

IMPROVING THE STORAGE AND QUALITY OF DISCRETE COLOR IMAGES USING LOSSLESS IMAGE COMPRESSION TECHNIQUE

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Abstract

In this paper, We have presented lossless image compression techniques on discrete color images such as maps, satellite images, etc. The methods applied are Huffman coding and Arithmetic coding on layered separated images after row-column reduction to obtain a reduced size image. Due to which the quality of the image is same as that of original image. To compare the result of original image and reconstructed image we are using the parameter such as PSNR and MSE. PSNR and MSE value are inversely proportional to each other. Compression ratio is high as compared to other techniques.

Key Words: layer separation, Row column Reduction, Huffman coding, Arithmetic coding, PSNR, MSE.

1. INTRODUCTION

Image compression is diminishing the amount of data required to represent an image without degrading the quality of the image to an unacceptable level. The objective of image compression [1] is to reduce the unnecessary pixel/redundancy of the image and to store or transfer data in an efficient form. The contraction in file size allows more images to be stored in a given amount of disk or memory space.

There are two types of image compression: lossless compression and lossy compression. With lossless compression, the original image is recovered exactly after decompression. Sadly, with images of usual scenes it is rarely possible to obtain error-free compression at a rate of above 2:1. Much higher compression ratios can be gained if some error, which is usually difficult to realize, is allowed between the decompressed image and the original image. In many cases, it is not significant or even desirable that there be

error-free replication of the original image. Let's consider, if some noise is present, then the error due to that noise will usually be somewhat reduced via some denoising method. Some small amount of error are introduced by lossy compression may be sufficient. Another application where lossy compression is common is in fast transmission of still images over the Internet [7].

Lossy compression is a data encoding technique that compresses data by eliminating some of it. The procedure aims to minimize the amount of data that needs to be managed or transfer by a computer. It permits reconstruction only of a resemblance of the original data, this usually allows for enhanced compression rates (and therefore smaller sized files). Lossy methods are exclusively suitable for natural images such as photographs in applications where minor loss of fidelity is acceptable to achieve a massive reduction in bit rate. The lossy compression that produces gradual differences may be called visually lossless.

This work presents the details of a new, innovative lossless compression method that is suitable for compressing a broad class of discrete-color images. Consider an effective system comprising an information source, which assembles uniformly sized block of binary images, and a channel that outputs them. Suppose these block resemble mosaic tiles, which when group in some way will reproduce and give meaning to the image conveyed by the mosaic. In light of that metaphor, assume that the procedure of generating that image group obeys a stationary stochastic process. For every time change, the distribution of such group should remain the same. Consequently, the probabilities may be used to determine the compression execution for each and every possible image that the fictitious source could assemble.

In order to construct a large sample of binary images, we considered collecting and partitioning binary images into 8×8 blocks to inspect the long-term system

entropy. Entropy coders, such as Huffman and Arithmetic coding, add to the idea of establishing a universal codebook comprising pairs of 8×8 blocks and their Huffman or Arithmetic codes. In order to achieve such a codebook, we form a structure of binary images anyway collected from different sources and distinct as possible in their pixel representations. Thereafter, we eliminated images that contained salt-and pepper noise. This preprocessing is useful in constructing an unbiased codebook. Finally, we studied the relative prospect of all blocks in the sample and, thus, we calculated the entropy of binary images based on the relatively large sample. We used the probability distribution of 8×8 blocks to construct Huffman and Arithmetic codes for all blocks with absolute frequency number greater than 1. We are aware that a stochastic discrete dynamic system may assemble infinitude of binary images for a determining a explicit entropy value. A hypothetical source such as the one described here may not produce rare sequences of blocks, any more than an equivalent source may not produce sequences.

Huffman Encoding: In information theory, Huffman coding is an entropy encoding algorithm used for lossless data compression method. It was developed by David Huffman. Huffman coding [2] today is usually used as a "back-end" to some other compression methods. The word refers to the use of a variable-length code table for encoding a source type where the variable-length code table has been derived in a distinct way based on the estimated probability of occurrence for each possible value of the code. The pixels in the image are treated as symbols. The symbols which occur more often are assigned a smaller number of bits, while the symbols that occur again and again are assigned a relatively bigger number of bits. Huffman code is a prefix code. This aid that the (binary) code of any symbol is not the prefix of the code of any other symbol.

Arithmetic Coding: Arithmetic coding is a form of entropy encoding used in lossless data compression. Normally, a cord of characters such as the words "hello" is represented using a fixed number of bits per character, as in the ASCII code. When a string is novice to arithmetic encoding, frequently used characters will be stored with little bits and not so generally occurring characters will be stored with more bits, resulting in fewer bits used in total. Arithmetic coding vary from other forms of entropy encoding such as Huffman coding [3] in that rather than separating the input into basic symbols and replacing each with a code, arithmetic coding encodes the entire message into a single string.

2. LITERATURE SURVEY

To analyze the various image compression methods this paper presents a survey of existing research papers. In this paper we consider different types of existing system of image compression. Compression of an image is somewhat distinct then compression of binary raw data.

Literature review of image compression technique by D.Meenakshi [4]. The Huffman's algorithm is used to achieve minimum redundancy codes compared to further algorithms. This method has successfully used in text , image, video compression, as well as communication system such as, JPEG, MPEG-2, MPEG-4, H.263 etc. This coding method collected the unique code from the basis image as well as calculates its possibility value for each symbol with sets the symbols based on its probability value. In this coding the probability of symbol value arranged from minimum value to maximum value symbol. After that these two values are combined to form a binary tree.

Literature review of image compression technique by V.Karthika[5]. It is the mainly reliable method for statically lossless encoding. It provides extra flexibility plus better competence than the Huffman coding. The main aim of arithmetic code is to provide code words with a perfect length. Arithmetic code is the most useful method to code symbols according to the probability of their occurrence. The average code range is very close to the possible minimum given by information theory. The arithmetic code assigns an interval to each symbol whose size reflects the probability for the presence of this symbol. The code word of a symbol is an arbitrary rational number belongs to the similar interval.

A Survey: Various Techniques of Image Compression In 2013 by S. Dharanidharan [6], et al presents a new altered data encryption algorithm to encrypt the full image in an reliable secure manner, and encryption after the original file will be disjointed and converted to other image file. By using Huffman algorithm the disjointed image files are merged and they merge the entire disjointed image to compress into a individual image. Finally they fetch a fully decrypted image. Next they find an efficient way to relocate the encrypted images to multi path routing techniques. The above compressed image has been sent to the single pathway and now they enhanced with the multi path routing algorithm, finally they get an efficient transmission and reliable, efficient image.

This paper presents various techniques of image compression. These are still a challenging task for the researchers and academicians. There are mainly two types of image compression techniques exist. Comparing the performance of compression technique is difficult unless identical data sets and performance measures are

used. Some of these techniques are obtained good for certain applications like security technologies [8]. After study of all techniques it is found that lossless image compression techniques are most effective over the lossy compression techniques. Lossy provides a higher compression ratio than lossless.

3. PROPOSED SYSTEM

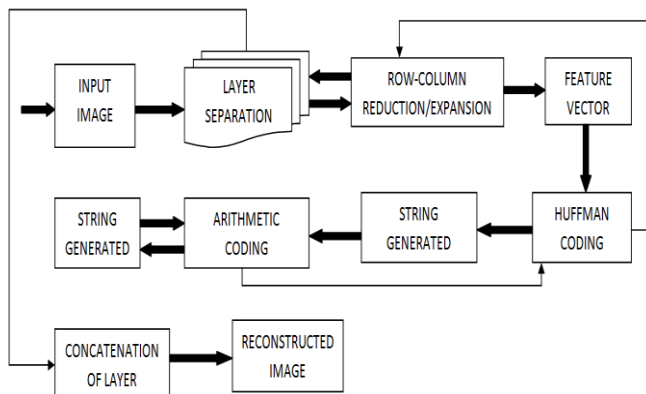


fig 1- system architecture

Layer Separation : In a layer separation method, the layer of different object present in the image are separated by their color present in it. Means because the discrete images consist of many object of layer of images to extract all the layers from it we are using the K-means algorithm to extract the entire layer present in image.



fig 2 -Layer Separation

Row Column Reduction: In a row column reduction technique we give an image as input to this technique. Here the processing will be going on image per pixel and it will generate the binary values .If the images will contain the same per pixel then it will consider the unique value and the remaining values will be consider as 0. After all this it will generate a feature vector values that we will get store in the file automatically to the computer.

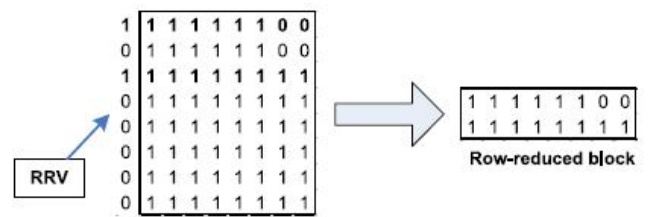


fig 3- The row-reduction operation applied on a block

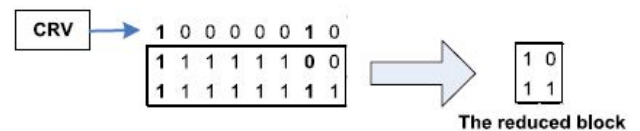


fig 4- The column-reduction operation applied on the row-reduced block .

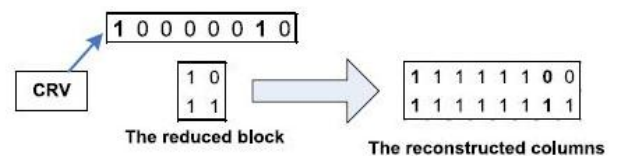


fig 5-Column reconstruction based on the column-reference vector (CRV).

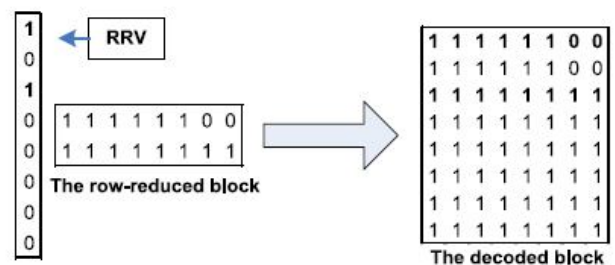


fig 6- Row reconstruction based on the row-reference vector (RRV).

Huffman Coding: The result from Huffman's algorithm can be taken as a variable-length code table for encoding a source image. The algorithm acquires these values from the predicted probability or frequency of occurrence for each possible value of the source image. The more similar symbols are generally represented using fewer bits than less common symbols. Huffman's algorithm can be efficiently implemented, searching a code in linear time to the number of input values if these weights are arranges. However, although optimal among methods encoding symbols separately, Huffman coding is not always excellent among all compression methods.

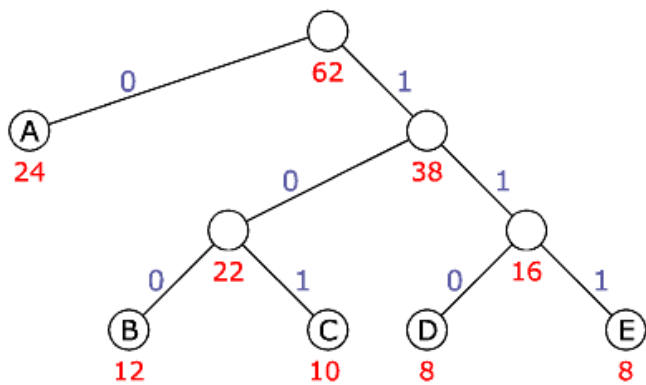


fig 7 :Huffman Tree

Arithmetic Coding: Arithmetic coding is a form of an encoding technique used in lossless data compression. Normally, a string of characters such as the words is represented using a fixed number of bits per character, as in the ASCII code. When a string is transform to arithmetic encoding, usually used characters will be stored with fewer bits and not so generally occurring characters will be stored with more bits, resulting in less bits used in total. Arithmetic coding differs from other forms of encoding technique, such as Huffman coding, in that rather than separating the input into component symbols and replacing each with a code, arithmetic coding encodes the entire message into a single string.

4. MSE and PSNR CALCULATION:

Mean Square Error (MSE) is a measure of the distortion rate in the reconstructed image.

$$MSE = \frac{1}{m \cdot n} \sum_{i=0}^{m-1} \sum_{j=0}^{n-1} [I(i, j) - K(i, j)]^2$$

PSNR has been accepted as a widely used quality measurement in the field of image compression.

$$PSNR = 10 \log_{10} \frac{255^2}{MSE} (dB)$$

5. RESULT

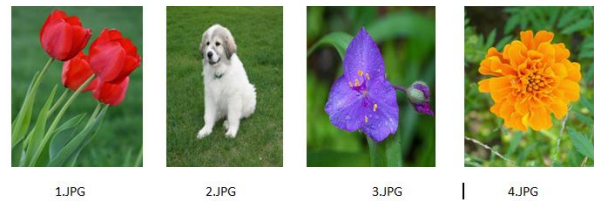


IMAGE NAME /FORMAT	IMAGE SIZE (KB)	MSE	PSNR
1.JPG	15.1	0.19775	55.2036
2.JPG	27.1	0.001187	77.4185
3.JPG	16.7	0.052187	60.9891
4.JPG	20.5	0.298078	53.4215

6. CONCLUSIONS

In this paper we have used the lossless image compression technique to gain compressed image. We have combined the two methods which are basically used for the compression process. Both are easy and simple, but from the two of methods one is actually used for the compression of image and another one is used for compression of string format. We merged them for the better performance and we have achieved it. The quality of the image after the compression and decompression is good. So, we finally get successful results of the both of the algorithm combinly on the image compression process. The algorithms are providing the better performance, better quality of the image and ultimately diminish the bandwidth over Internet after all the process is done.

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