A Review on Detecting Carcinoma of Lung at an Early Stage

[1]Mehak Saini, [2]Priyanshu Tripathi, [3]Dr. KK Saini
[1]Aricent Pvt. Ltd, Gurgram, Haryana, India
[2,3]Dept. of Electronics and Communication Engg., Hindu College of Engineering Sonepat, India

Abstract
This paper presents a survey on Lung cancer and its effects. Lung cancer, also known as carcinoma of the lung is a malignant lung tumor characterized by uncontrolled cell growth in tissues of the lung. If left untreated, this growth may spread beyond the lung by process of metastasis into neighbor tissue or other parts of the body. Detecting lung cancer at an early stage is a challenging and difficult task since there are very few or no symptoms in this stage of the disease and majority of the cases are diagnosed in the later stages of the disease. Treating cancer in the early stages can provide more treatment options and increases the survival rate. There are many methods which can be used to detect the cancer cells. These methods include Artificial Neural Network, Fuzzy Clustering Methods, Segmentation and Thresholding methods.

Keywords
Lung cancer, Artificial Neural Network, Segmentation, Thresholding, Fuzzy clustering.

I. Introduction

Most cancers that start in the lung, known as primary lung cancers, are carcinomas that derive from epithelial cells. The main primary types are small-cell lung carcinoma (SCLC) and non-small-cell lung carcinoma (NSCLC). The most common symptoms are coughing (including coughing up blood), weight loss, shortness of breath, and chest pains. The vast majority (80–90%) of cases of lung cancer are due to long-term exposure to tobacco smoke. About 10–15% of cases occur in people who have never smoked. These cases are often caused by a combination of genetic factors and exposure to some gases, or other kinds of air pollution, including second-hand smoke. Lung cancer may be seen on chest radiographs and Computed Tomography (CT) scans. The diagnosis is confirmed by biopsy which is usually performed by bronchoscope or CT-guidance.

Treatment and long-term outcomes depend on the type of carcinoma, the stage (degree of spread), and the person's overall health, measured by some kind of performance status. Some Common treatments include surgery, chemotherapy, and radiotherapy. NSCLC is sometimes treated with surgery, whereas SCLC usually responds better to chemotherapy and radiotherapy. Approximately 20% of people in the United States diagnosed with lung cancer survive five years after the diagnosis, while outcomes on average are worse in the developing world. Worldwide, lung cancer is the most leading cause of cancer-related death in men and women, and was responsible for nearly 2 million deaths annually, as of 2017 [1-3].

II. Signs and Symptoms

Signs and symptoms which may suggest lung cancer include.

A. Respiratory Symptoms

Coughing, coughing up blood, wheezing or shortness of breath.

B. Systemic Symptoms

Weight loss, fever, clubbing of the fingernails, or fatigue

C. Symptoms due to the cancer mass pressing on adjacent structures:

Chest pain, bone pain, superior vena cava obstruction, difficulty swallowing. If the cancer grows in the airways, it may obstruct airflow, causing breathing difficulties. The obstruction can lead to accumulation of secretions behind the blockage, and predispose to pneumonia.

III. Research Directions

Performing a chest radiograph is one of the first investigative steps if a person reports symptoms that may suggest lung cancer. This may reveal an obvious mass, widening of the mediastinum (suggestive of spread to lymph nodes there), atelectasis (collapse), consolidation (pneumonia) or pleural effusion. CT imaging is typically used to provide more information about the type and extent of disease. Bronchoscopy or CT-guided biopsy is often used to sample the tumor for histopathology.

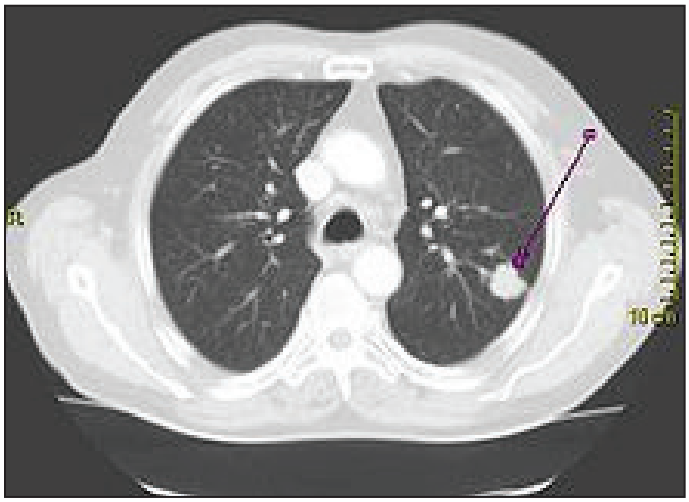

Fig. 1: CT Image Showing Lung Tumor

Current research directions for lung cancer treatment include immunotherapy, which encourages the body's immune system to attack the tumor cells, epigenetic, and new combinations of chemotherapy and radiotherapy, both on their own and together. Many of these new treatments work through immune checkpoint blockade, disrupting cancer's ability to evade the immune system.

Other immunotherapy treatments interfere with the binding of programmed cell death 1 (PD-1) protein with its ligand PD-1 ligand 1 (PD-L1). Signaling through PD-1 inactivates T cells. Some cancer cells appear to exploit this by expressing PD-L1 in order to switch off T cells that might recognize them as a threat. Monoclonal antibodies targeting both PD-1 and PD-L1, such as pembrolizumab and nivolumab are currently in clinical trials for treatment for lung cancer.

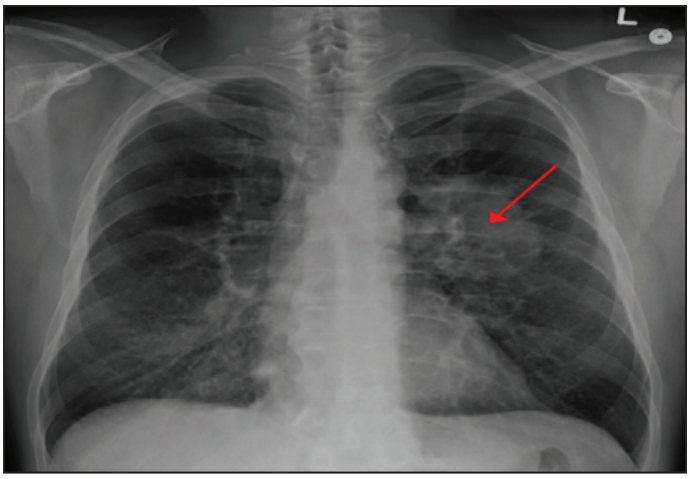

Fig. 2: A chest X-ray showing a tumor in the lung (marked by arraow).

Epigenetics is the study of small, usually heritable, molecular modifications – or 'tags'- that bind DNA and modify gene expression levels. Targeting these 'tags' with drugs can kill cancer cells. Early-stage research in NSCLC using drugs aimed at epigenetic modifications shows that blocking more than one of these 'tags' can kill cancer cells with fewer side effects. Studies also show that giving patients these drugs before standard treatment can improve its effectiveness. Clinical trials are underway to evaluate how well these drugs kill lung cancer cells in humans. Several drugs that target epigenetic mechanisms are in development. Histone deacetylase inhibitors in development include valproic acid, vorinostat, belinostat, panobinostat, entinostat, and romidepsin. DNA methyltransferase inhibitors in development include decitabine, azacytidine and hydralazine [1-2].

IV. Problem Formulation

Many factors may affect lung CT image intensity such as acquisition protocol, subject tissue volume, air volume, transpulmonary pressure, and physical material properties of the lung parenchyma. In general different thresholds are required for different subjects. When using threshold to segment lungs from CT slices, previous studies usually utilized a fixed threshold for all CT slices in a patient's stack. This in general is not an appropriate practice. In this study, we proposed an adaptive thresholding method for segmenting lungs from CT slices. The proposed method will find a good threshold for each slice, and hence the segmentation accuracy will be improved by using the threshold that is good in processing this slice. Another contribution of this study is the using of the different characteristics of the mean and the deviation of pixel intensities of the lungs and the trachea, respectively, to separate and remove the trachea form the lungs. Experimental results show that the proposed method is effective.

V. Methodology

A. Data collection

The data used for this purpose may be taken from reputed hospital. It may contain CT images of patients.

B. Preprocessing

Computer Tomography (CT) images are difficult to interpret. Preprocessing is essential to improve the quality of CT images. The image processing methods used for this phase are PSNR calculation, Erosion, Median Filter, Dilation, Outlining, Lung Border Extraction, Flood Fill Algorithm and finally extraction of lung parenchyma. The preprocessing methods are shown in figure 1.

Mainly, the CT chest image contains the lung region, background, heart, liver and other organs areas. The main aim of this preprocessing is to detect the lung region and regions of interest (ROIs) from the CT scan image. The first step is application of PSNR (Peak Signal-to-Noise Ratio) calculation to the CT scan images. Considering one patient CT images, it consists of more number of slices. It is important to retrieve one best from all. PSNR is most commonly used to measure of quality. Although a higher PSNR generally indicates that the reconstruction is of higher quality. The best suitable with better accuracy is chosen for the further enhancement of lung region.

C. Segmentation

The segmentation is performed for determining the cancer nodules in the lung. This phase will identify the Region of Interest (ROI) which helps in determining the cancer region. Region growing method is used for segmentation. Selection of seed pixel depends mainly on the problem domain. To overcome this problem all the objects in an image are detected without any manual specification of the seed pixel. R. Bellotti, F. De Carlo proposed a CAD system using region growing and active contour model with detection rate of 88.5% which is still has to be improved [4-5].

VI. Conclusion

Lung cancer is the most dangerous and widespread in the world according to stage the discovery of the cancer cells in the lungs, this gives us the indication that the process of detection this disease plays a very important and essential role to avoid serious stages and to reduce its percentage distribution in the world. In this study several methods for detection of lung cancer are discussed.

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Mehak Saini (DOB: 1 April 1994) is B.Tech and M.Tech from Deenbandhu Chhoturam University of Science and Technology Murthal, Sonepat (Haryana), India. Currently, She is working as Software Engineer in Aricent Pvt. Ltd, Gurgram, Haryana, India. She has published more than 10 research papers in National/ International Journals. Her area of Interest is Optical Communication and Advanced Communication System and Image Processing.

Priyanshu Tripathi is B.Tech., M.Tech. from N.I.T. Jalandhar (Punjab), India. He is a young Technocrat and researcher. Currently, He is working as an Assistant Professor in Hindu college of Engineering Sonepat, Haryana, India. His area of Interest is Robotics and image processing. He has published various research papers in National, International and IEEE international conferences.

Kamalesh Kumar Saini is B.E., M.Tech. & PhD in Electronics & Communication Engineering. Currently, He is Director-Principal of Hindu College of Engineering Sonepat, Haryana, India. His Research area and area of interest is Optical Communication, Chaos based comm., Satellite Communication and Reliability Engineering. He has published more than 500 research papers in various reputed international journals, international conferences and IEEE International Transactions. He has guided Dissertation of more than 30 M.Tech. students and 7 Ph.D. scholars.