IMAGE COMPRESSION USING MATLAB

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ABSTRACT

Making, altering, and producing pictures in an exceptionally customary framework today is a noteworthy need. The first picture information produced by the camera sensor is extensive to store, so the productivity isn't high. Portable or data transfer capacity constrained frameworks turn out to be especially unwieldy, where the article is a moderate transmission capacity cost, for example, the World Wide Web. This circumstance requires the utilization of productive picture pressure systems, for example, JPEG calculation strategies, that see pictures with no loss of compacted picture stature. Today, the JPEG calculation has turned into the real standard for picture pressure. Can be the quantity of equipment MATLAB code yield to the quantitative DCT adaptation of the information picture and innovation used to accomplish a quick method to examine the JPEG calculation.

Keywords- Compression, Discrete Cosine Transform, Wavelet Transform.

I. INTRODUCTION

JPEG THEORY-JPEG is an image compression standard for storing images in compressed format. It represents the Joint Photographic Experts Group. The excellent quality of JPEG is to achieve high compression ratio, the quality of almost no loss. The JPEG format is very popular and is used to switch large images of multiple devices, such as digital cameras, and is selected in an environment with limited bandwidth, such as the Internet format. JPEG algorithm is best suited for photo and realistic scenes, tone and color screen uniform changes. JPEG does not apply to many edges and sharp changes, as this may result in many image artifacts in the resulting image. In these cases, it is best to use lossless formats such as PNG, TIFF or GIF. Thus, JPEG is not used for medical and scientific applications where the image needs to be accurate and a slight error cannot result in the retrieval of the captured data. JPEG images may accept further loss if it is often edited and then saved. Decompression and recompression operations can further reduce image quality. To solve this problem, the image should be edited and saved in lossless format and can only be converted to JPEG format before the final transfer to the desired media. This ensures minimal loss due to frequent savings. Save as a JPEG image file usually has an extension such as .jpg, jpeg or .jpe

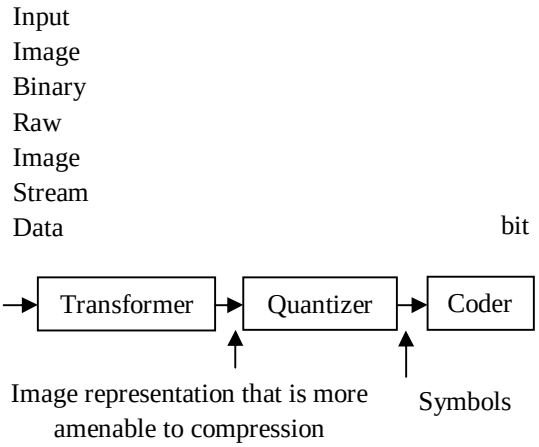

Fig.1 Typical Image Compression System

Types of Compression System: There are two types of compression system

1. Lossy compression system

2. Lossless compression system

1. Lossy Compression System

Lossy compression techniques can be used in image where some of the finer details in the image can be sacrificed for the sake of saving a little more bandwidth or storage space.

2. Lossless Compression System

Lossless compression system which aim at minimizing the bit rate of the compressed output without any distortion of the image. The decompressed bit-stream is identical to original bitstream

II. LITERATURE SURVEY

MISS ANAMIKA, Now a days Create, edit, and generate images in a very regular system for transmission is main priority. Original image data generated by the camera sensor is a very large store, and therefore is not efficient. It has become particularly troublesome to move or bandwidth-limited systems wherein the object is to be conservative bandwidth cost, such as the World Wide Web. This scenario requires the use of efficient image compression techniques, such as the JPEG algorithm technology, the quality of the compressed image height to which the perceived image with almost no loss. Today JPEG algorithms have become the de facto standard for image compression. The amount of hardware MATLAB code can be output to a quantized DCT version of the input image and techniques used to achieve expeditious manner JPEG algorithm were investigated procedures.

Dr. Madan Mohan, Digital Image Processing (DIP) is performed using sophisticated computer algorithms on satellite's raw imagery. The main processes are as image rectification and restoration i.e. geometric and radiometric corrections; image enhancement i.e. effective display for interpretation; and geospatial information extraction using digital classification and thematic geovisualisation. In other words, satellite's digital imagery requires algorithmic processing to achieve better outcome in real time for real world. The usage of specific algorithms depends on individual's goals for specific purpose. So, digital processing of imagery is based on complex algorithms processed in high-end sophisticated processor for simple tangible tasks. As a result, processed remote sensing satellite imagery have been more popularity in earth's resources exploration and management for sustainable regional development.

Prabhakar.Telagarapu, V.Jagan Naveen, A.Lakshmi..Prasanthi, G.Vijaya Santhi, Image compression is a widely addressed researched area. Many compression standards are in place. But still here there is a scope for high compression with quality reconstruction. The JPEG standard makes use of Discrete Cosine Transform (DCT) for compression. The introduction of the wavelets gave a different dimensions to the compression. This paper aims at the analysis of compression using DCT and Wavelet transform by selecting proper threshold method, better result for PSNR have been obtained. Extensive experimentation has been carried out to arrive at the conclusion.

Vaibhav Raman, Richa Gupta, To reduce the redundancy of image, image compression is used in order to store data in much more effective way. For effective & efficient image compression integer wavelet transform has been introduced. The aim of the integer wavelet transform is to get maximum compression ratio possible. Decomposition of image takes place up to certain levels; at different levels the value of image compression is different. Maximum compression & minimum compression can be achieved by integer wavelet transform method.

Kanchan Bala and Deepinder Kaur, The image compression is the technique in which image is compressed to reduce its size and complexity. The two type of compressions are used which are lossy and lossless compressions. The lossy is the type of compression which information of the image is lost at the time of compression. The ASWDR algorithm is the lossy type of compression algorithm which access textural and color features of the image. To improve efficiency of ASWDR algorithm decision tree is used for classification. The decision tree classifies the pixels which are required and which are not required and not required are removed from the image. The proposed technique performs well in terns of PSNR, MSE and compression ratio.

III. PROPOSED WORK

Compression. Transform the sub-blocks to associate the image data, thereby reducing inter frame redundancy. The transform is a lossless operation, so the inverse transform can be the perfect reconstruction of the original image. Quantize sub blocks using the fact that the human eye can not perceive some of the visual information in the image. This information is considered redundant and can be discarded without introducing significant visual artifacts.

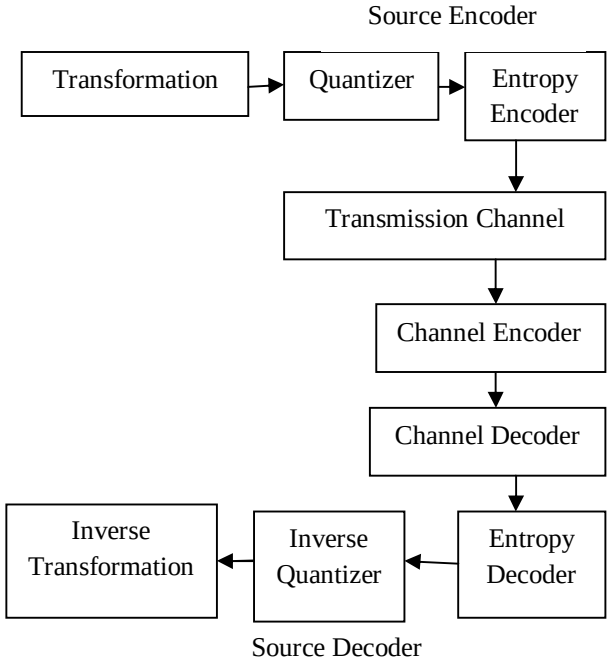

Fig.2 Components of Typical Image/Video Transmission

This redundancy is called mental vision redundancy. This idea can be extended to low bit rate receivers, due to its strict bandwidth requirements, may sacrifice visual quality to achieve bandwidth efficiency. This concept is the basis of the theory of rate distortion, that is, the receiver can tolerate some visual distortion to exchange bandwidth protection. The entropy encoder uses its conversion knowledge And quantization processing to reduce the number of outputs required for each symbol when quantized. Discrete cosine transform (DCT) has become the de facto image transform in most visual systems. DCT has been widely deployed by modern video coding standards such as MPEG, JVT and so on.

TECHNIQUES USED FOR IMAGE COMPRESSION

A. Image Compression Model

Image compression system is composed of two distinct functional components: an encoder and a decoder. The encoder performs the complementary operation of compression, and the decoder performs the complementary operation of decompression. Both compression and decompression operations can be performed in software, as in the case in web browsers and many commercial image editing programs, or in a combination of hardware and firmware, as in commercial DVD players. A codec is a device or program that is capable of both encoding and decoding.

Input image f(x, y) is fed into the encoder, which creates a compressed representation of the input. This representation is stored for latter use, or transmitted for storage and use at a remote location. When the compressed representation is presentation is presented to its complementary decoder, a reconstructed output image f^(x, y) is generated. In general, f^(x,y) may or may not be a replica of f(x,y). If it is, the compression system is called error free, lossless or information preserving. If not, the reconstructed output image is distorted and the compression system is referred to as lossy.

B. The Encoding or Compression Process:

The encoder is designed to remove the redundancies. In the first stage of the encoding process, a mapper transforms f(x, y) into a format designed to reduce spatial and temporal redundancy. This operation generally is reversible and may or may not reduce directly the amount of data required to represent the image. The run length coding is an example of the mapping that normally yields compression in the first step of encoding process. The quantizer reduces the accuracy of the mapper's output in accordance with per-established fidelity criterion. The goal is to keep irrelevant information out of the compressed representation. This operation is irreversible. It must

be omitted when error-free compression is desired. In the third and final stage of the encoding process, the symbol coder generates a fixed or variable length code to represent the quantizer output and maps the output in accordance with the code [12]. In many cases, a variable–length code is used. The shortest code words are assigned to the most frequently occurring quantizer output values- thus minimizing coding redundancy. This operation is irreversible. Upon its completion, the input image has been processed for the removal of each of the three redundancies (Coding, Inter pixel, Psycho visual).

C. The Decoding or Decompression Process:

The decoder contains only two components: a symbol decoder and an inverse mapper. They perform, in reverse order, the inverse operation of encoder's symbol encoder and mapper. Because quantization results in irreversible information loss, an inverse quantizer block is not included in the general decoder model [13].

D. Image Compression Algorithms:

Image compression can be lossy or lossless. Lossless compression is sometimes preferred for artificial images such as technical drawings, icons or comics. This is because lossy compression methods, especially when used at low bit rates, introduce compression artifacts. Lossless compression methods may also be preferred for high value content, such as medical imagery or image scans made for archival purposes. Lossy methods are especially suitable for natural images such as photos in applications where minor (sometimes imperceptible) loss of fidelity is acceptable to achieve a substantial reduction in bit rate[14-15].

E. Various Lossy Compression Methods are:

1) Cartesian Perceptual Compression: Also known as CPC
2) DjVu
3) Fractal compression
4) HAM, hardware compression of color information used in Amiga computers
5) ICER, used by the Mars Rovers: related to JPEG 2000 in its use of wavelets
6) JPEG
7) JPEG 2000, JPEG's successor format that uses wavelets.
8) JBIG2
9) PGF, Progressive Graphics File (lossless or lossy compression) Wavelet compression.

F. Various Loss-Less Compression Method are:

1) Run-length encoding – used as default method in PCX and as one of possible in BMP, TGA, TIFF
2) Entropy coding
3) Adaptive dictionary algorithms such as LZW – used in GIF and TIFF
4) Deflation – used in PNG, MNG and TIFF.

G. The Steps involved in Compressing and Decompressing of Image are:

1) Specifying the Rate (bits available) and Distortion (tolerable error) parameters for the target image.
2) Dividing the image data into various classes, based on their importance.
3) Dividing the available bit budget among these classes, such that the distortion is a minimum.
4) Quantize each class separately using the bit allocation information derived in step 3.
5) Encode each class separately using an entropy coder and write to the file.
6) Reconstructing the image from the compressed data is usually a faster process than compression. The steps involved are step 7 to step 9.
7) Read in the quantized data from the file, using an entropy decoder. (Reverse of step 5).
8) Dequantized the data. (Reverse of step 4).
9) Rebuild the image. (Reverse of step 2).

2. DISCRETE COSINE TRANSFORM (DCT):

The discrete cosine transform (DCT) is a technique for converting a signal into elementary frequency components. Like other transforms, the Discrete Cosine Transform (DCT) attempts to de correlate the image data. After de correlate each transform coefficient can be encoded independently without losing compression efficiency.

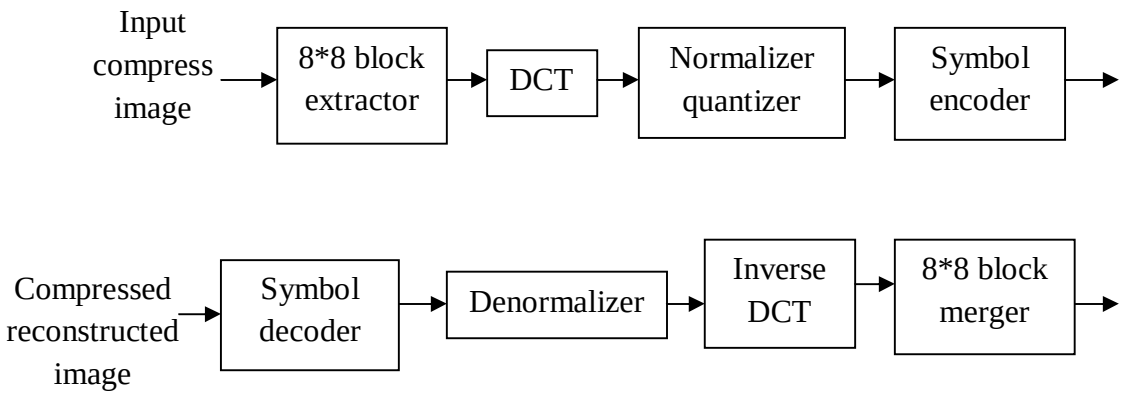

Fig.3 image compression using DCT

2.1 Proposed DCT Algorithm:

- The following is a general overview of the JPEG process
- The image is broken into 8×8 blocks of pixels.
- Working from left to right, top to bottom, the DCT is applied to each block.
- Each block is compressed through quantization.
- The array of compressed blocks that constitute the image is stored in a drastically reduced amount of space.
- When desired, the image is reconstructed through decompression, a process that uses the inverse Discrete Cosine Transform (IDCT).

3. Introduction to Wavelet Transform

Wavelet transform (WT) is a method of representing time-frequency signals from wavelet transform. It is called wavelet based on varying frequency and finite duration. Wavelet transforms use multiple resolutions, where the resolution of the different resolutions is different. This will provide a more detailed analysis of the signal.

The conversion can provide more information than the original information by remapping. Wavelet transform can be used as another way to describe the properties of a time-varying waveform, but in this case the waveform is not divided into time periods but segmented. We can modify the wavelet coefficients before performing the reconstruction steps. We perform wavelet analysis because the coefficients thus obtained have many known uses, the most important of which is denoising and compression. But wavelet analysis is still a new area. There is no doubt that many unknown uses wavelet coefficients are waiting. The toolbox can be a means of exploring possible applications and the application of wavelet analysis so far unknown.

These tiles then transform the wavelet into any depth, contrast, JPEG 1992 using 8 × 8 block size discrete cosine transform. JPEG 2000 uses two different wavelet transforms::

1. Irreversible: CDF 9/7 wavelet transform. It is considered "irreversible" because it relies on the introduction of the accuracy of the quantization noise decoder.

2. Reversible: biorthogonal CDF 5/3 wavelet transform circle. It uses only integer coefficients, so the output does not need to be rounded (quantized), so no quantization noise is introduced. It is used for lossless coding.

The wavelet transform is realized by lifting scheme or convolution.

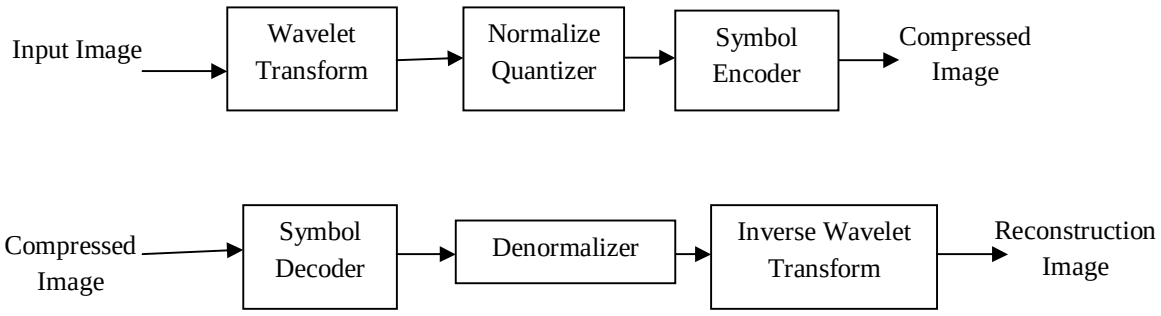

Fig.4: Image compression using wavelets

IV. EXPERIMENTAL RESULTS

Matlab approach has been implemented for compressing images. Matlab is capable of handling simultaneous multiple matrix of images. In this firstly given RGB image is divided into three matrices which are compressed individually and then these are merged together to construct final compressed image. Image processing tool box of matlab is used to perform all compression task.

Matlab based environment ensures high scalability, availability and reliability through redundancy mechanisms. Hence matlab computing proves to be an appropriate platform for compressing images by various techniques. Matlab provides High-level language for technical computing and Development environment for managing code, files and data. It is an Interactive tool for iterative exploration, design and problem solving. It provides Mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization, numerical integration and Tools for building custom graphical user interfaces.

In this study compressing of images is taken by splitting image matrix into R,G,B matrix which are compressed individual and then these are merged for construction of compressed image. It is an efficient approach for performing compression for large size images of different format. Time and space is reduced to great extent with the help of Matlab computing.

An RGB image, sometimes referred to as a true color image, is stored as an m-by-n-by-3 data array that defines red, green and blue color components for each individual pixel. RGB images do not use a palette.

The colour of each pixel is determined by the combination of the red, green, and blue intensities stored in each colour plane at the pixel's location. Graphics file formats store RGB images as 24-bit images, where the red, green, and blue components are 8 bits each. This yields a potential of 16 million colours.

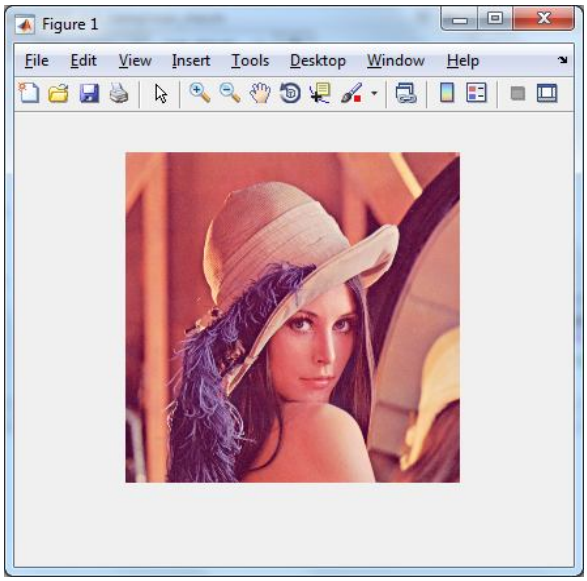

Fig.1. Output Compressed Image

Peak Signal to Noise Ratio (PSNR):

The PSNR is most commonly used as a measure of quality of reconstruction in image compression etc. It is most easily defined via the mean squared error (MSE) which for two m×n monochrome images I and K where one of the images is considered a noisy approximation of the other is defined as:

$$MSE = \frac{1}{MN}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}\|I(i,j) - K(i,j)\|^2$$

The PSNR is defined as:

$$PSNR = 10\log_{10}\left(\frac{MAX_1^2}{MSE}\right) = 20\log_{10}\left(\frac{MAX_1}{\sqrt{MSE}}\right)$$

Here, MAXi is the maximum possible pixel value of the image. When the pixels are represented using 8 bits per sample, this is 255. More generally, when samples are represented using linear PCM with B bits per sample, MAXI is 2B-1.

V. CONCLUSION

Since jpeg is a picture pressure standard, this paper considers the fundamental procedure of jpeg encoding. Pressure can be accomplished by utilizing DCT procedures that partition the picture into various recurrence segments. The superfluous data would then be able to be expelled from the picture by quantization. This implies DCT assumes an essential job in JPEG picture pressure. As the pressure proportion is getting greater and greater, increasingly more data. In this manner, the need to acquaint high productivity DCT calculation with accomplishes better picture pressure.

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