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A Review of Lung Cancer Detection Using Image Processing Techniques

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***Abstract*—In this paper, we analyze the image process technique for detection of lung cancer disease. Image processing techniques are wide utilized in several medical issues for picture enhancement in the detection phase to support the early medical treatment. Recently, image processing techniques are frequently utilized in several medical areas for image improvement in earlier detection and treatment stages, whenever the time factor is very consequential to discover the abnormality issues in target pictures, significantly varied cancer tumours like lung cancer, breast cancer and so on. Image quality and accuracy is that the core factors of this analysis, image quality assessment additionally as improvement are depending on the enhancement stage wherever low pre-processing strategies is used primarily based whole on Gabor filter within Gaussian regulations. Here a complete assessment for the prediction of lung cancer by previous researcher using image processing techniques is presented.**

***Index Terms*—Lung Cancer detection, Image Processing, Feature extraction, Enhancement, Segmentation, Pre-Processing**

I. Introduction

One of the foremost reasons for non-accidental death is cancer. Lung Cancer disease is one of the most serious human body issues in the world. The death rate of lung disease is the topmost of all other types of cancer death in male and female worldwide. It is very difficult to study the cancer in its early stage. Many PC aided systems have been designed to detect the lung cancer in its premature stage. Image enhancement and classification may be massive task, particularly while performing in medical field. During this paper, various strategies have been discussed for the detection of lung cancer disease and to show whether it is benign or malignant. Computer Tomography (CT) can be more effective than X-ray in detecting and diagnosing the lung cancer.

II. Literature Review

In literature various researchers have been used image processing techniques to predict the lung cancer.

B. Sahiner et.al., [1] in the paper preprocessing method has two phases. In the first phase, noises and film artifacts can be removed by using median filter. In the second phase, erosion is applied to the structuring element three times; but every time decreases the size of the structuring element by one. Unwanted ribcage portion has been removed from the obtained result. This preprocessing also reduce the over segmentation problem, while retain the tumor.

T. Sowmiya et.al., [2] in this paper data mining procedures which are used for lung cancer prediction for the patients. Data mining concept is useful in lung cancer classification .The Ant Colony Optimization (ACO) Technique is used in data mining ,this data mining and ant colony optimization technique for appropriate rule ,generations and classification on diseases, which is for exact lung cancer classification .It provides further improvement in lung cancer diagnosis.

Ada, R. Kaur [3] in this paper Histogram Equalization is used for images and neural network classifier to check the patient stage whether it's normal or abnormal. In this paper, Neural Network Algorithm is implemented and its performance is compared to other classification algorithm .This shows best result with high TP rate and FP rate in classification it gives 96.04 %result compared with other classifiers.

N. Panpaliya et.al., [4] in this paper the image preprocessing stage which begins with image enhancement aims to improve interpretability or sensitivity of information included to provide better input than other image technique. Image Enhancement technique is divided into two methods -Spatial domain& Frequency domain .And in this method Histogram Equalization is used for image enhancement stage .This aims for selective elimination of redundancy in scanned image without affecting original image this plays a vital role in lung cancer diagnosis. Histogram equalization is preprocessed for image superiority.

D. Sharma, G. Jindal [5] used lung CT images extracted from NIH/NCI Lung Database Consortium and proposed an automatic computer aided diagnosing system for detection of lung cancer by analyzing these lung CT images. The authors of the paper have used several steps for the detection of lung cancer. Firstly, they extracted the lung region from the computer tomography image using various image processing techniques such as bit image slicing, erosion and wiener filter. In the first step the bit image slicing technique was used to convert the CT images into a binary image then after extraction the region growing segmentation algorithm was used for segmenting the extracted lung regions. After segmentation of lung region they used rule based model to classify the cancer nodules. Finally, a set of diagnosis rules were generated from the extracted features and with the help of diagnostics indicator.

It was observed that the proposed method achieved the overall accuracy of 80%.

V. A. Gajdhane, L. M. Deshpande [6] in this paper Gabor filter and watershed segmentation gives best results for pre-processing stage. From the extracted region of interest, three features are extracted i.e., area, perimeter and eccentricity. These three features help to identify the stage of lung cancer. The results indicate that the tumors are of different dimensions. By measuring the dimensions of the tumor the lung cancer stage can be detected accurately using the proposed method. The results show good potential for lung cancer detection at early stage.

W. Alakwaa et.al., [7] in this paper proposed a CAD system for lung cancer classification in CT images. The image processing step included segmentation followed by normalization down sampling and lastly zero centering. The 3D CNN produces an accuracy of 86.6 % which was tested in Kaggle's CT scans. The future work of the researchers aims to detect the exact location of the cancerous nodules with the help of the current model. Also, they have thought of use of watershed algorithm for segmentation and making the network deeper.

I. Levner, H. Zhangm [8] in this paper presented the novel approach for creation of topographical function and object markers used within watershed segmentation. According to the author, two key operations in computer vision are segmentation and pixel grouping. While many image segmentation algorithms exist, when objects of the same predefined class are in close proximity to one another, pixel grouping is necessary to cluster the classified pixels into objects. The watershed algorithm is commonly used within the unsupervised setting of segmenting an image into a set of non-overlapping regions.

A. Amutha, R. S. D. Wahidabanu [9] this paper describes Level set-Active Contour Modeling was used as a method in diagnosing lung tumor. First step was removing noise from image using kernel based non-local neighborhood denoising function and done feature extraction based on histogram to classify between normal and abnormal classes. At the final step or in tumor detection, level set active contour modeling with minimized gradient to the image was introduced.

V. A. Gajdhane, L. M. Deshpande [6] this stage is an important stage that uses algorithms and techniques to detect and isolate various desired portions or shapes of a given image. When the 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. As the lung cancer tumors are generally spherical in shape, basic characters of feature extraction are area, perimeter and eccentricity.

III. Material And Methods

Following figure1shows a general description of lung cancer detection system that contains four basic levels. The first level starts with taking a collection of CT images (normal and abnormal) from the available Database from IMBA Home (VIA-ELCAP Public Access) [10]. The second level applies many strategies of picture enhancement, to get best level of value and clearness. The third level applies image segmentation algorithms which play a powerful rule in picture processing stages, and therefore the fourth level obtains the overall options from increased divided image which supplies indicators of normality or abnormality of pictures.

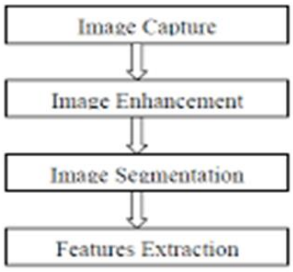

Fig. 1. Lung cancer image processing stage

In this research, to obtain more accurate results we divided our work into the following three stages:

- Image Enhancement
- Image Segmentation
- Feature Extraction

Image Enhancement stage:

To make the image better and enhance it from noising, corruption or interference. The following three methods are used for this purpose: Gabor filter (has the best results), Auto enhancement algorithm, and FFT Fast Fourier Transform (shows the worst results for image segmentation). Filtering is an important step in image pre-processing. Various filtering techniques are averaging filters, median filtering and Morphological filtering.

Image Segmentation stage:

Image segmentation is the process in which a digital image is divided into multiple segments. Image segmentation process involves operations like thresholding, edge detection, watershed transform.

Feature Extraction:

To obtain the general features of the enhanced segmented image using binarization and Masking Approach. Normality and abnormality of an image can be determined in this stage. The detected features provide a basis for process of classification. Various features of an image can be area, perimeter, eccentricity, intensity, etc.

IV. Outline for the Classification of Lung Cancer

In Literature, it's discovered that the image processing strategies with the procedure intelligence based mostly approaches are helpful for the prediction and decision making

of lung cancer. The Table-1 provides the outline of image processing strategies and classification approaches with their overall performance evaluation for the detection of lung cancer. The outline of lung cancer disease detection and classification is presented in Table-1.

TABLE I
SUMMARY FOR THE CLASSIFICATION OF LUNG CANCER

Author	Images	Classification Techniques	Result
Sahiner B	CT	Gaussian rules	Reduce over segmentation problems.
Sowmiya T	CT	ACO Techniques	Provides improvements of diagnosis
Ada, Kaur R	CT	Neural Network	TP rate & FP rate gives 96.04%
Panpaliya N	CT	Grey level co-occurrence method	Increase the accuracy of lung cancer detection
Sharma D	CT	Diagnostic Indicators	Gives more accuracy (80%)
Gajdhane VA	CT	Gabour Filter & Watershed segmentation	Good Potential lung cancer detection at early stage
Alakwaa W	CT	CAD System	3D CNN Produce 86.6%
Levner I	CT	Classification-Driven technique	Watershed segmentation gives good results.
Amutha A	CT	Level Set-Active contour	Remove noise and tumor detection

V. CONCLUSION AND FUTURE WORK

In this paper, various lung cancer detection techniques are mentioned. Prediction of lung cancer is most challenging problem due to structure of cancer cell, where most of the cells are overlapped each other. An image processing technique is required for earlier lung cancer detection and treatment stages. Here, a complete assessment for the prediction of lung cancer by previous researcher using image processing techniques was presented. The outline of the prediction of lung cancer by previous researcher using image processing techniques is also presented. In my next paper, I will be able to discuss the technique thoroughly to enhance the system accuracy with techniques which has been discussed are better.

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