DIAGNOSIS SUPPORT SYSTEM FOR LUNG CANCER DETECTION BY USING ARTIFICIAL INTELLIGENCE: A Review

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Abstract—The Lung cancer is the most commonly diagnosed cancer and lung is a most frequent site of metastasis from other cancers that manifest as pulmonary nodules. The Chest Computed Tomography (CT) is the most sensitive diagnostic imaging modality for the detection of lung cancer and the resolution of any equivocal abnormalities detected on chest radiographs. We propose, system for early detection of lung cancer nodules from the Chest Computer Tomography (CT) images. There are five main phases involved in the system. They are image pre-processing, extraction of lung region from chest computer tomography images, feature extraction, classification of lung cancer as Benign or Malignant. The main aim of the method is to develop a Computer Aided Diagnosis system for finding the lung tumor using the lung CT images and classify the tumor as Benign or Malignant.

Keywords—Image Processing, Neural Solution (Neural Network), Transformed domain Technique, MATLAB, Microsoft office excel, CT images.

I. INTRODUCTION

There are many types of cancers. Lung cancer is one of the most common and deadly diseases in the world. It is the leading cause of cancer deaths in both women & men in developed and developing countries. The prognosis and the cure of lung cancer depend highly on the early detection and treatment of small and localized tumors. Lung cancer is on Third Top and the Highest in death rate. It is a dreaded cancer disease for the human death. Lung cancer results from an abnormality in the body's basic unit of life. Normally, the body maintains a system of checks and balances on cell growth so that cells divide to produce new cells only when new cells are needed. Disruption of this system of checks and balances on cell growth results in an uncontrolled division and proliferation of cells that eventually forms a mass known as a tumor. Tumors can be benign or malignant. Benign tumors usually can be removed and don’t spread to other parts of the body whereas malignant tumors, grow aggressively and spread to other sites in the body.

These patients are not confirmed with cancer & treated wrongly in early stages due to lack of experts, clinical interpreters. The delay in detection, false diagnosis by experts, lack of experts in small towns, costly diagnosis are some of the reasons to these hapless victims for increase in death rate. To overcome this, Lung cancer diagnosis Computation Intelligence system which could be deployed in hospitals located even in remote areas where experts could get second opinion for the confirmation of the disease in its early, curable stage.

II. LITERATURE REVIEW

1. Sir Kenji Suzuki develops Computer-Aided Diagnostic Scheme for Distinction Between Benign and Malignant Nodules in Thoracic Low-Dose CT and Use of Massive Training Artificial Neural Network incorporated with the integration ANN achieved a relatively high Az value of 0.882, and would be useful in assisting radiologists in the diagnosis of lung nodules in LDCT by reducing the number of “unnecessary” HRCTs and/or biopsies. [1]
2. JIA Tong, ZHAO Da-Zhe, WEI Ying, ZHU Xin-Hua, WANG Xu develops Computer-Aided Lung Nodule Detection Based on CT Images uses the automatic computer-aided detection (CAD)
3. scheme that can identify the lung nodule at an early stage from CT images. Use adaptive threshold segmentation, math morphologic, Gaussian filter, Hessian matrix algorithms. The detect result shows 95% sensitivity, the false positive nodule of each slice is 0.91. [2]

4. Prof. Sandrine Tomei, Simon Marache-Francisco, Christophe Odet, Carole Lartizien develop system for detection of active nodules in 3D PET oncology imaging using the Hotelling Observer and the Support Vector Machines. In this system image feature sets that serve as input data for both classifiers are similar and consist of the coefficients of an undecimated wavelet transform and for each classifier separately to select the best combination of parameters including the level of wavelet decomposition and the characteristics of the training database.[3]

5. Lung Cancer Metastases and Non-Metastases Tumid Lymph Nodes Classification in CT Image with Multi-resolution Histogram system develop by Jianwei Ma, Lu Liu, Bin Zhang, and Junli Yan, in this tumid lymph nodes are extracted from chest CT images using interactive segmentation and the multi-resolution histograms of tumid lymph nodes are directly calculated to receive a high dimensional features sample set with spatial information. Then the classifier for differentiating metastases and non-metastases tumid lymph nodes is constructed with making full use the advantage of SVM, then performance of classification is evaluated by testing the trained SVM with the test sample set.[4]

6. Prof Fatma Taher and Rachid Sammouda develop method for lung cancer detection by using artificial neural network and fuzzy clustering in this Hopfield Neural Network (HNN) and a Fuzzy C-Mean (FCM) clustering algorithm use for segmenting sputum color images to detect the lung cancer in its early stages.[5]

7. Tadashi Kondo, Junji Ueno and Shoichiro Takao develops Medical Image Diagnosis of Lung Cancer by Hybrid Multi-layered GMDH-type Neural Network Using Knowledge Base. In this algorithm, the knowledge base for medical image diagnosis are used for organizing the neural network architecture for medical image diagnosis, and the revised GMDH-type neural network algorithm can identify the characteristics of the medical images accurately. The optimum neural network architecture fitting the complexity of the medical images is automatically organized so as to minimize the prediction error criterion defined as Prediction Sum of Squares (PSS), and it is shown that the revised GMDH-type neural network can be easily applied to the medical image diagnosis.[6]

8. Semantic and Content-Based Medical Image Retrieval for Lung Cancer Diagnosis develop by Preeti Aggarwal and Renu Vig this process involves the analysis and experimentation of chest CT scan data for the detection and diagnosis of lung cancer. In lung cancer computer-aided diagnosis (CAD) systems, having an accurate ground truth is critical and time consuming. The contribution of this work include the development of lung nodule database with proven pathology using content based image retrieval (CBIR) and algorithms for detection and classification of nodules.[7]

9. Artificial Neural Network-Based Classification System for Lung Nodules on Computed Tomography Scans system develops by Emre Dand, Murat Çakruloğlu, Ziya Ek, Murat Özkaran, Özlem Kar Kurt, Arzu Canan Emre Dand and they uses Computer Aided Diagnosis (CAD) with Computed-Tomography (CT) images to ensure early diagnosis of lung cancer and differentiation between benign and malignant tumors. The designed CAD system provides segmentation of nodules on the lobes with neural networks model of Self-Organizing Maps (SOM) and ensures classification between benign and malignant nodules with the help of ANN (Artificial Neural Network) ANN gives t high accuracy rates (90.63 % accuracy, 92.30 % sensitivity and 89.47 % specificity) in classification. [8]

10. Fuzzy Rule based Expert System for Diagnosis of Lung Cancer develops by Farzad Vasheghani Farahani, M.H. Fazel Zarandi. system consists of four modules working memory, knowledge base, inference engine and user interface. The system takes the risk factors and symptoms of lung cancer in a two-step process and stores them as facts of the problem in working memory. The rule base consists of two different rule sets related to risk factors and symptoms of lung cancer. [9]
11. Joey Mark Diaz, Raymond Christopher Pinon, Geoffrey Solano develops system for Lung Cancer Classification Using Genetic Algorithm. Genetic algorithm as a method of feature (genes) selection for the support vector machine and artificial neural network to classify lung cancer status of a patient. Genetic algorithm (GA) successfully identified genes that classify patient lung cancer status with notable predictive. [10]

III. RESEARCH METHODOLOGY

Computational Intelligence techniques include the following will established techniques.

i) Image processing
ii) Learning Machines such as neural network.
iii) Transformed domain techniques such as FFT, WHT, DCT.

For choice of suitable classifier following configuration will be investigated.

i) Multilayer perceptron Neural network.
ii) Generalized feed forward network

For each of the architecture following parameters are verified until the best performance is obtained

i) CV-Test data
ii) Possibility different learning algorithms such as Standard Back-Propagation, Conjugate gradient algorithm, Quick propagation algorithm, Delta Bar Delta algorithm, Momentum etc.
iii) Number of hidden layers
iv) Number of processing elements of neurons in each hidden layer.

After regions training of the classifier, it is cross validated & tested on the basis of the following performance matrix.

i) Mean Square Error
ii) Normalized Mean Square Error
iii) Classification accuracy
iv) Sensitivity
v) Specificity

In order to carry out the proposed research work, Platforms/Software’s such as Matlab with all toolboxes, neuron solutions, will be used.

IV. RESEARCH OBJECTIVE

To develop an efficient classification algorithm based on computational intelligence approaches with 100% accuracy. To increase the classification accuracy for classification of tumor as Benign or Malignant and maintain the correctness & accuracy in the tumor classification, the input captured images are contaminated by known or unknown noise.

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VI. CONCLUSION

Use of the proposed Algorithm for diagnosis support system for lung cancer detection by using Neural network will be result in more accurate and reliable.

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