TUMOR DETECTION IN LUNGS

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Abstract:

Dealing with medical field the Lung Cancer is the most severe disease and the treatment for the same is a big challenge for the entire scientific research. As for the treatment of any disease the accurate diagnosis is a primitive step, this is the primary achievement in any case. But as the lung cancer disease is concerned, the accurate and early detection is a challenging task. Hence the mortality rate is much bigger due to this disease. Thus, its early detection will be helpful for cure of disease. Here for this, numerous techniques have been proposed and implemented in the literatures to help the medical science. This paper included the various methodologies which contributed for the detection of tumors or lung cancer. There are also different applications like as support vector machines, neural networks, image processing are available. This paper made the formal survey of different approaches adopted for detection of tumors in lung(s) or lung cancer using image processing.

Keywords: CLAHE, CT, ANN.

Introduction:

The late diagnosis of the cancer disease causes the severe impact on human life which leads to death. As the lung cancer is concern, it make the malfunction of lungs, since the lungs are working for taking oxygen to the body and removal of carbon dioxide from the body during important physical activities. The unwanted or excessive spread of tissues in lungs which are uncontrolled, that leads to lung cancer. The survey says approximately 1.3 million people die every year [1]. Since many people show no symptoms of this disease and this becomes more dangerous for the accurate treatment and survival. Hence the early diagnosis is very much needed, otherwise that can be spread among the different parts of body [1]. The recent innovations in image processing technology contributing for the early detection of lung cancer. Since, the advancements are made with low dose CT, which becomes helpful to detect the lung cancer at early stages. There are many techniques enlisted in literature survey of Image processing which have been proposed and implemented using recent machine learning approaches or several hybrid methods for the said purpose.

Literature Review:

Many researchers made the use of image processing as in advanced imaging of computed tomography to contribute towards the detection of lung cancer. Özge [1], et al; showcased the comparison of different algorithms for lung cancer detection. This made the use of ANN and other methods for comparison of accurate detection of lung cancer. Janee Alam [2], et al; proposed the machine learning approaches and use of multi class SVM classifier for the same task. A set of textural features extracted from the separated ROIs is classified by the SVM. This claimed the remarkable precision for cancer identification and cancer prediction. This made the use of watershed transform and GLCM along with SVM classifier. This combination claimed the detection rate to much remarkable levels. Ms. Twinkal Patel [3], et al; suggested the hybrid method for feature extraction, Also here the work extended to apply LESH and sensitivity analysis (SA) to detect lung cancer. The JSRT & clinical dataset was selected for research experiments. Bohdan Chapaliuk [4], et al; suggested the use of deep learning approach in computer aided detection system, the 3D convolution and recurrent neural network were considered. Jue Jiang [5], et al; suggested the technique where two MRRNs were developed, and the network so far developed which can make combination of different features which are there for multiple image resolution as well as the feature levels through remaining connections which can detect and make segmentation of lung tumors. With this, the development of multi-scale CNN approach was made which can make the segmentation of lung tumors to achieve the accurate, automated identification of and serial measurement of volume of tumor in lung.

Yang Chunran [6], proposed and implemented the detection and segmentation method for the said purpose using fully convolutional method, in addition the thresholding method also used. The author claimed the improved detection accuracy. Moffy Vas [7], explained the method of lung cancer detection using mathematical morphological operations which segment the lung region of interest, then the Haralick features are to be extracted from it. These extracted features can be further used to classify the cancer using ANN. It is also claimed to obtain the satisfactory result for segmentation using morphological operations. In addition, ANN also given the benefit of considerable accuracy. As this approach claimed to be efficient to detect the cancer at early stage with improved detection speed. This helps to get the detection in lesser time.

M. Mirah Kasturi [8], explained a method to locate and detect the cancerous cells effectively from the 2D and 3D CT scan images by reducing the detection error made by the physicians' naked eye. Also, it is claimed, early stage of cancer can be detected. Annette McWilliams [9], proposed and implemented the technique where the use of electronic nose was made. In this, the smoking status effects for early detection of lung cancer were focused. Sayali Satish Kanitkar [10], et al; suggested the technique using marker controlled watershed transform, this helped to detect cancerous cells effectively from the lung CT scan images. The author claimed the improved accuracy as compared to thresholding techniques. K.Punithavathy [11], explained the method for the said task from the PET/CT images. For this, CLAHE and Wiener filtering were used, this given the benefit of removal of artifacts which rises due to noise and the variations in contrast. In addition, the lung ROI extracted from images making use of morphological operations. The Haralick statistical texture features were used since they benefit to extract more textural information from the cancer regions as compared to visual assessment.

For classification of normal and abnormal regions FCM was used here. This method claimed to have better classification and detection purposes. The accuracy also claimed to be considerable. The Receiver Operating Characteristics ROC curve was used to evaluate the performance.

Sanjukta Rani Seja [12], included different techniques available to detect the lung cancer. This explained the method of detection using the texture analysis for the said purpose. To progress the efficiency of detection many methods have been introduced. Various applications like as support vector machines, neural networks, image processing techniques are broadly used in for cancer detection which was explained in this work. Anita chaudhary [13], here explained to get the more accurate results by using various enhancement and segmentation techniques. Nidhi S. Nadkarni [14], et al; suggested to use median filtering and implemented the same for detection, this helped to make the segmentation of lung ROI using mathematical morphological operations. The extracted features from ROI helped to compute the geometrical features, that further proceeds to make the categorization into normal and abnormal of CT scan images., SVM will be used here.

Methodology:

The generalized approach of the lung cancer detection using image processing is shown below in figure 1. This includes the preliminary step with data collection, followed by further image processing procedures. The basic procedures includes the image segmentation, feature extraction and the classification. There are various ,tools can be used for the classification. Thresholding technique was majorly used by many of the literatures, also the more common machine learning techniques contributed for classification of tumor and its spread or enlargement of area, that is the SVM.

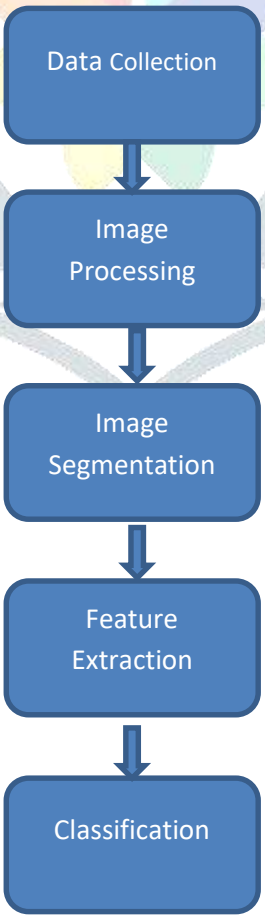


Figure 1. Generalized approach for detection [14]

There are some observations from the mentioned literatures as shown in Table 1. This shows the values for sensitivity and specificity in respect of different regions.

Table 1. Values of Sensitivity and Specificity [11]

Image Regions	Sensitivity	Specificity
Background	0	1
Border	0.71	0.94
Cancerous	0.89	0.63

Also there are some advanced methodologies are proposed and implemented, one of the approach is already quoted in literature survey section of this paper. The step wise flow of it as mentioned in figure 2.

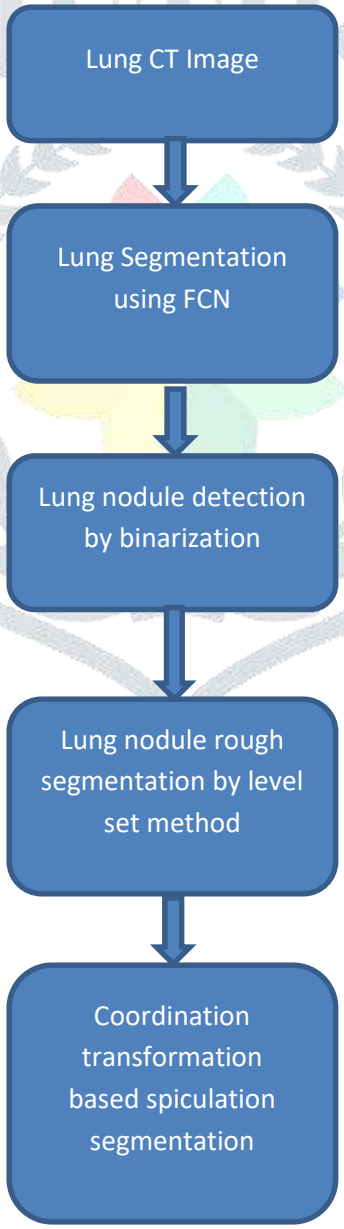
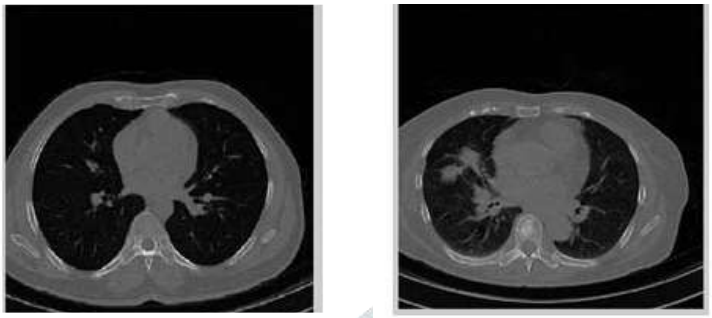


Figure. 2. An Approach using Fully Convolutional Network [6]

Figure 3 shows the examples of CT images from the database made available from hospitals. The same can be undergone through the several processes using ANN to detect the lung cancer.



a. Cancerous b. non-cancerous

Figure 3. Example of CT images (a. Cancerous and b. non-cancerous) [7]

The above shown images has to be filtered out and then passed to further procedure of segmentation [7] which then passed to further feature extraction.

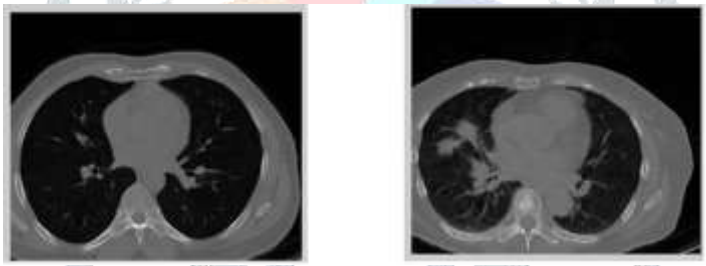


Figure 4. Filtered images [7]

Conclusion:

The efficient use of image processing for lung cancer or tumor detection is the revolutionary step in the era of medical field. Many approaches are already showcased by many researchers, and still motivating for the genuine task for the detection of deadly disease. The image processing is contributing much towards the early detection of this disease and which helps to survive the lives.

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