International Journal of Advance Research in Science and Engineering
Volume No.06, Issue No. 12, December 2017
www.ijarse.com
IJARSE
ISSN: 2319-8354

A Survey : Image Processing For Lung Cancer Detection

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ABSTRACT

Lung Cancer is the leading cause of death worldwide. Earlier detection of cancer is the only one solution to increase the survival rate. According to the report of World Health Organization (WHO), death rate due to lung cancer has is in the highest among all types of cancers in the world. Usually lung cancer does not cause symptoms early in the disease process and is mostly diagnosed at a late stage in a clinical setting, when the probability of cure is rare. So early detection of cancer is very important. In this paper the concern is about study of various methods to detect lung cancer using image processing. The different techniques used in real time application to find out the abnormal cell affected by cancer and how the manual detection may have the chances for false detection too.

Keywords: CT, Graph cut method , Image Segmentation, LOF, MGRF, PET, ROF, TBGA,Random Walk Method,

I.INTRODUCTION

The lungs are pair of spongy and air-filled organs which are located on both side of the chest or thorax. The trachea known as windpipe takes breathed air into the lungs via its branches which are tubular, called bronchi. They are then divided into smaller and smaller branches known as bronchioles. The bronchioles end in clusters of microscopic air sacs called alveoli. In the alveoli, oxygen from the air is absorbed into the blood. Carbon dioxide is a waste product of metabolism process that travels from the blood to the alveoli. A layer of fluid which is thin act as a lubricant, that allows the lungs to slip smoothly during the expansion and contraction whenever we breathe.

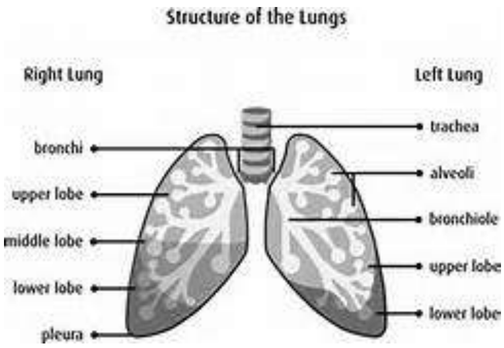

Fig.1: Structure of Lungs

Most growing research area is Image Processing now days. This is important application is in the field of medical images It is used to develop an algorithm for detecting abnormal formation of the cells in the lungs.

Lung cancer is the leading cause of cancer mortality around the world [17]. It is estimated that approximately 10 million patient will die due to lung cancer by 2030 according to the report from the WHO [18]. Early prevention can only improve the survival rate. So deep analysis of various imaging techniques of lung is very important. The analysis can used for medical research, computer aided diagnosis, radiotherapy and evaluations of surgery outcome as well.

II.RELATED WORKS

I. In this paper [1] author found a method for segmentation of lung fields by fusing shape information with intensity information. The results are performed over a available database and comparing with other algorithms. The important aim is to maximise information utilisation by effectively combining intensity information with shape priors. In this first a statistical model was developed for lung shape. The features include size, orientation, major and minor ellipse lengths, eccentricity and centroid locations for the right and left lung fields are computed from a database of manually segmented lung fields by expert radiologists. The algorithm has two limitations: (i) its dependency on human experts to extract the lung model shape, which means that for a new set of images with different spatial resolution the whole process of manual segmentation should be repeated; (ii) the algorithm is not designed to extract the lung tissues overlapping with the heart, because that area has different intensity characteristics.

II. In this paper [2] author presents a hierarchically segmented lung fields in chest radiograph using both shape and appearance sparse learning. As most learning-based methods, the proposed method consists of training stage and testing stage. It is concluded that experiments on 247 PA chest radiographs of JSRT dataset show that the proposed joint local shape and appearance models outperform the conventional shape and appearance models, respectively.

III. The paper [3] explains about a general lung nodule shape model which is designed by fusing the image intensity statistical information in variational segmentation framework. The fusion considers the image intensity with prior shape information. In this methodology nodule type and location are not considered. The experimental and validation results are performed on 742 nodules which are obtained from four different CT lung databases.

IV. This paper [4] explains about a algorithm for segmenting diseased lung lobes by hybrid of 2D/3D approach. Since human lungs consists of 5 lobes, separated by 3 fissures. The experiments where performed on 24 patient’s lungs with a variety of different diseases. The root mean square for segmenting LOF, ROF and RHF had been evaluated.

V. Solitary Pulmonary Nodule is one of the important characteristic of early cancer detection. In this [5] the original SPN image is decomposed into texture and cartoon components from where the seeds are obtained. Depending on seeds walker pixels are obtained. The precise segmentation is obtained even the image is poor.

VI.It explains [6] about a method for lung nodule detection. It consists of acquisition of CT images of lung, reduction of volume of interest through extraction and reconstruction of the original shape of parenchyma.

Finally there is application of growing neural gas to resulting VOI. Finally classifying as either nodules or non-nodules by their shape and texture measurements together with a support vector machine.

VII. The author [7] developed a region based contour model and Fuzzy C-Means techniques for segmenting lung nodules. The main aim of the process was to remove the portions that are part of the CT image other than lung lesion.

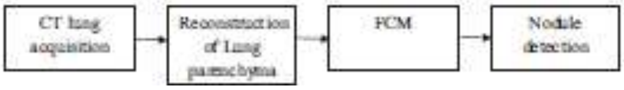

Fig2:Diagram of Segmentation Used

VIII In this paper [8], a new pulmonary nodule segmentation algorithm developed. It contains the FA system, the SA system and a hybrid system that uses both. The FA system requires only a single user-supplied cue point. While the SA system represents a new algorithm class requiring 8 user-supplied control points. The FA segmentation engine has 2 free parameters, and the SA system has 3. These parameters are adaptively determined for each nodule in a search process guided by a regression neural network (RNN).The systems used the new Lung Image Database Consortium and Image Database Resource Initiative (LIDC–IDRI) data.

IX. It [9] explains about a novel segmentation method for lung vessels. The method is based on a random forest classifier and sparse auto-encoder features. First, the multi-scale representations of lung images are obtained using the Gaussian pyramid. Second, a sparse auto-encoder of three layers is trained using randomly selected patches of these images. Next, the trained weight of the sparse auto-encoder is used as the convolution kernel to extract features of different scale images. Finally, a random forest classifier is exploited to segment the vessels.

X. In the paper [10],a stack of chest CT scans is modelled as a sample of a spatially inhomogeneous joint 3D Markov-Gibbs random field (MGRF) of voxel-wise lung and chest CT image signals (intensities). The proposed learnable MGRF integrates two visual appearance sub models with an adaptive lung shape sub model.

XI. The paper [11] explains about the problem in detecting cancer nodule due to possible attachments occurring between nodules and other lung structures, such as vessels or pleura. So for this automated correction method applied to an initial rough segmentation of the lung nodule and tested by a fixed image thresholding.

XII. The paper [12] demonstrates about the integration of two modalities by making use of the superior contrast of PET images and spatial resolution of CT images. Random walk and Graph cut method are integrated to solve the segmentation problem, in which random walk is utilized as an initialization tool to provide object seeds for graph cut segmentation on PET and CT.

XIII. The National Library of Medicine, in collaboration with Indiana University School of Medicine, AMPATH (The Academic Model Providing Access to Healthcare), is developing a computer-aided system for screening and detecting the pulmonary pathologies in chest radiographs. This paper [13] presents a lung boundary detection system incorporating nonrigid registration with a CXR database of presegmented lung regions to build an anatomical atlas as a guide combined with graph cuts based image region refinement.

XIV.In Paper [14], watershed segmentation is one of the important tools for image segmentation. This has two methods immersion approach and toboggan approach. The immersion approach starts from low altitude to high altitude whereas toboggan approach is just vice-versa of first one. It is found that with all the test images used toboggan approach was faster and more efficient in most of the cases.

XV. In [15] it is proposed a novel pathological lung segmentation method that takes into account neighbour prior constraints and a pathology recognition system. In this a fuzzy connectedness image segmentation algorithm for initial lung parenchyma extraction. And in parallel lung volume estimation using rib-cage information**.** The pathological lung segmentation method improves on current standard because of its high sensitivity and specificity and enhanced performance.

References:

XVI. In [16] paper a novel toboggan based growing automatic segmentation approach (TBGA) with a three-step framework, which is automatic initial seed point selection, multi-constraints 3D lesion extraction and the final lesion refinement was developed. It is concluded that the novel TBGA achieved robust, efficient and accurate lung lesion segmentation in CT images automatically.

III. CONCLUSION

Lung cancer is the leading cause of cancer mortality around the world [17]. It is estimated that approximately 10 million patient will die due to lung cancer by 2030 according to the report from the WHO [18]. Early prevention can only improve the survival rate. So deep analysis of various imaging techniques of lung is very important. The analysis can used for medical research, computer aided diagnosis, radiotherapy and evaluations of surgery outcome as well. For this purpose, accurate segmentation of lung lesions is the pre-requisite. However, accurate segmentation of lung lesions by an automatic method is also difficult because the heterogeneity of the lesions. The shape, intensity and location of lung lesions change greatly because of the existence of the spatial genetic heterogeneity of various lesions. So due to all these facts it is very challenging to achieve the precise delineation of lung lesions automatically. In this survey paper an idea of various segmentation methods is put together.

REFERENCES

[1] A. Dawoud,"Lung segmentation in chest radiographs by fusing shape information in iterative thresholding", Published in IET Computer Vision,Received on 15th December 2009,Revised on 20th September 2010,doi: 10.1049/iet-cvi.2009.0141.

[2] Yeqin Shao, Yaozong Gao, Yanrong Guo, Yonghong Shi, Xin Yang, and Dinggang Shen," Hierarchical Lung Field Segmentation With Joint Shape and Appearance Sparse Learning", IEEE TRANSACTIONS ON MEDICAL IMAGING, VOL. 33, NO. 9, SEPTEMBER 2014.

[3] Amal A. Farag, Hossam E. Abd El Munim, James H. Graham," A Novel Approach for Lung Nodules Segmentation in Chest CT Using Level Sets", IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 22, NO. 12, DECEMBER 2013.

[4] Q. Wei and Y. Hu, Member, IEEE," A Hybrid Approach to Segmentation of Diseased Lung Lobes", IEEE Journal of Biomedical and Health Informatics

[5] Dan Wang, Junfeng Wang, Yihua Du, and Peng Tang ," Adaptive solitary pulmonary nodule segmentation for digital radiography images based on random walks and sequential filter", DOI 10.1109/ACCESS.2017.2668523, IEEE Access,Access-2017-00212

[6] Stelmo Magalh~aes BarrosNetto , Aristo´ fanes Corrˆea Silva, Rodolfo Acatauassu´ Nunes , MarceloGattass," Automatic segmentation of lung nodules with growing neural gas and support vector machine", Computers in Biology and Medicine 42 (2012) 1110–1121

[7] Ezhil E. Nithila, S.S. Kumar," Segmentation of lung nodule in CT data using active contour model and Fuzzy C-mean clustering", Alexandria Engineering Journal (2016) 55, 2583–2588

[8] Temesguen Messay ,Russell C. Hardie , Timothy R. Tuinstra," Segmentation of pulmonary nodules in computed tomography using a regression neural network approach and its application to the Lung Image Database Consortium and Image Database Resource Initiative Dataset", Medical Image Analysis 22 (2015) 48–62, www.elsevier.com/locate/media

[9] Bowen Zhao, Zhulou Cao and Sicheng Wang," Lung vessel segmentation based on random forests", ELECTRONICS LETTERS 16th February 2017 Vol. 53 No. 4 pp. 220–222.

[10] Ahmed Soliman, Fahmi Khalifa, Ahmed Elnakib,Mohamed Abou El-Ghar, Neal Dunlap, Brian Wang, Georgy Gimel'farb, Robert Keynton, and Ayman El-Baz_," Accurate Lungs Segmentation on CT Chest Images by Adaptive Appearance-Guided Shape Modeling",IEEE Transcation on Medical Imaging.

[11] Stefano Diciotti, Simone Lombardo, Massimo Falchini, Giulia Picozzi, and Mario Mascalchi," Automated Segmentation Refinement of Small Lung Nodules in CT Scans by Local Shape Analysis", IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 58, NO. 12, DECEMBER 2011.

[12] W. Ju, D. Xiang, B. Zhang, L. Wang, I. Kopriva, and X. Chen, "Random walk and graph cut for co-segmentation of lung tumor on PET-CT images," IEEE Trans. Image Process., vol. 24, no. 12, pp. 5854–5867, Dec. 2015.

[13] Sema Candemir*, Stefan Jaeger, Kannappan Palaniappan, Jonathan P. Musco, Rahul K. Singh, Zhiyun Xue,Alexandros Karargyris, Sameer Antani, George Thoma, and Clement J. McDonald," Lung Segmentation in Chest Radiographs Using Anatomical Atlases With Nonrigid Registration", IEEE TRANSACTIONS ON MEDICAL IMAGING, VOL. 33, NO. 2, FEBRUARY 2014.

[14] Yung-Chieh Lin, Yu-Pao Tsai, Yi-Ping Hung, and Zen-Chung Shih," Comparison between Immersion-Based and Toboggan-Based Watershed Image Segmentation", IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 15, NO. 3, MARCH 2006.

[15] A. Mansoor, U. Bagci, Z. Xu, B. Foster, K. N. Olivier, J. M. Elinoff,A. F. Suffredini, J. K. Udupa, and D. J. Mollura, "A generic approach to pathological lung segmentation," IEEE Trans. Med. Imag., vol. 33, no. 12, pp. 2293–2310, Dec. 2014.

[16] Jiangdian Song, Caiyun Yang, Li Fan, Kun Wang, Feng Yang, Shiyuan Liu*, Jie Tian*," Lung lesion extraction using a toboggan based growing automatic segmentation approach", DOI 10.1109/TMI.2015.2474119, IEEE Transactions on Medical Imaging

[17] R. Siegel, D. Naishadham, and A. Jemal, "Cancer statistics, 2013," CA Cancer J Clin, vol. 63, pp. 11-30, Jan 2013.

[18] W. H. Organization, "Description of the global burden of NCDs, their risk factors and determinants," Geneva, Switzerland: World Health Organization, 2011.