



Lung Segmentation Using Region Growing Algorithm

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Abstract – Computer-aided diagnosis (CAD) system provides effective early lung diseases diagnoses. Parenchyma refers to the part Lung that is responsible for that Lung working properly. People with lung parenchymal disease often suffer from conditions such as sarcoidosis, characterized by tissue swelling and the formation of lumps in the tissue. Other conditions commonly found in the lung's parenchyma are emphysema and cancer. It becomes important for radiologist to detect parenchyma for further proper diagnoses. In this paper we are presenting an accurate Lung parenchyma segmentation system by using region growing algorithm. This can be used by radiologist for early detection of parenchyma disease.

Keywords – Computer-Aided diagnosis (CAD), Region Growing Algorithm, Image segmentation, Lung Extraction.

I. INTRODUCTION

Lung disease seems to be the common cause of death worldwide. Lung cancer is considered to be as the main Lung disease. Early detection of lung cancer can increase the chance of survival among people. Cancer, tumor and nodules that are to be examined are located within the lungs parenchyma. Segmented parenchyma from CT image dramatically lower the false detection of lesions found in same image without segmentation. There are many techniques to diagnosis lung disease, such as Chest Radiograph (x-ray), Computed Tomography (CT), Magnetic Resonance Images (MRI Scan) and Sputum Cytology. The purpose of this paper is to purpose the accurate parenchyma segmentation technique.

II. LUNG DISEASE

Lung disease refers to disorders that affect the lungs, the organs that allow us to breathe. Breathing problems caused by lung disease may prevent the body from getting enough oxygen [1]. Examples of lung diseases are:

- Asthma chronic bronchitis and emphysema
- Infections, such as influenza and Pneumonia
- Lung cancer

Lung cancer is a disease in which abnormal (malignant) lung cells multiply and grow without control.

III. CT SCAN IMAGES

High resolution X-ray computed tomography (CT) is the standard for pulmonary imaging. The CT scanner uses digital geometry processing to generate a 3-dimensional (3-D) image of the inside of an object. The 3-D image is made after many 2-dimensional (2-D) X-ray images are taken around a single axis of rotation. The CT scanner reveals soft tissue that cannot see in conventional X-rays.

IV. COMPUTER-AIDED DIAGNOSIS

Computer-aided diagnosis (CAD) has become one of the major research subjects in medical imaging and diagnostic radiology. The CAD output is used as a “second opinion” in assisting radiologists for their final decision [2]. The computer uses advance algorithms for image processing, image feature analysis and then the region of interest (RIO) from the whole image. The higher efficient lung segmentation helps in analysis and diagnosis for lung diseases. In mammography CAD highlights micro calcification clusters and hyperdense structures in the soft tissue. This allows the radiologist to draw conclusions about the condition of the pathology.

CAD system functionalities are based on highly complex pattern reorganization. It consist several steps that may include image processing, feature analysis, feature extraction and data classification via the use of tools. Lung segmentations are always a challenging problem due to changes in parenchyma area, shape and connection to neighboring pulmonary structures. The motivation and philosophy for our CAD system is to provide accurate parenchyma segmentation, which help radiologist in confidence Lung abnormality identification.

V. METHODOLOGY

Our segmentation algorithm is a composition of seven main steps; Image preprocessing, Histogram analysis threshold, region growing with threshold, edge detection, morphological filling, multiply the mask with original image. MATLAB is used in every process made throughout the project. Process involved in our algorithm is presented in Figure 1. Let's start with talking about images used in this experiment and then steps involved in detailed.

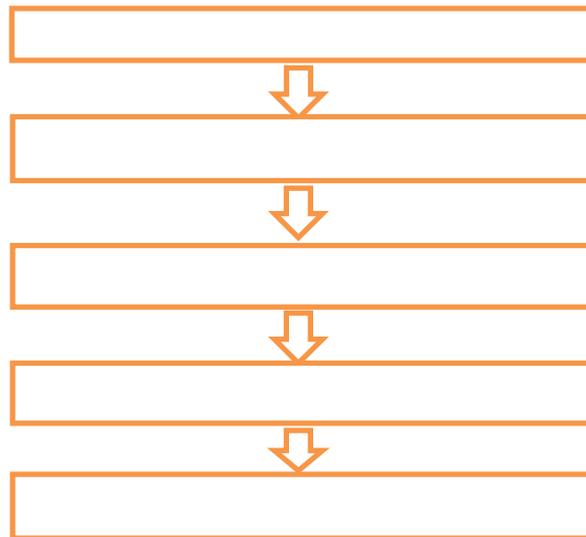


Figure 1: Proposed Algorithm Steps

Lung Image Database Consortium – The cancer imaging archive for public access provides a set of lung DICOM images for research (see shared list “NSCLC Radiogenomics”).

A. Image Preprocessing

In the first step of our segmentation algorithm we started with image enhancement; the aim of enhancement is reduction of artifacts (bugs in images), image noise reduction [6]. In our preprocessing first we convert image into gray scale, so that the processing time is reduced. Preprocessing provides a better image input for our algorithm. We map the intensity values in gray scale image to new values such that 1% of data is saturated at low and high intensities of gray image. This increases the contrast of the image.

B. Histogram Thresholding

The histogram thresholding is an iterative image thresholding method [12], a better method than conventional thresholding algorithms, in which threshold is chosen as the minimum between two maxima of the gray level histogram. With optimal thresholding, image is divided in two main classes (pixel groups): The background (high intensity pixels located in the body) and the foreground (low intensity pixels that are in the lung and surrounding air). The method tries to find the optimum threshold [13] level that divides the histogram in two good separated classes. This is an iterative method, repeated until convergence. Once the convergence is reached, the image threshold set at T. For each pixel intensity greater than T is set to 0, pixels below T are set to 1 which belongs to region of interest (ROI).

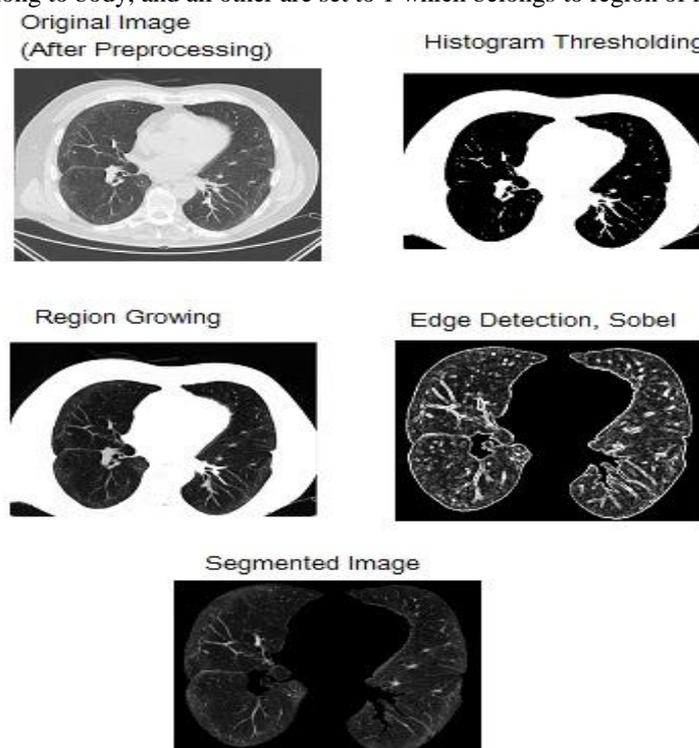


Figure 2: Result of proposed System

C. Resign Growing Algorithm

Region growing also classified as a pixel-based image segmentation method since it involves the of initial seed points [14].

It start with a seed pixel, the initial region begins as the exact location of seeds points. The regions are then grown from these seed points to adjacent points depending on certain criteria. This is an iteratively grown by keep examining the adjacent pixels of seed points. If they have the same intensity value with the seed points, it classifies them into the seed points. The deference between pixels intensity and the regions mean is used to classify the similarity of the image into regions. It is an iterated process until there are no changes in two successive iterative stages.

Our primary goal is to segment out lung from dark area that doesn't belong to lungs, so that we must select a set of seed points from dark region. The dark regions of lung parenchyma are tagged before applying region growing. Once the seed pixels are selected, region growing start marking all pixels which lie in the 4-connected neighborhood. This process is repeated for each pixel until all black pixels (background pixels) are marked. This will delete dark regions from whole image. Result is shown in figure 2.

D. Edge Detection

Edge detection method used in our algorithm for find the boundaries within last processed image in region growing; create a mask for the extraction of the lung. It works by detecting discontinuities in brightness. Common algorithms use for edge detection includes Sobel, Canny Prewitt and Roberts, methods. Sobel is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Sobel operator is either the corresponding gradient vector or the norm of this vector. Result is shown in figure 2.

E. Result and Discussion

CT images for this research were taken from "Lung Image Database Consortium". All images are well enhanced by using standard imaging protocols. Our algorithms are tested on 20 patients CT images. All lungs were accurately and automatically segmented.

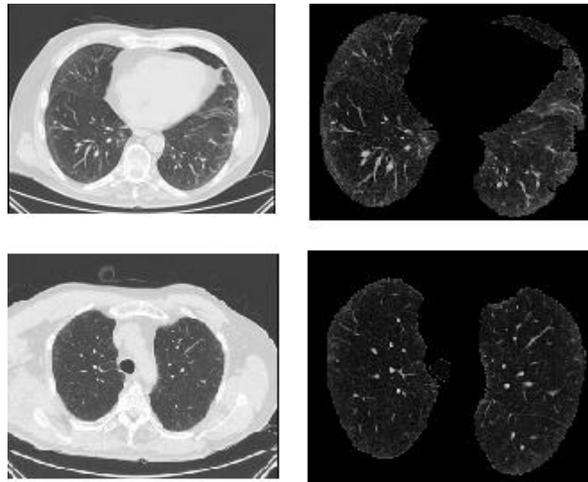


Figure 3: Some more results of proposed system

VI. CONCLUSION

Lung disease is the most dangerous and widespread in the world. Accurate segmentation lung helps radiologist in focusing region of interest. To obtain more accurate result we divided our work into seven stages as show in Figure 1. Stated with image enhancement, used histogram automatic thresholding method; Region growing separate background from lung area. In this algorithm only users can pay their attention only on the region of interest (ROI). This method can be evaluated to make more efficient.

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