DETECTION OF LUNG CANCER ON CT IMAGES BY USING IMAGE PROCESSING TECHNIQUES

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ABSTRACT:

Cancer refers to the abnormal growth of cells anywhere in the body which tends to multiply in an uncontrolled way. Amongst most of the cancers related deaths, Lung cancer is the most common cause of deaths throughout the world. The mortality rate due to Lung cancer can be decreased by its early detection. The overall 5-year survival rate for lung cancer patients can be increased from 14 to 49% if the disease is detected in time. There are various methods to detect the presence of cancerous tissues, but they can be time consuming. Hence, a lung cancer detection system (LCDS) using image processing is developed to classify the presence of lung cancer in CT-images. In this study, the image processing techniques such as image enhancement, segmentation and feature extraction has been discussed in detail. The aim of this report is to get more efficient results than the traditional detection techniques other than LCDS.

Keywords: CT Image, Matlab, Enhancement, Watershed Segmentation, ROI, Thresholding, Feature Extraction, Staging

[1] INTRODUCTION

The deaths caused due to lung cancer are the highest among all other types of cancer. Lung cancer is one of the most serious cancers in the world. The survival rate of lung cancer patients can be increased if it is detected in its early stage. An increase in survival rate from 14% to 49% can be achieved in 5 years’ time if the cancer is detected early. An estimated 85% of lung cancer cases in males and 75% in females are caused by cigarette smoking [1]. Cancer is 63%. Although surgery, radiation therapy, and chemotherapy have been used in the treatment of lung cancer, the five-year survival rate for all stages combined is only 14%. This has not changed in the past three decades[3]. The purpose of this paper is to identify the cancer nodules in its early stage and obtain more accurate result by using various enhancement and segmentation techniques of image processing [2].

[2] METHODOLOGY

In this report, mainly four processes are utilized for developing a lung cancer detection system. The processes are: 1) Pre-processing: This includes the removal of noise, Image enhancement.
2) Post Processing: In this stage, Segmentation of the image is done.
3) Feature Extraction: In this stage some of the features like Area, Perimeter, eccentricity and Image Intensity are extracted.
4) Classification: Using the features extracted above, classification process is carried out.
The entire processes were done using the Image Processing tool box in Matlab.
The whole process can be viewed as under:

![Flow-chart of Entire process of Lung Cancer Detection System.](image)

The LCDS system uses different types of Filters for image smoothening like Median Filter, Wiener Filter etc. Using the Image Processing tool box, the contrast and Color of the image is enhanced in the enhancement stage. Then the lung nodules are segmented using segmentation techniques like thresholding, Marker controlled watershed segmentation etc. Then feature extraction is done, in which some of the morphological features of nodules like area, perimeter, eccentricity etc. are extracted from the segmented image [3]. On the basis of these extracted features, the staging and classification of lung cancer cell nodule is done. The entire process is shown in the flowchart.

[2.1] IMAGE PRE-PROCESSING
The image Pre-processing stage starts with image smoothening. The aim of smoothening is to remove the noise present in the Ct image. Then comes the Image Enhancement stage. The aim
of enhancement is to improve the quality of the image for better perception. Therefore, the entire CT image has undergone through several pre-processing process [4].

[2.2] IMAGE SMOOTHENING

Image smoothening is done to remove different noises, like salt and pepper noise, present in the CT scan image. The use of different filters, like median filter, average filter, wiener filter, can help in the removal of such noise. In this paper, we used median filter for smoothening the image.[4]

[2.3] IMAGE ENHANCEMENT

Image enhancement is done to improve the image quality, but unfortunately, there is no such theory for determining what a “god enhanced image” is when it comes to human perception. Enhancement techniques can be divided into two broad categories: Spatial domain methods and frequency domain methods. In this paper, the image enhancement techniques used is auto-enhancement [4]

[2.4] IMAGE SEGMENTATION

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 [6]. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, texture. Image segmentation is an essential process for most image analysis tasks. In general, a number of image segmentation techniques are available, but in this paper Thresholding and Marker Controlled Watershed Segmentation is used. Thresholding is one of the most powerful tools for image segmentation. 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 [8]. Separating touching objects in an image is one of the more difficult image processing operations. The marker controlled watershed segmentation can segment unique boundaries from an image [6]. Watershed segmentation extracts seeds indicating the presence of objects or background at specific image locations. The marker locations are then set to be regional minima within the topological surface and the watershed algorithm is applied.

[3] FEATURE EXTRACTION

The features extraction stage is very important in our working. Feature extraction represents the final results to determine the normality or abnormality of an image [7]. These features act as the basis for classification process. The features that were extracted in this report are area, perimeter and eccentricity. These features are defined as follows;
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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. 2) Perimeter: It is a scalar value that gives the actual number of the outline of the nodule pixel. It is obtained by the summation of the interconnected outline of the registered pixel in the binary image. 3). Eccentricity: This metric value is also called as roundness or circularity or irregularity complex equal to 1 only for circular and it is less than 1 for any other shape.

[6] CONCLUSION

CT image of Lung Cancer has successfully undergone the image pre-processing procedure with four features: average intensity, area, perimeter and eccentricity. Results for image enhancement: Auto enhancement, automatically adjusts and enhances the image (brightness, color and contrast) to optimum levels, and this is clearly observed by following figure 3.

Results for Image segmentation: Segmentation divides an image into its constituent regions or objects. Here Thresholding and Marker Controlled Watershed Segmentation has been used. Thresholding is a non-linear operation that converts a grayscale image into a binary image where the two levels are assigned to pixels that are below or above the specified threshold value.

REFERENCE


