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PULMONARY FISSURE DETECTION IN CT IMAGES

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Abstract-*The fissure detection and classification of lung images is necessary for determining the presence of any sort of diseases in the lungs. Considering this, the most important disease is lung cancer. Early detection is necessary to save the lives. If we focus on the early detection of the disease, then the morality rate can be reduced and deaths can be minimised to larger extent. There are various methods used to detect lung cancer, like xrays and CT images. But we prefer CT images, as they give more reliable results compared to the former. In the proposed method, we will discuss about how segmentation could be applied for the pre-processing of CT scans. The results can be used in deep learning for getting more accuracy in learning of those CT scans. This method uses Sobel filter as the main tool for pre-processing. In this research work we will discuss the image manipulation techniques which could be carried out for achieving better results in detecting lung diseases with the CT images. In the proposed system, for determining the pulmonary fissure and to detect the presence of cancer we use MATLAB R2016a.*

Keywords: **Fissure detection, Sobel filter, lung cancer, segmentation, MATLAB R2016a.**

1. INTRODUCTION

The early prediction of lung diseases seems to be difficult because of the lack of devices for detecting the same. Cancer cells spread through blood vessels, or by lymph fluid. Lymph flows through lymphatic vessels, which drain into lymph nodes located in lungs and also in Centre of the chest. The Cancer in the lungs, is usually spread to the chest and parts around the chest because of the blood which is carried by the blood vessels to those parts.

There are two categories of lung cancer which includes, non-small lung cancer and small lung cancer. Lung cancer has four stages. The stages varies according to the size and shape of the cancer affected cells. CT scan is better than X-ray for the diagnosing the lung cancer. The main cause of lung cancer is considered as smoking. Hence, a frame work should be implemented to build a computer aided diagnosis system. The main challenge here, is that the images are obtained from different sources hence they will vary in size and format. Thus, pre-processing has to be carried out before processing the acquired images for required results. The purpose of this method is to implement convolution neural network(CNN) for classification of CT images.

2. BACKGROUND AND RELATED WORKS

In a perspective to check the cause of chronic obstructive pulmonary disease(COPD),about 573 samples were taken under consideration. The global initiative for chronic obstructive lung disease (GOLD) has specific criteria ,these subjects were differentiated into five subgroups, non-COPD, GOLD-I, GOLD-II, GOLD-III, and GOLD-IV, depending on seriousness of the condition of the lungs. The correlations between fissure integrity, and pulmonary functions (e.g., FEV1, and FEV1/FVC) and COPD severity were assessed with the help of Pearson and Spearman's correlation coefficients, respectively. To propose a technique for determining the completeness of fissure and for analysing the integrity of it, chest computed tomography commonly known as CT images were considered. CT scans of patients with severe emphysema was considered in this research. The automatically segmented lung images were made use for determining the completeness of the fissure. The completeness score obtained was then compared with a visual consensus read by radiologists using boxplots, rank sum tests and ROC analysis. For all fissures visually assessed as being complete, automatic method resulted in relatively higher completeness scores. The areas which were under the curves considered for the automatic fissural completeness were 0.88, 0.91 and 0.83 for the right major, right minor and left major fissures respectively. An automatic method was able to define the fissural completeness of the three radiologists. The main purpose of this method was to extract pure fissure patches rather than to generate a full lobe segmentation. This means that only the visible fissures on CT are extracted and no interpolation points were considered for filling in. An early version of the same process was presented on a conference, as a distinct 3D planar or surface structure in human lungs, the pulmonary fissures possess some distinguishable shape and appearance features. If we cut a volume CT image with

mutually orthogonal planes, the fissure profiles will typically appear as bright thin curvilines in at least two planes, see the normal fissure profiles. This observation is considered as an important property in our paper to discriminate the fissure patches from other pulmonary tissues. Consider an example, small pulmonary vessels might happen to be a bright line inside a single transverse plane, but they hardly show similar shapes in other perpendicular sections. An exception is those vessel segments running parallel to a certain coordinate axis, which might simultaneously take a linear shape across two orthogonal sections. This will happen with low probability and hence it is ignored. Based on the above observation, a fissure enhancement filter is developed. Although essentially a 2D filter, the 3D surface characteristics of fissures will be indirectly taken into account by merging information from orthogonal planes.

3. METHODOLOGY

The image for pre-processing and feature extraction consists of different steps. Pre-processing is done by smoothening of images, enhancement of images and finally segmentation. The feature extraction is done by morphological and calorimetric operations. The pulse of convolution filters was used in CT images for smoothening hence, enhancement of the image in terms of contrast and clarity becomes possible. Thresholding is the method used for nucleuses in the images to segment. Once these steps are achieved it utilizes colorimetric and morphological to extract feature from image of the nucleuses which is by thresholding. The average intensity, area, perimeter and eccentricity of the nucleuses includes the extracted morphologic features. In the image processing, the image acquisition is the step which we have selected for CT images because it involves less noise. CT images are the ones which have more accuracy and less distortion. The images are collected from various hospitals. The standard of CT image is DICOM (Digital Imaging and Communications in Medicine) has become a standard for medical Imaging. The image which are collected are raw data, hence, to improve the contrast, clarity and separate the background noise it is necessary for pre-processing to be done on these images. Therefore, smoothing and enhancement are to be used to get an appropriate image required.

3.1 Smoothing

The images considered will have salt and pepper noise. Smoothing is a step which is essential in reducing these noises. There are many filters available. But here the use of Sobel filter made it ideal to use in our research. The Sobel filter is more effective in removal of noise in the images and also offers a high spatial frequency.

3.2 Image Segmentation

The image is partitioned into multiple digital segments by a process, known as image segmentation. This process results to a set of images which would collectively contribute for the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture.Figure1,gives a view of CT image which is considered for image segmentation.

Fig-1: Image Segmentation

3.3 Histogram Equalization

This gives a graphical representation of the intensity distribution of the CT image. This step involves improving contrast in images. It accomplishes this by stretching out the intensity range of the image. This method increases the global contrast of the image in order to maintain the contrastin various sparts of the image. Thus the lower contrast are as gain shigher contrast.

3.4 Filtration

Filtration is a process which comes under pre processing, a Sobel filtering technique is used to remove unwanted noise in the enhanced image. The Sobel filtering technique uses mean to calculate PSNR value.

3.5 Dilation

Dilation is a process which adds pixels boundaries of the objects in an image, while erosion removes pixels on object boundaries. The number of pixels added or removed depends only on size and shape of the image as denoted by the structuring element.

3.6 Feature Extraction

It is the most important part of this particular project. The properties such as standard deviation, entropy, contrast etc are extracted from the image and are used to train the dataset for classification.

3.7 Classification

The image is classified into various groups by image segmentation. The convolution neural network (CNN), is used to segment and classify the images in datasets.

CNN is a most powerful unsupervised method for the analysis of data and construction of the models. CNN is more natural than hard clustering. The CNN algorithm works by assigning membership to each data point corresponding to each cluster center on the basis of distance between the cluster center and data point. Depending on the position of the data point in relation with the cluster centre its relationship is determined.

4. RESULTS

Fig-2: Input lung image

Fig -2,is a CT image of a lung, which we take as the image for processing and detecting, whether it is a affected lung or a healthy lung.

Fig-3: Histogram equalization

The resultant image of histogram equalization is shown in Fig -3.

Fig-4: Segmentation

The equalized image is now segmented into pixels,as illustrated in Fig-4.

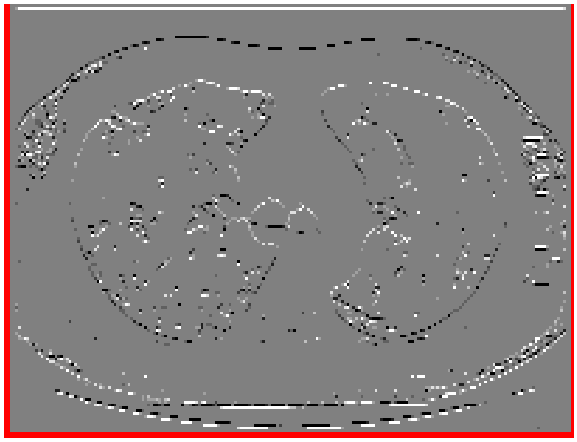

Fig-5: Filtration

The unwanted salt and peper noise is removed using sobel filter, resulting in Fig-5.

Fig-6: Dilation

The dilated image is shown in Fig-6.

Fig-7: Fissure

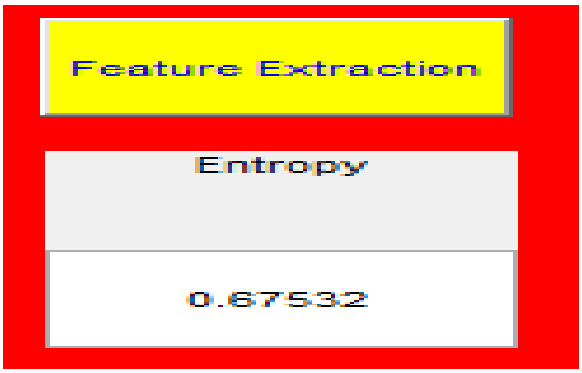

Fig-8: Feature Extraction

The most important feature, entrophy which is obtained by processing of input image is shown in Fig-8.

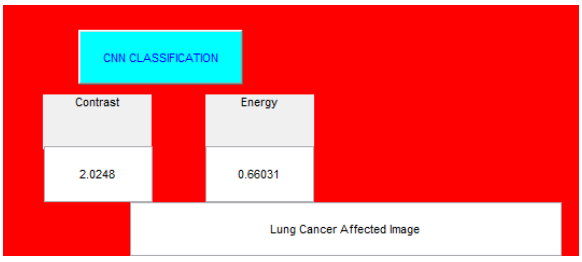

Fig-9: Classification

CNN is used for classification, and the final result is given in Fig-9.

The above figures included, shows the tested results of each step involved in the project.

5. CONCLUSION

The CT images are processed with image processing in MATLAB. The convolution neural network is made use for the classification of the images. The proposed one is a valuable approach, which can significantly supports accurate detection of fissure with a little computational effort. Using a CNN classification technique, to categorize images severity proved to be more efficient and largely reliable .The simulation proved reliable for rapid detection of diseases. It is rather simple to use and execute and gives higher performance compared to other classical techniques.

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