Australian Journal of Basic and Applied Sciences, 9(16) Special 2015, Pages: 467-472

ISSN:1991-8178

Australian Journal of Basic and Applied Sciences

Journal home page: www.ajbasweb.com

Prediction of Ct Lung Disease Using Back Propagation Network And Spatial Fuzzy Clustering

[1]R.Priyatharshini, [2]R.Krithika, [3]I.Monisha, [4]P.S.Nithya, [5]Dr.S.Chitrakala

[1]*Assistant ,Professor,Department of IT, Easwari Engineering College,Chennai,Tamil Nadu,India*
[2]*Department of IT, Easwari Engineering College,Chennai,Tamil Nadu,India*
[3]*Department of IT, Easwari Engineering College,Chennai,Tamil Nadu,India*
[4]*Department of IT, Easwari Engineering College,Chennai,Tamil Nadu,India*
[5]*Department of CSE, Anna University,Chennai,Tamil Nadu,India*

ARTICLE INFO

Article history:
Received 20 January 2015
Accepted 02 April 2015
Published 20 May 2015

Keywords:
Lung cancer detection
Image segmentation
Back Propagation Network
Spatial fuzzy clustering

ABSTRACT

Background: This paper presents an automatic decision support system for lung disease stage classification using artificial neural network and to detect lung cancer through Fuzzy clustering methods for medical application.**Objective:**To implement an automatic decision support system for diagnosing the CT lung cancer based on back propagation with feed forward network and segmentation of cancer cell using spatial fuzzy clustering approach. **Results:**Our proposed system provides 100% sensitivity, 75% specificity and 90% accuracy. The processing time taken was 6.566 seconds. The performance of proposed algorithm is compared with other existing algorithms**. Conclusion:** In this paper lungs are classified based on the stage of tumor using Back Propagation Network. After classification, if the results are abnormal then the tumor is segmented using Spatial Fuzzy Clustering and background is suppressed using morphological processing.

To Cite This Article: R.Priyatharshini, R.Krithika, I.Monisha, P.S.Nithya, Dr.S.Chitrakala., Prediction of Ct Lung Disease Using Back Propagation Network And Spatial Fuzzy Clustering. ***Aust. J. Basic & Appl. Sci.,*** *9(16): 467-472, 2015*

INTRODUCTION

Cancer is the most disastrous and life threatening disease to human beings globally among various diseases. In India Cancer is the second largest disease which is responsible for maximum mortality about 0.3 million deaths per year. According to GLOBOCAN 2012 statistics, it was found that around 14.5 million new cases were diagnosed and around 8.3 million deaths occurred in 2012, due to cancer which is little high when compared to statistics of 2008 which was 12.8 million new cases and 7.7 million deaths due to cancer. According to study it has been found that out of all the cancers, lung cancer is considered to be the main cause of mortality worldwide amongst all types of cancers. The main reason behind high rate of mortality due to lung cancer is that it is not easily detected in the initial stage and it is very difficult to overcome this disease at later stages of cancer. If lung nodules can be identified accurately at an early stage, the survival rate of the patient can be increased to a significant percentage. In today's world, the field of automated diagnostic systems plays crucial role in the diagnosis of any disease. Image Processing is a field where automated diagnostic system designed especially for medical diagnosis leads to solution which will help in decreasing the mortality rate and these medical diagnostics systems helps in detecting the disease at initial filed which is very remarkable in the field of bioinformatics.

The purpose of this paper is to review related work on automatic diagnosis of lung cancer. The paper is organized in five sections. Section I explains about the introduction. Section II covers literature pertaining to image processing and classification algorithms, and applications of these techniques for lung cancer diagnosis. Section III provides summary of lung cancer detection and classification. Section IV and V covers the result and conclusion.

In (AparnaKanakatte, et al., 2008) an algorithm for automated process of tumor delineation and volume detection from each frame of PET lung images is defined. Data is represented by using spatial features (geometric moments) and frequency domain features (discrete cosine transform, wavelets) and comparison has been made. K-nearest neighbor and support vector machines (SVM) classifiers were used to analyze performance of these features.

In (Fatma Taher, et al., 2012) a system for Bayesian classification and a Hopfield Neural

Corresponding Author: R.Priyatharshini, Assistant ,Professor,Department of IT, Easwari Engineering College Chennai, Tamil Nadu, India

Network algorithm for extracting and segmenting the sputum cells for the purpose of lung cancer in early stage is diagnosis. The HNN segmentation algorithm outperforms the Fuzzy C-Mean clustering, it allows the extraction of nuclei and cytoplasm regions successfully. Morphological processing on the segmented image improved the performance of HNN algorithm.

In (Morphological) a system for fast, automated segmentationmethod that is based on morphological processing which is suitablefor both small and large lesions is done. In addition, the proposed approachaddresses clinical challenges to volume assessment such asvariations in imaging protocol or inspiration state by introducinga method of segmentation-based partial volume analysis (SPVA)that follows on the segmentation procedure. The issues identified in the paper are the use of different scanners, even from the samevendor, will most likely introduce further imaging variability's,which may or may not be compensable by partial volume-basedapproaches, and which should be examined in the future.

In ("Use of Anatomical) a system for anatomical information was used as priors to extract the lung structures from the co-aligned PET data. The performance of a conventional iterative pixel-classification algorithm of fuzzy c-means (FCM) cluster analysis for segmenting the PET data with and without the use of the priors was quantitatively evaluated. A Monte Carlo simulation of PET with anatomical priors derived from the Zubal whole-body phantom was used in the evaluation. We demonstrate that the use of the anatomical priors to restrict the PET data to regions of interest consisting only of lung structures is able to improve the accuracy and reliability of the cluster analysis segmentation of lung tumors in PET images. However the issue is that it uses FCM method to segment the lungs.

In (Negar Memarian, et al., 2006) it proposes a system which efficiently predicts lung tumor from Computed Tomography (CT) images through image processing techniques coupled with neural network classification as either benign or malignant. Optimal thresholding is applied to the denoised image to segregate lung regions. Region growing method is used to segment Lung nodules which are of relatively high density found within the lung regions. A set of textural features extracted from the extracted ROIs is classified as cancerous or non-cancerous by the back propagation neural network.

The Accuracy and Sensitivity percentage values obtained from the previous algorithms are not good as expected.

2. Overview Of Proposed System:

An approach for lung cancer detection and classification has been proposed using BPN and Spatial Fuzzy Clustering. In our proposed method, Feature extraction based on texture is been done for our input CT lung images. The input images are compared with the reference sample images based on the result, the stage of lung cancer is identified (ie. normal, benign or malignant). The overview of our proposed system is shown in "Fig. 1," In case of the stage identified is benign or malignant, tumor is segmented using Spatial Fuzzy C-Means Clustering and Boundary Tracking. From the result obtained, background is suppressed using Morphological Processing. The reference sample images are shown in "Fig.2,".

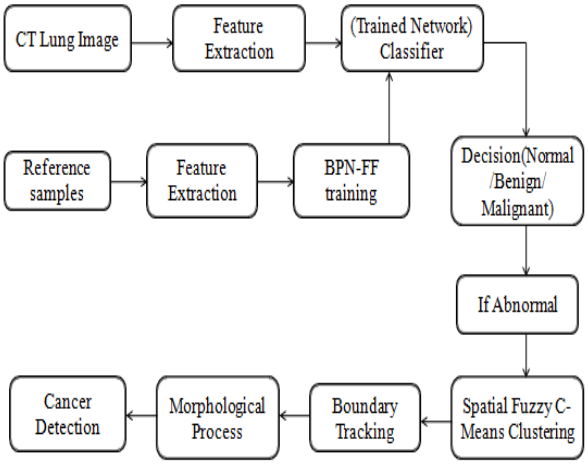

Fig. 1: Overview of Proposed System

.

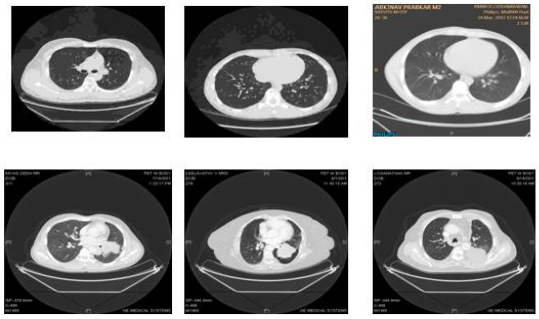

Fig. 2: Reference Images for lung disease stage classification

A.Feature Extraction:

Principal Component Analysis is an algorithm for feature extraction from an image to recognize the texture pattern. Principal Component Analysis is used to reduce the large dimensionality of the data and multi spectral band reduction through extracting features like covariance, Eigen values and vectors.It is useful for discriminating the pattern of different image samples with limited features. The feature reduction is used to explain the majority of its variability compared to multiband features. It is also named as Karhunen-Loève transform or proper orthogonal decomposition as shown in "Fig.3,".

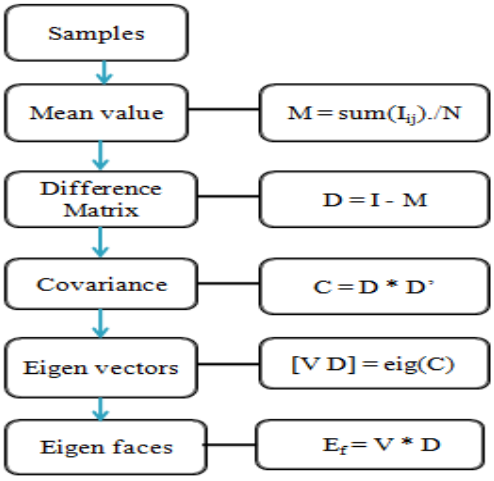

Fig. 3: Steps involved in Feature Extraction

B. BackPropagation Network:

The performance of the Back Propagation network was evaluated in terms of training performance and classification accuracies. Back Propagation network gives fast and accurate classification and is a promising tool for classification of the tumors.Back propagation algorithm is finally used for classifying the pattern of malignant and benign tumor.The back-propagation learning rule can be used to adjust the weights and biases of networks to minimize the sum squared error of the network as shown in "Fig .4," .

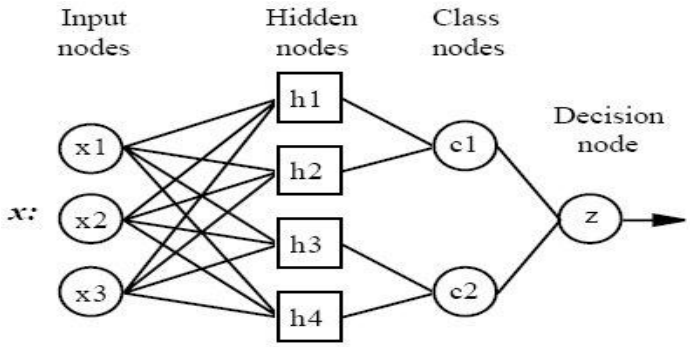

Fig. 4: Backward Propagation Network

C. Morphological Process:

Morphological operations are applied on segmented image for smoothening the lung parenchyma's. It processes the image based on shapes and it performs on image using structuring element. Dilation and erosion process will be used to enhance (smoothening) the lung region by removing the unwanted pixels from outside region of tumor part. Erosion: It is to remove the pixel from the object boundary depends on structuring element. Dilation: It is the process of adding a pixel at object boundary based on structuring element as shown in "Fig. 5,".

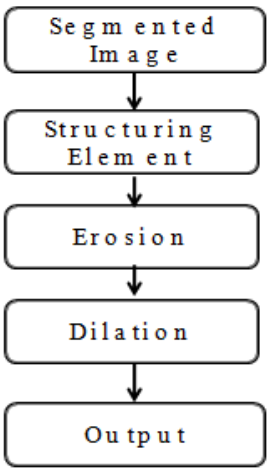

Fig. 5: Steps involved in Morphological Process

3. Experimental Results:

In our paper we have taken 15 reference samples which are trained according to texture and stored based on covarience value.When an input sample is given it makes a comparison with reference samples and stage of lung cancer is identified and displayed. The Comparitive performance analysis graph is shown in "Fig 6,". Our proposed system provides 100% sensitivity, 75% specificity and 90% accuracy. The processing time taken was 6.566 secs. The performance of proposed algorithm is compared with other existing algorithms is shown in Table 1. The screenshot of our experimental results are shown in "Fig.7,".

Table 1: Performance Evaluation of Proposed System

Lung Cancer detection Algorithm	Lung Disease stage classification Algorithm	Accuracy	Sensitivity
Bounding box and Threshold Segmentation	SVM(GRBF kernel type)	87.82%	93.75%
Weighted fuzzy based clustering	SVM(RBF kernel type)	86.30%	82.05%
Spatial Fuzzy(Our proposed system)	Backward propagation network	90%	100%

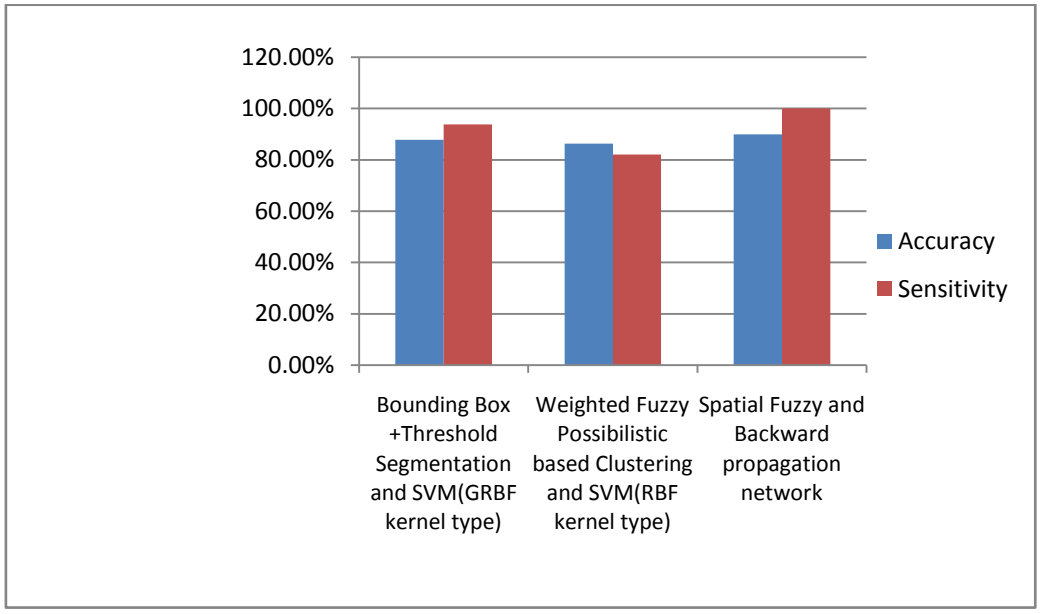

Fig. 6: Performance index of various methods

Conclusion:

This project implemented a CT lung image classification using texture features and it will be classified effectively based on artificial neural network. The segmentation technique also utilized to extract the lungs and cancer from whole image using fuzzy c means clustering Back propagation neural network was used for classification based on unsupervised learning using principle features and target vectors. The neural network training and classification was done efficiently by using Matlab neural network toolbox within less time. Finally this system is very useful to diagnose the computed tomography lung images for cancer diagnosis.

5. Exprimental Result:

Fig. 7: Identification Of Tumor Stage In The Input Image

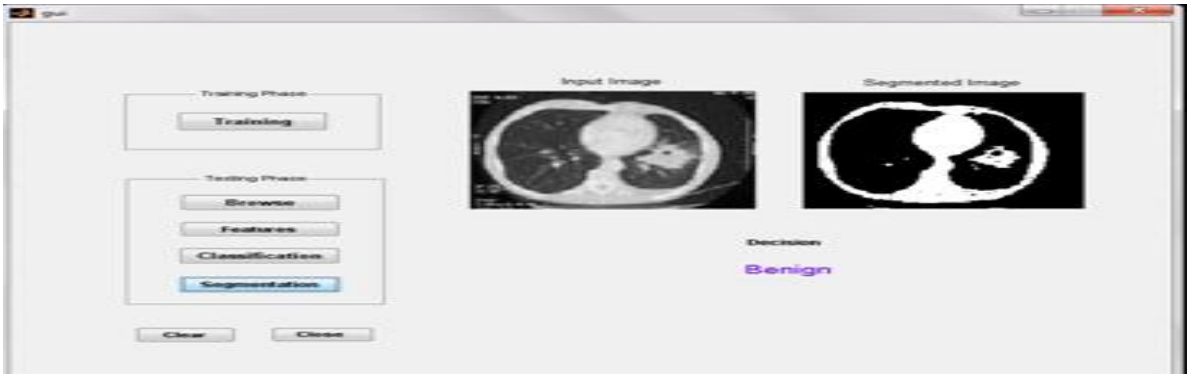

Fig. 8: Segmented Tumor Image

REFERENCES

AparnaKanakatte, Nallasamy Mani, BalaSrinivasan, Jayavardhana Gubbi, 2008. "Pulmonary Tumor Volume Detection from Positron Emission Tomography Images", International Conference on Biomedical Engineering and Informatics, pp: 213-217.

Fatma Taher, Naoufel Werghi and Hussain Al-Ahmad, 2012. "Bayesian Classification and Artificial Neural Network Methods for Lung Cancer Early Diagnosis", IEEE, pp: 773-776.

"Morphological Segmentation and Partial Volume Analysis for Volumetry of Solid Pulmonary Lesions in Thoracic CT Scans" done by Jan-Martin Kuhnigk*, Volker Dicken, Lars Bornemann, Annemarie Bakai, Dag Wormanns, Stefan Krass, and Heinz-Otto Peitgen.

"Use of Anatomical Priors in the Segmentation of PET Lung Tumor Images" by Jinman Kim1, Member IEEE, Lingfeng Wen1,2, Member IEEE, Stefan Eberl1,2, Member IEEE, Roger Fulton1,2,3, Senior Member IEEE and David Dagan Feng1,4, Fellow IEEE.

Jan-Martin Kuhnigk, Volker Dicken, Lars Bornemann, AnnemarieBakai, Dag Wormanns, Stefan Krass, and Heinz-Otto Peitgen, 2006. 'Morphological Segmentation and Partial Volume Analysis forVolumetry of Solid Pulmonary Lesions in Thoracic CT Scans', ISSN: 0278-0062.

Kesav Kancherla, SrinivasMukkamala, 2013. "Early Lung Cancer Detection using Nucleus Segmentation based Features", IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB), pp: 91-95.

Negar Memarian, JavadAlirezaie, Paul Babyn, 2006. "Computerized Detection of Lung Nodules with an Enhanced False Positive Reduction Scheme", ICIP, pp: 1921-1924.

VijaiAnand, S.K., 2010. "Segmentation coupled Textural Feature Classification for Lung Tumor Prediction", ICCCCT, pp: 518-524.

Udeshani, K.A.G., R.G.N. Meegama, T.G.I. Fernando, 2011. 'Statistical Feature-based Neural Network Approach for the Detection of Lung Cancer in Chest X-Ray Images', International Journal of Image Processing (IJIP).