

Performance Analysis Lung Cancer Segmentation using Soft Computing Techniques

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Abstract—Lung cancer is the most common and leading cancer of death among the men and women. Image segmentation is one of the main roles of medical image processing. So the Lung cancer is using image processing and then finally used to segmentation of the help of CT (computed tomography) image of lung. So CT image of lung is used as input image and obtained the output image of JPEG format. Especially various type of cancer, such as lung cancer, breast cancer etc. There are different method and techniques existing, but proposed the better accuracy of segmentation. Study of, large number of image with various type of segmentation was selected and examined. In this paper focus on K-means, Fuzzy C Means and Watershed Segmentation, so the method are implemented or segmenting the images. There are various parameters of RMSE, SNR, PSNR, and MAE calculated and compared.

Keywords- CT image, Image Segmentation, K-means, Fuzzy C Means, Watershed segmentation.

I. INTRODUCTION

Cancer is the one of the most serious health problem of the word. Cancer is the one of the most serious health problem of the word field, and then highest cancer of the all other type of cancer. Smoking is the one of the main reason of the lung cancer. A person smokes more than one pack of cigarettes per day of 20-25 times [1]. An estimated 85% of lung cancer in males and 75% of females [2]. 42,000 people were diagnosed with lung cancer in 2010, and every day for 115 people [3]. So the lung CT scan images are taken for the work. Normally a doctor is first analysis the CT image of lung [4]. Medical image segmentation is a process of automatic detection of the boundaries within a medical image. The image can be obtained the different modalities, (X-ray, MRI, PET etc). Image segmentation is the process of the dividing image in to different parts [5]. First Region-Based image segmentation, and Edge-Based image segmentation and finally Threshold technique. Region Based image segmentation means, Region is a group of connected pixels with a similar properties. And then Edge Based image segmentation means, Edge detection is use of the derivative method to detect the edges. Medical image segmentation is the visual components of a large number of the application [6]. There are different type of lung cancer, small cell lung cancer, and non small cell lung cancer. Using the different type of algorithm in the image segmentation. So the algorithm for K-means, Fuzzy c-means, and watershed segmentation. There are different processing of the image

segmentation so first stage starts with the collection of the CT image, so available in the database. Second stage applies for several image pre-processing. Finally for the image segmentation, so applies in different type of algorithm. RMSE values SNR, PSNR, and MAE values are calculated for various image processed using different segmentation methods.

II. METHODOLOGY

Lung CT image through the system for following method, image acquisition, pre-processing, and then image segmentation. Proposed method of the lung cancer is show in figure 1.

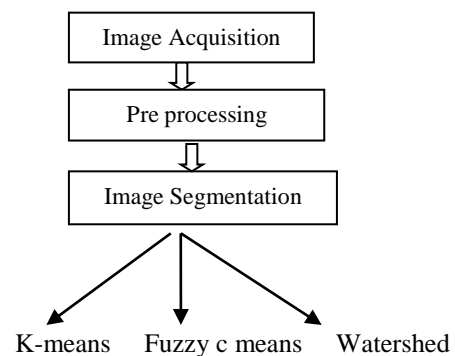


Fig1. Proposed Method of Lung cancer

III. IMAGE ACQUISITION

Image acquisition is the first step of the Image processing. CT image of lung is the input of images. So the images are important role of the lung cancer. There are different type of images are (PET-Positron Emission Tomography, MRI-Magnetic Resonance Imaging, RBS-Radionuclide Bone Scanning, X-ray, CT, Endoscopy etc). So finally using for CT image of lung as input. Why should be select for CT images, because CT image are more sensitive and finding the tumor size of the lung. The main advantage of the CT image is the better clarity. CT image is a low noise when compared to the scan image and MRI image. So also known as input image of the CT image of JPEG format.

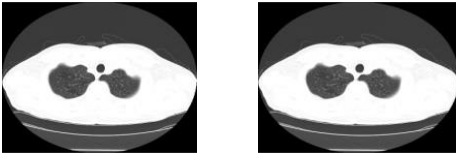


Fig2. Sample Lung CT Images

IV. PREPROCESSING

Pre processing is the second step of image processing. The purpose of pre processing is improved the image data and unwanted distortion. So the image is processed by two methods.

- Denoising
- Median Filter

A) Denoising

Mostly image denoising algorithm may be used in the image processing. The grayscale image contains noise such as the white noise, and slat & paper noise and many more. It can be removed by using the median filter from the extracted the lung image.

B) Median Filter

Median filter is a nonlinear computerized filter the system, regularly used to the uproot noise[7]. The best of the order-statistics filter is the median filter, which as its name implies, replaces the value of a pixel by the median of the gray levels in the neighborhood of the pixel[8]. Most admired and useful of the different types of filters is Median Filter [20].

V. IMAGE SEGMENTATION

Process of image Segmentation is the partition of image into meaningful region and identity of the object from the digital image. Segmentation is the process of the straight forward approach. The aim of the segmentation is the simplify and change the representation of an easier to analyze. Use of the image segmentation is the typically to locate the object and boundaries (line, curves and many more) in the images. The Image segmentation is primary process of image analysis in any situation [19]. There are many applications in the medical field for the segmentation of the 2D medical images [9]. In this paper focus on K-means, Fuzzy c-means, and watershed segmentation.

A) K-Means Algorithm

K-means is a simple algorithm for the grouping objects, and clustering [6]. The algorithm should be tested for different outcomes used to the partition image into k clusters. The performance of k-means algorithm is depends on initial value of cluster centers [10]. So k-means algorithm is fast and simple to the large datasets.

Step1: The dataset is partitioned into the K clusters and points are randomly assigned to the clusters. so resulting in clusters have roughly the same number of data points .

Step2: Each data points

Step3: Calculate the distance of the data point to each cluster.

Step4: The data point is closest to its own cluster, leave it where it is. The data point is not closest to its own cluster, move it into the closest cluster.

Step5: Repeat the above step until a complete pass.

B) Fuzzy-C Means Algorithm

The fuzzy c-means is system of clustering which lets one piece of data to belong to two or extra clusters [11]. Fuzzy means enhancement methods is divide in to fuzzy c-means segmentation, direct& indirect methods [12]. Fuzzy c-means clustering is a mentioned to be the appropriate method of brain it has a high computational cost [13]. There are more than variety of fuzzy clustering methods, has been proposed most of them based upon distance criteria [14].

Step 1: Image Acquisition using CT Lung images.

Step 2: Images is converted into gray scale images and Median filter is used to design the technique using FCM to improve the Image contrast.

Step 3: The algorithm is proposed and implemented to enhance image using the fuzzy Technique. Algorithm is used to convert the image properties into fuzzy.

Step 4: Image denoising and segmented done by fuzzy c means.

c) Watershed Algorithm

Finally using the watershed Algorithm. Watershed algorithm is the more representative in the application of mathematical morphology theory of image segmentation [10]. The watershed segmentation is extracts the seeds indicating the presence of object or background at the specific image location [15]. Marker location is set to be regional minima typically gradient of the original input image and the watershed algorithm is applied [16]. The watershed algorithm is commonly used to the unsupervised setting of segmenting the image in to a set of non –overlapping regions [17]. Refine the rough segmentation provided by morphologic filtering; we developed the clustering segmentation technique [18].

Step1: The points belong to the regions minimum.

Step 2: The Points which a drop of the water, if placed at location of any of this points, would fall with certainty to the single minimum.

Step 3: The points at the water would be equally likely to fall to more than minimum of one. The watershed algorithm is a iterative adaptive thresholded algorithm.

VI. RESULT AND DISCUSSION

In this paper, image segmentation is processed by using CT lung images as an input images and final result also obtained by various image processing techniques. The CT image of lung cancer is a successfully undergo the image segmentation. The image segmentation procedure for three feature, K-means, Fuzzy c-means, and finally watershed segmentation. So CT image is processed by each step of lung cancer and the resulted was obtained. Additional to the values the RMSE, SNR, PSNR, and MAE. PSNR value and MAE value is calculated and using the formula [6].

$$PSNR = 20 \log_{10} \left(\frac{255^2}{MAE} \right) \quad (1)$$

$$MAE = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N |X(i,j) - Y(i,j)| \quad (2)$$

Implemented the sample image and the accuracy values are table 1 below.

Table1.Accuacy values are both measurements.

Algorithm	RMSE	SNR	PSNR	MAE
k-mean	119.9393	0.531374	8.026636	29.25055
Fuzzy c mean	45.89279	2.257131	15.18648	27.70338
Watershed	112.3784	20.94145	7.595432	73.07565

Using the parameter is RMSE, SNR, PSNR, MAE. So description of the Evaluation measurements in show the table2.

Table 2: Evaluation measurements and Description.

S. No	Parameter	Description
1	RMSE	Root Mean Square Error
2	SNR	Signal-To-noise Ratio
3	PSNR	Peak Signal-To-noise Ratio
4	MAE	Mean Absolute Error

RMSE formula and SNR formula

$$RMSE = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \hat{x}_i)^2} \quad (3)$$

And

$$SNR(dB) = 20 \log \left(\frac{V_{RMS(Signal)}}{V_{RMS(Noise)}} \right) \quad (4)$$

The PSNR value must increase and MAE value must decrease for a good segmented image. So the PSNR and MAE values are compared between the original image and the segmented image. The PSNR value and MAE value of best of original image in the fuzzy c means. Accuracy of all measurements show in fig3.

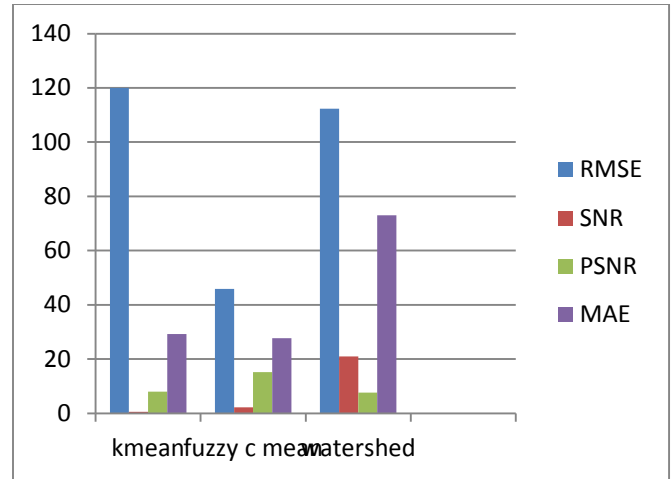
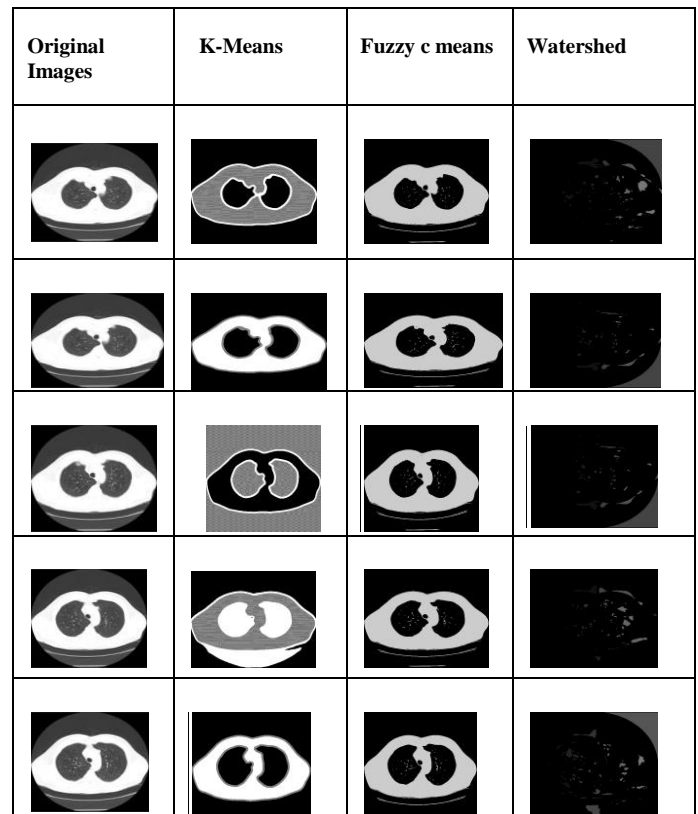


Fig3. Accuracy of all measurements

The fuzzy c means, PSNR value is increase and MAE values is decrease. So finally the segmentation is done with FUZZY C MEANS algorithm when compared to the k-means, and watershed algorithm. Original image and output image from the both segmentation technique show in table3.

Table 3.Original image and output image from the both segmentation technique.



VII.CONCLUSION

Image segmentation is used to the, see objects and background. In this paper segmentation of the lung image is

using by three methods. Such as K-means, fuzzy c means, watershed. PSNR values and MAE values are compared the both of segmented images. The fuzzy c means method is proved to the best in obtaining the PSNR and MAE value. So finally better segmentation algorithm and good result of FUZZY C MEANS algorithm when compared to the k-means, and watershed algorithm.

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