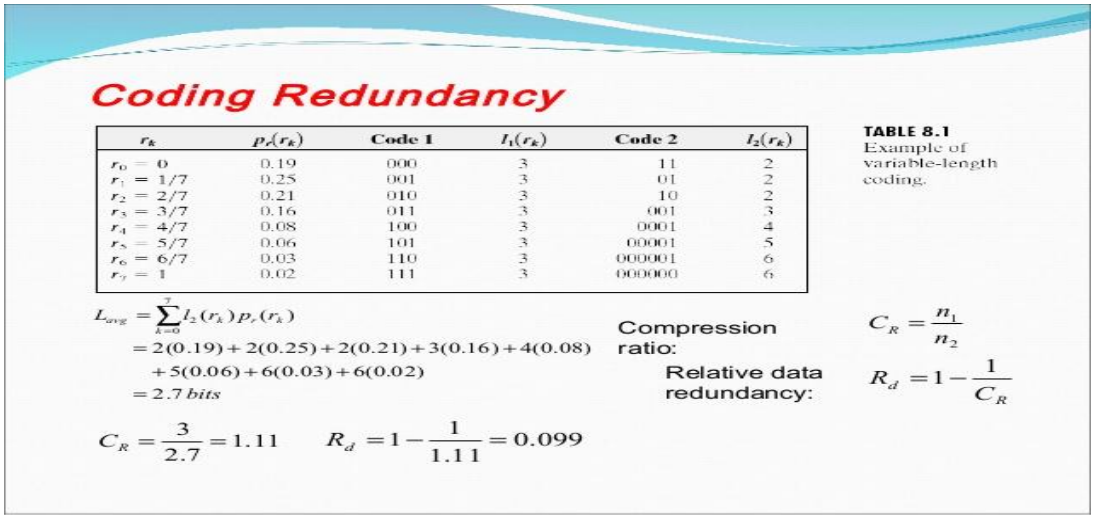
Keywords*— Lossy, DCT, PSNR, Scaling Factor, Compression Ratio, Triggered, Redundancy.

I. INTRODUCTION

An image may be defined as a two-dimensional function, for example let f(x, y) is a function and it depend on two variable so f is dependent on independent variable x and y, where x and y are plane coordinates. We know when we take an image which is function of x and y then with help of x and y we can calculate the intensity level of image or can say pixel. As we know intensity value lies between o to 255. At every point intensity level would be different it depend upon which type of image we fetched [1-3]. When x, y and the amplitude values of f are all finite, different quantities, we can call the image a digital or binary form. Digital image processing allows the use of complicated algorithms for image processing, and hence, can offer both more sophisticated performance at simple tasks and the implementation of different approach which would be impossible by analog means. In particular, digital image processing is one of the best practical technology for Classification, Feature extraction, Projection, Multi-scale signal analysis. DIP techniques are generally more versatile, reliable, and accurate. They have the additional profit of being easier to analyse or evaluate than their analog counterparts. Specialized hardware is still used for digital image processing: computer structures based on pipeline processing have been the most commercially successful [7-8].

(A) Principle behind Compression: Digital image is made up of a large number of pixels and every image consist numerous number of pixels with each pixel defined by a numeric which provide color. Data compression degrades picture quality and due to which some information is lost [4]. We know every neighbour pixel have some correlation and therefore contain redundant information. Now our main task then is to find less correlated representation of the image. Two major or fundamental parts of compression are irrelevancy reduction and redundancy.

Coding Redundancy: When gray levels of an image or data are coded in such a way that which uses more code symbols than absolutely necessary to represent each gray level, final image is said to contain coding redundancy.



r_k	$p_r(r_k)$	Code 1	$l_1(r_k)$	Code 2	$l_2(r_k)$
$r_0 = 0$	0.19	000	3	11	2
$r_1 = 1/7$	0.25	001	3	01	2
$r_2 = 2/7$	0.21	010	3	10	2
$r_3 = 3/7$	0.16	011	3	001	3
$r_4 = 4/7$	0.08	100	3	0001	4
$r_5 = 5/7$	0.06	101	3	00001	5
$r_6 = 6/7$	0.03	110	3	000001	6
$r_7 = 1$	0.02	111	3	000000	6

$$L_{avg} = \sum_{k=0}^{7} l_2(r_k) p_r(r_k)$$
$$= 2(0.19) + 2(0.25) + 2(0.21) + 3(0.16) + 4(0.08) + 5(0.06) + 6(0.03) + 6(0.02)$$
$$= 2.7 \text{ bits}$$

$$C_R = \frac{n_1}{n_2} \qquad R_d = 1 - \frac{1}{C_R}$$

$$C_R = \frac{3}{2.7} = 1.11 \qquad R_d = 1 - \frac{1}{1.11} = 0.099$$

Figure 1 coding redundancy procedure

II. LITERATURE SURVEY

In today's communicative and multimedia computing world, JPEG images play a vast consequential role. The JPEG images have been able to satisfy the users by fulfilling their demand of preserving numerous digital images within considerably less storage space. Although the JPEG standard offers four different sorts of compression mechanism, among them the Baseline JPEG or Lossy Sequential DCT Mode of JPEG is most popular since it can store a digital image by temporarily removing its psycho visual redundancy and thereby offering a very less storage space for a large image. In these day we use of digital imaging is implemented in many applications e.g., object recognition, satellite imaginary, biomedical instrumentation, digital entertainment media, internet etc. The main function of the Digital image processing is to provide the clear picture as per the interest while attenuating detail irrelevant to a given application, and the information regarding the scene is taken out from the improved image [13-14]. With the help of the digital image processing one can get the reversible, virtually modified image which is noise free and the image is in the form of matrix integers in place of the classical darkroom manipulations or filtration of time-dependent voltages which is necessary for analog images and video signals. Present image processing algorithms are extremely helpful. A digital image, or "bitmap", consists of a grid of dots, or "pixels", with each pixel defined by a numeric value that gives its color. . Let us assume that a random variable r_K lying in the interval [0, 1] represents the gray levels of an image and that each r_K occurs with probability $P_r(r_K)$.

$$P_r(r_K) = N_k / n \text{ where } k = 0, 1, 2\ldots L\text{-}1$$

L = No. of gray levels.

N_k =No. of times that gray appears in that image

N = Total no. of pixels in the image

If no. of bits used to represent each value of r_K is $l(r_K)$, the average no. of bits required to represent each pixel is

$$L_{avg} = l(r_K) P_r(r_K)$$

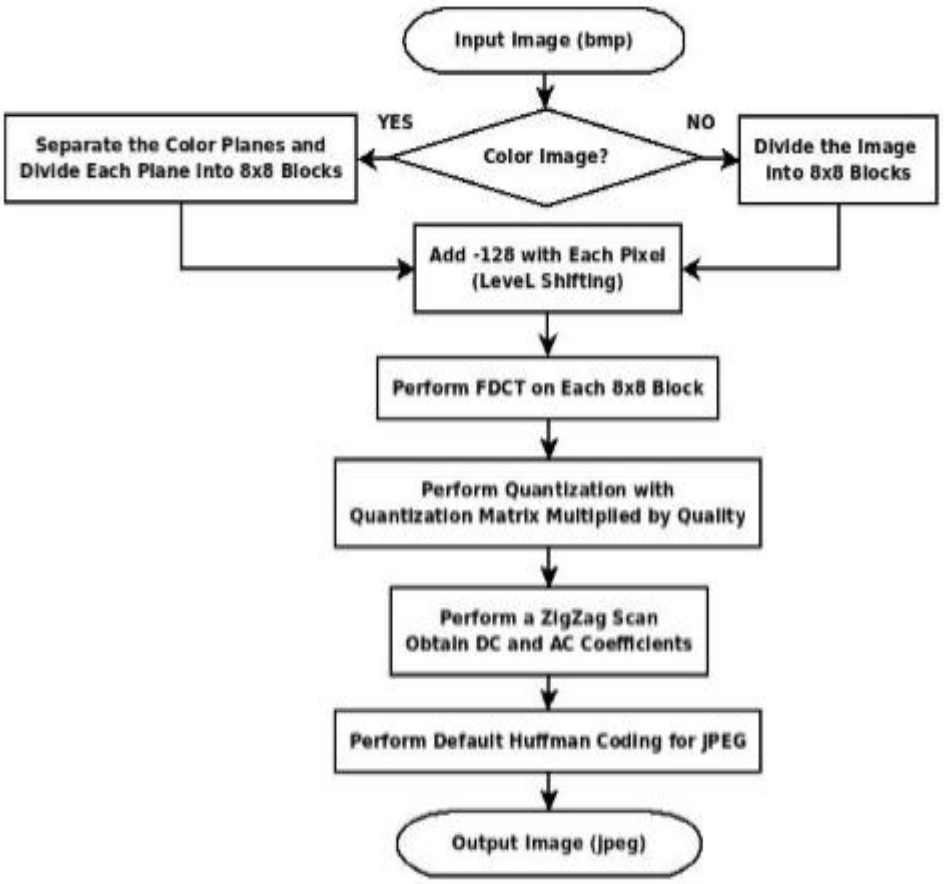


Figure 2 Flowchart of Baseline JPEG

III. PLANNING OF WORK/METHODOLOGY

Types of Compression

Lossy Compression: Lossy Compression means compressed image when decompressed back, isn't quite the same as the one we first started. More compression means more decrement in size of image and more reduction in Image Quality. Ex. JPEG- good for storage

Lossless Compression: This scheme does not lose any of the image data when the compressed image is decompressed back. That is the images look exactly the same as the first one. But the compression achieve by of this lossless scheme isn't quite as high as lossy, usually about 2:1[6]

Lossless versus Lossy Compression: Lossless compression has many applications and used generally for technical drawings, clip art, comics, archival purposes and often medical imaging. Lossy compression methods introduce compression artifacts, when it is used at low bit rates. When an image is formed by lossy compression technique than reconstructed image quality degraded as compared to original image. Lossy schemes can achieve higher compression ratio as compared to lossless scheme. Example of lossy scheme where it is used is natural images such as photos in applications where minor (sometimes imperceptible) loss of information can be considered to get a substantial reduction in bit rate[15]. With pace of time there is improvement in technology and there are two type of compression lossy and lossless. Predictive coding is a spatial domain technique. In predictive coding, information already sent or available is used to predict future values, and the difference is coded. Since this is done in the image or spatial domain, it is relatively simple to implement and is readily adapted to local image characteristics.

Differential Pulse Code Modulation (DPCM) is one particular example of predictive coding. Transform coding, on the other hand, first transforms the image from its spatial domain representation to a different type of representation using some well-known transform and then codes the transformed values (coefficients). This method provides greater data compression compared to predictive methods, although at the expense of greater computational requirements [17]. We will work over two method of image compression. However both are based on DCT but the encoding technique has been changed. In this section a brief overview of approaches are explained with the help of flow chart

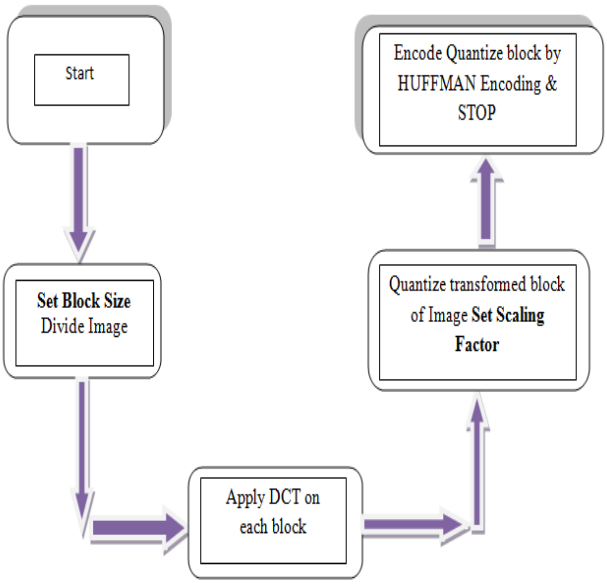


Fig.3 Flow Chart for DCT Image compression with Huffman Encoding

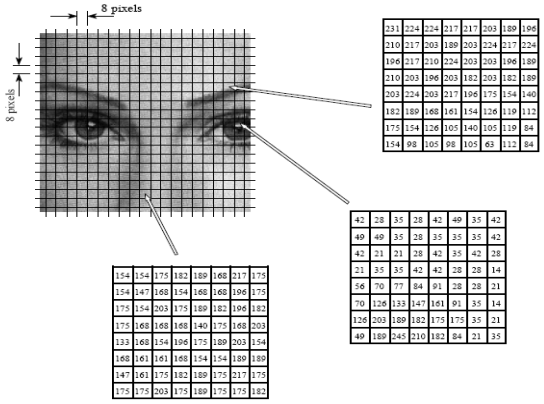


Figure 4 Division of Image in Blocks

Why use 8×8 pixel groups instead of, for instance, 16×16. The 8×8 grouping was based on the maximum size that IC technology could handle at the time the JPEG standard was developed.

DCT image compression with Huffman encoding

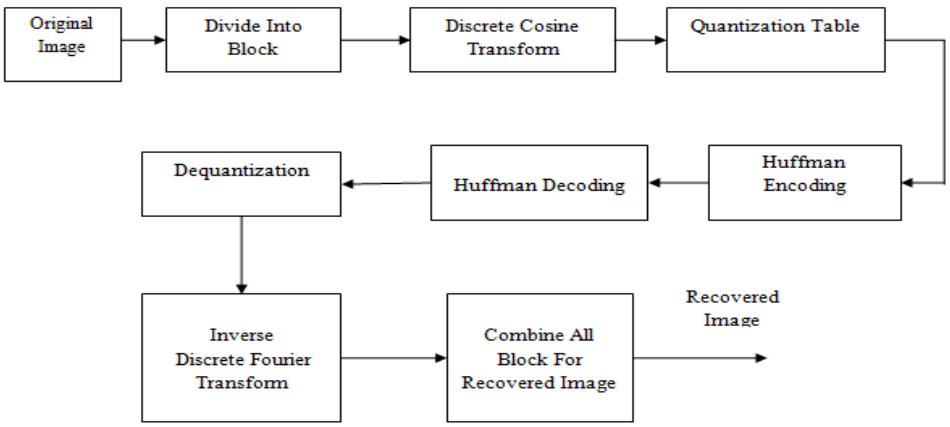


Figure 5 Block diagram of DCT Compression and Decompression with Huffman Encoding

IV. SOFTWARE USED AND SIMULATION RESULT

Software: MATLAB Version R2015a: It is powerful software that provides an environment for numerical computation as well as graphical display of outputs. In Matlab the data input is in the ASCII format as well as binary format. It is high-performance language for technical computing integrates computation, visualization, and programming

in a simple way where problems and solutions are expressed in familiar mathematical notation.

- Acquisition, Data Exploration, Analysing &Visualization
- Engineering complex drawing and scientific graphics
- Analysing of algorithmic designing
- Mathematical and Computational functions
- Modelling and simulating problems prototyping
- GUI (graphical user interface) building environment.

Using MATLAB, you can solve technical computing problems very easily and time saving as compared to traditional programming languages, such as C, C++, and FORTRAN.
The name MATLAB stands for matrix laboratory.

MATLAB Features

- MATLAB is a high-level language used for numerical computation, visualization, and application development
- It create very friendly environment for iterative exploration, design, and problem solving
- Mathematical functions for solving ordinary differential equations, Fourier analysis, linear algebra, statistics, filtering, optimization, numerical integration
- Development tools for enhancing code quality and maximizing performance
- Tools for building applications with custom graphical interfaces (GUI)
- Functions for integrating MATLAB based algorithms with external applications and we can able to generate code in hex file, c, embedded etc.

CONCLUSION

In this thesis we will work on different field like image compression using DCT. In which we analyse what will be impact of quality factor on image when we will increase value of quality factor value and observe the impact on following parameter for example peak signal to noise ratio, processing time of DCT, compression ratio and processing time of IDCT. As we change the value of quality factor then all these parameters value changes. Now we have to analyse the pattern to carry out a final conclusion. As we increase value of quality factor then image compression ratio will must be increased it means that quality of image degraded but size of image will be decreased so that when we have to transmit image over channel or through electromagnetic waves it can be transmitted easily and take less time. One point is very crucial that we did not increase value of quality factor so much high that its quality will be se degraded that at receiver side we cannot access valuable information so over all we can say if compression ratio will be high image quality will be worst so we have to take a trade off between these parameters. On other hand very PSNR (peak signal to noise ratio) is very important parameter. CR and PSNR are inversely proportional to each other and we have to make a trade-off between these two parameters.

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