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Diagnosis Of Interstitial Lung Disease By Pattern Classification

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Abstract

Diagnosis of interstitial lung disease (ILD) using pattern classification consists of image preprocessing, feature extraction, selection and classification. Feature extraction is initially done using textons and then LTCOP method is used. Classification is initially done using ANN, KNN and Deep CNN classifiers. Deep CNN produces greater accuracy than ANN and KNN classifiers. Feature selection is initially done using ReLu activation and then histogram method is used. Hybrid kernel based SVM classification is a new method that produces more accuracy compared to ANN, KNN and Deep CNN classifiers. Performance of classification are determined using confusion matrix, recall rate, precision, F_{average} and accuracy.

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Keywords: Interstitial lung disease; pattern classification; feature extraction; Deep CNN; ANN; KNN; Hybrid kernel based SVM classifier

1. Introduction

Interstitial lung disease (ILD) is referred as a kind of inflammation occurring in the lungs that can cause severe scarring of the lung tissues. This type of disease will mainly affect the tissues and space around air sacs of the lungs. As a result of this respiratory disease called scarring of lungs, it can cause difficulty in breathing leading to serious

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breathing problems. It also causes stiffness in the lung tissues, reduces ability to carry oxygen to blood stream and remove carbon dioxide [1]. The ILD is mainly caused due to autoimmune diseases, genetic abnormalities and exposure to hazardous materials. The diagnosis of ILD cannot be confirmed by the process of radiology. The different ILD patterns have similar clinical manifestation with each other, making it a heterogeneous disease. Also, the large radiological data of different ILD patterns makes it difficult for differential diagnosis by the experienced physicians. Then the method of surgical biopsy was adopted to diagnose the interstitial lung disease. But this method results in producing bad impacts to health as well as increases cost of surgery. So, this is followed by a Computer Aided Diagnosis (CAD) system that involves the method of classifying the different lung disease patterns.

1.1. Different interstitial lung disease patterns

The different ILD patterns are: Ground glass opacity (GGO), micronodules, consolidation, reticulation, honeycombing, combination of GGO and reticulation and finally the healthy tissue. The Fig. 1 shows different ILD patterns. The ILD patterns are classified using different classification methods such as Artificial Neural Network (ANN), K Nearest Neighbor (KNN), Deep Convolution Neural Network (Deep CNN) and finally with Hybrid kernel based SVM classifier.

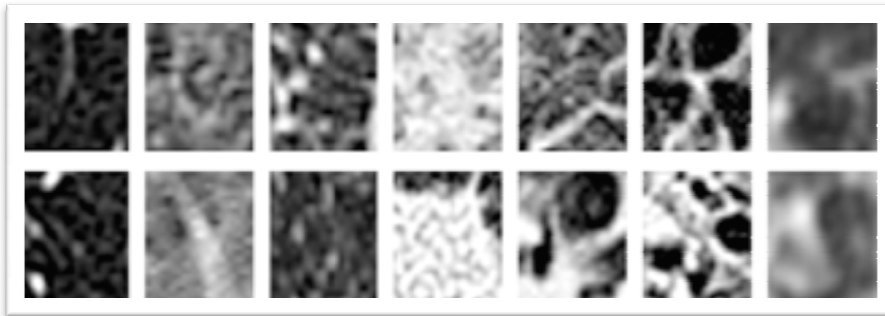


Fig. 1. Different ILD patterns (healthy, GGO, micronodules, consolidation, reticulation, honeycombing, combination of GGO and reticulation)

Firstly, rescaling is done with the input CT image and then the features are extracted from the patches formed. The best possible features are selected from the test and train data and it is fed to the classifier to produce the classified ILD patterns. The Hybrid kernel based SVM classifier is a new method of ILD pattern classification that can produce better results in terms of classification performance (accuracy), training time and feature selection.

The following section describes related works, block diagram of ILD pattern classification, the different classification methods of ILD such as ANN, KNN, Deep CNN and Hybrid kernel based SVM classifier. Finally the results associated with all these are discussed and the performance of different classification methods are analyzed.

2. Related works

The related works associated with diagnosis of ILD by pattern classification includes different methods adopted for feature extraction and classification of ILD patterns.

2.1 Different methods of feature extraction

Different methods of feature extraction are used right from the beginning of ILD pattern classification. Adaptive Multiple Feature Extraction Method (AMFM) was the initial method used for feature extraction. It includes the methods such as first order gray level statistics, Gray Level Co-occurrence Matrices (GLCM), Run Length Matrices

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