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Review on: Adaptive Segmentation of the Pulmonary Lobes and Tumor Identification from Chest CT Scan Images

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Abstract: Lobewise analysis of the pulmonary parenchyma is of clinical relevance for diagnosing and monitoring pathologies. Segmentation of images has become important and effective tool for many technological applications like lung segmentation fron CT scan images, medical imaging and many other post-processing techniques. The best method of implementing for medical image analysis is first to preprocess the image in order to segment it. In this paper we present a fully automatic lobe segmentation approach to accurately segment the lung parenchyma of lung CT images, which can help radiologist in early diagnosing lung diseases like lung tumor.

Keywords: Lobe segmentation, CT (Computer Tomography), Lung tumor

I. INTRODUCTION

The first step of lung computed tomography patient image is generally to first segment the region of interest, in this case lung, and then analyze separately each area obtained, for a tumor, cancer, node detection or other pathology for diagnosis. This is generally much easier approach, because the area used for setting the right diagnosis, is getting smaller with the process of segmentation, so the radiologist can focus his observation only on specific data inside the specific region.

Lung cancer is one of the leading causes of death in the world. It is very difficult for patients to detect lung cancer symptoms until the cancer is in an advance stage. So its early detection is very necessary [1]. Lung diseases are some of the most common medical conditions worldwide. Tens of millions of people suffer from lung disease worldwide. Smoking, infections, and genetics are responsible for most lung diseases [2].

Most occurred ones are: asthma, acute bronchitis, cystic fibrosis, emphysema, pneumonia, tuberculosis, emphysema, pulmonary edema, lung cancer, sarcoidosis, and different kind of pulmonary edemas. Segmentation is an important tool in medical image processing and it is been widely used in many medical diagnostic applications, such as measuring tumor volume and its response to therapy, detection of micro calcification on mammograms automated classification of blood cells, studying brain development, image registration, etc [3]. Imaging plays a vital role in the diagnosis of lung cancer, with the most common modalities including chest radiography, CT, PET, magnetic resonance imaging (MRI), and radionuclide bone scanning , but in this work, we will primarily use CT images for analysis. X-Ray imaging will show most lung tumors, but CT is used because it is more sensitive in finding tumor size and the presence of lymph node metastases. However, with CT imaging, it is not always easy to distinguish the limits between tumor and normal tissue, especially when the dense pathology is present. Recent advances in Computed Tomography (CT) technology have enabled its use in diagnosing and quantifying different diseases [3]. Several lung diseases are diagnosed by investigating the patterns of lung tissue in pulmonary CT images, therefore segmentation and analysis is one of the important parts of any systems for proper diagnosis of the disease [4, 5]. Cancer, tumor and nodules that are to be examined are located within the lungs parenchyma anywhere in fissures, vessels or bronchi, in an area which is usually no more than half of the area of the computed tomography (CT) image slice: this means that a lot of processing time can be saved if the segmentation algorithms only run on this inner part of the lungs area. Moreover, the number of false detection of lesions found in a segmented image is dramatically lower than that found in the same image without segmentation, because no signals at all will be found outside of the lungs. Lung segmentation is a common preprocessing step of lung image analysis systems. If CT datasets contain large number of images then manually segmenting the lungs is tedious and prone to inter observer variations. Taking into account all this, an fully

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automatic segmentation of lungs based on fissure, vessels and thus bronchi and identification of tumor is necessary.

II. RELATED WORK

Some authors explored the segmentation techniques in medical imaging depending on the region of interest [6]. Some of them use a semi-automatic algorithm and still need some user interaction, while others are fully automatic and the user has only a verification role. Numerous of articles can be found regarding lung CT segmentation. E. A. Hoffman [7] have developed an automatic method for identifying lungs in 3D X-ray CT images. Zhang and Valentino [8] have suggested using artificial neural networks to classify each pixel in the CT slice into different anatomical structure. Kuhnigk et al. [9] have used anatomy guided 3D watershed transform for lung lobe segmentation. Hu et al. [10] describe a method of global thresholding for that purpose. Pohle and Toennies [11] suggest adaptive region growing for segmentation of medical images. Segmentation of pulmonary X-ray computed tomography (CT) images is a precursor to most pulmonary image analysis applications [12]. Various algorithms from different authors can be found for medical image segmentation such as thresholding [13], region growing [14]. These methods may be effective for specific types of disease, segmentation of lungs is always a challenging problem due to changes in pathology in the parenchyma area, or in shape and anatomic connection to neighboring pulmonary structures, such as blood vessels or pleura. Manual segmentation of lung images is extremely time consuming for users, labor intensive and prone to human errors and hence an automated technique with proven algorithm is the only road to success in such applications. There is no generally applicable automatic segmentation technique that will work for all images as the images itself are quite complex and unique depending upon the domain application. This paper mainly focuses on an efficient segmentation algorithm that can segment a region of interest into a more meaningful set of regions and objects and can be applicable for all images. here, we developed an automatic approach in order to segment the lung area and it will show good results for other organs like the parotid glands (risk areas) and even on tumors with also encouraging results.

In some applications segmentation may be useful to classify image pixels into anatomical regions, such as bones, muscles, and blood vessels, while in others into pathological regions, such as cancer, tumor, tissue deformities and multiple sclerosis lesions. Image segmentation is the process of partitioning an image into regions by grouping together neighborhood pixels based on the some predefined similarity criterion. The similarity criterion can be determined using specific properties or features of pixels representing objects in the image.

III. PROPOSED WORK

Here we proposed a system that can perform automatic and robust segmentation of lung from CT scan images. The most standards for receiving the scans from hospitals is DICOM. While the analyse format is required for the image processing algorithms. Thus there is need to convert these DICOM images into analyse format like JPEG, TIF, BMP, PCX, PNG, WMF, TGA, EMF, etc. Here CT scan images of upto 512*512 can be used for the segmentation. The block diagram of the proposed algorithm in depicted in Figure 1.

A. *Block diagram*

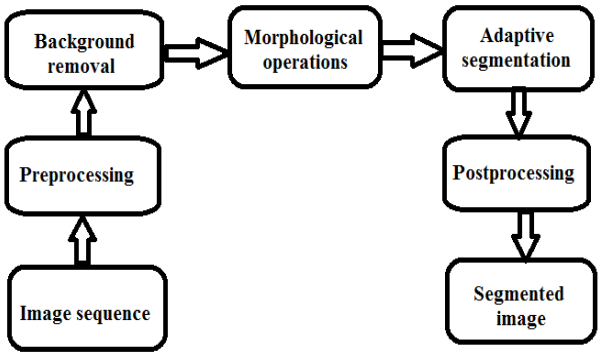

Figure 1: Block diagram of the proposed system

1. *Preprocessing block*

Usually, medical images are characterized as low contrast images with complex noise. This complex nature of noise is attributed to acquisitions, transmission storage and display devices. Another reason for this is application of different types of quantization, reconstruction and enhancement algorithms. Irrespective of whichever technique, devices or algorithm is used, all medical images contain visual noise. Noise is much more prevalent in certain types of imaging procedures than in others. In order to segment the medical image correctly, this preprocessing is used to detect whether the input image is corrupted with noise or not. In case of a corrupted image, the tumor detection after segmentation can be affected.

2. *Background removal*

This is useful for extracting the lung part from background. There is high similarity between gray levels of lung and the image background. So there is need of mechanism to remove the whole background.

3. *Morphological operations*

After the above two steps, for further processing some morphological operations are required such as edge detection, border thinning, erosion, dilasion, opening,

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closing, etc. In medical image edge detection, we must select appropriate structuring element by texture feature of image.

4. *Adaptive segmentation and postprocessing*

Then an algorithm will be applied for lobe adaptive segmentation. Also the segmentation of fissures, vessels and bronchi will be carried out to get the detail of the lung anatomy. After this we will get the segmented lung image at the output, which will make easy to detect the tumor.

CONCLUSION

Here we have proposed an efficient system that can perform fully automatic lung lobe segmentation and can be robust against missing or incomplete pulmonary fissures and is very useful in challenging cases, In addition, the proposed system has the advantage that it will not require any prior i information about the image.

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