Medical Image Processing using Image Compression Methods

Prof. Feroza. M. Mirajkar[1] Dr. Ruksar Fatima[2] Prof. Md. Yousuf Ahmed[3]
[1,3]Assistant Professor [2]Head and Professor
[1,2,3]Department of Electronics & Communication Engineering
[1,2,3]Khaja Banda Nawaz College of Engg. & Technology, Gulbarga, Karnataka, India

Abstract— Image is the combination of pixel and pixel is the element present in the image in the dot form. In today's era image is in the form of 3D form, but earlier it was in the form of 1D or 2D text. The image compression methods are applied for the biomedical images and actually the biomedical images are very huge in size and if any biomedical image is to transfer then it required applying compression methods on the images. Hence in this paper the image compression methods are used to transfer and LZW technique is used reduce the size of the image.

Key words: Picture processing, image compression, compression ratio, DICOM image

I. INTRODUCTION

In today's scenarios health care services and the development of the mutual platforms for biomedical diagnosis have resulted in the technique to compress the medical data in a efficient way. Compression refers to size storage, cost reduction and achieve the transmission speed of medical information from one source network to other destination network; therefore, medical images are important in the form of compressed images for research [1]. Due to large size of medical images, it takes a lot of storage space as compared to normal images. Image compression can be completed in two ways- lossless and lossy form.

In lossless compression, achieved data is same as the original data even after the compression. On the other hand, in lossy compression, when compression is performed, the resultant data is missing. Some part of the original image with minimum loss of data. Applications of lossless compression can be used for text and medical and satellite type images. Whereas applications of lossy compression are used for signals like speed, natural images, etc [2].

A. Lossless Image Compression Methods Are [3]:

1) Run-length encoding – used in default method in PCX and as one of possible in BMP, TGA, TIFF.
2) Area image compression.
3) DPCM and Predictive Coding.
4) Entropy encoding.
5) Adaptive dictionary algorithms such as LZW – used in GIF and TIFF.
6) Deflation – used in PNG, MNG, and TIFF.
7) Chain codes

B. Dicom Image

Digital technology is presented in every field of medical application and provides application-specific mechanisms to support various use-cases. There is a wide development in noninvasive medical imaging technique. There are various medical equipment dealers and manufactures which established a standard DICOM for storing & exchanging the medical images from source to destination [1].

C. LZW

Lempel, Ziv and Welch (LZW) compression name is originate from the scientists Abraham Lempel, Jakob Ziv and Terry Welch. LZW is an adaptive technique. LZW compression algorithm is Simple, lossless and dictionary based compression algorithm. Dictionary based algorithms scan a file and search the sequences of data or string that occur more than once in a file. LZW compression works by replacing strings of characters with single codes without doing any analysis of the incoming text data. It adds every new found characters of string in the dictionary and data compression occurs on the single code. These strings are then stored in a dictionary and the compressed file with references are put wherever repetitive data occurred. The replaced code can be of any arbitrary length, but it must have more bits in it than a single character. The first 256 codes when using eight bit characters are initially assigned to the standard character set and the remaining codes are assigned to strings as the algorithm proceeds [4].

II. RELATED WORK

The related work is formed by comprehensive analysis of different research papers based on lossless methods. Figure 1 shows the steps for finding the literature for this paper.

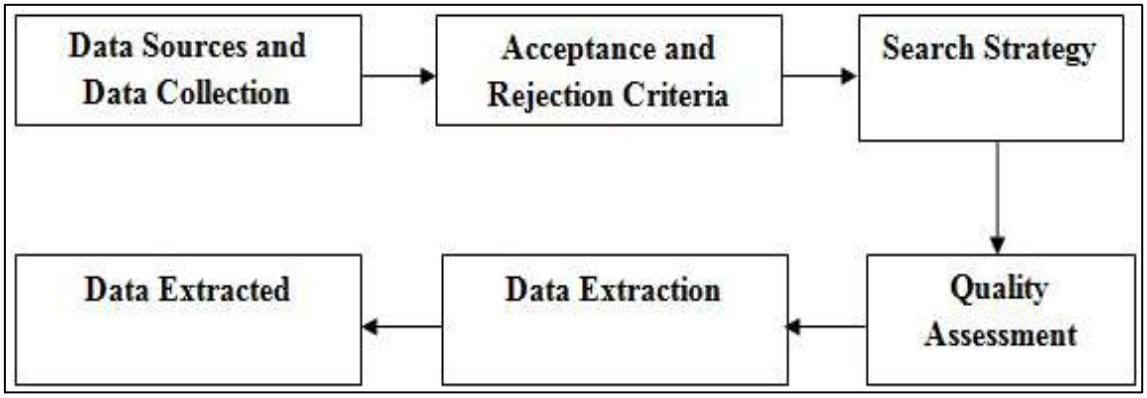

Fig. 1: Steps for related work

Gunasekaran G. and Bimal kumar ray, the authors demonstrate that the image encryption algorithm is efficient and highly secure. The scheme can resist most known attacks, such as statistical analysis and brute-force attacks [5].

An algorithm that works by applying a reversible transformation on the fourteen commonly used files of the Calgary Compression Corpus is proposed. It does not process its input sequentially, but instead processes a block of texts as a single unit, to form a new block that contains the same characters, but is easier to compress by simple compression algorithms, group characters together based on their contexts. This technique makes use of the context on only one side of each character so that the probability of finding a character closer to another instance of the same character is increased substantially. The transformation does not itself compress the data, but reorder it to make it easy to compress with simple algorithms such as move-to-front coding in combination with Huffman or arithmetic coding [6].

Lossless compression is preferred for artificial images such as technical drawings, icons or comics. This is because lossy compression methods when used especially at low bit rates, introduce compression artifacts. It can also be used for high value content, such as medical imagery or image scans in health industry where there is archiving of large number of images. Lossless compression increases the efficiency of sharing and viewing personal images, uses less storage space and is quicker in transmission and reception of images [7].

III. PROPOSED WORK

Figure 2 shows the step by step procedure of the proposed work. Biomedical image is first pre-processed and segmented using segmentation techniques. Once the ROI region is encoded, both the ROI and Non-ROI part are combined together and compressed .Now the compressed image is first encrypted and then decrypted using RSA algorithm. The resultant image is decoded using LZW technique.

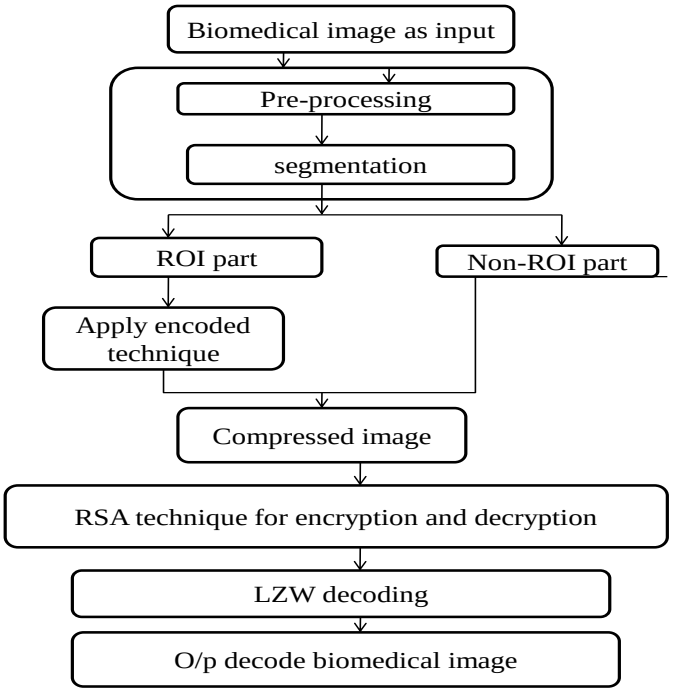

Fig. 2: Activity Diagram for Image Compression

IV. RESULTS AND DISCUSSIONS

Fig. 3: a) Original image b) ROI of image

ROI is Region of Interest and it is used to find the place where there is a need to compress the image or it is a portion of an image that is to be filtered or some other operation is to be performed.

Fig. 4: Original and Decoded Image Using LZW

Images	Original Image Size (MB)	LZ77 Compressed Image Size (MB)	LZ78 Compressed Image Size (MB)	LZW Compressed Image Size (MB)
1.dcm	53.9	52.74	35.08	23.70
2.dcm	269	39.06	39.66	35.38
3.dcm	54.5	38.74	37.70	19.03
4.dcm	268	40.45	39.88	24.77
5.dcm	256	51.79	30.04	21.77
6.dcm	133	29.08	35.29	4.23
7.dcm	136	28.04	35.09	18.91
8.dcm	513	45.12	32.83	6.37

Table 1: Comparison between Size of Compressed image and Original image through different techniques using ROI

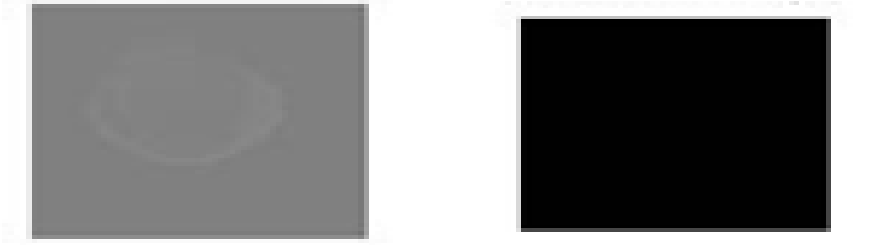

Fig. 3: Decrypted and Decoded Image

Images	Original Image Size (MB)	LZ77 Compression Ratio	LZW Compression Ratio
1.dcm	53.9	1.02	2.27
2.dcm	269	6.89	7.60
3.dcm	54.5	1.41	2.86
4.dcm	268	6.63	10.82
5.dcm	256	4.94	11.76
6.dcm	133	4.57	31.44
7.dcm	136	4.85	7.19
8.dcm	513	11.37	80.53

Table 2: Compression Ratio for different compression techniques using ROI

In Table 1 shows the comparison between size of compressed image and Original image through different techniques using ROI. It is seen that, size of the compressed image using LZW is much smaller as compared to the other two techniques. Table 2 shows the comparison of compression ratios for different techniques in which shows compression ratio of LZW is more than the other techniques, which is one of the most efficient result seen the literature.

V. CONCLUSION

In this Paper image Compression is performed by using the LZW technique. By comparing LZW to the other techniques like LZ77 and LZ78, it is seen that the compression ratio of LZW is more and size of the compressed image is smaller than other

techniques. There are various techniques for image compression, and but by using this method the result is improved and efficient.

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