Nodule Detection In Lung Intervention Using MTANN Techniques

B. Vinothini
M.E Communication System, PREC, Thanjavur

G. Kannan
M.Tech, Associate Professor, Dept of ECE PREC, Thanjavur

Abstract: Computed tomography is used to detect the lung nodules, but x-rays are preferred due to the low cost and low radiation dose. But x-rays does not effectively detect lung nodules because ribs and clavicles suppress the nodules and produce the false positive result. The main objective of this paper is to identify the lung nodules in Chest Radiography at early stages and also identify the Severity of the diseases so we developed a CAD scheme for detection of pulmonary nodules by use of the MTANN techniques and mathematical morphology to improve the sensitivity for nodules overlapping ribs and clavicles and to reduce FPs caused by these structures. First we create the VDE image by suppressing the ribs and clavicles using MTANN Techniques. Next Segmentation of lung is done by M-ASM segmentation. Then Features are extracted in order to identify the lung nodules. Gray level co-occurrence matrix is used to detect the features from VDE tissue images. The features that are include shape, surface, color, size and texture features. Based on the features, various number of lung cancer are classified and analyze the severity level of the disease using artificial Neural networks. This Technique is applicable to both x-rays and CT scan.

Keywords: Artificial Neural Network, Chest Radiography (CXR), computer aided diagnosis (CAD), Massive training artificial neural network (MTANN)

I. INTRODUCTION

Chest radiographs are of paramount importance in the identification of patients with abnormal pulmonary conditions. A plain chest radiograph frequently also provides a good general indication of the type of pathology present. Lung nodules do, pneumoconiosis and pulmonary emphysema. CXR is preferred due to low cost, low radiation dose and widely available. According to 2012 statistics, it was found that 14.1 million new cases were diagnosed and 8.2 million deaths occurred in 2012, due to cancer. The death rate is high when compared to statistics of 2008. Lung cancer is the serious cause of death, since identification of such nodule at an early stage is difficult task. If lung nodules can be identified accurately at an early stage, the survival rate of patients can be increased by significant percentage. The most common subtype of lung cancer is adenocarcinoma. It is caused by drinking of alcohols. Adenocarcinoma represents 50% of malignant pulmonary nodules and is typically peripheral in location. Squamous cell carcinoma is the second most common subtype of lung cancer and two-thirds of these cancers are situated centrally. This type of cancer is caused by smoking. 37 additional subtypes of lung carcinoma can also there as SPNs. In addition, 16% to 40% of carcinoids occur in the peripheral lung. The main objective of this paper is to develop a technique so lung nodules can be detected using x-rays at an early stage and severity level also identified. Then various type of lung cancer also classified based on the features. Here we consider the size, shape, surface, color, texture as a feature. If the size of the lung nodule is either small or appears to have calcium deposit, then the doctor would wait for few days if the person is not presenting with symptoms. For people with large nodule or have asymmetric shape, then a biopsy is required.

II. RELATED WORK

In [3] J. K. Frost et al. The Johns Hopkins Lung Project was designed to determine whether the addition of cytologic screening to the radiographic screening of high-risk volunteers could enhance the early detection of asymptomatic lung cancer and whether early therapeutic intervention in detected cases could significantly reduce the mortality from this disease. Male volunteers, 45 yr of age and older, who smoked at least 1 pack of cigarettes per day were recruited from the Baltimore metropolitan area. All of the 10,387 acceptable high-risk volunteers received annual chest radiographic screening. By random assignment, one half received cytologic examination of induced sputum in addition to the roentgenogram. This report describes the results of the initial screening. Compared with usual methods of clinical diagnosis, screening by both roentgenography and cytology identified a greater proportion of the lung cancer cases at an earlier stage.
Screening by sputum cytology was found to improve the detection only of squamous cell carcinoma. In the dual-screen group, sputum cytology accounted for 28% of the detected cases, and resulted in 39% additional detection of lung cancer over that achieved by roentgenography. There was no corresponding decrease in prevalence. Lung cancers detected by cytology alone were found at very early stages. Although there has been an increase in average survival, much of this increase, if not all, may have resulted from lead-time and sampling bias.

In [4] R. S. Fontana et al. The initial (prevalence) radiologic and cytologic screening for lung cancer in the Mayo Clinic study (Mayo Lung Project) involved 10,933 outpatients. All were men at high risk for lung cancer, but none were suspected of having it when they entered the Mayo Clinic. Screening identified 91 lung cancers (8.3 per 1,000 screened). Nearly two thirds of the prevalence lung cancers were detected by chest roentgenography alone. Half of these cancers were resected. Only a fifth of the cancers were detected by sputum cytologic examination alone; however, all but 1 of these was resected. Compared with a group of lung cancers encountered in contemporary clinical practice at the Mayo Clinic, the prevalence cancers were more than twice as likely to be (1) resectable, (2) postsurgical Stage I or II (AJCC), and (3) associated with survival 5 yr after treatment.

In [5] C. I. Henschke et al. Computed tomography (CT) imaging as an excellent approach to the detection and characterization of small solitary pulmonary nodules (SSPN) raises three questions: (1) How often does CT imaging lead to detection of SSPN? (2) How often is such an SSPN malignant? (3) If malignant, how curable is it? The first question pertains to decisions about screening use of CT, the second to decisions about screening for SSPN and diagnosis of malignancy given SSPN, and the third—in the context of known curability at ordinary clinical diagnosis—to decisions about screening for SSPN, diagnosis given SSPN and intervention given malignant SSPN. We present a three component study design that addresses these questions. The first is directed primarily to the first question. Some 1000 persons at high risk for lung cancer will be screened for SSPN using screening-type CT. The primary aim is to determine the prevalence of CT-detectable SSPN as a joint function of risk-relevant aspects of the person. The second component addresses the prevalence of malignancy among the detected cases of SSPN. To develop the prevalence function, a larger series of CT-detected SSPN will be obtained by developing a multi-center SSPN "registry." A subsequent, third component will focus on the registered cases of malignant SSPN screening incidentally detected and address their curability on the basis of long-term follow-up. This design, in lieu of a randomized trial, may represent a new paradigm for applied research on radiologic technologies in cancer screening, given its advantages in terms of research efficiency and implications to decisions about diagnostic workup and therapeutic intervention.

III. PROPOSED METHOD

In the proposed method, the CT scan images or x-ray images are fed as an input. Then there is a step by step process to detect the lung nodules and severity level at an early stage.
- Preprocessing of chest radiography
- Suppressing ribs and clavicles using MTANN Techniques (VDE Image)
- Segmentation of lungs using M-ASM Segmentation
- Lung Features are Extracted
- Identification of nodule
- Classification of nodules and severity level is identified using ANN

A. MTANN AND NEURAL NETWORK

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process data. One of the best benefits of artificial neural networks is their capability to learn from their situation. Learning from the situation comes helpful in applications where complexity of the environment make implementations of other type of solutions not practical. As such artificial neural networks can be used for variety of tasks like categorization, filtering, data processing, decision making, compression, robotics, regulations, clustering, etc. Choosing the right artificial neural network topology depends on the type of the application and data representation of a given difficulty. When select and using artificial neural networks we need to be familiar with theory of artificial neural network models and learning algorithms. Complexity of the chosen model is crucial; using to simple model for specific task usually results in poor or wrong results and over complex model for a specific task can lead to problems in the process of learning. Complex model and simple task results in memorizing and not learning. There are many learning algorithms with numerous tradeoffs between them and almost all are suitable for any type of artificial neural network model. Choosing the right learning algorithm for a given task takes a lot of experiences and experimentation on given problem and data set.
IV. EXPERIMENTAL RESULTS

This paper is used for detecting lung nodule was developed by implementing VDE image using MTANN techniques. One of the advantages of the M-ASM segmentation method used in this work is that it is possible to know which point belongs to which type of boundary and which point is the translation point in the contour of the segmentation. Based on these points, the lung field can be automatically divided into segments based on the anatomy. It is helpful to suppress the bones in different anatomical segments automatically. This technology can effectively detect the lung nodules and severity level at an early stage and also reduce the false positive results.

V. COMPARISON

The comparison between the pixel based classification, support vector machine, dual energy subtraction, MTANN,MTANN and ANN compare the FP to find the FP rate and show how the proposed technique is best than the other techniques.

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>FP rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBC</td>
<td>1</td>
</tr>
<tr>
<td>SVM</td>
<td>0.8</td>
</tr>
<tr>
<td>MTANN</td>
<td>0.3</td>
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</tbody>
</table>

VI. CONCLUSION

In this paper, we are developing an automatic CAD system for early detection of lung cancer by analyzing Lung X-ray and CT images using several steps. The method starts by extracting the lung regions from the CT image using several image processing techniques, including preprocessing and image segmentation techniques. We introduced the MTANN techniques to create the VDE images which are used to suppress the ribs and clavicles. The image segmentation techniques applied in lung datasets. Then features are extracted to identify the nodules. The features that are include shape, size, texture, color, and surface. If the nodule is cancer means then we identify what type of cancer it is and also identify the severity level of the diseases using artificial neural network. Hospitals in India do not implement VDE technology because of cost effectiveness and requirement of special equipment. This cost effective method of detecting lung nodule is highly effective in terms of low radiation dose and no special equipment required. Just software implementation proves 90% accuracy of this system. It is applicable to both CT images and X-ray images and it is mainly used to radiologists.

REFERENCES


