A Survey of Current Image Segmentation Techniques for Detection of Lung Cancer

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Abstract— Lung cancer is the most acute type of cancer among all the cancers with less survival rate. It is very difficult to analyze the cancer at its early stage. itsIn the past few years, many Computer aided systems have been designed to detect the lung cancer at its early stage. The most of work is implemented on the Computer Tomography (CT) scan images because of better clarity, low noise and distortion. In this paper, various techniques have been discussed for the detection of lung cancer and to classify whether it is benign or malignant.

Key words: Computer Tomography, Lung cancer, Fast Fourier Transform

I. INTRODUCTION

Lung cancer is the type of cancer that begins in the lungs. Among all the cancers, the lung cancer causes the maximum cases of deaths in Men and Women. In United States 165,000 people die with lung cancer every year [1]. In a survey ,in males more than 80% and in females more than 70% lung cancer is caused by Cigarette smoking [2].According to the latest survey in year 2014, total 159,260 people had been died due to lung cancer in US [3].In INDIA every year 63,000 new lung cancer cases has been reported[4]. Detection of the cancer at the early stage is very difficult so Various CAD systems have been designed for the detection of the lung cancer at the early stage. Diagnose of the lung tumor at the early stage can increase the survival rate of 1 to 5 years.

The lung tumor causes due to an abnormality in body cells. In a normal case, the human body checks and maintains the growth of cells in order to produce the new cells whenever they are required. Due to growth of cell, the unbalance of the system results in uncontrolled division and proliferation of cells due to which a mass is formed, known as a tumor. Tumor can be two types: it can be benign or malignant. A tumor which can be removed and can be stopped spreading in other parts of the body, is type of benign tumor. Another part of Tumor which grows aggressively and spread into the other parts of the body is known as malignant. In spite of using invasive method like Biopsy, medical imaging is preferred to look inside the body because it is safe and comfortable for the effected person. Medical Imaging plays a very important role for the nodule detection and treatment of lung cancer. It is more accurate and efficient method for the diagnosis compare to other.

In medical Imaging different types of images are being used, but for the detection of lung diagnosis Computed Tomography (CT) images are being preferred because of better clarity, low noise and less distortion. It is also important compare to another images in terms of calculation of mean and variance of images.. The detection process mainly divided into four parts: Image Preprocessing and Enhancement of image, segmentation of Lung, Feature Extraction and Classification. In all the Processes Lung Segmentation is considered as the most difficult part because it includes various pre-processing steps.

This survey paper includes the discussions of previous work done based on the lung cancer detection and final Conclusion.

II. PREVIOUS WORK

Mokhled [5], discussed the various lung tumor detection techniques for different stages. Three methods were proposed for image enhancement, to remove the noise from the image and to make the image better: Auto enhancement, Gabor Filter and FFT (Fast Fourier Transform), Gabor filter is more efficient because it can effectively optimize the border differences among the lung regions. To separate the region image segmentation is required like watershed algorithm. To differentiate the extracted region from the lung structure binarization and masking approaches were proposed. In binarization, if the total numbers of black pixels were less than threshold value, then it was classified as abnormal otherwise normal. Masking step contain White area inside the lung region was referred as mass. Blue color of the mass shows normality while RGB shows the abnormalities of the mass. On the basis of these features, system classification accuracy was less.

Disha, Gagandeep [1], proposed a CAD system in which wiener filter was used to remove the noise content. Disha applied image slicing algorithm For extraction of lung region, author enhance the quality of image using various morphological operations like opening, closing followed by erosion, dilation which were applied to remove any irrelevant information in the image. With image segmentation each and every pixel were assigned a label so that the pixels that have same label, represent visual characteristics. Image segmentation is basically represent a set of contour (edge detection).Sobel method was used for the edge detection because of its accuracy and two dimension values of the pixels so that no pixel can be left nearby. In this paper, five features (area, calcification, shape, size, contrast Enhancement) were extracted on the basis of which the ROI was classified as tumor or non-tumor.

Figure 1 indicates basic Block Diagram of the Lung cancer Detection. First of all input image is taken from the Medical database. Then Pre-Processing is done on the input database using wavelet transform or curvelet transform. Preprocessing is used to remove noise and unnecessary information from the medical image like patient name. After preprocessing lung cancer region is extracted from the input image. Cancerous cell are segmented from the lung cancer image using various techniques. After that area of the lung cancer is find using different techniques. And based on that calculation decision is made that lung image is cancerous or not.

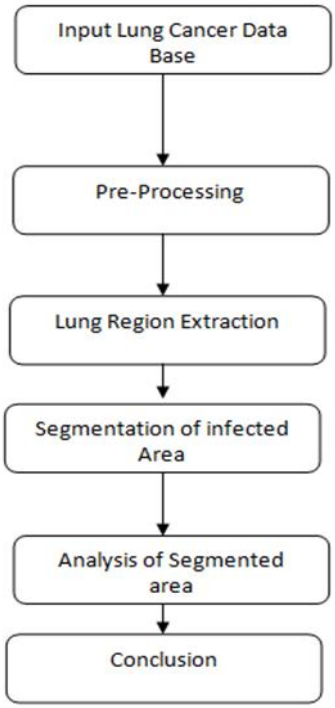

Fig. 1: System Level Block Diagram

Omar, Watson [2] focused on the texture of the region of interest. Combined CE-CT (Contrast Enhanced Computer Tomography) images were used for the fractal analysis to differentiate between aggressive (advanced stage) and non-aggressive (early stage) tumors. These images were in time sequence. The main aim of this research was to enhance tumor stage prediction accuracy by identifying the malignant tumor. DICOM images were acquired for this work, then by using Differential Box Counting (DBC) algorithm these images were transformed into the Fractal Dimension images .The ROI was easy to identify and can be selected manually after the fractal transformation. The differentiation accuracy between aggressive and non aggressive tumor was up to 83% and this system also gave the information about the aggressiveness

S.K Vijai[3], proposed a CAD system in which different image processing techniques combined with neural network were applied on the images. Noise content present in the image was removed using non-linear total variation denoising algorithm. To separate the lung region and to convert the image into binary form optimal thresholding was used. Morphological operations were applied on threshold image to remove any blood vassals which has a value less than defined value. Region growing method was used for the extraction of region of interest. GLCM (gray level co-occurrence matrix) was obtained which consist the white pixel values occurred in the ROI. Then from this matrix several textural features were calculated and these features were applied to input nodes of the back propagation network. On the basis of the inputs applied to the network a single output was obtained which gave the value between 0 and 1 and a threshold value was defined. The output value more than the threshold value predicted cancerous and value less than threshold value predicted non cancerous. The accuracy of this system was 86.3% and the implementation time was less than 3 minutes.

Lee [4], presented a template matching technique with the combination of conventional template matching for the detection of lung nodule in helical CT images. This technique was applied on both, inside the lung region and on the lung walls. In order to detect the nodules inside the lung region the generic algorithm for template matching (GALM) was used and for detection of nodule at the lung walls, lung wall template matching (LWTM) was used. There were number of false positives (FP) values are observed as a result so that system accuracy is decreased. so in order to reduce the FP values total 13 features had been calculated. 9 for generic algorithm template matching and 4 for lung wall template matching. For this system, detection of nodules in low contrast was difficult and the number of FP was high.

Jinsa [5], presented a system for the detection of lung tumor in CT scan images using artificial neural network. In this System, the scan image which was in gray scale firstly converted to binary image using grey level thresholding. The morphological opening was applied to the segmented image. And then different statistical parameters like mean, standard deviation, skewness, kurtosis, fifth and sixth central moment were calculated. Two neural networks: feed forward and feed forward back propagation networks were used for the pattern classification. As compare to the feed forward network, feed forward back propagation network provided better results because feed forward BPN was based on supervised learning. The weights were changed according to the applied input and flow of information travelled in a feedback manner. The network was trained with 13 training function among all function training function gave the maximum classification accuracy with minimum mean square error. Based on these Two training functions were proposed with which the sensitivity of the system was increased to 91.4% with 30FP/scan.

Daw, Chung, Wen [6], presented an extension of neural network based fuzzy model for the detection of lung nodule .After the thresholding stage, some part of the blood vessels or the large airways may also be removed. So, in order to fill these areas, morphological closing and labeling was applied to medical image. In order to make distinction between the nodules and other structure in lung region, three main features area, brightness and circularity were calculated. This neural network based fuzzy model consists of four layers: input layer, fuzzification layer, rule inference layer, defuzification layer. With this system, the classification accuracy of 89.3% was achieved. The false positive value was 0.21. The main advantage of this system, it was faster, no prior knowledge was required, the fuzzy rules were defined using learning procedure and Detection rate was high

A.Amutha, Wahidabanu[7], presented level set Active contour model for the detection of lung tumor. This method was based on kernel function having the minimum mean square error value. Then second order features were calculated which were based on the histogram of the noise free image. The classification between the normal and abnormal lung image was made on these features. The main drawback of this system was it can be able to work on 2-D images.

Anam, Usman, Younus [8], proposed a method in which median filter was used to remove noise content, the background was removed using gradient mean and variance

after that optimal thresholding was used to segment the lung region. Then different morphological operations were applied to remove the unwanted information. The region of interest was extracted and five texture based features were calculated. All These features formed a vector which was given to the hybrid classifier based on neural network. The hybrid classifier was a combination of self-organizing network and multilayer perception. The drawback of this system was computational time for larger data set was more.

III. Conclusion

An image improvement technique is developing for earlier disease detection and treatment stages; the time factor was taken in account to discover the abnormality issues in target images. Image quality and accuracy is the core factors of this research, image quality assessment as well as enhancement stage where were adopted on low pre-processing techniques based on Gabor filter within Gaussian rules. The proposed technique is efficient for segmentation principles to be a region of interest foundation for feature extraction obtaining. The proposed technique gives very promising results comparing with other used techniques. Relying on general features, a normality comparison is made. The main detected features for accurate images comparison are pixels percentage and mask-labeling with high accuracy and robust operation.

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