10th International Conference on Recent Innovations in Science, Engineering and Management
Dhruva Institute of Engineering and Technology, Nalgonda, Telangana State (ICRISEM-17)
7th July 2017, www.conferenceworld.in ISBN: 978-93-86171-53-5

Neural Network Based ROI Detection and Hybrid Image Compression

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ABSTRACT

Region of Interest based compression is an efficient method of compression for images with a particular part to be most significant. It is always a better choice to compress the ROI with lossless compression while the rest of image with lossy compression technique. This paper proposes lossless compression for medical image(ROI) and near lossless compression for the rest of the image. Image other than ROI may contain information that is useful, that is why it is appropriate to use near lossless compression for the rest of the image. In this method of compression, PSNR obtained is remarkable and compression ratio can be increased by increasing the base value which is in power of two. Image compression is essential where images need to be stored, transmitted or viewed quickly and efficiently. The artificial neural network is a recent tool in image compression as it processes the data in parallel and hence requires less time and is superior over any other technique. The reason that encourage researchers to use artificial neural networks as an image compression approach are adaptive learning, self organization, noise suppression, fault tolerance and optimized approximations. In this method of compression, medical image will be compressed completely loss less by using morphological operations. In this paper region of interest (ROI) is detected by Artificial Neural Network(ANN) & then compress the part of ROI using lossless method & the part other than ROI compressed by using lossy method. The reason, wavelet method of compression preferred for the rest of the image is, despite of insignificance of region of image other than ROI.

Keywords –CR (Compression ratio), Mean square error, Near lossless compression, PSNR(Peak signal to noise ratio), ROI(Region of Interest)

I. INTRODUCTION

In this era of digital science, the transmission of information takes place worldwide by means of communication channels. This information has to be transmitted faster in a very compact size. Reducing the size of data content sent, increases the rate of transmission and saves the energy required for transmission. During image transmission, it becomes necessary to compress image without degrading its quality. Mainly, image compression techniques can be classified in two groups -1) lossy compression techniques and 2) lossless image compression. Lossy compression techniques achieve a high compression ratio, but it compromises the quality of recovered image.

Lossless compression achieves high quality of recovered image (high PSNR) but unable to achieve a good compression ratio. Method of compression, which can achieve good CR without risking the quality of recovered image (high PSNR) can be the best substitute for these two compression techniques.

Neural networks (NNs) have been used for image compression for their good performance. However, the image compression convergence time is not efficient. If an image can be sorted in half of its original size yet has a

reasonable resolution, 50% of storage capacity can be saved and the transmission speed will be improved by up to 100%. To achieve a successful image size reduction, the image quality should not be compromised.

II. LITERATURE SURVEY

1. Huffman Coding- Huffman coding [4] is a widely used compression method. With this code, the most commonly used characters contain the fewest bits and the less commonly used characters contain the most bits. It creates variable-length codes that contain an integral number of bits.

2. Shannon-Fano Method- The Shannon-Fano [4] tree is built according toa specific algorithm designed to define an effective code table. The actual algorithm is as follows:

a. For a given list of the symbols, develop a corresponding list of the probabilities or frequency counts so that each symbol's relative frequency of occurrence is known.

b. Sort the list of the symbols according to the frequency, with the most frequently used symbols at the top and the least common at the bottom.

c. Divide the list into two parts, with the total frequency counts of the upper half being as close to the total of the bottom half as possible

d. The upper half of the list is assigned the binary digit 0, and the lower half is assigned the digit 1. This means that the codes for the symbols in the first half will all start with 0, and the codes in the second half will all start with 1.

e. Recessively apply the same procedure t each of the two halves, subdividing groups and adding bits to the codes until each symbol has become a corresponding code leaf on the node.

3. Arithmetic Coding- Arithmetic coding [4] bypasses the idea of replacing input symbols with a single float in point output number. More bits are needed in the output number for longer, complex messages. This concept has been known for some time, but only recently were practical methods found to implement arithmetic coding on computers with fixed sized-registers. The output from an arithmetic coding process is a single number less than 1 and greater than or equal to 0. The single number can be uniquely decoded to create the exact stream of symbols.

4. Run-length encoding - Run-length encoding is very simple form lossless data compression in which runs of the data are stored as single data value and count rather than as the original run. This is most useful on data that contains many such runs. Consider for example, line drawing and animation. It is not useful with files that don't have many runs as it could greatly increase the file size.

5. Entropy encoding -In information theory an entropy encoding is a lossless data compression scheme that is independent of the specific characteristics of the medium. One of entropy coding creates and assigns a unique prefix free code to each unique symbol that occurs in the input. These entropy encoders then compress data by replacing each fixed length input symbol with the corresponding variable length prefix free output codeword approximately proportional to the negative logarithm of the probability. Therefore, the most common symbols use the shortest codes.

6. Chain codes - A chain code is a lossless compression algorithm for monochrome images. The basic principle of chain codes is two separately encode each connected components, or "blob", in the image. This encoding method is particularly effective for images consisting of a reasonably small number of large connected components.

7. Lempel-Ziv-Welch (LZW) – LZW is a universal lossless data compression algorithm created by Abraham Lempel, Jacob Ziv, and Terry Welch it was published by Welch in 1984 as an improved implementation of the

LZ78 algorithm published by Lempel and Ziv in 1978. The algorithm is simple to implement, and has potential for very high throughput tin hardware implementation. It is the algorithm of the widely used Unix file compression utility compress, and is used in GIF image format.

2.1 Problem Formulation

To propose a novel ROI based hybrid algorithm to compress the image based on priority of regions. Medical imaging is one of the best techniques for monitoring the person's health condition which is used widely nowadays. Also some of diseases can be detected using medical imaging methods. One of the problems that physicians encounter with it to store the medical images. This storage occupy more area for storing images long time as there is need to keep the record of numerous patients. So there is need to compress the image to be resolved in a variety of medical images. The rapid and reliable digital transmission and storage of medical and biomedical images would be tremendous boon to the practice of medicine. Patients in urban areas or even in rural areas could have convenient access to second opinions. Patients readmitted in hospitals could have earlier imaging studies instantly available. Rather than waiting for others to finish hard copy films, medical and surgical teams collaborating on patient care could have simultaneous access to imaging studies on monitors throughout the hospitals. So this long term rapid transmission is prohibitive without image compression, to reduce the size of file. To compress the size of medical images is also useful in helping radiologist or surgeons to examine the previous data of their patient; in order to detect pathologic or abnormal regions, and planning suitable treatment, magnetic resonance images are used. To make the Medical Images more useful and process able, there is need to reduce the transmission time and storage space for the images. The image may become more visual too, by compressed as it will also help to reduce transmission errors as less data will be transmit, also reduce the cost.

2.2 OBJECTIVES

The objectives of the proposed work are,

1) Detect the Region of Interest (ROI) by performing

a) Morphological operations

b)Segmentation

2) Design and implement Neural Network to find area of interest.

3) Compare the results of first and second step.

4) Carry lossless compression for ROI.

5) Perform lossy compression for rest of the image.

6) Analyze performance of developed algorithm with existing algorithms in terms of mean square error, Peak signal to noise ratio, compression ratio etc.

7) The image processing technique includes five phases namely pre-processing, enhancement, segmentation, feature extraction.

a) The first phase is the pre-processing, in which noise is removed in order to get good quality of the image/medical image.

b) The second phase is enhancement is used to enhance the image/medical image & identified the expected region.

c) The third phase is segmentation, where the identified expected region is segmented into its region.

d) The fourth phase is the feature extraction is used to extract the surface of expected region

8) Feature Extraction: After the completion of image segmentation stage, Shapes features are performed on

the segmented objects or regions in the scene. For each shape in the binary image the Matlab function region props have a number of properties. The properties which include Major axis length, Minor axis length, Euler Number, Solidity, Area and Circularity. The description of these features is given below:

a) Major axis length: Major axis length is calculated by using the maximum diameter of the shape, which holds the number of pixels in that longest diameter of the ellipse.

b) Minor axis length: The minor axis is the shortest diameter. It is calculated by using the minimum diameter of the shape, which holds the number of pixels in that shortest diameter of the ellipse.

c) Euler Number: Euler number represents the fundamental relationship between the number of components of the connected object C and the number of holes in the object H.

d) It specifies the number of objects in the region minus the total number of holes in those objects.

e) Solidity: The concavity of the particle can be measured by Solidity.

f) Area: The area of the object is calculated using the actual total number of pixels which are present inside the object, which describes the area of that region.

g) Circularity: Cicularity represents the degree of similarity in the particles to the circular shape. It takes into consideration the degree of smoothness surroundings. This means that the circularity is a measure of particle shape and roughness.

III. METHODOLOGY

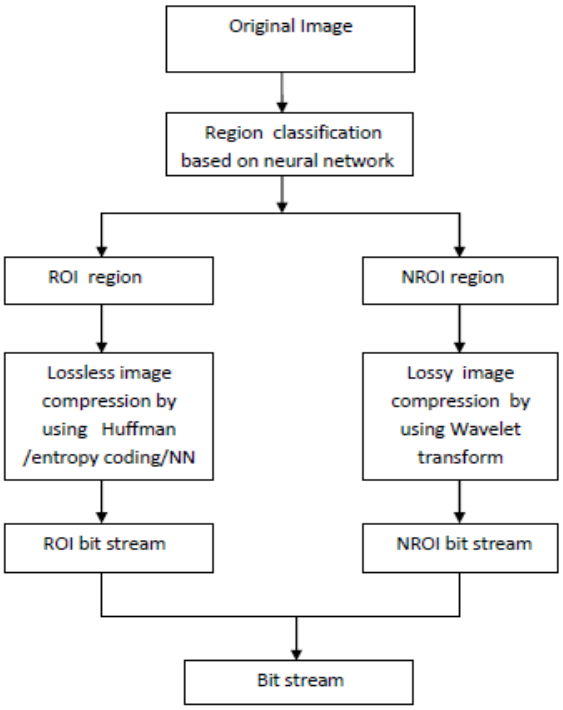

Fig: Flow chart of proposed system

This dissertation work proposes an algorithm to compress the image based on priority of regions.The main objective of proposed work is to detect the region of interest (ROI) by performing various simplest arithmetic

operations are used like morphological operations, segmentation operation.ROIis compressed with loss less compression comparison technique.

Perform lossy compression for rest of the image. Wavelet based methods will be used to compress the non ROI area of image i.e rest of image.Wavelet is one of the powerful tools used for image compression. JPEG 2000 uses discrete wavelet transform (DWT) for compression. So, it is proposed to use DWT to compress non ROI region. This proposed algorithm will be compared with existing algorithms in terms of mean square error, Peak signal to noise ratio, compression ratio etc.

IV. CONCLUSION

Today, some of diseases can be detected using medical imaging methods. This paper presents the different types of image compression techniques. These techniques are basically classified into two. Lossy compression techniques and lossless compression technique. As the name indicates in lossless technique the image can be decoded without any loss of information. But in case of lossy compression it cause some form of information loss. This work discusses ROI-based medical image compression. This region of interest based compression techniques helps to reduce the size of the image without degrading the quality of the important data. These techniques are good for various applications. Lossy compression is most commonly used to compress multimedia data like audio, video, and still images. By contrast, lossless compression is required for text and data files, such as bank records and text articles.

V. ACKNOWLEDGEMENT

We would like to express our gratitude towards all those who help us to complete this paper.

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