Scientific Journal Impact Factor (SJIF): 1.711

e-ISSN: 2349-9745
p-ISSN: 2393-8161

International Journal of Modern Trends in Engineering and Research
www.ijmter.com

Lung Nodule detection System

Ms.Kalim bhandare[1], Prof.Rupali Nikhare[2]
[1,2]*Computer Engineering, Pillai Institute of Information Technology, Mumbai*

Abstract— Image segmentation is still an active reason of research, a relevant research area in computer vision and hundreds of image segmentation techniques have been proposed by the researchers. All proposed techniques have their own usability and accuracy. In this paper we are going present a review of some best lung nodule existing detection and segmentation techniques. Finally, we conclude by focusing one of the best methods that may have high level accuracy and can be used in detection of lung very small nodules accurately.

Keywords : Computer aided diagnosis, image segmentation, CT medical imagine Digital Image Processing

I. INTRODUCTION

Lung cancer is a one of the major cause of death. The types are small-cell lung cancer (SCLC) and non-small-cell lung cancer (NSCLC). Lung cancer is a state which consists of uncontrollable growth of cell and tissues. If left untreated, this growth can spread beyond the lung by process of metastasis into nearby tissue or other parts of the body. Such treatments involve surgery, chemotherapy and radiotherapy. Overall, 15% people diagnosed with lung cancer survive five year after the diagnosis.

Lung Cancer Types

Cancer that starts in the lung is called first stage lung cancer. Lung cancer include different types and these are divided into two main groups

1. Small cell lung cancer

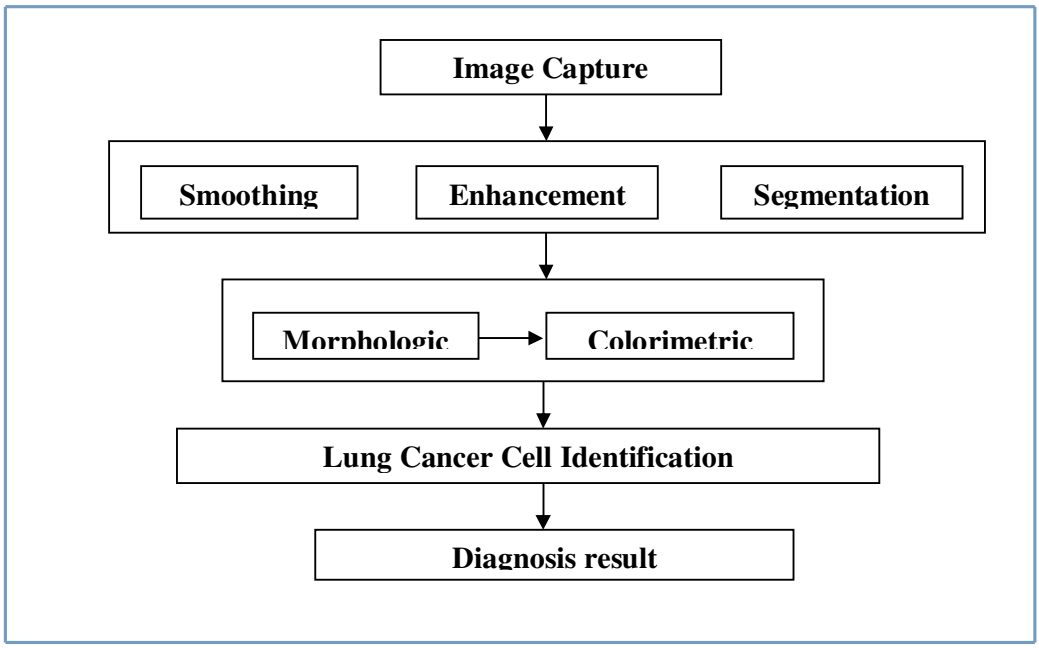
About 20 out of every 100 lung cancers diagnosed are this type. the small cells are mostly filled with the nucleus so it is called small cell lung cancer. The main reason for such type of cancer is smoking. Small cell lung cancer often spreads quite early on and so doctors often suggest chemotherapy treatment rather than surgery.

2. Non small cell lung cancer

Non small cell lung cancer is of three type. These are grouped together because they behave in a similar way and respond to treatment in a different way to small cell lung cancer. The early detection of lung cancer can increase overall 5-year survival rates from 14 to 49% for patients. Hence, computer-aided diagnosis (CAD) systems using images processing are used to extract the presence of lung cancer cell in a CT-Scam images of patients.

II. STEPS FOR LUNG NODULE DETECTION SYSTEM

The entire diagnosis process of Lung Cancer Detection System is shown in Figure



In the image Pre-processing stage we started with image enhancement the aim of image enhancement is to improve the interpretability or perception of information in images for human viewers, or to provide `better' input for other automated image processing techniques.

Image enhancement techniques can be divided into two broad categories: Spatial domain methods and frequency domain methods. In image enhancement stage we used three techniques: auto-enhancement, Gobor filter, and Fast Fourier transform techniques.

Image segmentation is an essential process for most image analysis subsequent tasks. In many of the existing techniques for image description and recognition depend highly on the segmentation results. That used Thresholding and marker controlled watershed segmentation techniques.

Thresholding is one of the most powerful tools for image segmentation. the advantages of Thresholding is fast processing speed, also the smaller storage space and ease in manipulation as compared with gray level image. Therefore, thresholding techniques have drawn a lot of attention during the past 20 years.

The presence of objects or background at specific image locations is extracted by watershed.Image Enhancement can define image enhancement to get improve the quality of image, because of which the resultant image is better than the original one , the process of improving the quality of a digitally stored image by manipulating the image with MATLAB™ software. It is very easy, to make an image lighter or darker, or to change contrast.

Image enhancement techniques are of two types:
1. Spatial domain techniques, which operate directly on pixels.

2. Frequency domain techniques, which operate on the Fourier transform of an image.

Segmentation divides an image into its constituent part. The segmentation of medical images in 2D, has many useful applications for the medical professional: visualization and volume estimation of objects of interest, detection of Abnormalities (e.g. tumors, etc.), tissue quantification and are more.

The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easy to understand. Image segmentation is used to locate objects and boundaries (lines, curves, etc.) in images. Mostly, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

Two approaches to predict the probability of lung cancer presence; first approach is Binarization and the second approach is masking, both of these methods are based on facts strongly related to lung anatomy and related information of lung CT imaging.

- Binarization Approach

This approach depends on the number of black pixels is much more than white ones in a normal lung image, so we started to count the black pixels for normal and abnormal images to get the average which will be denoted later as threshold then each image black pixels will be compared to this threshold, whether it is greater, and then it will be normal, else the opposite.

- Masking Approach

This method depends on the fact that the masses are appeared as white connected areas inside ROI (lungs) as they increase the percent of cancer presence increase. Combining the two approaches together will lead us to take a decision whether the case is normal or not .

3.4 Image Features Extraction

The Image features Extraction stage is important in our working in image processing techniques which using algorithms and techniques to detect and isolate various desired portions or shapes (features) of an image.

III. LUNG NODULE DETECTION TECHNIQUES

Lung nodules detection is complicated, Nodules in CT images show up have relatively low contrast white circular shape and it is overlap with vessels, ribs, and shadows.

A. Chest radiograph

Chest radiography is the most commonly performed diagnostic imaging test for the diagnosis of many pulmonary diseases. It provides simplicity, low radiation, low cost, large amounts of information and wide availability are advantages of this technique. The most satisfactory routine radiographic views are the postero–anterior (PA) and lateral projections with the person standing up. Lordotic projections, with the X-ray beam ,can be used for an improved visibility of the lung apices, superior mediastinum and thoracicin let. Oblique studies are sometimes useful in locating a pleural or chest wall disease process. The most remarkable is the rapid conversion from film-based to digital radiographic (DR) systems. Advantages of DR systems are the high image quality and the potential for dose reduction together with a favorable cost–benefit ratio and an increased efficiency. Post-processing techniques in digital radiography are temporal subtraction and dual-energy subtraction.

B. Computed Tomography (CT)

Computed tomography (CT) is the second most important imaging modality of the chest. Before1991, a conventional or incremental CT scan of the chest was performed and consisted of a series of cross-sectional slices obtained during suspended respiration (the ‘‘stop-and-go’’method). In 1991, helical CT was introduced in the imaging of the chest and dramatically improved the quality of CT images of thoracic structures . Helical CT produces a singlevolumetric dataset within one breath-hold during continuous scanning while the patient is moved through the CT gantry. The X-ray beam copies a helical or spiral curve in relation to the patient.More recently, multi-detector CT (MDCT) scanners have been developed . These new CT scanners use multiple rows (4, 8, 16, 32, 64 or 128 rows) of detectors. The MDCT have advantages as revolutionised the diagnostic approach to lung cancer. there is an increased temporal resolution. Data acquisition is so rapid that scanning of the entire lung can be performed within a single breath-hold. Because of to better temporal resolution, tit also provide a better contrast material administration possible. Secondly, there is an more spatial resolution.Continuous acquisition of thin slices allows the increase in improvement of the image quality of multiplanar reconstruction (MPR) images .

C. CAD System

Computer-aided diagnosis, generally consist two main stages: selection of candidate nodule and second elimination of false positive nodules.

Initially, Enhancement techniques used to enhance the nodule to separate them from background and it also lead to suppress other false structures. Usually, thresholding is used to separate candidate nodules from the background. For different shaped and sized nodules can be detected by using different techniques. such as 3D Cylindrical and spherical filters are used to detect small nodules, and circular and semicircular nodules can be detected by template matching whereas pattern-recognition techniques such as clustering, linear discriminate functions etc. are used in the detection of lung nodules.

D. Magnetic Imaging Resonance (MRI)

The lung remains a difficult organ for MR because of several limitations: the high susceptibility of MR to motion artifacts (i.e. pulsation and breathing), the intrinsic low proton density of lung parenchyma and the decrease in signal intensity due to air–soft tissue interfaces. That is the reason that MR was considered for many years as a useful problem-solving technique for specific instances when used in addition to CT :

1) Detection of tumor invasion in the chest wall and the meditational structures (pancoast tumor)
2) Comparison between solid and vascular hilar masses
3) Assessment of abnormalities
4) the study and follow-up of mediastinal lymphoma. New applications, like whole-body MR (WBMR) imaging, may significantly increase MR-sensitivityin the near future.

E. High Resolution Computed Tomography (HRCT)

High-resolution computed tomography (HRCT) imaging of the lungs is well-established for evaluating many diseases. Optimal methods of acquisition and interpretation of high-resolution images require knowledge of anatomy and pathophysiology, as well as familiarity with the basic physics and techniques of computed tomography. This parameter gives the principles for performing high-quality HRCT of the lungs. HRCT is the use of thin section CT images (0.625 to 2 mm slice thickness) often with a high-spatial-frequency reconstruction algorithm to detect and characterize disease affecting parenchyma and airways. Referring the development and widespread availability of multi-detector CT scanners capable of acquiring

data throughout the entire thorax in a single breath-hold, there are 2 general approaches available for acquiring HRCT images.

IV. SEGMENTATION TECHNIQUE

The accurate segmentation of lung nodules is very important and crucial. Best segmentation makes physicians life easy. It plays a crucial part in proper diagnosis and treatment procedure for lung cancer. The segmentation accuracy directly affects many factors, such as the malignancy classification of lung nodules in CAD x for feature extraction. In section of paper we review various segmentation techniques for lung nodules from CT images.

A. Thresholding (TH)

Thresholding is the most simple and popular image segmentation technique. It used to generate binary image by labeling each voxel by testing whether its intensity greater or less than given intensity value. The automatic threshold determination was proposed by using K-mean clustering and average gradient and boundary compactness. The CT scan can be separated into two types of voxels, characterized by the density differences between the two anatomical structures. The high-density regions primarily consist of the body surrounding the lung cavity, whereas the low-density regions contain the lung cavity, the air surrounding the body, and other low-intensity regions.

B. Mathematical Morphology (MM)

MM is a most popular segmentation method to process binary and gray scaled images. MM is a theory and technique for the analysis and processing of geometrical structures. Is an effective method for binary morphological filtering with various combinations of these basic operations. Mathematical morphology is a tool for extracting image components. The operations of MM are originally defined as set operations and are used to extract the edges of an image, to filter an image and to skeletonise an image. Here we have used this for filtering the false positives from the detected nodules.

C. Region Growing (RG)

Region growing also classified as a pixel-based image segmentation method since it involves the of initial seed points . It start with a seed pixel, the initial region begins as the exact location of seeds points. The regions are then grown from these seed points to adjacent points depending on certain criteria. This is an iteratively grown by examining the adjacent pixels of seed points. If the pixels have the same intensity value with the seed points, it classifies them into the seed points. The deference between pixels intensity and the regions mean is used to classify the similarity of the image into regions. It is an iterated process until there are no changes in two successive iterative stages. There are more recent studies on this algorithm that have extended its approach as main component of their segmentation algorithm. Proposed a region growing method by using fusion-segregation criteria using geodesic distances.

D. Graph Cut and Watersheds

Graph cut and Watersheds are both well-known as standard image segmentation techniques. Goodman used Watersheds in their study. Watersheds semiautomatic used to first segment each nodule and then by a model-based shape analysis used to determine anatomical characteristics of all type of nodules.

Marker-driven watershed segmentation technique extracts seeds that indicate the presence of objects or background at specific locations. Marker locations are then set to be regional minima within the topological surface (typically, the gradient of the original input image), and the watershed algorithm is used. Separating touching objects in an image is one of the most difficult image processing operations, where the watershed transform is often used to solve such problem. Marker-controlled watershed concept has two types: External associated with the background and Internal associated with the objects of interest. Image Segmentation using some watershed transforms works well if we can identify or "mark" foreground objects and background locations, to find "catchment basins" and "watershed ridge lines" in an image by treating it as a surface where light pixels are high and dark pixels are low. Figure shows a segmented image by watershed

V. ADVANTAGES AND DISADVANTAGES

Table 1: Advantages and Disadvantages

Techniques	Advantage	Disadvantage
Chest-Radiography	• It is simple. • It has low cost. • It has low radiation. • It provides large amount of information.	• It cannot detect invasion of chest wall. • Diaphragm and mediastrinum and nodal involvement.
CT (Computed Tomography)	• It produces volumetric dataset with one breath-hold. • It has revolutionised the diagnostic approach to lung cancer.	• It has high cost. • It deliver high dose of radiation. • It promotes lazziness.
MRI(Magnetic Resonance Imaging)	• It is used for scanning and detection of soft tissue. • There is no involvement of any kind of radiation in MRI. • It can provide information about blood circulation.	• MRI scan is done in enclosed space. • MRI scan involves loud noise. • It is expensive..
CAD (Computer Aided Diagnosis) System	• It helps the radiologist to improve sensitivity. • It gives large amount of information. • It is used for early detection of lung cancer.	• Still it produce large number of false positive. • Efficiency is reduced.

HRCT (High Resolution Computed Tomography)	• It is possible to take thin section. • It can be reconstructed well	• It expose excessive radiation.

VI. CONCLUSION

The techniques described have been very popular among commercial semiautomatic softer packages and used into the medical practice. The review tells that all the proposed methods from different research have different level accuracy in different areas. Region growing algorithm is the best know algorithm in the field of image segmentation and also most useful in lung nodule detection.

Many studies for lung nodules have been going on. And the present challenges, in this field, suggested that the search is more effective and accurate CAD for lung cancer detection will remain an active research area.

REFRENCES

[1]. Sunil kumar, Ashok kumar, Sanjay bhargava, "**Lung nodule detection and segmentation techniques review",** International Journal of Advanced Research Computer Science And Software Engineering, 102-104, April 2014.

[2]. Nidhi, Shilpa Mehta," **Review of existing Techniques of Lung Nodule Cancer Detection and Existing Algorithms That Can Be Used For Efficient Detection In Future".** International Journal of Emerging Science And Software Engineering, 1-3, February 2014

[3]. Mr. Vaibhav K. Likhitkar1 Prof. Ujwalla Gawande2 Mr. Kamal,Hajari,**" Automated Detection of Cancerous Lung Nodule from the Computed Tomography Images",**IOSR Journal of Computer Engineering, 5-11, February 2014.

[4]. Ella A. Kazerooni, MD, FACR, Chair Phillip M. Boiselle, MD Lynn S. Broderick, MD, FACR H. Page McAdams, MD Paul L. Molina, MD, FACR Reginald F. Munden, MD, DMD, MBA, FACR David P. Naidich, MD Robert D. Tarver, MD, FACR, "**Acr Practice Parameter For The Performance Of Highresolution Computed Tomography (HRCT) Of The Lungsin Adults",** 1-7, Amended 2014

[5]. M. Gomathi and P. Thangaraj, "**A Computer Aided Diagnosis System for Lung Cancer Detection \Using Support Vector Machine",**American Journal of Applied Sciences 7, 1532-1538, 2010

[6].W. De Wever, J.Coolen, J.A. Verschalelen, **" Imagng techniques n lung cancer"**,339-346, June 2011.

[7]. Mokheld S .AL-TARAWNEH, " **Lung Cancer Detection Using Image Processing Techniques"**, Leonardo Electronic Journal of Practices and Technologies, 147-158, January-June 2012 .

[8]. Anita Chaudhary, Sonit Sukhraj Singh, **" Lung Cancer Detection Using Digital Image P ",** IJREAS, 1351-1359, February 2012.

