# A Review on Early Lung Cancer Detection Using Artificial Neural Network

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***Abstract:*** *Prediction of lung cancer is most challenging problem occurred due to structure of cancer cell, in which most of the cells are overlapped each other. Image processing is the technique used for prediction of lung cancer and also for early detection and treatment to prevent the lung cancer. This dissertation work, aims to develop early detection of lung cancer through an automated process to minimize human error and making the process more accurate. The proposed system using image processing algorithms and artificial neural network have been employed to design an computer automated diagnosis process for early detection of lung cancer.*

*To predict the lung cancer early various features are extracted from the images therefore, pattern recognition based approaches are useful to predict the lung cancer. Here, a comprehensive review for the prediction of lung cancer by previous researcher using image processing techniques is presented in this paper . The summary for the prediction of lung cancer by previous researcher using image processing techniques is also presented here.*

***Key Words:*** *CT scan, Lung ,Artificial Neural Network.*

## 1. INTRODUCTION:

Lung cancer is the leading cause of cancer-related deaths worldwide, with 1.6 million lung cancer deaths each year [6]. After the age of 45 years, the incidence of lung cancer greatly increases in both males and females. Despite improvements in surgical treatment, chemotherapy and radiotherapy, the long-term survival of lung cancer remains low[7]. The lack of improvement in long-term survival is mostly due to the fact that lung cancer is still generally diagnosed at a late stage. Most patients with early-stage lung cancer are asymptomatic that leads to delays in diagnosis. Lung cancer survival is strongly related to stage at time of diagnosis, with 5 year survival decreasing from 85% for treated stage IA disease, to around 6% for stage IV disease [7]. However, in routine clinical care, only 15% of lung cancer cases are stage I at diagnosis, and curability of lung cancer diagnosed at later stages greatly decreases [8].

The survival rate of lung cancer is very low when compared with all other types of cancer. The need for identifying lung cancer at an early stage is very essential and is an active research area in the field of medical image processing. Several Computer aided systems have been intended to distinguish the lung cancer at its initial stage. Various types of images are used for detection of lung diagnosis. The most important challenging task is detection of lung nodule. Computed Tomography (CT) images are generally chosen due to less distortion, low noise, better clarity, less time consumption and low cost. Lung cancer often spreads toward the center of the chest because the natural flow of lymph out of the lungs is toward the centre of the chest. Lung cancer can be divided into two main groups, Non-small cell lung cancer and small cell lung cancer.

Lung cancer is a disease, which is also referred as lung carcinoma nothing but malignant lung tumor and that is characterized by the highly uncontrolled cell growth arising in the lung tissues. Tumors composed of cancer cells are called malignant tumors and the tumor composed of mainly non-cancerous cells are referred as benign tumors. If this left unchecked, then cancer can grow and spread to other parts of the body. So early lung cancer detection is very necessary & that is the aim of this paper.

## 2. MOTIVATION:

Lung cancer is a malignant lung tumour which is characterized by uncontrolled cell growth in tissues of the lung. Traditionally, the judgments for the phase of lung cancer usually take a considerable amount of time for doctors to observe the huge number of medical images. Accurately determining the diagnosis and stage of lung cancer is very much important to enable patients to be offered the best possible treatment but the process is often complex. So the challenge is to design a pathway that is both accurate and flexible enough to allow patients to choose the most appropriate treatment for them without delay. There is a need of early stage detection which will increase the rate of survival. For survival of cancer patient, early detection and treatment is very helpful and effective.

This Paper aims at early detection of cancer through an automated process to minimize human error and making the process more accurate and hassle-free.

## 3. LITERATURE REVIEW:

Madhura J et al [ICIMIA] [2017] [1] :Author has described the different types of noise in medical imaging and explained the different techniques for the removal of noise.

Qing Wu and Wenbing Zhao (ISCSIC) [2017] [2] : Author has proposed a novel neural-network based algorithm, which they refer as entropy degradation method (EDM), to detect small celllung cancer (SCLC) from computed tomography (CT) images for early cancer prediction.

Rachid Sammouda (KACST) [2016] [3] :Author has developed an automatic CAD system for early detection of lung cancer for that purpose they analyzed lung human CT images using several phases & the approach starts by extracting the lung regions from the CT image using classical image processing techniques, including bit-planes representation of raw 3D-CT images producing 2D slices. They have applied various procedures, Erosion, Median filter, Dilation, Outlining, Lung Border Extraction and Flood Fill algorithm, in sequence.

Awais Mansoor et al (Radio Graphics 2015; 35:1056–1076) [2015] [4] : Authors have presented the review and explained the capabilities and performance of currently available approaches for segmenting lungs with pathological conditions on chest CT images, with illustrations to provide radiologists with a better understanding of potential choices for decision support in everyday practice. Firstly, object segmentation is defined and explained, followed by summaries of the five major classes of lung segmentation: (a) thresholding-based, (b) region-based, (c) shape-based, (d) neighboring anatomy– guided, and (e) machine learning based methods.

## 4. PROPOSED WORK:

A. Methodology:

The early lung cancer detection is done using as shown in figure-1. It includes CT Images as input, Pre-Processing, Segmentation, Feature Extraction, Classification and Result as malignant or benign.

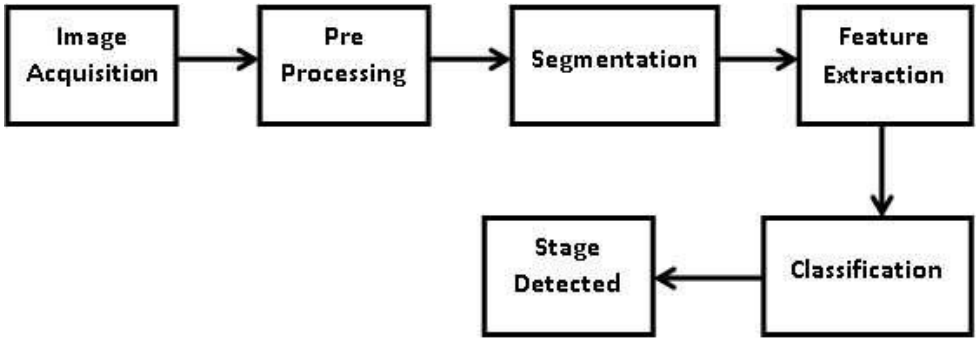


Fig. 1: Flow chart showing proposed method of Early Lung Cancer Detection

a) Image Acquisition:

The CT images available on internet can be used as image database for the proposed work

b) Image Pre-processing:

The size of the images will be resized to same size if required. The quality of the image is improved using suitable image enhancement techniques such as adaptive histogram equalization. The noise will be removed by applying different filtering such as wiener filter, median filter [1].

c) Lung Segmentation:

Image segmentation is process of partitioning a digital image into multiple segments. So the goal of segmentation is to simplify or change the representation of an image into something that is more meaningful and easier to analyse. Region based segmentation is used to find region of interest (ROI) and segmented for further processing [4]. Region based methods have the purpose of grouping pixels having similar intensities. Region based segmentation follows this basic procedure as follows:

i. For region-based lung segmentation, the “seeded” scheme is commonly applied. In such cases, small patch (seed) that is considered to be most representative of the target region (lung) is first identified.
ii. Seed points are the coordinates of a representative set of points belonging to the target organ to be segmented, and they can be selected either manually or automatically.
iii. Once the seed points are identified, a predefined neighbourhood criterion is used to extract the desired region. Different methods ,features are used for determining the lung boundaries. For instance, one of possible criterion could be to grow the region until the lung edge is detected.

d) Feature Extraction:

This stage is an important stage which uses algorithms and techniques to detect and isolate various desired portions or shapes of a given image. When input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant, then the input data will be transformed into a reduced representation set of features. The basic characters are area, perimeter and eccentricity. These are measured in scalar. These features are defined as follows:

i. Area: It is the scalar value that gives actual number of overall nodule pixel in the extracted ROI. Transformation function creates an array of ROI which contains pixels with 255 values.
Area = A = (Ai,j , X ROI[Area] = I , Y ROI[Area] = j)
Where, i, j are the pixels within the shape. ROI is region of interest. X ROI[ ] is vector contain ROI x position ROI[ ] is vector contain ROI y position [6].

ii. Perimeter: It is a scalar value that gives actual number of the nodule pixel. It is the length of extracted ROI boundary. Transformation function create array of edge that contain pixel with 255 values that have at least one pixel which contain 0 values.
Perimeter = P =(Pi,j , X edge[P ] = i, Y edge[P ] = j)
Where, X edge [ ] and Y edge[ ] are vectors represent the co-ordinate of the ith and jth pixel forming the curve , respectively.

iii. Eccentricity: This metric value is also called as roundness or circularity or irregularity complex (I) equal to1 only for circular and it is less than 1 for any other shape.
Eccentricity =Length of Major Axis / Length of Minor Axis

iv. Nodule Size: The nodule size is determined by fitting the circle in detected nodules. The nodules with size greater than 2mm are cancerous

e) Classification

Artificial Neural Network (ANN) with associated learning algorithms that analyze data and recognize patterns, is used as a classifier for early lung cancer detection. First feature database of all the known images is built in training phase. In testing phase features of test image is classified using Artificial Neural Network to predict malignant or benign. Parameters like classification accuracy, sensitivity, false acceptance ratio and false rejection ratio will be calculated.

f) Stage Detection

Finally the stage is detected as malignant or benign

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