A SURVEY ON LUNG TISSUE CATEGORIZATION

Dr.J.Preethi, Mrs. Shalini Raju, Ms. Sowmiya Sekaran

ABSTRACT

HighResolution Computed Tomography or HRCTis a medical diagnostic test used for diagnosis and assessment of interstitial lung disease. Classification of lung tissue is an important factor for lung diseases prediction. Most of the existing system introduced different methods such as Wavelet Frames, support vector machines classifier, Isotropic Wavelet Frames for lung tissue classification. The existing methods are not able to produce high classification accuracy. To solve this problem, the patch-adaptive sparse approximation (PASA) algorithm is introduced for lung tissue classification. The various methods in this research analysis is implemented and evaluated in terms of different performance measures. The performance evaluation conducted were proved that the proposed mechanism achieves better result than the existing mechanism in terms of classification accuracy and precision.

***Key words*: Interstitial lung disease, Lung tissue, Feature extraction, Selection, classification**

I.INTRODUCTION:

Auto Immune disease which is also known as ILD represents a group of 150 disorders of the lung parenchyma and more. This disease cause progressive scarring of the tissue of the lung which most commonly affect breathing. The specific type of disorder should be determined. HRCT imaging is the standard practice since it is of high imaging quality. Imaging scans are often used for diagnosing accurately. Different ILDs normally exhibit different combinations of tissue patterns on HRCT images which is critical for radiologists to identify the actual type of interstitial lung disease. Each Patient has various physical conditions and medical histories; hence even those with the similar type of ILD could display quite various tissue models [3]. The manual explanation of the images leads to error. Particularly the radiologists are under weighty workload with short time frames. Therefore it is recommended that an automatic system to distinguish the tissue patterns would be useful to offer initial screening or second opinions [4]. The classification of lung tissues is normal, emphysema, ground class, fibrosis and micronodules which are the main types of interstitial lung disease.

Emphysema:

Emphysema is a form of long term lung disease. People who are suffering from emphysema have difficulty breathing from a limitation in blowing air out. The main cause of emphysema is smoking. Emphysema is one of the main types of COPD (Chronic Obstructive Pulmonary Disease).

Fibrosis

Fibrosis refers to the connective tissue deposition which occurs as a part of normal healing or to the deposition of excess tissue that occurs as a pathological process. Pulmonary fibrosis refers to a condition where the interstitial lung is damaged followed by fibrosis and loss of lung elasticity.

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Micronodules:

Micronodules are spherical lesions which occur in the lung. They appear as small masses of tissue in the lung. The range of micronodules may be from millimeters to centimeters. The nodules appear as a white or round shaped shadows in a chest X-ray and Computed Tomography. A lung nodule which is greater than 30 millimeter is cancerous. Noncancerous lung nodules are caused mostly by previous infections which does not require any treatment.

Lung tissue classification involves the process of obtaining an input image, preprocessing of an image, feature extraction, feature selection and classification.The method for lung tissue classification is given in figure1.1

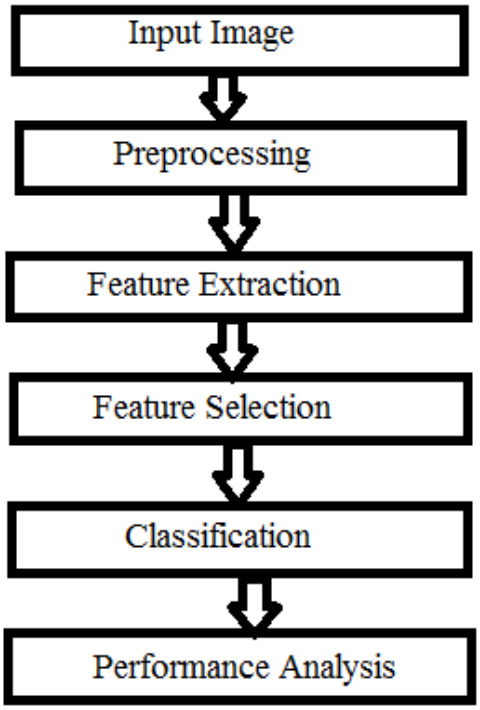

Figure1.1

Image preprocessing:

Preprocessing of images is a method of removal of unnecessary noise. An image is preprocessed to increase the reliability. The image is preprocessed using various filtering operations. The preprocessing methods are given below

- Smoothing
- Background Subtraction
- Dialation
- Erosion
- Max, Min and median

Feature extraction:

Feature extraction is the process of extracting the features from an image. The features of an image may be corner, blob, edge or a line. Feature extraction enables to derive a set of feature vectors which are also known as descriptors. The features are represented in the form of values. The T-I-G (Texture Intensity Gradient) feature are extracted using two descriptors. The two descriptors are

- RGLBP (Rotation- invariant Gabor Local Binary Pattern) is used to extract the texture features.
- MCHOG (Multi Co-ordinate Histogram Oriented Gradients) is used to extract the gradient features.

Feature selection:

Feature Selection is done after the feature extraction to select
the optimal features to factors for better classification. The techniques used for feature selection are

- Particle Swarm Optimization
- Cuckoo Search Algorithm
- Monarchy Butterfly Algorithm

Classification:

The featured values are combined and calculate a feature vector to
classify the given image based on the training set. The
various kind of classification algorithms which are used for classification are as follows

- K-Nearest Neighbor
- Support Vector Machine
- Patch Adaptive Sparse Approximation

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- Bayesian Classifier
- Artificial Neural Network

From this it can be understood that efficient lung tissue classification is a very important part. Due to the importance of this problem, various solutions have been proposed to solve. In this paper we will describe various types of lung tissue classification techniques and analyze each of these solutions, identify their strengths and limitations.

The organization of the analysis work is given as follows:

In section II, the various research work which are implemented based on increasing the profit in discussed and evaluated.

In section III, the research works that has been discussed in the previous section is evaluated by listing their merits and demerits.

In section IV the final conclusion of this entire analysis work is listed.

II.LITERATURE REVIEW

(2007) In [5] , Adrien Depeursingel introduced a Lung Tissue Classification scheme which is based on the Wavelet Frames. The lung tissue patterns such as emphysema, ground glass, fibrosis and Microdules are selected from database which is classified by using discrete wavelet frame decomposition. The DWT is not accurate to classify emphysema and micronodules. In order to solve this proposed, combination of histogram and DWF features are used. This method is highly efficient particularly while processing multiclass classification. The overall multiclass accuracy reaches 92.5% of correct matches when the two types of features are combined, which are found to be complementary. However it suffers from lack of resolution in scales with the DWF decomposition.

(2008) In [6], ,Adrien Depeursinge introduced a new scheme for Lung Tissue Classification. The clinical factor of high resolution computed tomography (HRCT) images are utilized for lung tissue classification. The collection of contextual information in addition to images is most commonly time consuming. One the other hand a high level knowledge of the application domain is needed in order to discover closely connected contextual parameters. The selection of parameters for contextual medical image examination has to be processed based on domain specific literature along with knowledge basis of computerbased diagnostic decision support systems. The clinical attributes with highest information gain ratio show to be relevant and stable for the purpose of classification of lung tissue patterns. The visual and clinical elements allowed a mean of ninety three percent of correct predictions of testing illustrations among the different types of lung tissue with optimized SVM which represents a significant benefit of eight percent compared to a pure visually–based classification. However SVM based classification is does not suitable for large dataset.

(2010) In [7],, Adrien Depeursingeintroduced a new mechanism lung tissue classification. The 2D regions of interest in HRCT axial slices from patients pretentious with an interstitial lung disease are involuntary classified into different types of lung tissue. The optical information is extracted High Resolution Computed Tomography image and it combined with clinical parameters of the corresponding patient. The information of multiple modalities has the following two steps. First one is identification of best modalities. Each and every modality described by a set of features. Second one is the best modality informations are combined with an efficient scheme. Finally the fusion process is executed based on these two categories. To make a unique feature space the feature are concatenated into one vector. Finally the fusion executed at the decision level. However the negative synergies still occur among features using a late fusion scheme.

(2010) In [8], Dr Elke Thönnes introduced a Classification of Lung Disease scheme in HRCT Scans. The set of features are extracted from the highresolution computed tomography images. The extracted features are used to compute local morphological and topological of the 3 dimensional pixels within the lung parenchyma. Finally the features are applied to classification. The Murkowski functional measures are computed from integral

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geometry features such as volume V, surface area S, the mean breadth B. Finally classification on lungs containing differentstages of chronic lung disease such as emphysema, fibrosis and honey-combing. Both the training set and the lung tissue to be classified were subdivided into 5x5x1 pixel windows. However an efficient mechanism is needed for Classification.

(2012) In [9], Adrien Depeursingintroduced a Lung Tissue Analysis scheme based on the Isotropic Wavelet Frames. The near-affine-invariant texture descriptors are derived from isotropic wavelet frames. These near-affine-invariant texture descriptors are used to characterize the lung tissue patterns in highresolution computed tomography imaging. To enable the knowledge of non-predictive appearance of an image without a priorilocalizations or sizes, the affine invariance is desired. The Grayscale values having valuable information which is used for characterization of objects and coarsenessand are complementary to its features. The classification analysis scheme achieves 76.9% of classification accuracy while combined with gray-level histograms. However tuning of the parameters of QWF is needed for achieve high accuracy.

(2013) In [6] ,Yang Songintroduced a new Lung Tissue Classification method which is based on the Feature-Based Image Patch Approximation. The classification method is used for five categories of lung tissues in high resolution computed tomography (HRCT) images. The texture, intensity, and gradient features are extracted from each image patch. A new feature descriptor namely RGLBP and multi-coordinate HOG (MCHOG) descriptor are proposed. The RGLBP feature descriptor is used to describe the texture features and LBP histograms. The MCHOG descriptor is used to extract the gradient features. The image patch is image patch is classified into one of the five tissue categories by using patch-adaptive sparse approximation (PASA) algorithm. Finally, an annotated ROI (AROI) labelling is obtained on the basis of the probability of evaluation from the patch-wise classification. The proposed system improves the overall performance of the system.

III. COMPARISON OF METHODOLOGIES

This section provides an overview about the pros and cons that are occurred in the research methodologies whose functional scenarios are discussed in depth in the previous section. From the following table, it can be predicted a better approach that provides considerable improvement in the proposed scenarios.

Table 1

S.NO	TITLE OF PAPER	AUTHOR NAME	MERITS	DEMERITS	CITATION
1	Lung Tissue Classification Using Wavelet Frames	Adrien Depeursinge, Daniel Sage, Asmˆaa Hidki, Alexandra Platon, Pierre–Alexandre Poletti, Michael Unser and Henning M¨uller	It achieves overall accuracy of 92.5%.	It suffers lack of resolution in scales with the DWF decomposition.	[5]
2	Lung Tissue Classification in HRCT data Integrating the Clin ical Context	Adrien Depeursinge, Jimison Iavindrasana and Gilles Cohen	The classification is optimized with SVM	Support vector machine classifier id does not suitable for large database.	[6]
3	Fusing visual and clinical information for lung tissue classification in high-resolution computed tomography	Adrien Depeursinge , Daniel Racoceanu , Jimison Iavindrasana , Gilles Cohen , Alexandra Platon ,	High robustness High accuracy	The negative synergies still occur among features using a late fusion scheme.	

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		Pierre-Alexandre Poletti and Henning Muller			[7]
4	Classification of Lung Disease in HRCT Scans using Integral Geometry Measures and Functional Data Analysis	Dr Elke Thönnes Dr Abhir Bhalerao Dr David Parr	Efficient Method High accuracy	Optimal mechanism is needed for achieve improved Classification accuracy	[8]
5.	Near-Affine-Invariant Texture Learning for Lung Tissue Analysis Using Isotropic Wavelet Frames	Adrien Depeursinge, Dimitri Van de Ville, Alexandra Platon, Antoine Geissbuhler, Pierre-Alexandre Poletti, and Henning M¨uller	It provide accurate descriptions of textures that do not contain prevailing orientations.	The parameters running of QWF is needed for achieve high accuracy.	[9]
6.	Feature-Based Image Patch Approximation for Lung Tissue Classification	Yang Song, Weidong Cai, Yun Zhou, and David Dagan Feng,	Classification accuracy is superior than other methods	It requires further improvement More robust techniques needed for feature selection	[10]

IV.CONCLUSION

An instinctive classification process for diagnosing lung disease in high resolution computed tomography images is propounded in this survey. Five types of lung tissues – normal, emphysema, ground glass, fibrosis and micro nodules—that are significant for ILD disease diagnosis. This survey work analyze the innumerable research methods which has been conducted in terms of classification accuracy. All the research works that has been introduced in the previous works are examined and scrutinized in terms of their eminence and drawback. From this analysis, it is concluded that lung tissue classification using Feature-based Image Patch Approximation approach which is can lead to a performance improved in terms of improved accuracy and efficiency.

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First Author: Dr. J. Preethi M.E.Ph.D, Assistant Professor, Department of Computer Science and Engineering, Anna University Regional Campus Coimbatore

Second Author: Mrs.Shalini Raju P.G Scholar, Department of Computer Science and Engineering, Anna University Regional Campus Coimbatore

Third Author: Ms.Sowmiya Sekaran, P.G Scholar, Department of Computer Science and Engineering, Anna University Regional Campus Coimbatore

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