A Study of Different Chest CT Scan Image Segmentation for Pulmonary Lobes

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Abstract

Many number of people gets affected by Chronic Obstructive airway diseases. Since the discovery of the X-ray radiation by Wilhelm Conrad Roentgen in 1895,the field of medical imaging has developed into a huge scientific discipline. Medical image processing is essential to increase amount of data and to explore and present the contained information in suitable way for specific medical task .CT scan Image many of the researches are doing image segmentation research on CT scan image segmentation .this survey provides analysis of various CT scan image segmentation for Different chest ct scan image segmentation for pulmonary lobes for chest. From this literature it gives mean, Pulmonary function tests (PFT)metrics for performing analysis.

Index terms:-*Pulmonary lobe, segmentation, Bronchi*

1. Introduction

The rural people are easily gets affected by chronic disease in airways because they cook themselves by firing the unwanted material .In that unwanted material smoke is released out through air .so if people smoke those air, the people gets infected by airways. Factories releases unwanted smoke(CH2,N2O,NC3L).so it pollute air. So its more harmful for rural woman when she breathe because of that rural women's are severely affected by chronic obstructive airway diseases in that situation. It is essential for monitoring rural woman from chronic obstructive airway disease .because in Tamil Nadu many of the rural women's(chronic obstructive airway disease)affected.

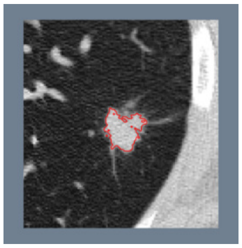
One of the method is, quantitative monitoring of pulmonary diseases such as emphysema or fibrosis. To prevent Chronic Obstructive airway diseases am implementing this project. The human lungs are subdivided into five lobes that are separated by visceral pleura called pulmonary fissure. There are three lobes in the right lung, namely upper, middle ,and lower lobe. the upper and the lower lobe, that are divided by the left major fissure A lobe-wise analysis shows the progression of the disease in more detail. hand, pathologies can deform the lobes and make the fissures unrecognizable. And on the other hand, even in patients with normal lung parenchyma the fissures are often not complete . Moreover, an analysis of the relation between segmentation quality and fissure completeness showed that the method is robust against incomplete fissures.

1.1. Preprocessing

In pre-processing used to remove the noise from the CT images. Here the wiener filter. Wiener filter is the one of method to remove the noise from the image processing remove the noise from the CT images .use the wiener filter. so according to the Wiener filter is more suitable for pulmonary lobes.

ISSN: 2320 - 8791
www.ijreat.org

1.2 .Lung segmentation

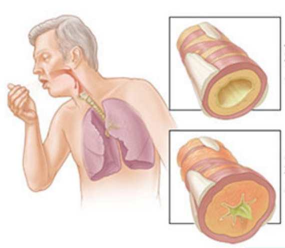


Selle, Bernhard Preim this segmenting lung from the CT image. First we choose the seed point in the image. From that point we find the similarity pixel to the CT image. Finally these similarity pixel will be segment from the CT image.

1.3.Nodule Detection

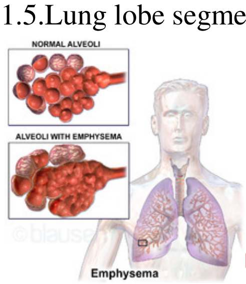
Stefano Diciotti Lung this Nodules are segmented using adaptive thresholding. Mean of CT image is used as threshold. Initially histogram equalization is used to enhance the contrast of the nodule. In order to test the segmentation algorithm, real time clinical CT images from twenty patients have been processed .

1.4. Fissure Detection



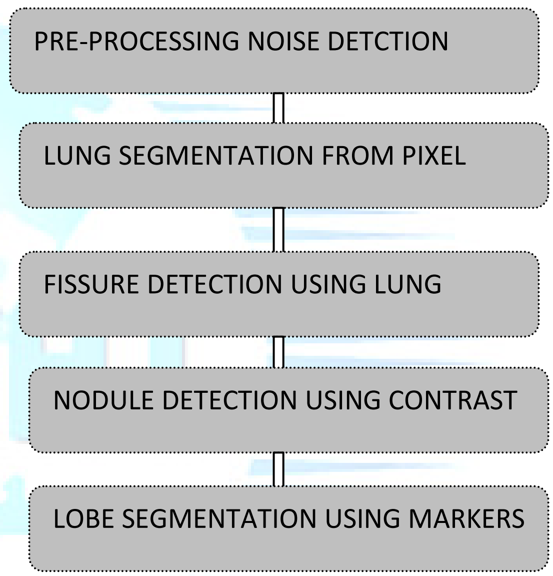
Fissure regions are identified using the fissure sweeping technique and the fissures are enhanced using region growing method. The fissure sweep technique finds the fissure regions in the preprocessed CT images. This signifies that in the pre-processed binary images, fissures are represented by large amounts of air or space extending from the middle to the lateral side of the lungs.

1.5.Lung lobe segmentation



In watershed, internal markers to obtain watershed lines of the gradient of the image to be segmented. Use the obtained watershed lines as external markers .Each region defined by the external markers contains a single internal marker and part of the background. In watershed, Regions without markers are allowed to be merged.

2. Flowchart



3.Literature Survey

Jiantao Pu, Joseph K. Leader etel[1] introduces an Identification of pulmonary fissures, which form the boundaries between the lobes in the lungs, may be useful during clinical interpretation of computed tomography (CT) examinations to assess the early presence and characterization of manifestation of several lung diseases. Motivated by the unique nature of the surface shape of pulmonary fissures in 3-D space, we developed a new automated scheme using computational geometry methods to detect and segment fissures depicted on CT images. After a geometric modeling of the lung volume using the marching cubes algorithm, Laplacian smoothing is applied iteratively to enhance pulmonary fissures by depressing non fissure structures while smoothing the surfaces of lung fissures. Next, an extended Gaussian image based procedure is used to locate the fissures in a statistical manner that approximates the fissures using a set of plane "patches."

*Techniques of etel[1]:*Marching Cubes Algorithm used to better differentiate the fissure from other tissues and isolated voxels, we use the Laplacian smoothing method that adjusts the location of each mesh vertex to the geometric center of its neighboring triangles without modifying the topology of the mesh developed a new automated pulmonary fissure detection and segmentation scheme with virtually no dependence on prior knowledge of lung anatomy except the surface shape of fissures. The anatomy knowledge dependence could add complexity due to the large variability in lung anatomy among individuals. The scheme uses a computational geometry based approach, including the MCA, Laplacian smoothing, and EGI to achieve high detection sensitivity of fissure plane patches and eliminate other non fissure related patches.

Dirk Selle, Bernhard Preim* etel[2] proposed two novel 3D nodule segmentation solutions which improve performance for the difficult juxtapleural cases. The morphological opening-based (WR) and prior-constrained mean shift-based (MS) solutions, extended from the robust Gaussian fitting approach, are evaluated with a large clinical CT dataset. The validation results show that i) they can effectively segment the juxtapleural cases, ii) WR performs better than MS for the small juxtapleural cases, and iii) MS performs better than WR for the cases attached to non-wall structures. Toward our goal of the volumetric measurement of nodules, the accuracy by our methods is limited due to the ellipsoidal boundary approximation.

*Techniques of etel[2]:*Skeletonization and Graph Analysis: 3-D skeletonization algorithms have been developed as part of a vessel analysis pipeline or in order to compute a path for virtual endoscopy. Our presented methods for the analysis and visualization of hepatic vasculature and for the approximation of vascular territories. Our analysis of eight human corrosion casts revealed the accuracy of the methods for the prediction of vascular territories. The approximation algorithms are also employed to suggest tumor resections with respect to certain safety margins. In cases, with several metastases or a tumor in a central location, these suggestions are helpful because it is not obvious whether the patient is respectable at all.

The author Soumik Ukil and Joseph etel[3] have presented an automatic method for the segmentation of the lobar fissures on chest CT scans. The method uses the interactive watershed transform, calculated on a vessel distance map, to obtain an initial segmentation. The initial segmentation is refined using 3-D optimal surface detection on a ridgeness map. We have tested the method on images from 12 normal and 17 emphysematous subjects and compared the computer results to the results obtained by manual analysis

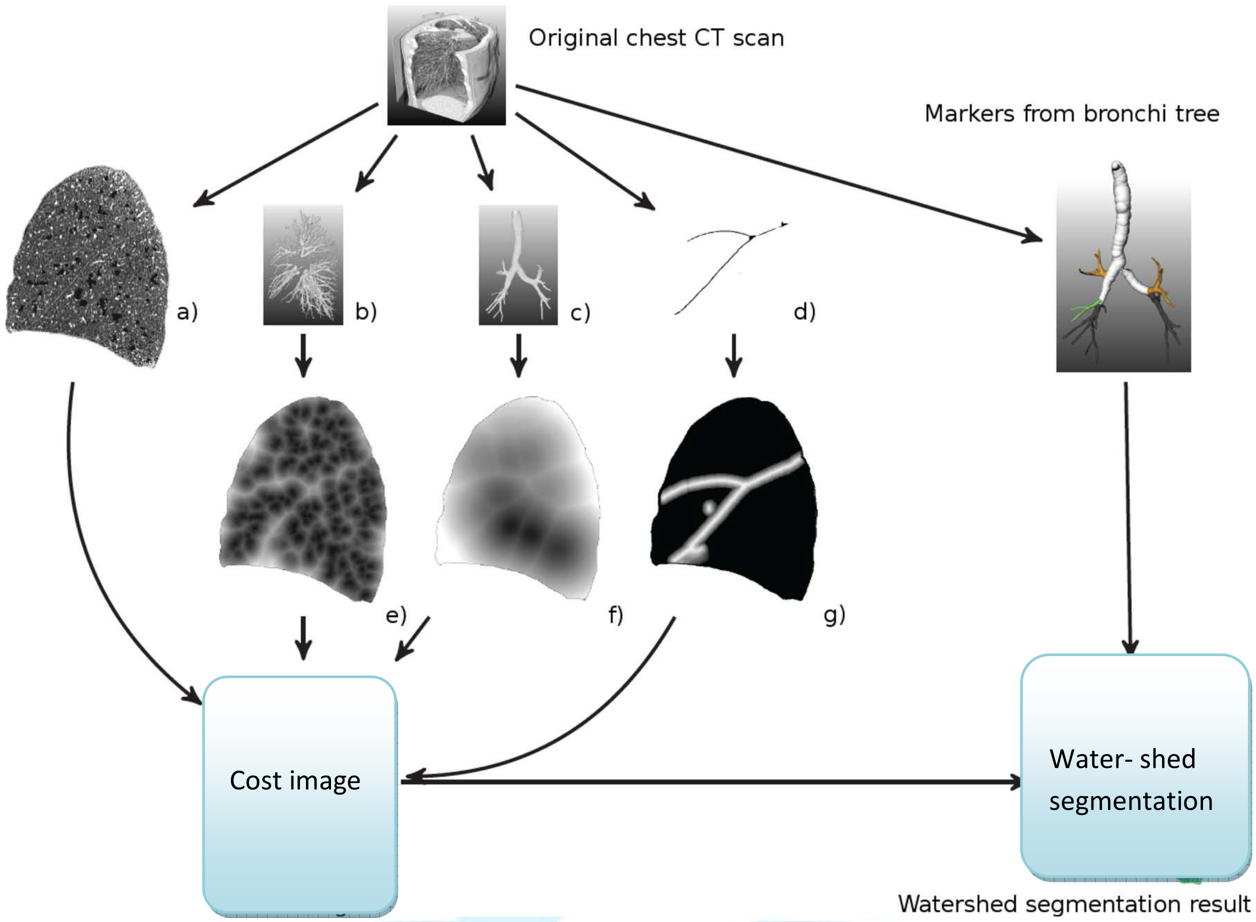
*Techniques of etel[3]*Oblique Fissure Refinement Three ROIs are defined for the fissure refinement step, and LUNG Region consists of all voxels in the lung mask that area distance or less from the initial fissure segmentation .Region represents the set of likely fissure endpoints, and consists of all voxels outside the segmented lungs that are a distance from the initial fissure segmentation The method uses the interactive watershed transform, calculated on a vessel distance map, to obtain an initial segmentation.

The author Joseph M. Reinhardt etel[4] introduces High-resolution X-ray computed tomography (CT) imaging is routinely used for clinical pulmonary applications. Since lung function varies regionally and because pulmonary disease is usually not uniformly distributed in the lungs, it is useful to study the lungs on a lobe-by-lobe basis. Thus, it is important to segment not only the lungs, but the lobar fissures as well. In this paper, we demonstrate the use of an anatomic pulmonary atlas, encoded with *a priori information on the pulmonary anatomy,* to automatically segment the oblique lobar fissures. Sixteen volumetric CT scans from 16 subjects are used to construct the pulmonary atlas. A ridgeness measure is applied to the original CT images to enhance the fissure contrast. Fissure detection is accomplished in two stages: an initial fissure search and a final fissure search. A fuzzy reasoning system is used in the fissure search to analyze information from three sources: the image intensity, an anatomic smoothness constraint, and the atlas-based search initialization. Our method has been tested on 22 volumetric thin-slice CT scans from 12 subjects, and the results are compared to manual tracings.

Techniques of etel[4]Lung Surface-Based Registration the lung boundaries and the lobar fissures. The lung boundaries are used as features to register the fissure surfaces in the atlas onto a new data set. The validation results show that some occasional errors exist due to poor image quality, but in most cases the automatic method can delineate fissures close to those defined by manual tracings. Occasional errors occur near lung boundaries, but their influence on the overall lobe segmentation is small. nodule.

The author Stefano Diciotti etel[5],One of the most important problems in the segmentation of lung nodules in CT imaging arises from possible attachments occurring between nodules and other lung structures, such as vessels or pleura. In this report, we address the problem of vessels attachments by proposing an automated correction method applied to an initial rough segmentation of the lung nodule. The method is based on a local shape analysis of the initial segmentation making use of 3-D geodesic distance map representations. The correction method has the advantage that it locally refines the nodule segmentation along recognized vessel attachments only, without modifying the nodule boundary elsewhere. The method was tested using a simple initial rough segmentation, obtained by a fixed image thresholding. The validation of the complete segmentation algorithm was carried out on small lung nodules, identified in the ITALUNG screening trial and on small nodules of the lung image database consortium (LIDC) dataset.

*Techniques of etel[5]:*Architecture of a Complete Nodule Segmentation Algorithm To evaluate its effectiveness, the correction method was applied to a simple initial nodule segmentation. The method has the advantage that the correction is *locally* applied along vessel attachments only, without modifying the nodule boundary elsewhere. It was applied to the results of a simple segmentation algorithm featuring very good performance in terms of both



percentage of successful segmentations and reproducibility of lung nodule volume.

Eva M. van Rikxoort etel[6] introduces a method for automatic segmentation of pulmonary lobes from computed tomography (CT) scans is presented that is robust against incomplete fissures. The method is based on a multi atlas approach in which existing lobar segmentations are deformed to test scans in which the fissures, the lungs, and the bronchial tree have been automatically segmented. The key element of our method is a cost function that exploits information from fissures, lung borders, and bronchial tree in an effective way, such that less reliable information (lungs, airways) is only used when the most reliable information (fissures) is missing. To cope with the anatomical variation in lobe shape, an atlas selection mechanism is introduced.

Techniques of etel[6] :Lung Border Segmentation
From the segmentation of the lungs, the borders of the lungs are extracted as those voxels in the lung segmentation for which at least one of the six-connected neighbors is outside the lung segmentation A limitation of the simulations as performed for experiment 2 is that the incomplete fissures are simulated from scans with complete fissures. In practice, the fissures can be incomplete for two reasons: by nature or due to pathological processes. In the latter case, the morphology of the lobar boundary might be different than the morphology of subjects with complete fissures. The results of

experiment 2b provided in Table IV show that the lobe segmentation method proposed in [13] is able to perform equally well for the major fissures in cases with (nearly)complete fissures..

The above mentioned author in the year 2009 evaluates an Automated extraction of pulmonary anatomy provides a foundation for computerized analysis of computed tomography (CT) scans of the chest. A completely automatic method is presented to segment the lungs, lobes and pulmonary segments from volumetric CT chest scans. The method starts with lung segmentation based on region growing and standard image processing techniques. Next, the pulmonary fissures are extracted by a supervised filter. Subsequently the lung lobes are obtained by voxel classification where the position of voxels in the lung and relative to the fissures are used as features. Finally, each lobe is subdivided in its pulmonary segments by applying another voxel classification that employs features based on the detected fissures and the relative position of voxels in the lobe. The method was evaluated on 100 low-dose CT scans obtained from a lung cancer screening trial and compared to estimates of both inter observer and intra observer agreement

*Techniques of etel[7]*A supervised enhancement filter_used to The lobes can not be directly obtained from the fissure segmentations .In general, the automatic system performed better for the left lung than for the right lung. Inspection of the confusion matrices shows that this is mainly due to relatively low accuracies obtained for segments 8, 9, and 10 in the right lung (56%, 66%, and 71%, respectively). This is, however, comparable to performance of the human observers, especially the inter observer agreement.

The author Jiantao Pu etel[8] explains The pulmonary lobes contains Lobe identification in computed tomography (CT) examinations is often an important consideration during the diagnostic process as well as during treatment planning because of their relative independence of each other in terms of anatomy and function

*Techniques of etel[8]*Adaptive Border Marching Algorithm lung segmentation, a previously developed automated scheme is applied to detect pulmonary fissures by combining computational geometry approaches with statistical analysis. The computerized scheme did not work well with CT examinations having a section thickness of 2.5 mm. enable automated segmentation and quantitative lung CT image analysis.

The author Joseph M. Reinhardt ,etel[9] these images have been used to measure airway geometry, study airway reactivity, and guide surgical interventions. Prior to these applications, airway segmentation can be used to identify the airway lumen in the CT images. Airway tree segmentation can be performed manually by an image analyst, but the complexity of the tree makes manual segmentation tedious and extremely time-consuming We describe a fully automatic technique for segmenting the airway tree in three-dimensional CT images of the thorax. We use grayscale morphological reconstruction to identify candidate airways on CT slices and then reconstruct a connected 3-D airway.

*Techniques of etel[9]*Branch point algorithm used to described an automatic airway segmentation method for 3-D X-ray CT images of the lungs The method uses a combination of grayscale morphological reconstruction, bounded space dilation, and region connectivity to identify and reconstruct the 3-D airway tree. Overall airway branch detection sensitivity was approximately 73% compared with manually defined airway tree gold standard.

Eva M. van Rikxoort*etel[10]in medical image processing, many filters have been developed to enhance certain structures in 3-D data. In this paper, the output of a rich set of basis filters serves as input to the classifier. In a feature selection process, this set is reduced to a compact, efficient subset. We show that the output of the system can be reused to extract new features, using the same filters, that can be processed by a new classifier. Such a multistage approach further improves performance. A supervised fissure enhancement filter is evaluated on two data sets, one of scans with a normal clinical dose and one of ultra-low dose scans. Results are compared with those of a recently proposed conventional fissure enhancement filter.

Techniques of etel[10]Non supervised Enhancement These filters exploit the characteristics of idealized shapes like tubes and plates, sometimes extended with task-specific measures like intensity Next to better performance, there are other reasons to prefer a supervised approach to a non supervised approach. First of all, the supervised approach is flexible. It can be used for any structure provided the appropriate examples, whereas the non supervised approach requires the design of a completely new and different system for each specific structure. Secondly, supervise approaches usually are less sensitive to the settings of specific parameters than non-supervised approaches are, especially when using feature selection.

Rafael Wiemker T, International etel [11] Congress Series in 1281 (2005) 1121– 1126 a robust identification and segmentation of the three fissures separating the five lung lobes is a crucial building block for automated segmentation of the lung lobes and enabling pulmonary CAD applications such as automated volume try of the lung lobes, lobe-wise emphysema quantification, perfusion analysis, location analysis of computer detected lung nodules, local therapy response monitoring, surgical resection planning, etc. Both suggested filters (one using first derivatives, one using second derivatives) are well suitable for enhancing the lobar fissures effectively enough to support unsupervised segmentation. The Hessian matrix filter performs slightly faster than the structure tensor approach.

3.1 General of metrics:

1.A(ASA)Assessing Segmentation Accuracy:

Fissure positioning accuracy was assessed by computing the mean, root mean square (rms), and maximum distances between the manually defined fissures and the computer-defined fissures.

$$D_i = \min_j \left\{ \sqrt{\left(\left(x_j^2 - x_i^2\right)^2 + \left(y_j^a - y_i^m\right)^2\right)} \right\}$$

3.2 A Best match displacement (BMD):

best match displacement (BMD) fields by matching lung boundaries with similarity measures.

After global transformation, each lung is processed separately. For computational efficiency we first down-sample the lung boundaries into sparse sampling points, then for each boundary sample

point,a sub-image (cube), centered at the sample point, is defined as edge cube

$$\vec{D}\left\{\left\|C_{Q_i - C_p}\right\| s_{maxs_i} < \epsilon - i = 0,1,2\right\}$$

3.3 A Pulmonary function tests (PFT):

$$F(X) = \sum_{i=1}^{n} \partial i_{\varphi}(|x - x_i) + P(X)$$

In our specific case, the degree of the polynomial should be four or lower. Otherwise, it may be difficult to control the fitting result . By setting a proper constraint on the polynomial part, even in sparse datasets, appropriate shape features can be captured in the fitted surface

3.4 A Mean squared error(MSE):

The MSE thus assesses the quality of an estimator or set of predictions in terms of its variation and degree of bias. Since MSE is an expectation, it is not a random variable. It may be a function of the unknown parameter θ, but it does not depend on any random quantities. However, when MSE is computed for a particular estimator of $\theta$the true value of which is not known, it will be subject to estimation error

$$MSE = \frac{1}{N}\sum(\hat{Y} - YI)^{\wedge}2$$

4. Conclusion

This Study of Automatic Segmentation of Pulmonary Lobes from chest CT Scans based on Fissures, Vessels and Bronchi ,We analyzed Marching Cubes Algorithm, Skeletonization and Graph Analysis,_Oblique Fissure Refinement, Lung Surface-Based Registration, Architecture of a Complete Nodule Segmentation, Lung Border Segmentation, a supervised enhancement filter these for segmentation and we are also analysis various segmentation this methods.

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