Lung Cancer Detection and Classification : A Review

Miss. Sayali Kanitkar
PG Student, Department of E &TC Engineering, Sinhgad Technical Education Society's,Sinhgad college of Engineering Pune 41, Maharashtra, India

Prof. Nilima D. Thombare
Asst.Professor, Department of E &TC Engineering, Sinhgad Technical Education Society's, Sinhgad college of Engineering Pune 41, Maharashtra, India

Prof. Sunita S. Lokhande
Asso.Professor, Department of E &TC Engineering, Sinhgad Technical Education Society's, Sinhgad college of Engineering Pune 41, Maharashtra, India

Abstract

Lung cancer has been the largest cause of cancer deaths. Early detection of lung cancer can increase the chance of survival among people. The overall 5-year survival rate for lung cancer patients increases from 14 to 49% if the disease is detected in time. Its early detection significantly increases the chances of an effective treatment. In this Computed Tomography (CT) images are used which can be more efficient than X-ray. Hence, a lung cancer detection system using image processing is used to classify the presence of lung cancer in CT- images. In this study, MATLAB have been used. The processes such as image pre-processing, segmentation and feature extraction and classification are performed. To get the more accurate results various enhancement and segmentation techniques are performed.

Keywords **- *Cancer Detection, Image processing, Feature extraction, Enhancement, Marker Controlled Watershed Transform***

1. Introduction

In recent years the image processing mechanisms are used widely in several medical areas for improving earlier detection and treatment stages, in which the time factor is very important to discover the disease in the patient as possible as fast. Its early detection significantly increases the chances of an effective treatment. In 2005, approximately 1,372,910 new cancer cases are expected and about 570,280 cancer deaths are expected to occur in the United States.

It is estimated that there will be 163,510 deaths from lung cancer, which forms 29% of all cancer deaths. Worldwide, it is the most common cancer in terms of both incidence and mortality (1.35 million new cases per year and 1.18 million deaths) Cancer begins in a part of the body when cells start to grow out of control. There are many kinds of cancer, but they all start because of out-of-control growth of abnormal cells.

Lung cancer is a disease of abnormal cells multiplying and growing into a tumour. Cancer cell growth is different from normal cell growth. Instead of dying, cancer cells continue to grow and form new, abnormal cells. Early detection of lung cancer is very important for successful treatment. Diagnosis is mostly based on CT images. Cancer which starts in the lung is called primary lung cancer. There are several different types and these are divided into two main groups:

- Small cell lung cancer
- Non small cell lung cancer

Our current work focuses on finding nodules, early symptoms of the diseases, appearing in patients' lungs. In this modified Watershed segmentation is used to isolate a lung of a CT image.

2. Literature Review

In [2] Nihad Mesanovic , Mislav Grgic, Haris Huseinagic, Matija Males, Emir Skejic, Muamer Smajlovic proposed CT Image Segmentation of the Lungs with Region Growing Algorithm. Region growing algorithm starts with a seed pixel, examines other pixels that surrounds it, determines the most similar one, and, if it meets certain criteria, it is included in the region. The region is iteratively grown by examining all unallocated neighbouring pixels to the region.

In[3] Nikita Pandey, Sayani Nandy Proposed A novel approach for detection of cancerous cells from Lungs CT scan images. This work proposes a method to detect the cancerous cells effectively from the CT scan images by reducing the detection error made by the physicians' naked eye for medical study based on Sobel edge detection and label matrix. Sobel operator helps to find the edges in an image; it does so by finding the image gradient. Image gradient is the change in the intensity of the image. Prof. Samir Kumar Bandyopadhyay [4] provides a method using Computer Aided Diagnosis System (CAD) for detection of edges from CT images of lung for detection of diseases. Fatm Taher, Naoufel Werghi and Hussain Al-Ahmad [5] deals with filtering thresholding algorithm for extracting the sputum cell from the raw sputum image for lung cancer early detection.

Qinghua Ji, Ronggang Shi [6] This paper presents a new method of image segmentation using watershed transformation. To use morphological opening and closing operations to process the gradient image aim to eliminate the over-segmentation areas, and reconstruction of the morphological gradient can maintain the shape of gradient image. The proposed method can simplify gradient image while maintaining the contours of the exact location of the dividing line, eliminating the root causes of the phenomenon have been split.

The purpose of this paper is to find the early stage of lung cancer and more accurate result by using various enhancement and segmentation techniques.

3. Proposed Method

The proposed work focuses on finding tumour, early symptoms of the diseases, appearing in patients' lungs. In this, available lung cancer images are passed through the system: pre-processing stage, feature Extraction stage and classification.

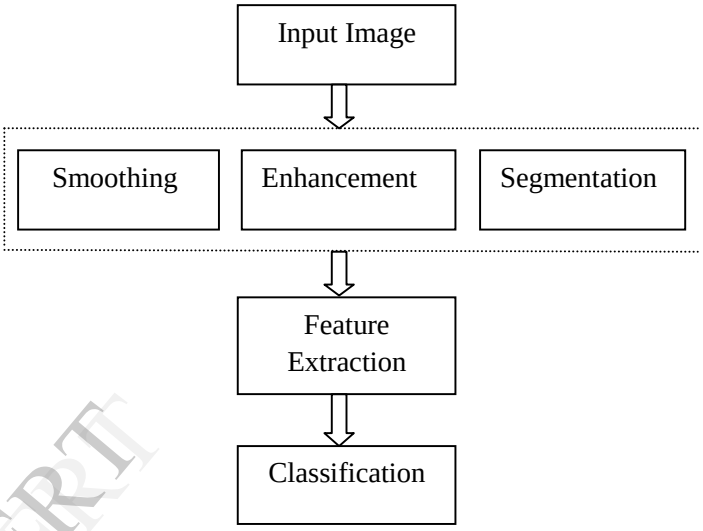

Figure 1.Block Diagram of Proposed System [1]

The first stage starts with taking a collection of CT images (normal and abnormal) from the available database. The second stage applies Gabor filter, auto enhancement and Fast Fourier transform techniques of image enhancement. In the third stage image segmentation algorithms are applied to extract the region from the image. In this thresholding and watershed segmentation algorithms are used, which plays an effective role in image processing stages. In the fourth stage, the general features like average intensity, area, perimeter, eccentricity and texture features are obtained from enhanced segmented image. In the classification stage tumour is classified as a normal or abnormal with the help of classifier.

3.1 Image pre-processing

In the image Pre-processing stage image enhancement is the first stage. The aim of image enhancement is to provide 'better' input for other automated image processing techniques. Therefore, the entire images have been undergoing several pre-processing process. Image pre-processing process involved is smoothing, enhancement, and segmentation is done.

3.1.1 Image Enhancement

In image enhancement stage three techniques used: Gabor filter, auto-enhancement and Fast Fourier transform techniques. The Gabor function has been recognized as a very useful tool in computer vision and image processing, especially for texture analysis, because of its optimal localization properties in both spatial and frequency domain. Auto enhancement, automatically adjusts and enhances the image (brightness, colour and contrast) to optimum levels. Fast Fourier Transform technique operates on Fourier transform of image. Fast Fourier Transform is a faster version of the Discrete Fourier Transform (DFT).

3.1.2 Image Segmentation

Segmentation divides an image into its constituent regions or objects. The segmentation of medical images in 2D, slice by slice has many useful applications for the medical professional

Image segmentation is an essential process for most image analysis subsequent tasks. In particular, many of the existing techniques for image description and recognition depend highly on the segmentation results. In this Thresholding and watershed segmentation techniques are used. Thresholding is one of the most powerful tools for image segmentation. Thresholding is a non-linear operation that converts a gray-scale image into a binary image where the two levels are assigned to pixels that are below or above the specified threshold value. The segmented image obtained from thresholding has the advantages of smaller storage space, fast processing speed and ease in manipulation, compared with gray level image which usually contains 256 levels. Watershed segmentation extracts seeds indicating the presence of objects or background at specific image locations. The marker based watershed segmentation can segment unique boundaries from an image.

3.2 Feature Extraction

The Image features Extraction stage is very important in image processing techniques which using algorithms and techniques to detect and isolate various desired portions or shapes (features) of an image. Feature extraction is an essential stage that represents the final results to determine the normality or abnormality of an image. These features act as the basis for classification process. Only these features were considered to be extracted; average intensity, area, perimeter and eccentricity. The features are defined as follows:

1) Area: it is a scalar value that gives the actual number of overall nodule pixel. It is obtained by the summation of areas of pixel in the image that is registered as 1 in the binary image obtained.

2) Perimeter: It is a scalar value that gives the actual number of the outline of the nodule pixel which is obtained by the summation of the interconnected outline of the registered pixel in the binary image.

3). Roundness: Eccentricity: This metric value or roundness or circularity or irregularity index (I) is to 1 only for circular and it is <1 for any other shape. Here it is supposed that, more circularity of the object. [1]

3.3 Classification

Lung nodule is smallest growths in the lung that measure between 5mm to 25mm in size. Malignant nodules tend to be bigger in size >25mm, and have a faster growth rate. In the normal images nodule size is less than 25mm. And in the abnormal images its size is greater than 25mm [1]. In the segmentation that nodule is detected and then we use feature extraction to extract the features from that segmented image by which we can identify the stages of lung cancer. Lung nodule show up as round, white opacities on chest x-rays and computed tomography scans. Previous scan x-ray or scan and the current x-ray and CT-scan is used to determine if there is any change in shape, size, or appearance of the nodules. If the nodule do not grow larger after monitoring for a 2 year period, no further treatment is necessary.

4. 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. To get more accurate results, work is divided into following stages: Image Enhancement stage, Image Segmentation stage and Features Extraction stage and classification.

Acknowledgment

I wish to express my sincere thanks and deep sense of gratitude to respected mentor and guide Miss.N.D. Thombare Assistant Professor in Department of Electronics and Telecommunication Engineering and Mrs.S.S.Lokhande Associate

Professor in Department of Electronics and Telecommunication Engineering of Singhgad college of Engineering ,Vadgaon(BK),Pune 41 for the technical advice, encouragement and constructive criticism, which motivated to strive harder for excellence.

References

[1] Anita chaudhary, SonitSukhraj Singh"Lung Cancer Detection on CT Images by Using Image Processing"2012 International Conference on Computing Sciences

[2] Nihad Mesanovic , Mislav Grgic, Haris Huseinagic, Matija Males, Emir Skejic, Muamer Smajlovic"Automatic CT Image Segmentation of the Lungs with Region Growing Algorithm"

[3] Nikita Pandey, Sayani Nandy *"*A Novel Approach of Cancerous Cells Detection from Lungs CT Scan Images*''* International Journal of Advanced Research in Computer Science and Software Engineering Volume 2, Issue 8, August 2012

[4] Prof. Samir Kumar Bandyopadhyay "Edge Detection From Ct Images Of Lung'' International Journal Of Engineering Science & Advanced Technology Volume - 2, Issue - 1, 34 – 37

[5] FatmTaher, NaoufelWerghi and Hussain Al-Ahmad "Extraction of Sputum Cells using Thresholding Techniques for Lung Cancer Detection" 2012 International Conference on Innovations in Information Technology

[6] QinghuaJi,Ronggang Shi "A Noval Method of Image Segmentation Using Watershed Transformation"2011 International Conference on Computer Science and Network Technology