ABSTRACT

The advances in the field of information technology have led to the development of Computer Aided Diagnosis (CAD) Systems for diagnosis of diseases. CAD Systems aid the physicians in diagnosing diseases that are otherwise difficult to diagnose. In this work a model has been developed for computer aided diagnosis of lung disorders from chest Computed Tomography (CT) images. The CAD Systems that comply with the proposed model first segment the lung parenchyma from the outer chest region. The regions that bear features similar to that of Pathology Bearing Regions (PBRs) are then extracted as Regions of Interest (ROIs). Objective data are extracted from the ROIs and the diagnostic result is derived based on quantitative analysis of the objective data.

In this work, approaches have been developed to improve the performance of computer aided diagnosis of lung disorders. The improvement is achieved in two ways. First, the number of ROIs missed is decreased by enhancing the approaches that are available for extracting the lung parenchyma from the chest CT. Second, the quantitative analysis of the ROIs is strengthened by considering features from different domains. This improves the performance of the CAD System for diagnosis of lung disorders. The disorders considered in this work are lung cancer, bronchiectasis, tuberculosis and pneumonia.
The problem of segmenting the lungs affected by high density pathologies that are connected to the lung border has not yet been solved (Lai and Ye 2009). The existing segmentation approaches (Hu et al 2001; Chen et al 2007) are unable to segment the complete lung parenchyma in cases with peripherally placed PBRs. They tend to eliminate the peripherally placed PBR with the outer chest region. This work focuses on complete segmentation of the lung parenchyma even in the presence of severe peripherally placed PBR.

A segmentation algorithm developed for a specific type of image will not be suitable for segmenting other types of images (Lai and Ye, 2009). Hence many of the existing approaches discussed in the literature are not suitable for segmentation of lung CT images with different types of pathology. In this work a segmentation approach that works effectively with CT images affected by the lung disorders, namely, Bronchiectasis, Tuberculosis and Pneumonia has been developed.

The existing works (Yudong et al 2010) use features from a single domain, i.e. they may involve features extracted from the spatial domain, frequency domain, wavelet domain, fractal analysis, Gray Level Cooccurrence Matrix (GLCM) or analysis of the histogram. Hence they fail to capture all the characteristics of the ROIs. In this work an approach that analyses the ROIs based on features extracted from the spatial domain, histogram, GLCM and wavelet transform has been developed.

In this work five approaches have been proposed in accordance with the proposed model. The first approach divides the given chest CT into
subimages of size 15×15, extracts features from the subimages and compares them for similarity with images that were already labeled by expert, using Manhattan distance measure; this is meant for detection of cancerous tissues. In the second approach, a CAD scheme has been developed to diagnose Bronchiectasis. This involves the usage of a trained Probabilistic Neural Network (PNN) in conjunction with a Knowledge Base (KB) and Mahalanobis similarity measure. The third approach involves segmenting the lung parenchyma by taking into account the convex edge of the lung as a single connected component and then using a trained neural network classifier for diagnosis of lung cancer. The fourth approach involves a novel segmentation approach for reconstructing the major lobes of the lung in cases of severe peripherally placed pathology bearing regions using graphical methods, namely, reflection and translation. It then uses a Back Propagation Neural Network (BPN) in conjunction with a KB for diagnosis of three lung disorders, namely, bronchiectasis, pneumonia and tuberculosis. The fifth approach involves a scheme for selection of the slice that is best suited for analysis of a nodule. It then extracts features from the ROI and uses a Radial Basis Function Neural Network (RBFNN) for diagnosis of lung cancer.

The approaches developed in this research work aid in improving the performance of CAD systems used for diagnosis of lung disorders, thereby improving the diagnostic accuracy and reducing the mortality rate for lung disorders.