ISSN 2348 – 9928
IJAICT Volume 4, Issue 3, March 2017 Doi:01.0401/ijaict.2014.07.25 Published on 05 (3) 2017

A SURVEY ON COMPUTERIZED DETECTION, QUANTIFICATION AND CLASSIFICATION OF LUNG DISEASE

Ms. I.Christa Mary
Student,
Department of Computer Science and Engineering
Anna University Regional Centre Coimbatore,
Tamil Nadu, India

Ms. J.Preethi
Assistant professor,
Department of Computer Science and Engineering
Anna University Regional Centre Coimbatore,
Tamil Nadu, India

Abstract— ***Lung is the complex organ that consists of spongy, elastic tissue equipped with structures that infuse our blood with fresh oxygen while ridding it of carbon-dioxide. This paper provides a comprehensive survey of Computer-Aided Diagnosis System (CAD) for early detection of lung disease. Lung diseases are mainly occurred as airway disease, lung tissue disease and lung circulation disease are studied. In the computerized detection and classification of lung image five main methodologies are used. They are image preprocessing, segmentation, feature extraction, feature selection and classification. The comparisons with these methods are described in tab***

Keywords— Computer Aided Diagnosis System, Feature Extraction, Feature Selection, Classification.

I. INTRODUCTION

In radiology, Computer Aided Detection (CAD) also called computer aided diagnosis is the procedures in medicine that helps to assist the doctors in the interpretation of medical images. Imaging techniques in general X-ray, MRI and Ultrasound diagnostics provide a great deal of information, in which radiologist has to analyze and evaluate the disease in a short time. CAD system helps to scan the digital images (example from the computed tomography) that identifies and diagnosing the disease [1]. CAD is a relatively young interdisciplinary technology which combines the digital image processing with radiological image processing and artificial intelligence. A most typical application involves a detection of tumor.

In recent years, some hospitals are using CAD to support the preventive measures for medical check-ups in mammography (diagnosing breast cancer) and the lung cancer. In the present stage of this technology does not replaces the doctor instead it helps them to draw conclusion about the condition and severity of disease. Various applications of CAD include the detection following factors

- Clustered micro-calcifications in mammograms,
- Intracranial aneurysms in magnetic Resonance Angiography
- Interval changes in successive whole-body bone scans

II. LUNG DISEASE

Lung diseases are most common medical condition to detect and diagnose in the world [9]. Ten millions of people suffer by lung disease in U.S. Smoking, genetics and infections are the most common lung disease. The lungs are part of a complex apparatus, expanding and relaxing thousands of times each day to bring in oxygen and expel carbon dioxide. The lung diseases are detected in various kinds of image based on choosing the 3D and 2D features. Some of them are Computed Tomography (CT) [1], High Resolution Computed Tomography (HRCT) [2], Multi Detector Computed Tomography (MDCT) each has special view that helps to diagnose.

The various lung diseases are

- Lung Disease Affecting the Airways (Bronchial Signs)
- Lung Disease Affecting the Air Sacs (Alveoli)
- Lung Disease Affecting the Interstitium
- Lung Disease Affecting the Blood Vessels
- Lung Disease Affecting the Pleura
- Lung Disease Affecting the Chest Wall

2.1 Emphysema

Emphysema is a long-term (chronic) lung disease and a main type of Chronic Obstructive Pulmonary Disease. People with emphysema have difficulty breathing due to a limited ability to blow air out. The most common cause of this disease is smoking. It is measured by the aberrations of PF tests. [3]

2.2 Lung Cancer

Emphysema is a long-term (chronic) lung disease and a main type of Chronic Obstructive Pulmonary Disease. People with emphysema have difficulty breathing due to a limited ability to blow air out. The most common cause of this disease is smoking. It is measured by the aberrations of PF tests. [3]

2.3 Lung Disease

There are many disorders when parenchyma is affected and is commonly referred as diffuse parenchyma lung disease (DPLD) or Interstitial Lung Disease (ILD) [2].

ISSN 2348 – 9928
Doi:01.0401/ijaict.2014.07.25 Published on 05 (3) 2017

III. METHODOLOGY

The most common methodology in the CAD system has been shown in the Fig.1.

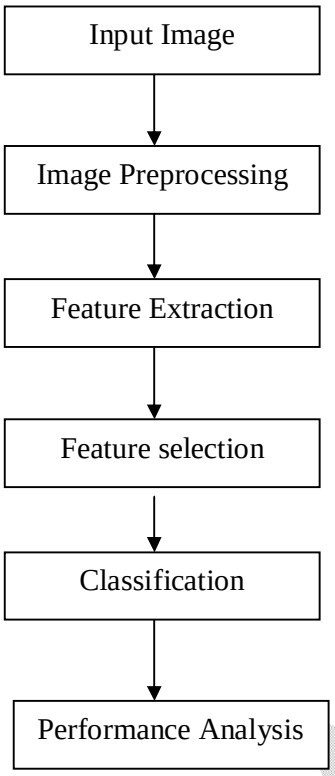

Fig 1: Computer Aided Detection System

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

2.4 Preprocessing

Preprocessing reduce the bugs in the image, improving the image quality by leveling (e.g. using different exposure parameter) and removes the noise according to our process it will change. After the preprocessing, segmentation can be done depending on our process [4].

2.5 Feature Extraction

In common, feature extraction helps to retrieve the desired image from a large collection based on the features extracted from the image. The features will vary based on the image (2D or 3D). The feature extracted from the 3D image are described in [4] and 2D features in [3] [5]. Texture Descriptors helps to extract the features .In [2] described about two descriptors for extracting texture and gradient features.

2.6 Feature Selection

Feature Selection is done after the feature extraction to select the optimal features to factors for better classification [4].

2.7 Classification

Featured values are combined and calculate a feature vector to classify the given image based on the training set [3] [2]. The various kind of classification algorithms are

- KNN
- SVM
- PASA
- Bayesian Classifier
- Artificial Neural Network

IV. LITERATURE REVIEW

Emphysema is detected by the low-attenuation values and varies as Paraseptal emphysema (PSE) and centrilobular emphysema (CLE). In [6] the author proposed a KNN classifier to identify the CT image as normal tissue, Centrilobular emphysema based on the texture feature analysis. Rotation invariant LBP (Local Binary Patterns) and rotation invariant GFB texture features are calculated. Based on the above two features a feature histogram is calculated. In which the sequential forward selection algorithm has been applied after which classified with an accuracy rate of 95.2% and qualitative measure of emphysema is derived. It has achieved high correlation with Pulmonary Function Test (PFT) than with other standard measure such as relative area (RA) of emphysema.

Detecting the Diffuse Lung Disease (DLD) in the High Resolution Computed Tomography (HRCT) is difficult even for the radiologist due to its high complexity. In order to overcome it, the author [7] proposed a bag of words approach for detecting and diagnosing DLD pattern. The set of statistical measure of local features are calculated from both Eigen values and CT values of Hessian matrices is commonly called bag of word approach. Considering the local feature alone provide the high recognition rate of 95.85% than the global feature. Finally, SVM classifier classified the HRCT image as normal tissue, consolidation, ground glass opacity; honey combing, emphysema and nodules based on the concept of Bag of word approach. The local features in this paper are extracted from 3D Region of Interest (ROI) where in the paper [6] considered the 2D ROI.

Computed Tomography (CT) plays a role in becoming the modality of choice for lung images and High Resolution. Computed Tomography (HRCT) only samples a small portion of Lung Parenchyma (LP) [8]. The Multi Detector Computed Tomography (MDCT) allows the acquisition of volumetric datasets that helps for enabling visualization, characterization

ISSN 2348 – 9928
Doi:01.0401/ijaict.2014.07.25 Published on 05 (3) 2017

Table 1: Studies disease detection system

Citations	Purpose	Image	Categories	2D/3D	Classifier	Result
[6]	Texture classification into 3 classes	CT	Normal, Centribular emphysema, Paraseptal emphysema	2D	KNN	Obtained 95.2% accuracy
[7]	Bag of words approach for classifying into 6 types of disease	HRCT	Normal, consolidation, Ground glass opacity, Honey combing, Emphysema, Nodular	2D/3D	SVM	Achieved the recognition rate of 95.85%
[8]	Identification and characterization of lung parenchyma	MDCT	Normal,ground glass, Recticular patterns	3D	-	Performance are evaluated in the metrics of volume overlap, true positive, false positive on the scanned image
[5]	Detection and quantification of Tree-In-Bud opacities	Conventional CT image	Detect TIB patterns	2D	-	Experimental results achieved 90.96% accuracy
[9]	Classify lung nodule into 4 classes	CT	Well circumscribed, Juxta-vascular, Juxta-pleural, Pleural-tail	2D	SVM	Location of lung nodule is found
[10]	Classify into 4 categories	MDCT	EC,MC,NC,NN,NS	2D/3D	Bayesian	Four text procedures are done for classification

and quantification of lung anatomy. The Computer Aided Detection automatically identifies and characterizes the DPLD patterns in CT image and two main stages are carried out. They are segmentation and classification. Segmentation is done using the gray-level methods and classification is for classifying the tissue as normal and abnormal. The k nearest neighbor (KNN) voxel classification is done after the removal vessel tree volume for efficient characterization of lung parenchyma. With the help of volume overlap the performances are evaluated.

Computer Aided Detection system is developed to detect and quantify the Tree in Bud (TIB) opacities of CT scan. With the help of b-scale filtering and scale selection it provide the fast localization of candidate TIB pattern and combine both shape and the texture features to identify the TIB patterns. The shape features are used since it helps to achieve high detection rates and described the usefulness of Wilmore energy property [5].

In pulmonary CT, L.Sorensen [9] proposed a fully automatic data driven approach for texture based quantitative analysis of COPD. The quantitative measure is done on the individual Region of Interest by calculating its properties. The multi-scale rotation invariant Gaussian filter bank is done on the ROI texture. Finally the KNN classifier is carried to classify 200 independent images in the data set.

The identification of malignant cancer is found with the location of lung nodule. The process involves two steps. First labeling the voxels and classifies it into either foreground or background through a single graph cut algorithm. Second, learning is done based on the content characterization. The image taken for the classification is CT image. The overall result provides a good labeling performance based on the contours of nodes. In the surrounding parenchyma, mislabeling arise in some area with the faint vessel structures. The publicly available Early Lung Cancer Action Program (ELCAP) database is used. The graph model is

ISSN 2348 – 9928
Doi:01.0401/ijaict.2014.07.25 Published on 05 (3) 2017

constructed for labeling by using a conditional random field [10].

Xu,Y.[4] described about differentiating normal lung from subtle pathologies through MDCT. The differences are obtained by extending the 2D texture features to use the 3D features. The classification is done to find the smokers, non-smokers, mild emphysema, emphysema and the normal tissue patterns. The volumetric features in MDCT image are extracted and optimal features are selected and classified. The comparative studies of all the papers are shown in the Table.1 with their purpose.

V. CONCLUSION

A computer aided detection methodologies are developed for earlier disease detection and treatment stages, the time factor was taken in account to discover the abnormality tissues in the required image. Improving Image quality and accuracy is a core factor of this study and showed the comparison. The image quality assessment and enhancement stages are adopted on pre-processing, the most commonly used technique is Gabor filter. The Region of Interest features are extracted from the segmented region. All the process gives varying results based on the techniques used. In further study changing the optimized algorithm in the methodology process will provide an improved performance.

References

[1] Mythily.A,Veena.M.U,"Segmentation and classification of lung Tumor using Chest CT image for treatment Planning",Int.Journal of Engineering Trends and Technology-Vol.7,no.2,jan 2014.

[2] Yang Song,Weidong Cai,Yun Zhou,David Dagan Feng,"Feature-Based Image Patch Approximation for Lung Tissue Classification",IEEE.Trans on Med.img,vol.32,no.4,pg.797-808,april 2013.

[3] Y.Uchiyama, S.Schilham , M.Prokop,"Computer analysis of computed tomography scans of the lung" IEEE Trans.med.imag, April 2006.

[4] Y.Xu, M.Sonka, G.MaLennan, J. Guo, and E.A.Hoffman,"MDCT based 3-D Texture classification of emphysema and early smoking related lung pathologies", IEEE Trans.Med.Img ,vol 25,no. 4, pp.464-475,April 2006.

[5] U.yBagci,J.Mllura,"Automated detection and quantification of Tree-in-bud(TIB) opacities from CT scans,"IEEE Trans.Biomed.Eng.,vol. 59,no 6.1620-1632,jun.2012.

[6] L . Sorensen,S.B.shaker,and M.de.Bruijne, "Quantitative Analysis of Pulmonary Emphysema Using Local Binary Patterns" IEEE Trans.Med.Imag.vol. 29,pp.559-569,Feb 2012.

[7] Rui.Xu, Yasushi Hirano, Rie Tachibana, and Shoji Kido,"Classification of diffuse Lung Disease Patterns on High Resolution Computed Tomography by a Bag of Words Approach",in Medical Image Computing and Computer-Assisted Intervention-MICCAI. New York:Springer, 2011,vol.6893,LNCS,pp.183-190.

[8] P.D.Korfiatis,A.N.Karahaliou,A.D.Kazantzi,C.Kalogeropoulou, and L.I.Costaridou,"Texture-based identification and characterization of interstitial Pnenomonia Patterns in Lung Multidetector CT",IEEE Trans.Inf.Technol.Biomed.,vol.14,no.3.pp.675-680,May 2010.

[9] L.Sorensen,M.Nielsen,P.Lo,H.Ashraf,J.H.Pedersen, and M.de Bruijne,"Texture-based analysis of COPD:A data-driven approach,"IEEE Trans.Med.Imag.,vol.31,no.1,pp.70-78,jan 2012.

[10] Y.Song, W.Cai,Y.Wang, and D.D.Feng,"Location classification of lung nodules with optimized graph construction,"in Proc.Int.Symp.Biomed.Img.,2012,pp.1439-1442.