Segmentation and Classification of Lung Diseases

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***Abstract:-* Detection and segmentation of lung with lung abnormalities is a difficult task as abnormal lung are often large in size, irregular in shape and grow against surrounding structures of similar density and intensity. For normal lung, segmentation can be performed by making use of excellent contrast between air and surrounding tissues. But it fails when lung affected by high density pathology. So, the lungs with high density pathology have to be detected. Active contour model based lung segmentation technique is proposed here which accurately detect and segment the lung cancer from CT lung images. Literature survey for segmentation of lung from CT images using active contour model are done. Proposed method automatically detects the interior contours, from the CT lung images starting with only one initial curve. So region-based active contour can detect interior boundaries regardless of the position of initial contours. The use of pre-defined initial contours provides a method of automatic segmentation. The GLCM features are extracted from the segmented lung and classification is done using K-Nearest Neighbor classifier and Back Propagation Neural network classifier.**

Keywords: Active contour model, segmentation, GLCM, K-Nearest Neighbor classifier

II. INTRODUCTION

Lung cancer represents a major health problem. Worldwide lung cancer is responsible for 1.3 million deaths annually, according to the WHO. Tomographic imaging modalities like multi detector X-ray computed tomography (CT) play an important role in diagnosis, treatment, and research of lung diseases. Many automated lung image analysis methods require the segmentation of lungs in an initial processing step. Segmentation of normal lungs imaged with CT is a rather simple task, because of the large density difference between air-filled lung tissue and surrounding tissues. A number of algorithms can be found that deal with this topic. In case of diseased lungs (e.g., pneumonia, fibrosis, cancer, etc.), lung segmentation becomes a non-trivial problem. The majority of clinical lung CT scans is acquired in the context of parenchymal or oncological lung disease. Tuberculosis is spread through the air when people who have an active TB infection cough, sneeze, or otherwise transmit their saliva through the air. The classic symptoms of active TB infection are a chronic cough with blood-tinged sputum, fever, night sweats, and weight loss.

Diagnosis of active TB relies on radiology (commonly chest x-rays) as well as microscopic examination and microbiological culture of body fluids. Cystic fibrosis is characterized by abnormal transport of chloride and sodium across the epithelium, leading to thick, viscous secretions.CF is caused by a mutation in the gene coding for cystic fibrosis transmembrane conductance regulator,which is required to regulate the components of sweat, digestive juices, and mucus

III. METHODOLOGY

Fig:1 represented the workflow of this project as shown in below

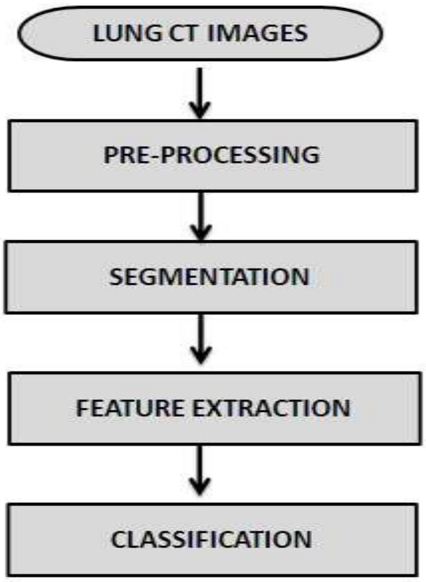


Fig1: Workflow diagram

A. pre-Processing

Pre-processing deals with techniques for enhancing contrast, remove noise, pictures less corrupted by the patient motion can be eliminated. To remove salt and pepper noise in CT image median filter is used.

B. Active Contour Based Segmentation

Active contours are connectivity-preserving relaxation methods, applicable to the image segmentation problems. Active contours have been used for image segmentation and boundary tracking since the first introduction of snakes. The basic idea is to start with initial boundary shapes represented in a form of closed curves, i.e. contours, and iteratively modify them by applying shrink/expansion operations according to the constraints of the image. Those shrink/expansion operations, called contour evolution, are performed by the minimization of an energy function like traditional region-based segmentation methods or by the simulation of a geometric partial differential equation. An advantage of active contours as image segmentation methods is that they partition an image into sub-regions with continuous boundaries, while the edge detectors based on threshold or local filtering, e.g. Canny or Sobel operator, often result in discontinuous boundaries. The use of level set theory has provided more flexibility

C. Feature Extraction

Images usually have a huge number of features. It is important to recognize and extract interesting features for an exacting task in order to decrease the complexity of processing. Gray-level co-occurrence matrix (GLCM) is the statistical method of examining the textures that considers the spatial relationship of the pixels. The GLCM functions characterize the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image, creating a GLCM, and then extracting statistical measures from this matrix.

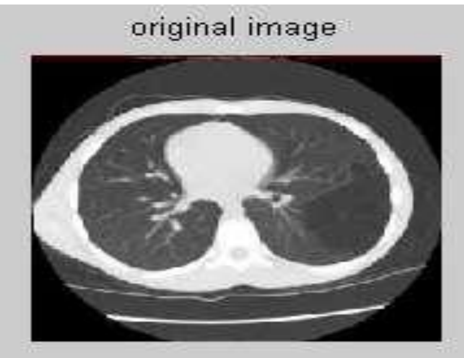
D. K-Nearest Neighbors (KNN) Classifier

K-Nearest Neighbors algorithm (KNN) is a non-parametric method used for classification .In K-Nearest Neighbors classification, the output is a class membership. An object is classified by a majority vote of its neighbors; with the object being assigned to the class most common among its k- nearest neighbours.Fig.2 shows the preprocessed image

IV. RESULT AND DISCUSSIONS

A. Pre Processing The CT Images

Median filter effectively denoise the medical images. The images distorted or blurred by shot or impulse noise can excellently denoised using this filter. These filters help to preserve edges and the edges are minimum degraded.



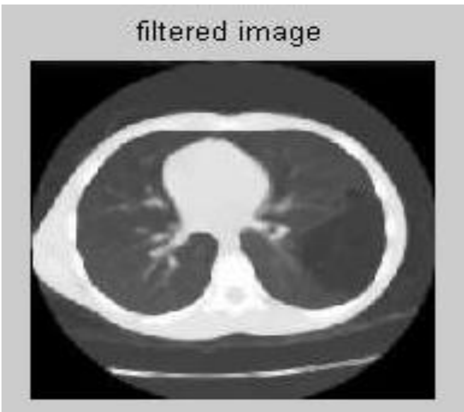


Fig:2 Preprocessed image

B. Segmentation of Pre-Processed Images

Active contour segmentation method automatically detects interior contours, from the CT lung images starting with only one initial curve. The position of the initial curve can be anywhere in the image, and it does not necessarily surround the objects to be detected. Active contours to detect objects in a given image, based on techniques of curve evolution. So region-based active contour can detect interior boundaries regardless of the position of initial contours.Fig:3 show the segmented output. Fig:4 Active Contour Segmentation for cancerous lung image and Fig:5 Active Contour Segmentation for Fibrosis image

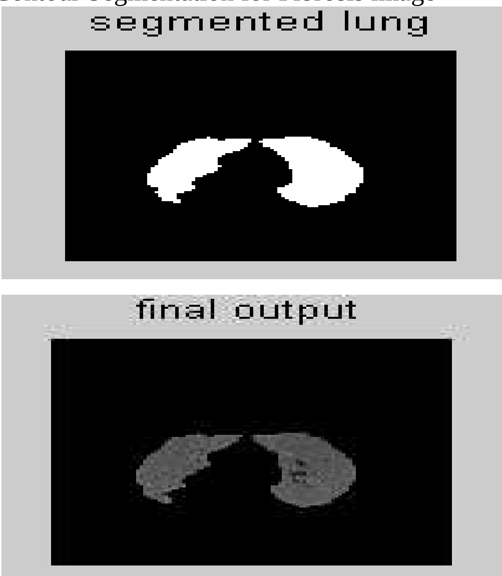


Fig:3 Segmented image

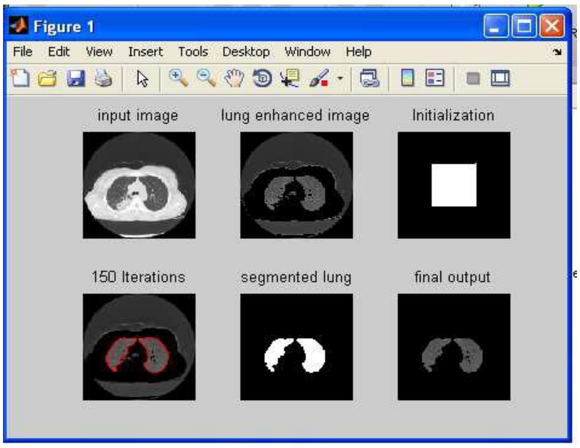


Fig:4 Active Contour Segmentation for cancerous lung image

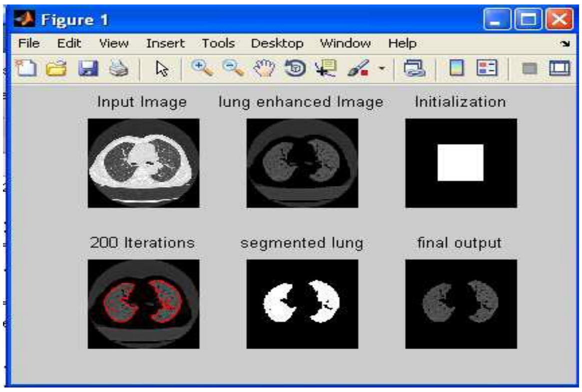


Fig:5 Active Contour Segmentation for Fibrosis image

C. Classification Based On K-Nearest Neighbor Classifier

The Nearest neighbor classification underlying intuitions are straightforward, and examples based on class of nearest neighbor are classified. More than one neighbour is considered and so the technique is usually called k-Nearest Neighbors (k-NN) where k nearest neighbors determines class. The neighbors are taken from a set of objects of 72 samples for which the class or the object property value is known. This can be thought of as the training set (72 samples of 4 classes) for the algorithm, though no explicit training step is required. Number of sample use for training and testing are listed in the table below 35 The training phase of the algorithm consists only of storing the feature vectors and class labels of the training samples. In the classification phase, k is a user-defined constant, and an unlabeled vector (a query or test point) is classified by assigning the label which is most frequent among the k training samples nearest to that query point.

CONCLUSION AND FUTURE WORK

Lung region is separated from CT lung image and feature extraction is performed by GLCM. Finally with the obtained texture features classification is performed to detect the occurrence of normal, cancer, and tuberculosis and fibrosis region. K-Nearest Neighbor classifier provides the accuracy of 90%

Type	Training	Testing
Cancer	20	8
Tuberculosis	20	8
Fibrosis	20	8
Normal	12	6

Table:1 No.of Samples For Each Disease Used In KNN Classifier

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