A STUDY ON IMAGE COMPRESSION TECHNIQUES

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Abstract: Even with the technological advances in storage/transmission, the demand placed on the storage capacities and on bandwidth of communication exceeds the availability. Also, multimedia data such as Images consumeda great proportion of our storage/transmission resources. And in today's world, the social media are almost impossible without image/graphics. Hence, image compression has proved to bea valuable technique as one solution to effectively utilize these crucial resources. This paper gives an introductory studies on the available image compression techniques. This is to enable the exploration of the possibilities for enhancement on any of the discussed method or if possible to come up with a new better method

I. INTRODUCTION

THE area of image compression is applicable to various fields of image processing. On the basis of comparing the current image compression techniques, we are going to comparatively study the various compression techniques with their respective advantages and disadvantages. Image compression addresses the problem of reducing the amount of data required to represent a digital image. It is a process intended to yield a compact representation of an image, thereby reducing the image storage/transmission requirements [2].

OBJECTIVES

The objective of image compression is to reduce the storage requirements per image, while maintaining image quality. Ideally, we would like to maintain the appearance of the image to a human observer [6]. Hence, It is objective is to reduce irrelevance and redundancy of an image data [3].

DEFNITIONS OF TERMS

- IMAGE: An image is an artifact that depicts or records visual perception. Image can be two dimensional (e.g. photograph) or three-dimensional (e.g. statue) [3].
- DIGITAL IMAGE: 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[5].
- Depending on whether the image is fixed, image may be of raster or vector type.
- A raster image contain a fixed number of row and columns of pixels (picture elements).
- A vector image resulted from mathematical geometry (vector).

AIMS

Since an image can be viewed as a multi-dimensional structure. And the modern digital technology has made it possible to manipulate multi-dimensional signals with systems that range from simple digital circuits to advanced parallel computers[1]. The goal of this manipulation on image can be categorize as:

Manipulation Goal

- Image Processing: - image in → image out; E.g. image compression, image filtration
- Image Analysis: - image in → measurements out; E.g. edge detection
- Image Understanding:-Image in> highlevel description out; E.g. face detection

For the purpose of this work, the studies of image compression which fall under the image processing will be carried out. The available compression techniques will be explored.

The Logic of Compression Techniques

A common characteristic of most images is that the neighboring pixels are correlated and therefore contain redundant information. The foremost task then is to find less correlated representation of the image. Two fundamental components of compression are redundancy and irrelevancy reduction [1].

Redundancy reduction aims at removing duplication from the signal source (image/video).

Irrelevancy reduction omits parts of the signal that will not be noticed by the signal receiver, namely the Human Visual System (HVS).

In general, three types of redundancy can be identified [1]:

- Spatial Redundancy(also called interpixel redundancy). A correlation between neighboring pixel values in an image.
- Spectral Redundancy or correlation between different color planes or spectral bands.
- Temporal Redundancy or correlation between adjacent frames in a sequence of images (in video applications).

Temporal redundancy is not considered in a still image compression. So, Image compression aims at reducing the number of bits needed to represent an image by removing the spatial and spectral redundancies as much as possible. Usually signals we wish to process are in the time-domain, but in order to process them more easily, other information such as frequency is required [5]. There are transforms that translates the information of signals into different representations. E.g. Fourier transform converts a signal between the time and frequency domains, such that the frequencies of a signal can be seen. Though, some modification need to be done to relate a frequency with time as in the Short Time Fourier Transform (STFT) that introduced the idea of windows through which different parts of a signal are viewed. For a given window in time, the frequencies can be viewed. However, Heisenberg's Uncertainty Principle states that: the resolution of the signal improves in the time domain and by zooming on different sections, the frequency resolution gets worse. Ideally a method of multi-resolution is needed, which allows certain parts of the signal to be resolved well in time and other parts to be resolved well in frequency. The power and magic of wavelet analysis is exactly the multi-resolution. Wavelet analysis can be used to divide the information of an image into approximation and detail sub-signals. The approximation sub-signals shows the general trend of pixel values and three detail sub-signals show the vertical, horizontal and diagonal details or changes in the image. If these details are very small then they can be set to zero without significantly changing the image. The value below which details are considered small enough to be set to zero is known as the threshold. The greater the no. of zeros the greater the compression that can be achieved. The amount of information retained by an image after compression and decompression is known as the "energy retained" and this is proportional to the sum of the squares of the pixel values. If the energy retained is 100% then the compression is known as "lossless", as the image can be reconstructed exactly. This occurs when the threshold value is set to zero, meaning that the detail has not been changed. If any values are changed then energy will be lost and this is known as Lossy compression. Ideally, during compression the no. of zeros and the energy retention will be as high as possible. However, as more zeros are obtained more energy is lost, so a balanced between the two needs to be found.

II. IMAGE

An image is an array, or a matrix, of square pixels (picture elements) arranged in columns and rows. In a (8-bit) greyscale image each picture element has an assigned intensity that ranges from 0 to 255. A grey scale image is what people normally call a black and white image, but the name emphasizes that such an image will also include many shades of grey. A normal greyscale image has 8 bit colour depth = 256 greyscales. A "true colour" image has 24 bit colour depth = 8 x 8 x 8 bits = 256 x 256 x 256 colours = ~16 million colours.Some greyscale images have more greyscales, for instance 16 bit = 65536 greyscales. In principle three greyscale images can be combined to form an image with 281,474,976,710,656 greyscales.

A. Image File Formats

Image file formats are standardized means of organizing and storing digital images. Image files are composed of digital data in one of these formats that can be rasterized for use on a computer display or printer. An image file format may store data in uncompressed, compressed, or vector formats. Once rasterized, an image becomes a grid of pixels, each of which has a number of bits to designate its color equal to the color depth of the device displaying it.

Here are some of the image formats:

BMP

The Bitmap (BMP) file format handles graphics files within the Microsoft Windows OS. Typically, BMP files are uncompressed, hence they are large; advantage is that their simplicity, wide acceptance, and use in Windows program [13].

NETPBM

Netpbm format is a family including the "Portable Pixel Map" file format (PPM), the "Portable Gray Map" file format (PGM) and the "Portable Bit Map" file format (PBM) [11]. These are either pure ASCII files or raw binary files with an ASCII header that provide very basic functionality and serve as a lowest-common-denominator for converting pixmap, graymap, or bitmap files among different platforms. Several applications refer to them collectively as the "Portable Any Map" (PNM). of the image storage algorithm are included as part of the file. In practice, TIFF is used almost exclusively as a lossless image storage format that uses no compression at all. TIFF files are not used in web images. They produce big files, and more importantly, most web browsers will not display TIFFs.

GIF

Graphics Interchange Format (GIF) is useful for images that have less than 256-(2^8) colors, grayscale images and black and white text. The primary limitation of a GIF is that it only works on images with 8-bits per pixel or less, which means 256 or fewer colors. Most color images are 24 bits per pixel [14]. To store these in GIF format that must first convert the image from 24 bits to 8 bits. GIF is a lossless image file format. Thus, GIF is "lossless" only for images with 256 colors or less. For a rich, true color image, GIF may "lose" 99.998% of the colors. It is not suitable for photographic images, since it can contain only 256 colors per image.

PNG

Portable Network Graphics (PNG) is a file format for lossless image compression. Typically, an image in a PNG file can be 10% to 30% more compressed than in a GIF format [14]. It allows to make a trade-off between file size and image quality when the image is compressed. It produces smaller files and allows more colors. PNG also supports partial transparency. Partial transparency can be used for many useful purposes, such as fades and antialiasing for text.

JPEG

Joint Photographic Expert Group (JPEG) is an excellent way to store 24-bit photographic images, such as those used for imaging and multimedia applications. JPEG 24-bit (16 million color) images are superior in appearance to 8-bit (256 color) images on a Video Graphics Array (VGA) display and are at their most spectacular, when using 24-bit display hardware (which is now quite inexpensive) [14]. JPEG was designed to compress, color or gray-scale continuous-tone images of real-world subjects, photographs, video stills, or any complex graphics, that resemble natural subjects. Animations, ray tracing, line art, black-and-white documents, and typical vector graphics don't compress very well under JPEG and shouldn't be expected to. And, although JPEG is now used to provide motion video compression, the standard makes no special provision for such an application.

JPG

JPG is optimized for photographs and similar continuous tone images that contain many, numbers of colors [6]. JPG works by analyzing images and discarding kinds of information that the eye is least likely to notice. It stores information as 24 bit color. The degree of compression of JPG is adjustable. At moderate compression levels of photographic images, it is very difficult for the eye to discern any difference from the original, even at extreme magnification. Compression factors of more than 20 are often acceptable.

RAW

RAW refers to a family of raw image formats (output) that are options available on some digital cameras [12]. These formats usually use a lossless or nearly-lossless compression, and produce file sizes much smaller than the TIFF formats of full-size processed images from the same cameras. The raw formats are not standardized or documented. Though lossless, it is a factor of three or four smaller than TIFF files of the same image. The disadvantage is that there is a different RAW format for each manufactures and so has to use the manufacturer's software to view the images. (Some graphics applications can read some manufacturer's RAW formats.)

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"Portable Any Map" (PNM).

B. Colors

For science communication, the two main colour spaces are RGB and CMYK.

RGB

The RGB colour model relates very closely to the way we perceive colour with the r, g and b receptors in our retinas. RGB uses additive colour mixing and is the basic colour model used in television or any other medium that projects colour with light. It is the basic colour model used in computers and for web graphics, but it cannot be used for print production. The secondary colours of RGB – cyan, magenta, and yellow – are formed by mixing two of the primary colours (red, green or blue) and excluding the third colour. Red and green combine to make yellow, green and blue to make cyan, and blue and red form magenta. The combination of red, green, and blue in full intensity makes white. In Photoshop using the "screen" mode for the different layers in an image will make the intensities mix together according to the additive colour mixing model. This is analogous to stacking slide images on top of each other and shining light through them.

CMYK

The 4-colour CMYK model used in printing lays down overlapping layers of varying percentages of transparent cyan (C), magenta (M) and yellow (Y) inks. In addition a layer of black (K) ink can be added. The CMYK model uses the subtractive colour model.

Gamut

The range, or gamut, of human colour perception is quite large. The two colour spaces discussed here span only a fraction of the colours we can see. Furthermore the two spaces do not have the same gamut, meaning that converting from one colour space to the other may cause problems for colours in the outer regions of the gamuts.

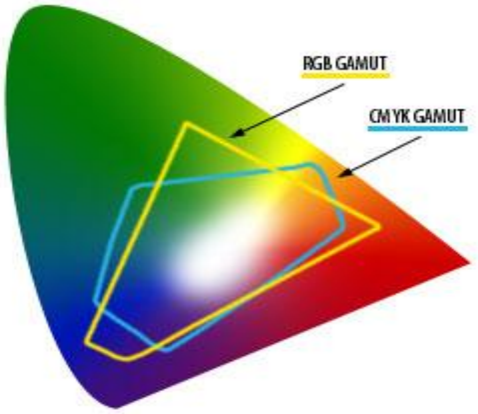

Figure 1

The additive model of RGB. Red, green, and blue are the primary stimuli for human colour perception and are the primary additive colours.

The colours created by the subtractive model of CMYK don't look exactly like the colours created in the additive model of RGB Most importantly, CMYK cannot reproduce the brightness of RGB colours. In addition, the CMYK gamut is much smaller than the RGB gamut

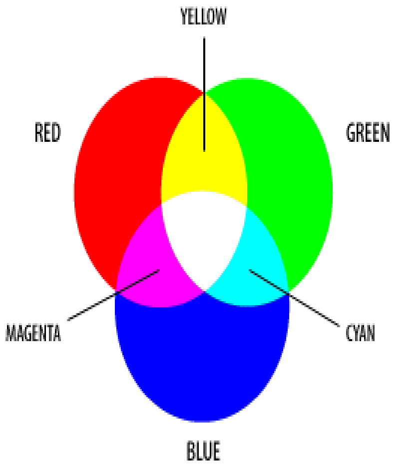

Figure 2

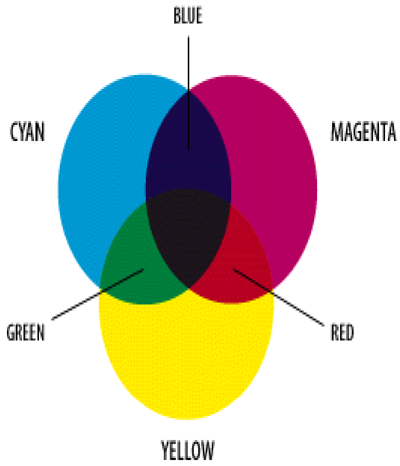

Figure 3

This illustration clearly shows the different gamuts of the RGB and CMYK colour spaces. The background is the CIE Chromaticity Diagram (representing the whole gamut of human colour perception).

III. IMAGE COMPRESSION TECHNIQUES

The amount of data in visual information is very large. Therefore, in order to efficiently store/retrieve such a large amount of data we need to have enormous memory and bandwidth capacity. Fortunately, modern technology has reasonable solutions to these. But, analysis has shown that there are a lot of unnecessary overhead (redundancy) submerge in an image. These unnecessary duplications (redundancies) can be effectively removed using the image compression techniques. Also, the redundancies should be removed whilepreserving the actual content of an image. A common characteristic of most images is that the neighboring pixels are correlated and therefore contain redundant information. The foremost task then is to find less correlated representation of the image. Images have considerably higher storage requirement than text; Audio and Video Data require more demanding properties for data storage. An image stored in an uncompressed file format, such as the popular BMP format, can be huge. An image with a pixel resolution of 640 by 480 pixels and 24-bit colors resolution will take up 640 * 480 * 24/8 = 921,600 bytes in an uncompressed format. The huge amount of storage space is not only the consideration but also the data transmission rates for communication of continuous media are also significantly large. An image, 1024 pixel x 1024 pixel x 24 bit, without compression, would require 3 MB of storage and 7 minutes for transmission, utilizing a high speed, 64 Kbits /s, ISDN line. Image data compression becomes still more important because of the fact that the transfer of uncompressed graphical data requires far more bandwidth and data transfer rate. For example, throughput in a multimedia system can be as high as 140 Mbits/s, which must be transferred between systems. This kind of data transfer rate is not necessary for images with redundancies and for effective utilization of resources, compression techniques can be used.

A. Image Compression Techniques

Image compression techniques are the methods used to reduce irrelevance and redundancy of an image data while maintaining the image quality.These compression methods are broadly classified into two categories, depending on whether or not an exact replica of the original image could be reconstructed using the compressed image.
These are:

- Lossless technique
- Lossy technique

Lossless Compression Technique

In lossless compression techniques, the original image can be perfectly recovered from the compressed (encoded) image. These are also called noiseless since they do not add noise to the signal (image). There is 100% energy retained in the lossless compression technique. This means that the original image can be reconstructed exactly. It is also known as entropy coding since it use statistics/decomposition techniques to eliminate (hide) redundancy. Lossless compression is used only for a few applications with stringent requirements such as medical imaging. Following techniques are included in lossless compression:

1. *Run length encoding*
   - Run length encoding
   - Area coding
2. *Statistical Coding*
   - Huffman encoding
   - LZW (Lempel- Ziv – Welch) coding
   - Arithmetic Coding
3. *Predictive Coding*

The Run Length Encoding Compression Technique

The run length encoding(RLE) technique is a very simple compression method used for sequential data. It is the most popular data compression algorithms in which the runs of data i.e. the sequence of similar data elements in the input data stream (repeating string) are replaced by a pair containing the symbol and the run length or the count. The RLE plays a vital role in cases where the data stream contains few and long runs. For any files that do have many runs there is a chance of increase in the file size and hence it is not useful [8].Consider two strings each with 20 characters, there are multiple different characters runs as shown below.

AAA HH DDDDDD EEEEEE FFF

ff q ww h g t rrr j n b vv cc ss

Both strings will requires 20 bytes to be represented (STORED). But, by using the RUN LENGTH compression method, the first string has five runs present in it and this could be represented (compressed) using 10 bytes as shown below.

3A 2H 6D 4E 5F

But, the second string has 13 runs and this will require 26 bytes as shown

2f 1q 2w 1h 1g 1t 3r 1j 1n 1b 2v 2c 2s

This very simple compression techniqueis very useful in case of repetitive data. In image compression, sequences of identical symbols (pixels),called runs are replace by shorter symbols. The run length code for a gray scale image is represented by a sequence { Vi , R i } where Vi is the intensity of pixel and Ri refers to the number of consecutive pixels with the intensity Vi as shown in the figure. If both Vi and R i are represented by one byte, this span of 12 pixels is coded using eight bytes yielding a compression ratio of 1: 5

Area Coding

Area coding is an enhanced form of run length coding, reflecting the two dimensional character of images. This is a significant advance over the other lossless methods. For coding an image it does not make too much sense to interpret it as a sequential stream, as it is in fact an array of sequences, building up a two dimensional object. The algorithms for area coding try to find rectangular regions with the same characteristics. These regions are coded in a descriptive form as an element with two points and a certain structure. This type of coding can be highly effective but it bears the problem of a nonlinear method, which cannot be implemented in hardware.

The Huffman Coding

This is a general technique for coding symbols based on their statistical occurrence frequencies (probabilities). The pixels in the image are treated as symbols. The method works on the concept of occurrence frequencies of pixels in an image, thus it is also called as an entropy coding based method. As per the theory entropy is the average minimum number of bits necessary to describe an aspect of a particular source (i.e., pixel within an image). Entropy is denoted as H(X) and takes into account the probability of occurrence for all items within a source [6]. In this method, a lower number of bits are used to encode the data with high probabilities and larger number of bits is used for data with low probabilities. A Huffman code is generated by merging together the two least probable characters, and repeating this process until there is only one character remaining. Using this process a code tree is generated and by labeling this code tree the Huffman code is obtained [8].

Lempel Ziv Welch (LWZ) coding

Lempel Ziv Welch coding is a dictionary based coding which can be static or dynamic. In static LZW coding, dictionary is fixed during the encoding and decoding processes. While the dictionary is updated on fly in dynamic LZW dictionary coding, this type of coding is widely used in computer industries [10]. It is also implemented as compress command on UNIX. The LZW works based on the occurrence multiplicity of character sequences in the string to be encoded. Its principle consists in substituting patterns with an index code, by progressively building a dictionary. The dictionary is initialized with the 256 values of the ASCII table. The file to be compressed is split into strings of bytes, each of these strings is compared with the dictionary and is added, if not found there. In encoding process the algorithm goes over the stream of information, coding it; if a string is never smaller than the longest word in the dictionary then it is transmitted. In decoding, the algorithm rebuilds the dictionary in the opposite direction; it thus does not need to be stored.

Arithmetic Coding

In this technique, instead of coding each symbol separately, whole image sequence is coded with a single code. Thus, the correlation on neighboring pixels is exploited. Arithmetic coding is based on the following principle. Given that

- The symbol alphabet is finite;
- All possible symbols sequences of a given length are finite;
- All possible sequences are countable infinite;
- The number of real numbers in the interval [0,1] is unaccountably infinite; we can assign a unique subinterval for any given input(symbols' sequence)

Predictive Coding

Predictive Coding Technique constitute another example of exploration of interpixel redundancy, in which the basic idea to encode only the new information in each pixel. This new information is usually defined as the difference between the actual and the predicted value of the pixel. The predictor's output is rounded to the nearest integer and compared with the actual pixel value: the difference between the two- called prediction error.

This error can be encoded by a Variable Length Coding (VLC). The distinctive feature of this method lies in the paradigm used to describe the images. The images are modeled as non-causal random fields, i.e. fields where the intensity at each pixel depends on the intensities at sites located in all directions around the given pixel [11].

B. LOSSY COMPRESSION

Lossy compression algorithms preserve a representation of the original uncompressed image that may appear to be a perfect copy, but it is not a perfect copy. Often lossy compression is able to achieve smaller file sizes than lossless

compression. Most lossy compression algorithms allow for variable compression that trades image quality for file size [15]. A lossy compression, may examine the color data for a range of pixels, and identify subtle variations in pixel color values that are so minute that the human eye/brain is unable to distinguish the difference between them [12]. The algorithm may choose a smaller range of pixels whose color value differences fall within the boundaries of our perception, and substitute those for the others. The finely graded pixels are then discarded. Very significant reductions in file size may be achieved with this form of compression, but the sophistication of the algorithm determines the visual quality of the finished product.
The following techniques are considered loosy algorithms.

i. Differential Pulse Code Modulation
ii. Vector Quantization (VQ)
iii. Transform Coding
    a. Discrete Cosine Transform (DCT)
    b. Wavelet Transform
iv. Block Truncation Coding
v. Sub-band Coding
vi. Fractal Compression

Differential Pulse Code Modulation
Differential pulse-code modulation (DPCM) is a signal encoder consisting of pulse code modulation (PCM) with added functionalities based on the prediction of the samples of the signal. The input to DPCM may be an analog signal or a digital signal. Since DPCM requires discrete time signal as an input, and if the input is a continuous-time analog signal, then it is required to be sampled first so that a discrete time signal is obtained which is then given to the DPCM encoder. It is an efficient data compression technique, which is useful for reducing transmission rate of digital picture information. The use of DPCM in image coding, however, requires some caution when transmission errors occur, because in the reconstructed DPCM image transmission errors tend to propagate and severely degrade the image quality [11].

Vector Quantization (VQ)
Vector quantization (VQ) techniques extend the basic principles of scalar quantization to multiple dimensions.This technique is to develop a dictionary of fixed-size vectors, called code vectors. A given image is then partitioned into non-overlapping blocks called image vectors. Then for each image vector, the closest matching vector in the dictionary is determined and its index in the dictionary is used as the encoding of the original image vector [18].
In vector quantization, normally entropy coding is used. It exploits linear and non-linear dependence that exists among the components of a vector. A dictionary of fixed-size vectors, called code vectors can be generated by using this technique. A given image is then partitioned into non-overlapping blocks called image vectors. Then for each image vector, the closest matching vector in the dictionary is deter-mined and its index in the dictionary is used as the encoding of the original image Vector. Thus, each image is represented by a sequence of indices that can be further entropy coded [5]. Because of its fast lookup capabilities at the decoder side, VQ-based coding schemes are most widely used in multimedia applications [11, 18].

Transform Coding
Transform coding algorithm usually start by partitioning the original image into sub images (blocks) of small size (usually 8 x 8). For each block the transform coefficients are calculated, effectively converting the original 8 x 8 array of pixel values into an array of coefficients closer to the top-left corner usually contain most of the information needed to quantize and encode the image with little perceptual distortion [14]. The resulting 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. 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.

Discrete Cosine Transform (DCT)
A discrete cosine transform (DCT) is the sequence of finitely many data points in terms of a sum of cosine functions oscillating at different frequencies. In this a reversible linear transform such as Fourier Transform is used to map the image into a set of transform coefficients, which are then Quantized and encoded. DCT and Fourier transforms convert images into frequency domain from time-domain to decorrelate the pixels in an image [16].

Wavelet Transform
It is similar to that of the DCT, where image pixels are transformed to spatial frequency coefficients. Wavelet based image compression scheme differs in two different aspects. The first aspect is the basis function used for compression. The basis function in DCT is the cosine waveform. On the other hand wavelets can have one of many basis functions that meet certain criteria. The other aspect is in DCT image compression the image is divided into 8x8 sub images before transformation but for the wavelets transform, the whole image is used as a single input [15]. A wavelet is a waveform of effectively limited duration "localized in time," localized in frequency and has an average value of zero. Wavelets are the irregular and asymmetric waveforms.
The basic idea of the wavelet transform is to represent any arbitrary function (p) as a superposition of a set of such wave-lets or basis functions. These basis functions or baby wavelets are obtained from a single prototype wavelet called the mother wavelet, by dilations or contractions (scaling) and translations (shifts).

Block Truncation Coding
Block Truncation Coding (BTC) is a technique for gray scale images. It divides the original images into non overlapping

blocks of pixels and then uses a Quantizer to reduce the number ofgrey levels in each block while maintaining the same mean and standard deviation. That is, for each block, threshold and reconstruction values are determined. The threshold is usually the mean of the pixel values in the block. Then a bitmap of the block is derived by replacing all pixels whose values are greater than or equal (less than) to the threshold by a 1 (0). Then for each segment (group of 1s and 0s) in the bitmap, the reconstruction value is determined. This is the average of the values of the corresponding pixels in the original block. It is an early predecessor ofthe popular hardware DirectX Texture Compression (DXTC) technique, although BTC compression method was first adapted to color long before DXTC using a very similar approach called Color Cell Compression. Sub blocks of 4 x 4 pixels allow compression of about 25% assuming 8-bit integer values are used during transmission or storage [15]. Larger blocks allow greater compression however quality also reduces with theincrease in block size due to the nature of the algorithm.

Sub-band Coding

The fundamental concept behind Sub-band Coding (SBC) is to split up the frequency band of a signal andthen to code each sub-band using a coder and bit rateaccurately matched to the statistics of the band [17]. SBChas been used extensively first in speech coding and laterin image coding because of its inherent advantages namely variable bit assignment among the sub-bands aswell as coding error confinement within the sub-bands. Atthe decoder, the sub-band signals are decoded, unsampledand passed through a bank of synthesis filters and properly summed up to yield the reconstructed image.

The advantage of this scheme is that the quantization and coding well suited for each of the sub bands can be designed separately [5].

Fractal Compression

The essential idea here is to decompose the image into segments by using standard image processing techniques such as color separation, edge detection, and spectrum and texture analysis. Then each segment is looked up in a library of fractals. The library actually contains codes called iterated function system (IFS) codes, which are compact sets of numbers. Using a systematic procedure, a set of codes for a given image are determined, such that when the IFS codes are applied to a suitable set of image blocks yield an image that is a very close approximation of the original. It relies on the fact that in certain images, parts of the image resemble otherparts of the same image. Fractal algorithms convert theseparts, or more precisely, geometric shapes into mathematical data called "fractal codes" which are usedto recreate the encoded image. Once an image has beenconverted into fractal code its relationship to a specificresolution has been lost; it becomes resolution independent. The image can be recreated to fill any screen size without the introduction of image artifacts orloss of sharpness that occurs in pixel-based compressionschemes.. This scheme is highly effective for compressing images that have good regularity and self-similarity.

IV. JPEG: DCT-BASED IMAGE CODING STANDARD

The JPEG/DCT still image compression has become a standard recently. JPEG is designed for compressing full-color or grayscale images of natural, real-world scenes. To exploit this method, an image is first partitioned into non overlapped 8×8 blocks. A discrete Cosine transform (DCT) [20] is applied to each block to convert the gray levels of pixels in the spatial domain into coefficients in the frequency domain. The coefficients are normalized by different scales according to the quantization table provided by the JPEG standard conducted by some psycho visual evidence. The quantized coefficients are rearranged in a zigzag scan order to be further compressed by an efficient lossless coding strategy such as run length coding, arithmetic coding, or Huffman coding. The decoding is simply the inverse process of encoding. So, the JPEG compression takes about the same time for both encoding and decoding. The encoding/ decoding algorithms provided by an independent JPEG group [14] are available for testing realworld images. The information loss occurs only in the process of coefficient quantization. The JPEG standard defines a standard 8×8 quantization table [14] for all images which may not be appropriate. To achieve a better decoding quality of various images with the same compression by using the DCT approach, an adaptive quantization table may be used instead of using the standard quantization table.

V. CONCLUSION

Based on the review of images and its compression algorithms we conclude that the compression normally chosen for compressing the images needs to beexperimented with the various compression methods on various types of images. The following general guidelines can be applied as a starting point to compress images:

- For true (photographic) images that do not require perfect reconstruction when decompressed, the JPEG compression can be used.
- For screen dumps, FAX images, computer generated images, or any image that requires perfect reconstruction when decompressed, the LZW compression can be used. The best algorithm is measured depends on the following 3 factors:
    - The quality of the image
    - The amount of compression
    - The speed of compression.

Quality of the Image

The quality of an image after being compressed depends on usage of two kinds of compression such as:

- Lossless compression
- Lossy compression

Amount of Compression

The amount of compression depends on both the compression method and the content of the image.

Speed of Compression

The speed of image compression and decompression depends on various factors such as the type of file,system hardware, and compression method.Future Image Compression Standard In future Image Compression standard is intended to advance standardized image coding systems to serve applications into the next millennium. It has to provide a set of features vital to many high-end and emerging image applications by taking advantage of new modern technologies. Specifically, the new standard will address areas where current standards fail to produce the best quality or performance. It will also provide capabilities to markets that currently do not use compression. New standard will strive for openness and royalty-free licensing. It has to be intended to compliment, not replace, the current JPEG standards. In future, the image compression will include many modern features including improved low bit-rate compression performance, lossless and lossy compression, continuous tone and bi-level compression of large images, single decompression architecture, transmission in noisy environments including robustness to bit-errors, progressive transmission by pixel accuracy and resolution, content-based description, and protective image security.

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