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A Critical Review of Well Known Method For Image Compression

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ABSTRACT: The increasing attractiveness and trust in a digital photography will rise its use for visual communication. But it requires storage of large quantities of data. For that Image compression is a key technology in transmission and storage of digital images. Compression of an image is significantly different then compression of binary raw data. Many techniques are available for compression of the images. But in some cases these techniques will reduce the quality and originality of image. For this purpose there are basically two types are introduced namely lossless and lossy image compression techniques. This paper gives intro to various compression techniques which is applicable to various fields of image processing.

Keywords: Compression; Image Compression; Lossy Compression; Lossless Compression; Encoding; Decoding; Redundancy

I. INTRODUCTION

Images are important documents now days. Work with images in some applications we need to do compression depends on our aim of the applications such as storage of images in a data base, picture archiving, TV and videoconferencing. Image compression plays a important role in the transmission and storage of image data because of storage limitations. The main aim of image compression is to represent an image in the less number of bits without losing the essential information content from original image.

Many algorithms that performs image compression in many different ways from that some are lossless and some are lossy. Lossless it will keep the same information as in the original image but in lossy compression we loss some information from original image while compressing an image. Image compression is nothing but reducing the amount of data required to represent an image. After performing compression we can calculate the compression ratio which is is defined as follows:

$$Cr= N1/N2$$

Where N1 and N2 are data of images respectively original image and compressed image. From this formula as increasing the compression ratio it will increase the reduction of data. From this equation as increase the compression rate decrease the data [1].

II. IMAGE COMPRESSION

Image compression is nothing but reducing the amount of data required to represent an image. Image compression was done by taking advantage of redundant data because every image having some redundant data redundant data means duplication of data or we can says that in a image some pixels

are duplicates or some pattern occurs frequently in an image. So we can achieve image compression when this redundancies are reduce or eliminated. There are three basic data redundancy use for the compression that are:

1. Inter Pixel Redundancy

In image pixel are not independent they are correlated to their neighboring pixels in this type of redundancy there are many ways from that one is predict the value of pixel by the value of their neighboring pixels.

2. Coding Redundancy

In this variable length code words are use and store in a lookup tables (LUTs).that variable length code words selected to match statistics of the original image. This technique is always reversible huffman coding and arithmetic coding are example of this technique.

3. Psycho Visual Redundancy

From many experiments prove that human eye does not respond equally to all visual information. For images some pieces are more important than others .now a day most of image coding algorithm using this type of redundancy technique.

The main purpose for using compression algorithm is to represent given data in to law bit rates[2]. There are number of ways to evaluating compression algorithm. and for the measuring an algorithm we can find complexity of the algorithm, how much memory require to implement an algorithm, on given machine how fast that algorithm will perform ,compression rate and how closely reconstructed image resemble the original image. simple block diagram for image compression system is as shown in fig(1). devise who perform compression task is known as encoder from given diagram encoder compress image from A to B. Where A is input image and B is compressed image which is then passes to decoder through channel or a storage system. Then from compressed data decoder will reconstruct or decompress image C as per our application channel will affected by noice so it will distort image during the transmission here we assume channel as a error-free channel from given figure for lossless compression C is identical to A where for lossy compression C is different from A.

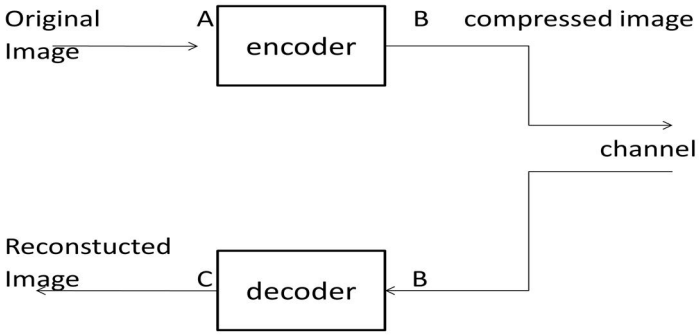

Figure 1. Block diagram of image compression system

2.1. Lossless Compression

As the name itself indicates the original image can be perfectly recovered using the lossless compression techniques. This technique is also known as entropy coding, noiseless compression etc. They will not introduce any noises to the image and they are using statistics or decomposition techniques to reduce the redundancy. These techniques are preferred for medical imaging, technical drawing etc. The following are some different type of the methods which are used for lossless compression.

1. Runlength encoding.
2. Entropy encoding.
3. Huffman encoding.
4. Arithmetic encoding.

1) Run Length Encoding:
It is a very simple form of image compression in which runs of data are stored as a single data value and count, rather than as the original run. It is used for sequential data and it is helpful for repetitive data. In this technique replaces sequences of identical symbol (pixel), called runs. The Run length code for a grayscale image is represented by a sequence {Vi, Ri} 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. This is most useful on data that contains many such runs for example, simple graphic images such as icons, line drawings, and animations. It is not useful with files that don't have many runs as it could greatly increase the file size. Run-length encoding performs lossless image compression [4]. Run-length encoding is used in fax machines.

35	35	35	40	40	40	40	70	70	70

{35,3}	{40,4}	{70,3}

2) Entropy Encoding:
In information theory an entropy encoding is a lossless data compression scheme that is independent of the specific characteristics of the medium. One of the main types of entropy coding creates and assigns a unique prefix-free code for each unique symbol that occurs in the input. These entropy encoders then compress the image by replacing each fixed-length input symbol with the corresponding variable-length prefix free output codeword.

3) Huffman Encoding: In computer science and information theory, Huffman coding is an entropy encoding algorithm used for lossless data compression. It was developed by Huffman. Huffman coding [8] today is often used as a "back-end" to some other compression methods. The term refers to the use of a variable-length code table for encoding a source symbol where the variable-length code table has been derived in a particular way based on the estimated probability of occurrence for each possible value of the source symbol. The pixels in the image are treated as symbols. The symbols which occur more frequently are assigned a smaller number of bits, while the symbols that occur less frequently are assigned a relatively larger number of bits. Huffman code is a prefix code. This means that the (binary) code of any symbol is not the prefix of the code of any other symbol.

4) Arithmetic Coding:
Arithmetic coding is a form of entropy encoding used in lossless data compression. Normally, a string of characters such as the words "hello there" is represented using a fixed number of bits per character, as in the ASCII code. When a string is converted to arithmetic encoding, frequently used characters will be stored with little bits and not-so-frequently occurring characters will be stored with more bits, resulting in fewer bits used in total. Arithmetic coding differs from other forms of entropy encoding such as Huffman coding [10] in that rather than separating the input into component symbols and replacing each with a code, arithmetic coding encodes the entire message into a single number.

2.2 LOSSY COMPRESSION TECHNIQUES

Lossy schemes provide much higher compression ratios than lossless schemes. By this scheme, the decompressed image is not identical to the original image, but reasonably close to it. But this scheme is widely used. Lossy methods are especially suitable for natural images such as photographs in applications where minor loss of fidelity is acceptable to achieve a substantial reduction in bit rate. The lossy compression that produces imperceptible differences may be called visually lossless. The following methods are used in lossy compression

1. Chroma subsampling
2. Transform coding
3. Fractal Compression

1) Chroma subsampling

This takes advantage of the fact that the human eye perceives spatial changes of brightness more sharply than those of color, by averaging or dropping some of the chrominance information in the image. It works by taking advantage of the human visual system's lower acuity for color differences than for luminance.[1] Ii is mainly used in video encoding, jpeg encoding etc. Chroma sub sampling is a method that stores color information at lower resolution than intensity information. The overwhelming majority of graphics programs perform 2x2 chroma sub sampling, which breaks the image into 2x2 pixel blocks and only stores the average color information for each 2x2 pixel group. This process introduces two kinds of errors.

2) **Transform coding**

It is a type of compression for natural data like photographic images. It will result a low quality output of original image. It is a core technique recommended by jpeg. Transform coding is used to convert spatial image pixel values to transform coefficient values. Since this is a linear process and no information is lost, the number of coefficients produced is equal to the number of pixels transformed. Many types of transforms have been tried for picture coding, including for example Fourier, Karhonen-Loeve, Walsh-Hadamard, lapped orthogonal, discrete cosine (DCT), and recently, wavelets.

3) **Fractal Compression** It is one of the lossy compression technique used in digital images. As the name indicates it mainly based on the fractals. This approach is good for natural images and textures. It works on the fact that parts of an image often resemble other parts of the same image. This mehod converts these parts into mathematical data. These data are called “fractal codes” Which are used to recreate the encoded image.

V. CONCLUSION

This paper survey different image compression techniques this methods are mainly classified into two major categories that are lossy compression and lossless compression . As their name it self suggest how they works. In lossless technique it decode without loss of any information. At other and in lossy technique there surtain loss of information from data which represent image both techniques have their own applications like lossy compression used in a multimedia data and lossless used in a text or data file like bank records, text articles. Sometimes it is helpful to make on master lossless file which is used to make compressed file for different applications.

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