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Comparison of Image Compression Techniques for MRI Brain Image

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ABSTRACT
Run length encoding (RLE) is the method that allows the data compression for information in which pixels are replaced constantly. This paper examines the performance of the RLE algorithm. To compression the image is evaluate and compared. Medical image compression techniques irrelevance and redundancy of the image data in order to be able to store or transmit data in an efficient form. It's useful process to save a lot of space and resources while sending images from one place to another.
Keywords : — Image compression, Run length coding, Lossless compression.

I. INTRODUCTION

A. Compression

Compression is a method that reduces the size of files. The aim of compression is to reduce the number of bits that are not required to represent data and to decrease the transmission time. Achieve compression by encoding data and the data is decompressed to its original form by decoding. A common compressed file extension is .sit, .tar, .zip; which indicates different types of software used to compress files (e.g. Fig. 1).

B. Decompression

The compressed file is firstly decompressed and then used. There are many software's used to decompress and it depends upon which type of file is compressed. For example WinZip software is used to decompress .zip file [1].

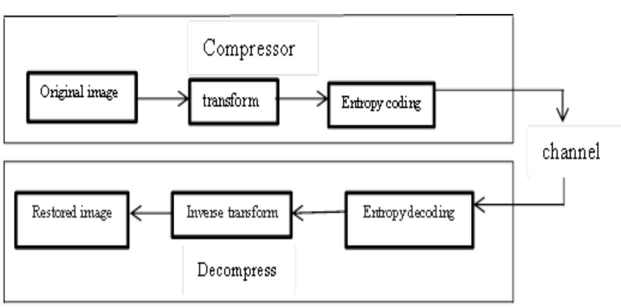

Fig. 1 Block Diagram of image compression

II. MEDICAL IMAGE COMPRESSION

Most hospitals store medical image data in digital form using picture archiving and communication systems due to extensive digitization of data and increasing telemedicine use. If we look inside the medical image processing, we can see that there are many medical issues being treated through this processing. These issues comprise subjects related to heart, brain, lungs, kidney, cancer diagnosis, stomach etc. An effort has been done to provide effective storage of medical images with patient medical record for future use and also for effective transfer between hospitals and health care centers. In the following, the most important medical image compression techniques that have been proposed are reviewed (e.g. Fig. 2, Fig. 3,Table 1).

TABLE 1
RESULTS OF IMAGES COMPRESSION USING RLA AND DWT

Image name	Original image size	Compression image size	Compression Ratio	TC for DWT	GC for DWT
IMG1	1572864	1105024	1.4234	10.4049	90.3891
IMG2	131072	84592	1.5495	2.7339	63.4216
IMG3	998784	764416	1.3066	6.6327	84.9232
IMG4	998784	889312	1.1231	12.3057	91.8737
IMG5	131072	87136	1.5042	8.6508	88.4403

Original image	Decompression image(RLC)	Decompression(DWT)

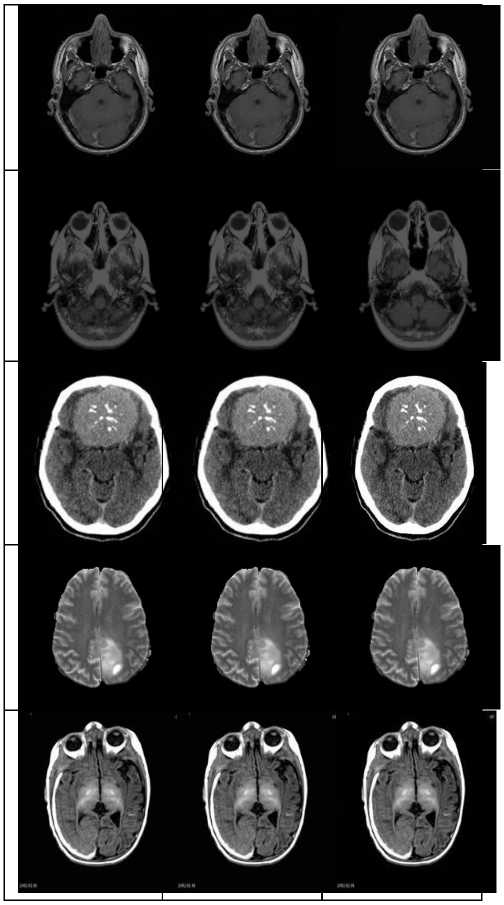

Fig. 2 Image compression using run length algorithm

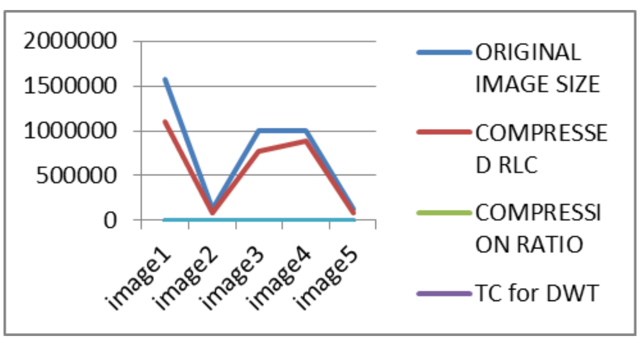

Fig.3 Comparison between discrete wavelet transform and run length

III. TYPES OF IMAGE COMPRESSION TECHNIQUES

There are two categories of image compression i.e. lossless and lossy compression. Lossless compression is used in artificial images. Basically, it uses low bit rate. In the Lossy compression techniques, there is the possibility of losing some information during this process. While lossless compression is basically preferred in medical images and military images, owing to the lesser possibility of loss of information. The explanation of these methods.

C. Lossy Compression

In compression technique, accuracy is very important in compression and decompression. There will be a possibility of data information loss but it should be under the limit of tolerance. It should be good enough for application of image processing. This kind of compression is used for sharing, transmitting or storing multimedia data, where some loss of data or image is allowed. JPEG is examples of lossy processing methods. When the receiver is human eye, lossy data is allowed, because human eye can tolerate some imperfection in data/information. Some lossy compression techniques are explained as follow [2].

Memory less source an information source that is independently distributed. Namely, the value of the current symbol does not depend on the values of the previously appeared symbols. Instead of assuming memory less source, Run-Length Coding (RLC) exploits memory present in the information source. Rationale for RLC: if the information source has the property that symbols tend to form continuous groups, then such symbol and the length of the group can be coded.

D. Lossless Compression

Lossless compression is a class of data compression algorithms that allows the original data to be perfectly reconstructed from the compressed data. By contrast, lossy compression permits reconstruction only of an approximation of the original data, though this usually improves compression rates (and therefore reduces file sizes).

Lossless data compression is used in many applications. For example, it is used in the ZIP file format and in the GNU tool zip. It is also often used as a component within lossy data compression technologies (e.g. lossless mid/side joint stereo pre-processing by the LAME MP3 encoder and other loss audio encoders) [3].

IV. OVERVIEW OF RUN LENGTH CODING

Simplest form of lossless image compression technique. Fig. 4 represents long sequences of same data by shorter form. Long runs of redundant data are stored as a single data value and count. Can be even more efficient if the data uses only two symbols (for example 0 and 1) in its bit pattern and one symbol is more frequent than the other. Images with repeating grey values along rows (or columns) can be compressed by storing "runs" of identical grey values in the format:

Grey value 1	repetition 1	Grey value 2	repetition 2	…

For B/W images (e.g. fax data) another run length code is used:

row #	colum n # run1 **begin**	column # run1 **end**	column # run2 **begin**	column # run2 **end**

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Run length coding
0																	03599
1																	11799
2																	
3																	344668 810101 214

Fig. 4 Gray value of run length

V. PROBABILISTIC DATA COMPRESSION

A discrete image encodes information redundantly if

- The grey values of individual pixels are not equally probable
- The grey values of neighboring pixels are correlated Information Theory provides limits for minimal encoding of probabilistic information sources.

Redundancy of the encoding of individual pixels with G grey levels each:

r = b – H

b = number of bits used for each pixel=[**log2 G**]

$$H = \sum_{g=0}^{G-1} p(g) \log 2 \frac{1}{p(g)}$$

H = entropy of pixel source = mean number of bits required to encode information of this source The entropy of a pixel source with equally probable grey values is equal to the number of bits required for coding.

E. Lossless Image Compression

In the decompression phase of lossy image compression, the output images are almost the same as input images. In addition, this method is useful where a little information from each pixel is important. The lossless method is also called as wavelet technique. The example of lossless compression methods are RLE, LZW, Entropy coding, Bhammar M.B et al,

Some of the lossless compression techniques are

- Run Length Encoding
- Huffman Encoding
- LZW Coding
- Area Coding
- Arithmetic Coding

F. Run Length Encoding

Run Length Encoding (RLE) is a simplest compression technique which is most commonly used. This algorithm searches for runs of bits, bytes, or pixels of the same value, and encodes the length and value of the run. RLE achieves best results with images containing large areas of contiguous colour, and especially monochrome images (e.g. Fig. 5), For example The string is aaaaaaaabbbbbcc would have representation as (a; 8)(b; 5)(c; 3) Then compress each (char; length) as a unit using, say, Huffman coding. Clearly, this technique works best when the characters repeat often,

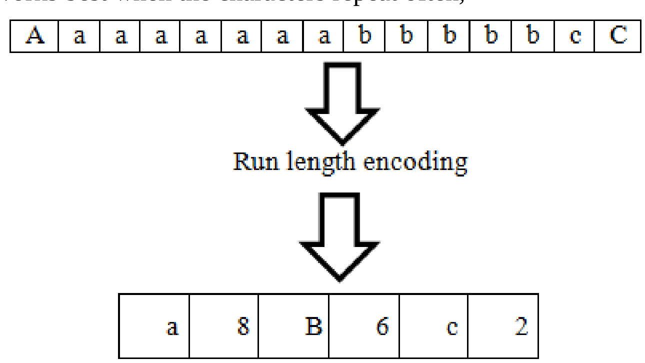

Fig. 5 Example of RLE

Steps of algorithm for RLE are as follows.

Step 1: Input the string.

Step 2: From first symbol or character give a unique value.
Step 3: Read the next character or symbol, if character is last in string then exit otherwise.
A: If: next symbol is same as the previous symbol then give same unique value as pervious.
B: Else if: next symbol is not same, than give its new value that is unmatched from previous value.
Step 4: Read and count additional symbols
Step 5: Go to step 3 until a non-matching value to the not same symbol from previous[4]–[7].

VI. CONCLUSION

Using the optimized run length coding to compress the MRI medical image has to helped greatly reduce the size of compressed image. This algorithm is used transform the data or image. The image compression techniques and it comparison between run length and discrete wavelet transform. The future work two different categories of compression have discussed enlarge on advantages and disadvantages. After we have to brief overview of some medical image compression techniques and provided descriptive comparison between them and the performance for image compression and the computational complexity can be enhanced.

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