ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 5, May 2015

Hybridized Approach for Lossless Image Compression

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Abstract: The lossless compression is that allows the original data to be perfectly reconstructed from the compressed data. The main objective of image compression is to decrease the redundancy of the image data which helps in increasing the capacity of storage and efficient transmission. . Image compression plays an important role in computer storage and transmission. The purpose of data compression is that we can reduce the size of data to save storage and reduce time for transmission. Image compression is a result of applying data compression to the digital image. The paper presents a lossless image compression technique using the hybridization of two different entropy coding techniques. Initially data folding technique has been applied to the image. A row folding is applied on the image matrix followed by a column folding. Multiple iterations of this process is applied on the image. After completing the data folding process another entropy coding technique known as arithmetic coding has been applied to the resultant image to get better results.

Keywords: Lossless image compression, data folding, arithmetic coding, compression ratio.

I. INTRODUCTION

Digital processing is the use of computer algorithms to perform image processing on digital images. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Image compression is an application of data compression that encodes the original image with few bits. Lossless compression programs do two things in sequence: the first step generates a statistical model for the input data, and the second step uses this model to map input data to bit sequences in such a way that probable**.** The objective of image compression is to reduce the redundancy of the image and to store or transmit data in an efficient form. The main goal of such system is to reduce the storage quantity as much as possible, and the decoded image displayed in the monitor can be similar to the original image as much as can be. The essence of each block will be introduced in the following sections.

Image compression techniques reduce the number of bits required to represent an image by taking advantage of these redundancies. An inverse process called decompression (decoding) is applied to the compressed data to get there constructed image. The objective of compression is to reduce the number of bits as much as possible, while keeping the resolution and the visual quality of the reconstructed image as close to the original image as possible. Image compression systems are composed of two distinct structural blocks: an encoder and a decoder.

II. COMPRESSION TECHNIQUES

A. Quantization Technique:

Quantization refers to the process of converting the continuous pixel values (such as decimal values) to discrete values (such as integers). The quantizer performs a lossy image compression. The input to a quantizer is the original data, and the output is always one among a finite number of levels. The quantizer is a function whose set of output values are discrete, and usually finite. This is a process of approximation, and a good quantizer is one which represents the original signal with minimum loss or distortion. The different types of quantization are–

- Scalar Quantization
- Vector Quantization.

B. Entropy Coding Technique

After the quantization has been applied to the image, a symbol encoding technique is applied to the image. Entropy is the amount of information present in the data, and an entropy coder encodes the given set of symbols with the minimum number of bits required to represent them.[7] Entropy Coding techniques mostly provide lossless compression. Some of the entropy coding algorithms are-

- Huffman Coding
- Arithmetic Coding
- Run Length Coding
- Data Folding

III. PROPOSED TECHNIQUE

Hybridization of two lossless image compression techniques has been used to obtain better results. Data Folding technique has been applied to the image followed by another entropy coding technique i.e. Arithmetic Coding. These two techniques have been individually used earlier to provide lossless image compression. But using these two techniques in one algorithm are supposed to provide better Compression Ratio (CR) and lesser Bits Per Pixel (BPP). Though none of the technique can be

ISSN (Online) 2278-1021
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International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 5, May 2015

considered as completely lossless but using these techniques the loss has been expected to be minimum.

A. Data Folding: Data folding is an iterative procedure, column folding followed by row folding, that is repeated at every image level. Original image (i.e. input image) must be square [2].

Data folding is a very effective algorithm that can be used for lossless image compression. The simple method applied on the image is to subtract the even pixels from odd pixels and the store this difference in a separate buffer. This one step is known as folding. Then further folding is applied to pixel values stored in the separate buffer. In this way, a number of iterations have been applied to the data. The process of data folding consists of two steps:

- Row Folding
- Column Folding

B. Arithmetic Coding: In this method, a code word is not used to represent a symbol of the text. Instead it uses a fraction to represent the entire source message [3]. The occurrence probabilities and the cumulative probabilities of a set of symbols in the source message are taken into account. The cumulative probability range is used in both compression and decompression processes. In the encoding process, the cumulative probabilities are calculated and the range is created in the beginning. While reading the source character by character, the corresponding range of the Character within the cumulative probability range is selected. Then the selected range is divided into sub parts according to the probabilities of the alphabet. Then the next character is read and the corresponding sub range is Selected. In this way, characters are read repeatedly until the end of the message is encountered. Finally a number should be taken from the final sub range as the output of the encoding process. This will be a fraction in that sub range. Therefore, the entire source message can be represented using a fraction. To decode the encoded message, the number of characters of the source message and the probability/frequency distribution are needed.

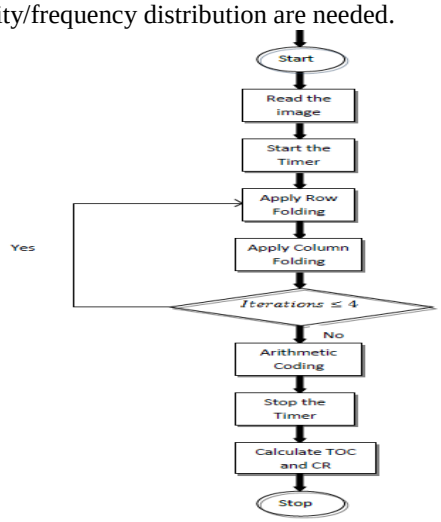

Fig: Flow Chart for Compression Procedure

IV. CONCLUSION

We had analysis the different compression techniques and concluded that these techniques are either lossy or lossless. After this analysis we have proposed a lossless image compression technique known as data folding followed by arithmetic coding. In this technique we have performed the hybridization of these two techniques. First row folding followed by column folding has been performed, after that arithmetic coding has been applied on the resultant image.

ACKNOWLEDGEMENT

Thanks to my family, my guide **Er. Navdeep Kaur** (AP, CSE Department), **Er. Harpreet Kaur** (AP & HOD, CSE Department), Bahra Group of Institute, Bhedpura, Patiala for having faith in me and allowing me to work with all terms and conditions and advising me time to time about this survey paper.

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