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Texture Analysis for Lungs Disease Diagnosis

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Abstract: ***Lung is very important organ of human body. Due to some reasons lungs functioning can disturb E.g. Smoking. Doctors also unable to diagnose accurate lungs disease by only viewing X-ray, CT image, MRI image etc. for this by using image processing we diagnose lungs disease. We describe texture analysis systems that diagnose the lungs disease from microscopic images of patients which are affected with interstitial lung disease (ILD). Many times doctors diagnose the lungs disease from high-resolution computed tomography (HRCT) images but we can increase accuracy of lungs disease diagnosis by using microscopic images.***

Keywords: Interstitial, microscopic, texture.

1. Introduction

Interstitial lung diseases (ILD) are also called as diffuse parenchyma lung disease (DPLD). Interstitial lung disease is a general category that includes many different lung conditions. All interstitial lung diseases affect the interstitiaum, a part of lungs' anatomic structure. The interstitium is a lace-like network of tissue that extends throughout both lungs. The interstitium provides support to the lungs' microscopic air sacs (alveoli). Tiny blood vessels travel through the interstitium, allowing gas exchange between blood and the air in the lungs. Normally, the interstitium is so thin it can't be seen on chest X-rays or CT scans [1,2].

It is very difficult to diagnose the ILD by visual inspection from x-ray images even for the expert doctors. Nowadays, the quantification of the emphysema extent using HRCT is done by visual scoring which is dependent on the skills of the observer. Some long-term studies have shown that different radiologists and physicians tend to disagree in the quantification of the emphysema when they evaluate CT from the same patients which highlight the problem of the inter-observer variability. so image processing of lungs images is best way to diagnose a correct disease [3].

Diagnosis of ILDs starts with a thorough history and physical examination. Blood tests may be ordered if hypersensitivity (allergic) reactions to environmental agents or connective tissue diseases (Rheumatologic disorders like Scleroderma, Lupus or Rheumatoid arthritis etc.) are suspected to be the cause for the interstitial lung disease. Almost all patients will need pulmonary function testing and a special CAT scan of the chest (High resolution scan performed specifically to visualize the pulmonary interstitium). If there is still uncertainty about the diagnosis, tissue biopsy may be required. This may sometimes be possible bronchoscopically (via a bronchoscope, which is essentially an endoscope for the lung), but in patients in whom a tissue diagnosis is required, a surgical lung biopsy is often required [4,5].

Our thoracic surgery partners use minimally invasive state of the art techniques for lung biopsy in patients for whom it is indicated. The minimally invasive surgery results in less pain and morbidity, and relatively short and uncomplicated hospital stays.

Treatment of the interstitial lung disease/pulmonary fibrosis depends on the etiology, severity of symptoms, physiologic impairment and other comorbidities; and can vary from watchful waiting, to various immunosuppressive therapies, or even lung transplantation for appropriately selected patients [6]. There are two methods to diagnose the lungs disease

1. Manual method
2. Digital image processing

In manual method doctors only observe images like X-ray, CT image, MRI image etc. and diagnose the disease but sometimes this manual method fails to diagnose correct disease. So the second method is implemented i.e. digital image processing in method images are processed by particular software and then we get correct results about image.

2. Objectives

1. To diagnose lungs disease like Lung cancer, ILD emphysema and ILD fibrosis
2. To implement principal component analysis method using DWT algorithm for disease diagnosis
3. To implement fuzzy logic for accurate results.

3. Survey of Images

1. **X-Ray images:-** X-radiation (composed of X-rays) is a form of electromagnetic radiation. X-ray image obtained by placing a part of the patient in front of an X-ray detector and then illuminating it with a short X-ray pulse. Bones contain much calcium, which due to its relatively high atomic number absorbs x-rays efficiently.

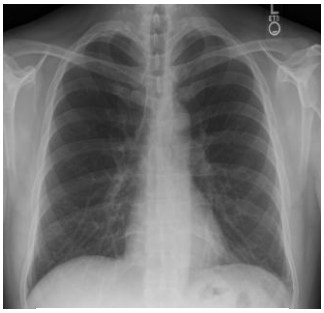


Figure 1: X-Ray image

2. **CT Images:-** Computed tomography, more commonly known as a CT or CAT scan, is a diagnostic medical test that, like traditional x-rays, produces multiple images or pictures of the inside of the body. The cross-sectional images generated during a CT scan can be reformatted in multiple planes, and can even generate three-dimensional images. These images can be viewed on a computer monitor, printed on film or transferred to a CD or DVD.

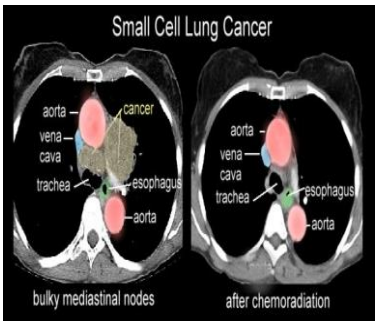


Figure 2: CT image

3. **MRI Images:-** Magnetic resonance imaging (MRI), nuclear magnetic resonance imaging (NMRI), or magnetic resonance tomography (MRT) is a medical imaging technique used in radiology to investigate the anatomy and physiology of the body in both health and disease. MRI scanners use magnetic fields and radio waves to form images of the body. The technique is widely used in hospitals for medical diagnosis, staging of disease and follow-up without exposure to ionizing radiation.

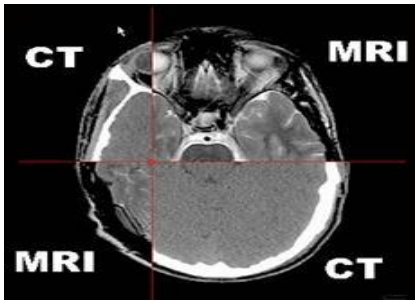


Figure 3: MRI image

4. **HRCT images:** - High-resolution computed tomography (HRCT) is computed tomography (CT) with high resolution. It is used in the diagnosis of various health problems. For example, HRCT of the lung is a medical diagnostic test used for diagnosis and assessment of interstitial lung disease. It involves the use of special computed tomography scanning techniques to assess the lung parenchyma.

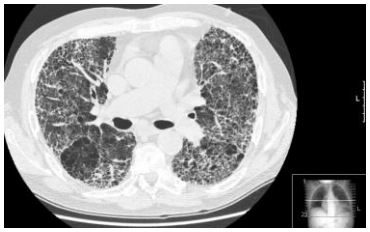


Figure 4: HRCT image

5. **Microscopic HRCT images:-**This is the type of HRCT images but these images are in the RGB format. These images can give better accuracy than other images [10].

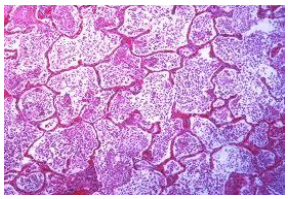
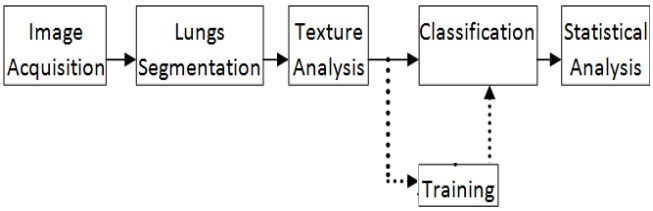


Figure 5: Microscopic HRCT image

4. System Development



Block Diagram

Figure 6: Diagram of the image analysis for the proposed method

Given a HRCT data set, the proposed automatic method first segment the right and left lung in three different sections, secondly it makes an analysis of the texture patterns and then a classifier is trained to distinguish between emphysema and no emphysema tissue. A statistical analysis is finally computed to assess the level of agreement between the results of the proposed method and the opinion of the experts.

4.1 Image acquisition

Image can be taken by two ways one is online and another is offline. In online image acquisition image is taken directly from machine or through internet. In offline image acquisition image is taken from database. After that we have to fix the size of image because sizes of input images are different.

4.2 Lungs Segmentation

Lungs segmentation is the important step in the method of lungs texture analysis. Depending on purpose of study there are different ways of lungs segmentation. In this firstly image is converted in from RGB to Grey image. Then we have to fix the size of image. Here we are using discrete wavelet transform (DWT) algorithm. In this algorithm image is divided into four parts Low- low, Low-high, High-low and High-high frequency component. Here we are considering only low-low frequency component [7].

Figure 7: Approximation component of image

Then feature components are calculated for the analysis and diagnosis of image that feature components are Entropy, Standard deviation and texture index.

1) Standard deviation:-It is the measure that is used to quantify the amount of variation of set of values
2) Entropy:-It is the grey level value on grey level plot of image. To calculate variation in grey level we use entropy.
3) Texture index:-It is the grey level intensity of the image[8].

4.3 Texture analysis and classification

In the texture analysis and classification values of standard deviation, entropy and texture index are considered. In classification of lungs disease fuzzy logic is used. In this image under process is compared with database images and correct disease is diagnosed [9].

5. Implementation

Figure 8: Input Image

Figure 9: Resized Image

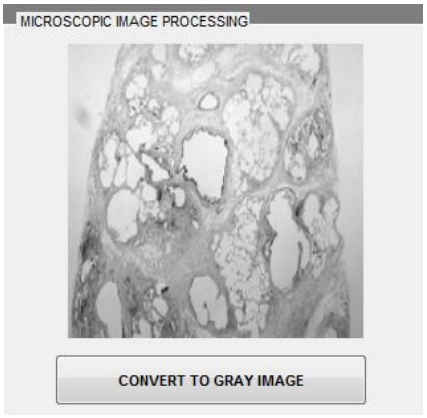


Figure 10: Gray image converted from RGB

Figure 11: Extraction of Wavelet component

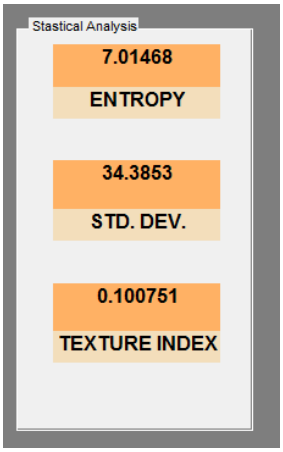


Figure 12: Statistical Analysis

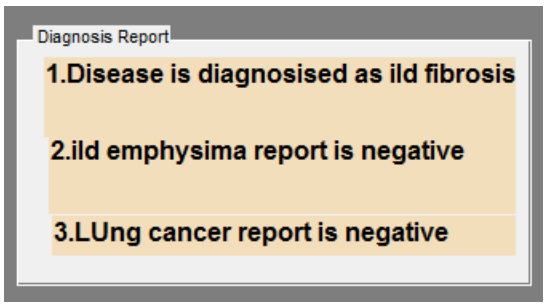


Figure 13: Diagnosis Report

6. Conclusion and Future Scope

We have implemented new method of texture analysis for lungs disease diagnosis. An automatic method of diagnosis

lungs disease is implemented in this paper. A HRCT image gives accuracy 70-80 percent but by using microscopic images we have increased accuracy to 90%. We have implemented fuzzy logic to classify the images so we get accurate results. This proposed method can be further improved by extracting more wavelet components to increase accuracy up to 100%.

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