IJCAT - International Journal of Computing and Technology, Volume 1, Issue 9, October 2014
ISSN : 2348 - 6090
www.IJCAT.org

A Review on - Lossless Image Compression Techniques and Algorithms

[1] Ms. Shilpa Ijmulwar, [2] Deepak Kapgate

[1, 2] Dept.Of CSE, G.H.Raisoni Academy of Engg.&Tech.,R.T.M.Nagpur University
Nagpur , Maharashtra, India.

Abstract-In this paper we are giving the brief review about the existing lossless image compression techniques and the algorithm which have been implemented using the existing techniques. The Rapid growth in the field of multimedia and in digital imaging need to transmit digital images Transmitting the images without compressing them takes more disk space as wel as much time for transmission over the network. So the basic idea is to remove the redundancy of data presented within the image so that we can reduce the size of image without affecting the essential data in the image i.e. without compromising the quality of an image.

Keywords **- Lossless Compression, Redundancy, Image Compression, Encoding.**

1. Introduction

Image compression plays an very important role in many applications. It helps in reducing the number of bytes of an original image exclusive of any misrepresentation in its quality, so that it will take less time, hard disk space or transmission bandwidth to send a data from one place to another For example, A 24 bit color image with 512x512 pixels will occupy 768 Kbyte's storage on a disk, and a picture double of this size will not fit in a only floppy disk. So, to transmit an image over a 28.8 Kbps modem would take almost 4 minutes. The motive of image compression is to reduce the amount of data required for representing sampled digital images and therefore reduce the cost for storage and transmission. There are different techniques for compressing images. Basically there are two types of compression that can be done on images. First one is "lossy" and the other is "lossless". In this paper we are discussing about only on the lossless image compression techniques. Lossless data compression is used when the data has to be uncompressed exactly as it was before compression.

Benefits of Image Compression:

- It provide a credible cost savings involved with sending less data over the switched telephone network where the cost of the call is really frequently based upon its interval.
- It not only reduces storage requirements but also on the whole execution time.
- It reduces the possibility of transmission errors since smaller quantity bits are transferred.
- It provides a level of security against illegal monitor

Basic Principle behind the Compression-

The basic principle behind the compression is to remove the redundancy in the image. Now the redundancy can be of different types-
1.Coding redundancy-Coding redundancy can be remove if it is possible to represent larger code with the smaller codes.
2.Interpixel redundancy-Interpixel redundancy is the result of same or correlated pixel of an image.
3.Psychovisual redundancy-In this type the data or the pixel can be ignored by normal visual system or the human eyes.

2. Gives the Basic Lossless Compression Techniques

2.1 Run Length Encoding

It is one of the simplest methods of image compression. It is used for sequential data only. This technique Replaces sequences of identical symbols (pixels), with the shorter symbols .It is represented as {v, r} where v denotes intensity of Pixel and r denotes the intensity of the pixels.

For Eg:

80	80	80	56	56	56	56	56	78

{80,3}	{56,5}	{78,1}

Fig1:Run length Encoding

2.2 Huffman Encoding

This method was developed by D.A .HUFFMAN. This methodology is used to remove coding redundancy in the image. In this approach, we code the symbols based on the statistical occurrence of frequencies and accordingly we make a tree. According to this method, Symbols with the most frequency will result in shorter code words and Symbols with lower frequency will have longer codeword‟s. It is also called variable length coding

2.3 LZW Encoding

Limpel-Ziv-Welch is a technique used for compression of data .It was developed by Abraham Lempel, Jacob Ziv, and Terry Welch. LZW encoding is working based on the amount of multiplicity of bit sequences in the pixel to be encoded . This is an error free compression approach which focus on removing spatial redundancy . It assigns fixed length code words to variable length sequences of source symbols. It works on file formats such as GIF, TIFF, and PD

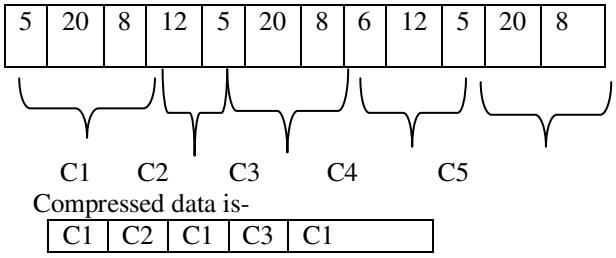

Fig2:LZW Encoding

2.4 Area Encoding

It is an enhanced form of run length coding. It mainly focuses on two dimensional characteristics of an image. This is one of the finest techniques out of all lossless techniques discussed before. This technique checks the rectangular regions manner same characteristics and then analyzing it. The major drawback of this method is that it is a non linear method and it can not be implemented in hardware.

3. Gives the Existing Algorithm for Lossless Compression

3.1 Spatial Domain Algorithm

1. Variable Block Size Compression

Rangnathan et.al developed a lossless image compression algorithm which exploit local and global redundancy present in most of the images. This is one of the spatial domain algorithms. Spatial domain technique involve methods for reducing the no. of bits required to represent the information contained in the image by directly operating on the raw image.In this algorithm segment image in the variable size block and encodes them based on properties exhibited by pixels within a block ,encoding is achieved via a run length coding scheme.The encoding scheme in this case exploits local redundancy in an image. for a block of size (2*2)a block matching scheme is used to determine if an identical block is exist or not,in the neighborhood of reference block by checking global redundancy present in an image.[5]

2. FELICs

FECICS is the compression that runs very fast with only minimal loss of compression efficiency. We call this technique FELICS, for Fast, Efficient, Lossless Image Compression System. It use raster-scan order, and we use a pixel's two nearest neighbors to directly obtain an approximate probability distribution for its intensity, in effective combining the prediction and error modeling steps. It use a novel technique to select the closest of a set of error models, each corresponding to a simple prefix code. Finally It encode the intensity using the selected prefix code. The resulting compressor runs about five times as fast as an implementation of the lossless mode of the JPEG proposed standard while obtaining slightly better compression on many images. By using an appropriate pixel sequence we can obtain a progressive encoding, and by using sophisticated prediction and error modeling techniques in conjunction with arithmetic coding It can obtain state-of-the-art compression efficiency.

3. Lossy+Residual

Basic concept is to send a lossy image primarily followed by residual with respect to original image using lossy+Residual original image can be constructed exactly the lossy image can be transmitted in many different way is to transmit it as the compresses data output of lossy compression algorithm. the reconstructed image in this case is an approximate of the original and can be use as estimated of the original .the main advantage of this kind of lossless scheme is that it gives the higher compression ratio.

Lossless JPEG compression standard is simple version of lossy+residual approach.

The JPEG compression standard specifies the following two coding methods for lossless image compression-
1.Lossless method for Huffman coding
2.Lossless method with arithmetic coding

3.2 Context Based Algorithm

1. CALIC–Context Based Adaptive Lossless Image Coder

This technique was developed by wu and menon. This is one of the Context Based Compression Algorithm This is basically Lossy+residual approach. In this type of algorithm the first stage of algorithm uses a gradient based nonlinear prediction to get a lossy image and the residual image. In second step the algorithm uses arithmetic coding. CALIC has mechanism to automatically trigger a binary mode. which is use to code either uniform or binary sub images or both.

2. LOCO-I (Low Complexity Lossless Compression for Images)

This is the algorithm at the core of the new ISO/ITU standard for lossless and near-lossless compression of continuous-tone images, JPEG-LS. It is conceived as a "low complexity projection" of the universal context modeling paradigm, matching its modeling unit to a simple coding unit. By combining simplicity with the compression potential of context models, the algorithm "enjoys the best of both worlds." It is based on a simple fixed context model, which approaches the capability of the more complex universal techniques for capturing high-order dependencies. The model is tuned for efficient performance in conjunction with an extended family of Golomb-type codes, which are adaptively chosen, and an embedded alphabet extension for coding of low-entropy image regions.[5]

3.3 Transformed Based Algorithm

1..S+P Transformed Based Compression

This type of algorithm exploit spatial frequency information contained in the image to achieve lossless compression. Said and Pearlmen developed an image multiresolution transform that is suited for both lossy as well as lossless compression. this require only integer addition and bit shift operation. Experimental ratio shows that this transform yields far superior compression ratio.[5]

4. Gives the Comparison of Compression Ratio of Different Images

Table1: Compression ratio

Images	JPEG	S+P	CALIC	RANGA	FELICS
LENA	1.56	1.77	1.83	1.59	1.75
MAN	2.04	2.65	2.77	2.49	1.68
CORAL	1.49	1.64	1.68.	1.48	_
SHUTTLE	1.59	2.01	2.12	1.63	-

5.Conclusion

While doing the review on various lossless compression techniques, here we are come to conclusion that as there are already so many algorithm are implemented for the lossless image compression, The best algorithm is measured depends on the following 3 factors: quality of the image, amount of compression, 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 substance of the image.

Speed of Compression: The speed of image compression and decompression depends on different factors such as the type of file,system hardware, and compression method

References

[1] Krishan Gupta , Mukesh Sharma , Pallavi Sharma "Lossless Compression Based Kmp Technique",ICROIT 2014,India,Feb 6-8-2014

[2] Khaled S Ahnoun, , Noureddine Benabadji ," A hybrid dpcm-dct and RLe coding for satellite image compression" Ieee Transactions On Image Processing Vol. 23, No. 4,April 2014

[3] Pralhadrao V Shantagiri and K.N.Saravanan,‖Pixel Size Reduction Lossless Image Compression Algorithm,IJCSIT, Vol 5, 2013.

[4] Gaurav Vijayvargiya Dr. Sanjay Silakari Dr.Rajeev Pandey A Survey: Various Techniques of Image Compression International Journal of Computer Science and Information Security, Vol. 11, No. 10, October 2013

[5] B.C.Vemuri,S.Sahani,F.Chen,C.Kapoor,C.Leonard and J.Fitszsimmons,"Lossless image Compression"

[6] Various Image Compression Techniques: A Review ,Er. Shruti Puniani, Er. Nishi Madaan International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 3 Issue 4, April 2014

[7] Deltahedron,"Run-length encoding", 5 February 2014. 8 April 2014 <http://en.wikipedia.org>

[8] Manjinder kaur, G. k., "A Survey of Lossless and Lossy Image Compression Techniques," International Journal of Advanced Research in Computer Science and Software Engineering, vol. 3,no. 2,pp. 323-326,February2013.

[9] Asha Lata1, Permender Singh2 " Review of Image Compression Techniques" International Journal of Emerging Technology and Advanced Engineering, Volume 3, Issue 7, July 2013.

[10] A. Alarabeyyat1, S. Al-Hashemi1, T. Khdour1, M. Hjouj Btoush1, S. Bani-Ahmad1, R. Al-Hashemi2,"

Lossless Image Compression Technique Using Combination Methods" Journal of Software Engineering and Applications, 2012, 5, 752-763

[11] Sindhu M1, Rajkamal R2," Images and Its Compression Techniques –A Review", International Journal of Recent Trends in Engineering, Vol 2, No. 4, November 2009.

[12] Subramanya A, "Image Compression Technique,"Potentials IEEE, Vol. 20, Issue 1, pp 19-23, Feb-March 2001

[13] Milos Klima, Karel Fliegel, "Image CompressionTechniques in the field of security Technology:Examples and Discussion,"Security Technology, 2004,38th Annual 2004 Intn. Carnahan Conference, pp 278-284,11-14 Oct., 2004

[14] Ismail Avcibas, Nasir Memon, Bulent Sankur, Khalid Sayood, " A Progressive Lossless / Near Lossless Image CompressionAlgorithm,"IEEE SignalProcessing Letters, vol. 9, No. 10, pp 312-314, October2002.