

A Review of Image Compression

Karmjeet Kaur¹ Er Amritpal Kaur²

^{1,2}Department of Computer Science & Engineering

^{1,2}SGGSWU, Fatehgarh Sahib, Punjab (140406)

Abstract— Image compression plays important role in the image processing. Image compression is the process of reducing the size of the image. The image stored in raw form needs large amount of space for storage that is considered as the biggest problem during the transmission of the image. So in this way the storage capacity and the transmission capacity of the image degrade. The data compression techniques can be used for the image compression but the quality of the image is decreased. To improve quality of image various image compression techniques have been introduced. Image compression can be lossy image compression or lossless image compression. In lossy the reconstructed image is not exactly same as the original image. In case of lossless image compression the reconstructed image after applying the compression is same as original image. Lossy and lossless compression techniques are further of various types. In this paper various lossy and lossless techniques are discussed. On the basis of the survey conducted the efficient and the effective technique of image compression is obtained. This will results in the best compression method for the image compression in which the quality of the image is not degraded and the information that is present in the image is not lost.

Key words: Image Processing, Image Compression; Lossy Method, Lossless Methods

I. INTRODUCTION

Signals representing the digital systems are called as image. Image is basically the array of the pixels. Image processing is process in which the various operations are performed on the image. For performing any processing on the image, the image is converted into digital form. Image compression is one of the of the image processing process in which the image is compressed. Data compression techniques can be used for the image compression but the results are not efficient. For different application like remote sensing, biomedical etc, different types of images are used. Compression is the process of removing the bits that are extra of the image that are of no use. Image compression is defined as the efficient process of the storing and transmitting the images.

A. Need of Compression

Compression is process of reduction of the bits to represent the same signal into reduced form. In the compression the extra bits are removed. So in this way the compression process will reduce the size of the data that in turn will reduce the memory consumption. This is useful as it help to reduce the data storage space, capacity of the data transmission. The bandwidth requirement is also less. The uncompressed data store large amount of space. So this the basic need of the compression. Data compression is considered as the significant application of the image processing. As the processing of the image is done the size

of the data is reduced. Transmission capacity of the system is also increased.

In addition to this the security of the system is also increased if the data is compressed.

B. Compression Principle

Images contain various redundant information the basic reason behind this is that neighboring pixels are related to each other so there is need to differentiate the pixel that contain redundant information. Redundancy and the irrelevancy reduction are the two important elements of the compression. Removing the duplicated bits from the signal is termed as the redundancy reduction is the. In case of Irrelevancy reduction the part of the signal that is notice by the receiver is removed. The foremost step is to detect the redundancy bits so that they can be removed. There are three ways in which the redundancy bits are identified in the signal.

1) Coding Redundancy

A information of the system is representd by the symbols that are called as the code. A group of code symbols that are used to represent the information is called as code word. The length ofteh code is defined as the number of symbols that are present in it..if more bits are present in the code that will indicate the redundancy.

2) Spatial Redundancy and Temporal Redundancy

As in image the neighboring pixels are related to each other. The information is repeated unnecessarily. These will just duplicate the information.

3) Irrelevant Information

In this the information that is neglected by the human visual system will be contained in the array .This is not of any use so the basic need of image compression is to remove such type of redundancy by reducing extra bit .

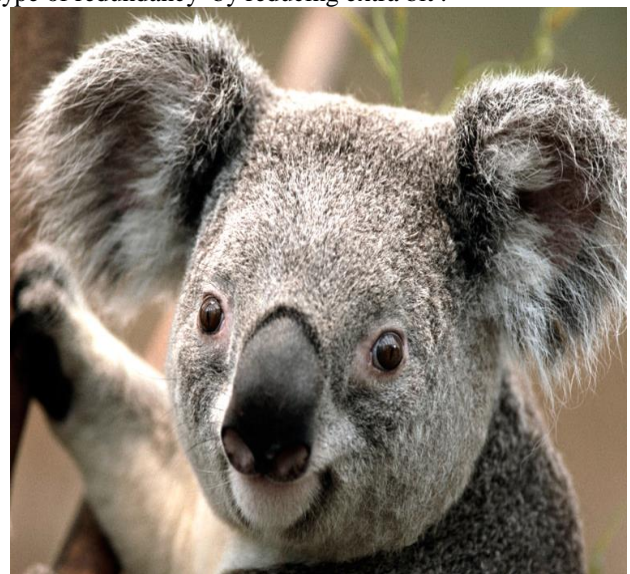


Fig. 1: Original image



Less compressed image Highly compressed image
Fig. 2: Less compressed image & Highly compressed image

II. IMAGE COMPRESSION

Image compression is the process in which the number of bits of the image are reduced so that the storage capacity is decreased along with this the transmission capacity of the signal is increased. To reconstruct the image the inverse process is applied on the compressed image. The main purpose of the image compression is to reduce extra bits of the image without decreasing the quality of the image. While the reconstruction of the image is done it should be obtained same as the original image.

The process of image compression is completed into two steps that are termed as

- 1) Encoding
- 2) Decoding

A. Encoding

Steps of the encoding step are described below:

- 1) An image is selected on which compression is to be applied. The mapper process is applied.
- 2) In next step the quantization is done.
- 3) Then the encoding is done and the compressed image is obtained.

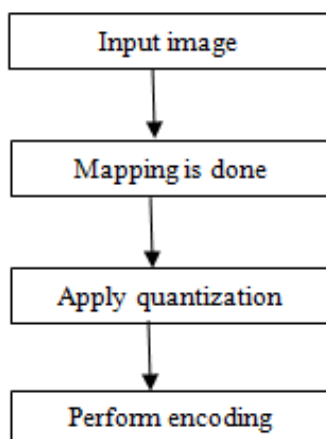


Fig. 1: Process of Image Compression

B. Decoding

In the decoding part the image that is compressed earlier is reconstructed. Steps of the decoding are described below

- 1) The encoding image is given to the decoder

- 2) Next step is to apply dequantization on the image obtained from the decoder.
- 3) Then inverse of the mapper is done and the output image is obtained.

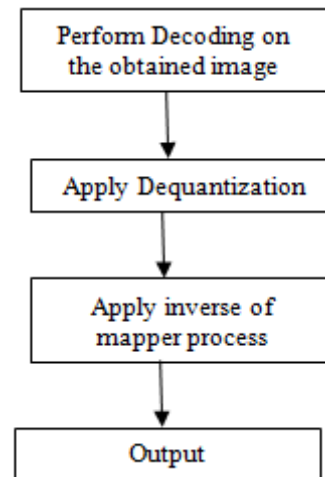


Fig. 2: Process of image decompression

III. TYPES OF IMAGE COMPRESSION

With the help of image Compression the size of the image is reduced to store it into the less space. The image is compressed without altering its information and quality. The reconstructed image should be same as the original the image compression is divided into two:

- 1) Lossy image compression
- 2) Lossless image compression

A. Lossy Image Compression

In lossy image compression the reconstructed image is not same as the original image, the image is close to the original one but not exact as the original image. This type of compression is suitable for those applications where a small amount of loss of information is acceptable. Various types of lossy image compression techniques have been proposed some of which are

- Transform coding
- Vector quantization
- Fractal coding
- Block truncation coding

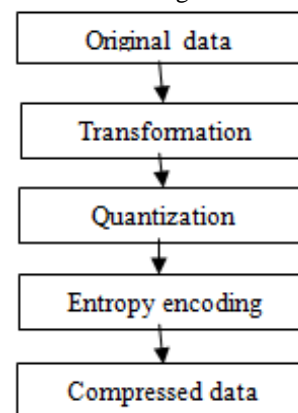


Fig. 3: Block diagram of lossy image compression

B. Lossless Image Compression

In lossless image compression the image is compressed with the help of various encoding algorithms and after the

decompression, the image that is obtained is same as the original image. There are lossless image compressions have been proposed that help in the compression of the image without altering the image quality. Some of the compression techniques are:

- Run length encoding
- Huffman encoding
- Area coding
- Data folding

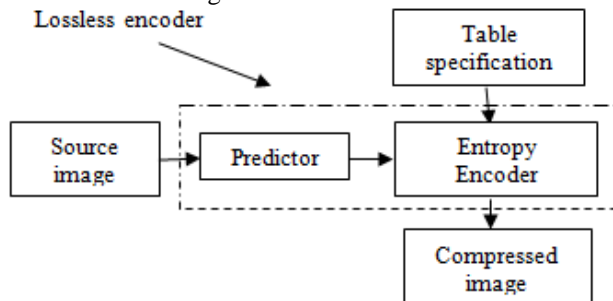


Fig. 4: Block diagram of lossless compression [20]

IV. RELATED WORK

This section represents the various compression techniques that are used for the compression of image. The basic need of the compression is to reduce the size of the data without reducing its quality. A survey of various image compression techniques have been discussed below:

Navpreet Saroya et al [13] presented the lossy technique for the compression of the data. DCT and DWT are the techniques that are used for the compression of the data. from the results obtained it is concluded that these techniques are efficient for the compression . The PSNR parameter is used for the calculation of the results.

Suresh Yerva et al [21] presented the lossless compression technique for the image compression. The data folding technique is used that is used for the redundancy reduction. In this both column folding and the row folding is applied .The data folding technique is considered to be the efficient technique of image compression as it provides god compression efficiency and along with that computational complexity is low .

Samir Kumar Bandyopadhyay et al [19] proposed the lossless compression technique for the compression of the image. An approximate matching technique and the run length encoding are used. In addition to this the comparison between the proposed algorithm and the JPEG compression technique is presented.

Nikita Bansal et al [14] proposed a hybrid approach by combing two techniques of image compression that are DCT and DWT. The advantage of using DCT is that it has high energy and required less computational resource and DWT is efficient when it comes to multi resolution transformation. The main goal of the image compression is to preserve the quality of the image that is reconstructed.

A.M. Raid [2] presented a survey on lossy image compression using discrete Cosine Transform .along with this the JPEG compression algorithm is also used for the still image application. it also describe the components of the image . As image compression is important for reducing the size of the data so an effective technique for the image

compression needs to be proposed. This technique is considered to be the efficient for image compression.

Sindhu M [20] presents the review on various image compression techniques. A comparison between various techniques is done among the techniques discussed the best technique of image compression is obtained. Image compression reduces the size of the image without degrading its quality.

Richa Goyal [18] studied various image compression techniques are. As image compression techniques are of two types lossy or lossless. This paper presents various compression technique advantages and disadvantage of techniques are discussed and on the basis of that the best technique is chose for image compression process.

V. APPLICATIONS OF IMAGE COMPRESSION

Image compression is important part of image processing. Different types of images are used for different type of application. Some of the applications of the image compression are described below:

- 1) The efficiency of the sharing and viewing the images has increased. This is useful for every industry where the sharing of information is essential part of the business .Industries like fax transmission, remote sensing and high definition television.
- 2) In field of medical images where large numbers of images are required .image compression is quite useful in such area. As images are compressed large amount of the data is stored from where it can be review later on. As the quality of the image is not degraded so this process is quite useful
- 3) Image compression also plays an important role to the organization where a standard is set for the viewing and storing the image .it can be useful for retail stores etc. the time is saved that can be utilized for some other work. In case of retail stores the introduction, replacement of new product or removal of any product can be completed easily if all the workers will view, process the image in the same way. In case of the federal government where the standard is maintained for viewing and transmitting the image, a large amount of time spent in explaining such things is saved that time can be utilized in some other process
- 4) Security of the system is also maintained with the help of the image compression. The image processing results in increasing the efficiency of recording, processing and storage. It is considered as very efficient process that is used in watermarking concept. The data that is to be sent is compressed by using the compression algorithms and then it sis send this has increased the security of the data. Image resolution and quality are the important as the network bandwidth, and security.
- 5) Image compression can be used in such cases where the accurate representation of the image is required such types of image is used in Museums and art galleries where the pictures that are used must be accurate.

VI. CONCLUSION AND FUTURE SCOPE

In this paper various image compression techniques have been discussed. The image compression is used for

compressing the image. With the help of the image compression technique the storage of the system is increased. Also the transmission capacity is increased. So by conducting this survey the best technique is selected that is used for the compressing the image, the quality of the image is not degraded.

From the results obtained it is concluded that the existing techniques of the image compression are not that much efficient as the size of the data is reduced but the quality of the image also decreased as different types of images are used for different application. So in future the approach can be enhanced by shifting to the frequency domain, so that the internal properties of the image are not altered. Along with this encoding algorithms can also be applied for the compressing the data.

REFERENCES

- [1] A. Alarabeyyat, "Lossless Image Compression Technique Using Combination Methods", *Journal of Software Engineering and Applications*, 5, 2012, Pp 752-763.
- [2] A. M. Raid, "Jpeg Image Compression Using Discrete Cosine Transform - A Survey", *International Journal of Computer Science & Engineering Survey (IJCSES)* Vol.5, No.2, April 2014, Pp 39-47.
- [3] Archana Parkhe, "Enhancing the Image Compression Rate Using Steganography" *The International Journal Of Engineering And Science (IJES)*, Vol 3, issues 2, Pp 16-21.
- [4] Bruno Carpentieri, "Lossless Compression of Continuous-Tone Images" *IEEE*, Volume: 88, Issue: 11, Pp 1797 – 1809.
- [5] Deepa T, "Image compression using Hybrid wavelet Transform and their Performance Comparison" Vol. 4, Issue 6, June. 2014, Pp 6-12.
- [6] Dr.S.S.Pandey, "Block wise image compression & Reduced Blocks Artifacts Using Discrete Cosine Transform" *International Journal of Scientific and Research Publications*, Volume 5, Issue 3, 2015, Pp 1-10.
- [7] Firas A. Jassim, "Five modulus method for image compression", *Signal & Image Processing: An International Journal (SIPIJ)* Vol.3, No.5, 2012, Pp 19-28.
- [8] François G., "Fast Adaptive Wavelet Packet Image Compression", *IEEE TRANSACTIONS ON IMAGE PROCESSING*, VOL. 9, NO. 5, MAY 2000, 792-800.
- [9] Jagadish h. pujar, "a new lossless method of image compression and decompression using huffman coding techniques", *Journal of Theoretical and Applied Information Technology*, 2010, PP 18-23.
- [10] Jeevan K.M, "Comparative Study of DCT based Image Compression on Hexagonal and Conventional Square Pixel Images", *International Journal of Computer Applications (0975 – 8887)* Volume 43– No.7, 2012, Pp 40-42.
- [11] Matt Marcus, "JPEG Image Compression", unpublished.
- [12] M. I. Khalil, "Image Compression Using New Entropy Coder" *International Journal of Computer Theory and Engineering*, Vol. 2, No. 1, 2010, Pp 39-41.
- [13] Navpreet Saroya, "Analysis of IMAGE COMPRESSION Algorithm Using DCT and DWT Transforms", *International Journal of Advanced Research in Computer Science and Software Engineering*, Volume 4, Issue 2, February 2014, Pp 897-900.
- [14] Nikita Bansal, "Image compression using hybrid transform technique" *Journal of Global Research in Computer Science*, Volume 4, No. 1, January 2013, Pp 13-17.
- [15] Ning Zhang, "An Improved Fast SPIHT Image Compression Algorithm for Aerial Applications" *JOURNAL OF MULTIMEDIA*, VOL. 6, NO. 6, 2011, Pp 494-501.
- [16] Prabhakar.Telagarapu, "Image Compression Using DCT and Wavelet Transformations", *International Journal of Signal Processing, Image Processing and Pattern Recognition*, Vol. 4, No. 3, September, 2011, Pp 61-74.
- [17] Rajesh K. Yadav, "Study and analysis of wavelet based image compression techniques" *International Journal of Engineering, Science and Technology* Vol. 4, No. 1, 2012, Pp. 1-7.
- [18] Richa Goyal, "A Review of Various Image Compression Techniques" *International Journal of Advanced Research in Computer Science and Software Engineering*, Volume 4, Issue 7, July 2014, Pp 708 - 710.
- [19] Samir Kumar Bandyopadhyay, "Image Compression using Approximate Matching and Run Length" *Journal of Advanced Computer Science and Applications*, Vol. 2, No. 6, 2011, Pp 117-121.
- [20] Sindhu M, "Images and Its Compression Techniques – A Review" *International Journal of Recent Trends in Engineering*, Vol 2, No. 4, November 2009, Pp 71-75.
- [21] Suresh Yerva, "Lossless Image Compression based on data folding" *IEEE*, 2011.