ISSN: 2456-8848, Vol. I, Issue. II, Sept-2017

International Journal
of
Linguistics & Computing Research

Image Compression Techniques

Sudha Mishra
Centre for Public Health and Food Safety
sudhamishra911@gmail.com

Abstract: ***Image compression is a process of reducing the size of an image file, so that it can be stored and transferred efficiently. There are different techniques which are used for image compression. This paper focuses on various image compression techniques and file formats. An image can be compressed by using either lossy or lossless image compression algorithm. Lossless algorithm provides the same information as the original image where as in lossy algorithm some information loss occurs.***

Keywords- Image Compression, Lossless, Lossy, Redundancy

I. INTRODUCTION

Image compression is a process of eliminating redundancy present in any image. An image consumes huge amount of memory space for its storage and causes inconvenient transmission over limited bandwidth channel. In order to resolve the problem of image storage and transmission, image compression was introduced. The main aim of image compression to save storage capacity, speed up file transfer and decrease costs for storage hardware and network bandwidth. Image compression is a sort of data compression which is used for digital images to reduce their cost for storage or transmission. In other words, we can say that image compression is the process of encoding or converting an image file in such a way that it consumes less space than the original file. The key role of image compression is to reduce the size of an image file without affecting to a greater extent. The reduction in file size facilitates more images to be stored in a given amount of disk or memory space. It also reduces the time required for images to be sent over the internet or downloaded from web pages.

II. NEED OF IMAGE COMPRESSION

- To handle large amount of information such as multimedia. One of the most important problems in multimedia applications is the storage and transmission of image, video and audio data. [1]
- To fulfill the goal of representing an image with minimum number of bits of an acceptable image quality.
- For focusing on removal or reduction of several types of redundancy in data or information.

III. REDUNDANCY

Every image contains some duplication of data which is called redundancy. Image compression can be done by eliminating redundancy. There are three basic data redundancies found and exploited in image compression. Compression of image can be done by the removal of one or more of the three basic data redundancies. These redundancies are as follows.

- Inter pixel redundancy
- Coding redundancy
- Psycho visual redundancy

a) INTER PIXEL REDUNDANCY

In image neighboring pixels are not statistically independent because there is correlation between neighboring pixels of an image. This type of redundancy is referred as inter pixel redundancy. Sometime this redundancy is also known as spatial redundancy. This redundancy can be explored in many ways, such as by predicting a pixel value based on the values of its neighboring pixels. [2].

b) CODING REDUNDANCY

Coding redundancy is related with the representation of information. The information is represented in the form of codes. If the gray levels of an image are coded in such a way that uses more code symbols than absolutely necessary to

represent each gray level then the resulting image is said to contain coding redundancy. This type of coding is always reversible and normally implemented by using lookup tables. Coding redundancy can be explored by using Huffman Codes and arithmetic coding technique [2].

c) PSYCHOVISUAL REDUNDANCY

Human visual system is not able to distinguish all colours simultaneously [3]. Image possess some information which is not sensitive to the human visual system (HVS)and may be extraneous to the intended use of image. The psycho visual redundancies occur because human perception does not involve quantitative analysis of every pixel or luminance value in the image. Images that convey little or no information to human observer are called psycho visual redundant. Many of the image coding algorithms which are used now a day to eliminate this type of redundancy, such as the discrete cosine transform based algorithm at the heart of the JPEG encoding standard.

IV. TYPES OF IMAGE COMPRESSION

Image compression algorithms have been divided into two major groups

1) Lossless image compression
2) Lossy image compression

a) LOSSLESS IMAGE COMPRESSION TECHNIQUE

In lossless compression, a loss of information is totally avoided where image data are reduced while image information is totally preserved. In lossless algorithm we can recover exact original data. The information content is not modified. when the image is decomposed it will be exactly identical to the original image. This compression algorithm removes statistical redundancy to represent data without losing any information. Lossless compression is used by some image file formats, for example GIF or PNG. Some basic compression methods are as follows-

a. HUFFMAN CODING

It was developed by Huffman. The main feature of Huffman coding is to generate optimal prefix codes. It is instantaneous because each code word in a string of code symbol can be decoded without referencing succeeding symbols. It is uniquely decodable because any string of code symbols can be decoded by examining individual symbols of string from left to right. Huffman coding has two main parts

i) To build Huffman tree from input characters.
ii) Traversal of the Huffman tree and assigning code to characters.

b. ARITHMETIC CODING

Arithmetic coding is a method of generating variable length code. It generates non-block codes. One to one correspondence between source symbols and code words does not exist. In fact, the entire sequence of source symbols is encoded into a single arithmetic code. Code word defines an integer of real numbers between 0 and 1.

c. LZW CODING

LZW (Lempel-Ziv- welch) coding is a lossless data compression algorithm which is named after Abraham Lempel, Jacob Ziv, and Terry Welch. Itis a dictionary-based coding. This algorithm is very simple and easy to implement. It is error free compression approach that also exploits spatial redundancies in an image. It assigns fixed length code words to variable length sequence of source symbols. It does not require prior knowledge of probability of occurrence of the symbols to be encoded.

d. RUN LENGTH CODING

Run length Encoding (RLE) is one of the most commonly used image compression technique. It is done by replacing a sequence (run) of identical symbols by a pair containing the symbol and the run length [4]. Run length coding represents consecutive runs of the same value in the data as the value followed by the count (or vice versa). Run length can be defined as number of consecutive equal values. Let's take an example, an image may have areas of colour that do not change over several pixels; instead of coding "blue pixel, blue pixel, blue pixel ….." the data may be encoded as "300 blue pixels".

e. LOSSLESS PREDICTIVE CODING

Predictive coding technique focus on eliminating the inter pixel redundancies of closely spaced pixels. It encodes only new information in each pixel. The new information is the difference between the actual value and the predicted pixel value.

b) LOSSY IMAGE COMPRESSION TECHNIQUE

The lossy compression technique leads to loss of some information. Lossy schemes provide much higher compression ratios than lossless schemes [5]. The compressed image is not similar to the original uncompressed image because few losses of information occurs. In this technique perfect recovery is not possible. Lossy algorithm is mostly used for sound and video, where some amount of information loss is not detected by users. Major performance techniques include following scheme:

- Compression ratio
- Signal to noise ratio
- Speed of encoding and decoding

Lossy image compression techniques include following schemes

a. SCALAR QUANTIZATION

Scalar quantization is the most common type of quantization scheme. Scalar quantization is represented as Y=Q(x), is the process of using a quantization function Q to map a scalar input value x to a scalar output value Y.

b. VECTOR QUANTIZATION

Vector quantization is a classical quantization technique which maintains a dictionary of fixed sized vectors known as code vectors.it was originally used for image compression.

V. TYPES OF FILES

A. GIF

GIF is abbreviation of graphics interchange format. It is a bitmap image format introduced in 1987 by CompuServe. GIF images are compressed by using the Lempel–Ziv–Welch (LZW) lossless data compression technique which reduces the file size without degrading the visual quality. It is suitable for simpler images such as graphics or logos with solid areas of color. The basic obstruction of a GIF is that it only works on images with 8-bits per pixel or less, which means 256 or fewer colors. Usually color images are 24 bits per pixel. It can be used for animated images.

B. JPEG

JPEG stands for Joint Photographic Expert Group which is an image format that uses lossy compression in order to create smaller file sizes. JPEG's big advantage is that it allows the designer to fine tune the amount of compression used. The use of JPEG in still photographs or a video with very low fps (frame per second). The data is compressed of individual photographs.

C. M-JPEG

M-JPEG stands for motion Joint Photographic Expert Group. It is a video compression format. It is same as JPEG because each frame is compressed separately as a JPEG image. But in M-JPEG format images are at a very high fps (frame per second) which shows an illusion of a running video.

D. MPEG

MPEG 4 is abbreviation of Moving Picture Experts Group which comes in different versions. It is an audio and visual digital data compression format. MPEG 4 image compression is frequently used in industry. This technology emphasizes on the dealing with the change in previous and subsequent frames instead of each frame itself. It stores only that portion of the frame which is changed from that of its previous state.

E. PNG

Portable Network Graphics (PNG) is a file format which is widely used on the internet. It is another bitmapped image format that supports lossless data compression. Images can be highly compressed than GIF file format. It facilitates more color and creates smaller file which takes less time to be downloaded or uploaded therefore fast transmission is possible. PNG was created to replace the GIF image format. Mostly browsers support PNG. The main advantage of PNG is that it supports a number of transparency options, including alpha channel transparency.

VI. APPLICATIONS OF IMAGE COMPRESSION

Now a day the digital technology has been playing an important role in our daily life. Image compression is used to compress digital images in order to manage huge amount of information. Image compression is also required in compressing medical images to decrease the storage space and efficiency of transfer the images over network for access. Today image compression is needed in every field to handle large amount of information such as multimedia. Some applications of image compression in various fields are-

- Broadcast Television.
- Remote sensing via satellite.
- Military communication via radar, sonar.
- Tele conferencing.
- Facsimile transmission.
- Medical images: in computer tomography.
- Magnetic Resonance Imaging (MRI).
- Satellite images, geological surveys, weather maps.
- Image compression enhanced the efficiency of recording, processing and storage.

VII. BENEFITS OF IMAGE COMPRESSION

- It provides a believable cost savings involved with transmitting less data over the switched telephone network where the cost of the call is really usually based upon its duration.
- It reduces storage requirements and overall execution time as well.
- It decreases the probability of transmission errors since fewer bits are transferred.
- It provides a level of security against unauthorized monitoring.

CONCLUSION

This paper represents the concept of image compression and various techniques used in the image compression. All the image compression techniques are useful in their respective areas. it is found that lossless image compression techniques are more effective than the lossy compression techniques. Lossy provides a higher compression ratio than lossless. This paper gives clear idea about basic compression techniques and image types.

REFERENCES

[1]. Himali B. Kotak, Sanjay A. Valaki, A study of image compression techniques and its application in telemedicine and teleconsultation, in the Journal of information, knowledge and research in computer science and applications, volume – 03, issue – 01, 2014, Pg. 568.

[2]. 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.

[3]. Khobragade P. B., Thakare S. S., Image Compression Techniques- A Review, International Journal of Computer Science and Information Technologies, Vol. 5 (1), 2014, pgs 272-275.

[4]. Sonal Chawla, Meenakshi Beri, Ritu Mudgil, Image Compression Techniques: A Review, International Journal of Computer Science and Mobile Computing, Vol.3 Issue.8, August- 2014, pg. 291-296

[5]. Anurag Bhatt, Dr. Ashutosh Kumar Bhatt, Image Compression Algorithms under JPEG with Lapped Orthogonal Transform and Discrete Cosine

Transformation, International Journal of Engineering Research and Development, Volume 7, Issue 3 (May 2013), Pg. 06-10