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Image Compression Techniques: A Survey

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Abstract:- The increasing attractiveness and trust on digital photography has given rise to its use for visual communication. It requires storage of large quantities of data. Due to limited bandwidth and storage capacity, images must be compressed before storing and transmitting. Many techniques are available for compressing the images. But in some cases these techniques will reduce the quality and originality of image. Some traces like blocking artifacts, transformation fingerprints etc are also introduced in to the reconstructed image as a result of compression. It mainly affect the medical imaging by reducing the fidelity and there by introducing diagnostic errors. Many hybrid techniques are also developed to overcome these problems. This paper addresses various compression techniques as it is applicable to various fields of image processing.

Keywords:- Compression, Image compression, lossy compression, lossless compression, encoding, decoding

I. INTRODUCTION

Digital images become popular for transferring visual information. There are many advantages to using these images over traditional camera film images. The digital cameras produce instant images, which can be viewed without the delay of waiting for film processing. But these images are large in size. The compression techniques helps to reduce the cost of storage and efficient transmission of digital images. The compression techniques are mainly classified into two.Lossy compression techniques and loseless compression techniques.In the first one invertible 2D transforms like Discrete transform coefficient,discrete wavelet coefficient etc are used.We can apply these techniques to image either by applying to a set of pixels or to the whole images. Lossy methods are especially suitable for natural images such as photographs in applications where minor (sometimes imperceptible) 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. Lossless compression is preferred for archival purposes and often for medical imaging, technical drawings, clip art, or comics. [wiki]

II. COMPRESSION TECHNIQUES

This section discuss a set of compression techniques used in image processing are for various applications.

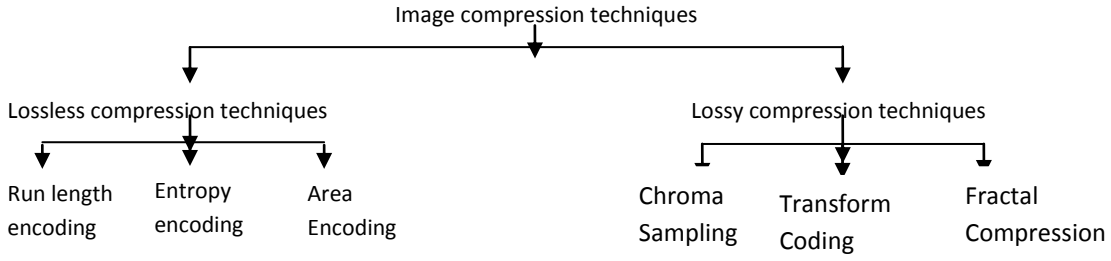

Fig.1 Various Compression techniques

This section discuss a set of compression techniques used in image processing are for various applications.

a) LOSSLESS COMPRESSION TECHNIQUES

As the name indicates the original image can be perfectly recovered using the lossless compression techniques. They are 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. As mentioned earlier they are preferred for medical imaging, technical drawing etc. The following are some of the methods which are used for lossless compression.

1. Runlength encoding
2. Entropy encoding
3. Area coding.

Runlength encoding

This method is a simple loseless compression method.It is mainly used for sequential data{}.This is most useful on data that contains repetitive information.This method will replace identical symbols.these identical symbols are known as runs.They are replaced by shorter symbols.This technique is supported by most bitmap file formats, such as TIFF, BMP, and PCX[wiki]. RLE is suited for compressing any type of data regardless of its information content, but the content of the data will affect the compression ratio achieved by RLE. Although most RLE algorithms cannot achieve the high compression ratios of the more advanced compression methods, RLE is both easy to implement and quick to execute, making it a good alternative to either using a complex compression algorithm or leaving your image data uncompressed. There are a number of variants of run-length encoding. Image data is normally run-length encoded in a sequential process that treats the image data as a 1D stream, rather than as a 2D map of data. In sequential processing, a bitmap is encoded starting at the upper left corner and proceeding from left to right across each scan line (the X axis) to the bottom right corner of the bitmap But alternative RLE schemes can also be written to encode data down the length of a bitmap (the Y axis) along the columns), to encode a bitmap into 2D tiles, or even to encode pixels on a diagonal in a zig-zag fashion Odd RLE variants such as this last one might be used in highly specialized applications but are usually quite rare. [http://www.fileformat.info/mirror/egff/ch09_03.htm].

Entropy encoding

Entropy encoding is another lossless compression technique. It works independent of the specific characteristics of medium. Beside using it as a compression technique it can be also used to measure the similarity in data streams. This method works as follows. It will create a unique prefix code and assign this code to unique symbol in the input. Unlike RLE entropy encoders works by compressing data by replacing the fixed length output with a prefix code word. This is of varying size after creating the prefix code. This will be similar to the negative logarithm of probability. There are many entropy coding methods. The most common techniques are Huffman coding and arithmetic coding. Huffman coding was developed by David A. Huffman. It will use a variable-length code table for encoding a source symbol (such as a character in a file) where it has been derived in a particular way based on the estimated probability of occurrence for each possible value of the source symbol. The prefix code used in this technique is known as prefix-free codes. This technique is similar to block encoding technique and it is optimal for symbol by symbol encoding. But when symbol by symbol restriction is dropped it will not be optimal.

Constant Area Encoding

This method is an enhanced form of run length encoding method. There is some significant advantage of using this technique over other lossless methods .In constant area coding special code words are used to identify large areas of contiguous 1's and 0's.Here the image is segmented in to blocks and then the segments are classified as blocks which only contains black or white pixels or blocks with mixed intensity. Another variant of constant area coding is to use an iterative approach in which the binary image is decomposed into successively smaller and smaller block .A hierarchical tree is built from these blocks. The section stops when the block reaches certain predefined size or when all pixels of the block have the same value. The nodes of this tree are then coded. For compressing white text a simpler approach is used. This is known as white block skipping. In this blocks containing solid white areas are coded to 0 and all other areas are coded to 1.They are followed by bit pattern.

b) 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

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 subsampling is a method that stores color information at lower resolution than intensity information. The overwhelming majority of graphics programs perform 2x2 chroma subsampling, 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.

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.

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.

III. CONCLUSION

This paper presents the different types of image compression techniques. These techniques are basically classified into two. Lossy compression techniques and lossless compression technique. As the name indicates in lossless technique the image can be decoded without any loss of information. But in case of lossy compression it cause some form of information loss. These techniques are good for various applications. Lossy compression is most commonly used to compress multimedia data like audio, video, and still images, especially in applications such as streaming media. By contrast, lossless compression is required for text and data files, such as bank records and text articles. In many cases it is advantageous to make a master lossless file that can then be used to produce compressed files for different purposes.

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REFERENCES

1) Subramanya A, "Image Compression Technique," Potentials IEEE, Vol. 20, Issue 1, pp 19-23, Feb-March 2001
2) David Jeff Jackson & Sidney Joel Hannah, "Comparative Analysis of image Compression Techniques," System Theory 1993, Proceedings SSST '93, 25th Southeastern Symposium,pp 513-517, 7 –9 March 1993.
3) Ming Yang & Nikolaos Bourbakis, "An Overview of Lossless Digital Image Compression Techniques, "Circuits & Systems, 2005 48th Midwest Symposium ,vol. 2 IEEE ,pp 1099-1102,7 – 10 Aug, 2005 6.
4) Ismail Avcibas, Nasir Memon, Bulent Sankur, Khalid Sayood, " A Progressive Lossless / Near Lossless Image Compression Algorithm,"IEEE Signal Processing Letters, vol. 9, No. 10, pp 312-314, October 2002.
5) C.K. Li and H.Yuen, "A High Performance Image Compression Technique for Multimedia Applications," IEEE Transactions on Consumer Electronics, Vol. 42, no. 2, pp 239-243, 2 May 1996.
6) Vijay Chandrasekhar1, Gabriel Takacs1, David Chen,Sam S. Tsai1, Jatinder Singh, Bernd Girod,"Transform Coding of Image Feature Descriptors", 1Stanford University, Stanford, CA, USA
7) Anitha S,"2D image compression technique-A survey", International Journal of Scientific & Engineering Research Volume 2, Issue 7, pp 1-7July-2011.
8) Ricardo L. de Queiroz "Processing JPEG-Compressed Images and Documents", IEEE Transactions On Image Processing, Vol. 7, No. 12, Pp1661-1667december 1998.
9) Dr.B Eswara Reddy and K Venkata Narayana "A Lossless Image Compression Using Traditional and Lifting Based Wavelets", Signal & Image Processing: An International Journal (SIPIJ) Vol.3, No.2, and April 2012