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459 – 462

Using Various Processing Methods to Identify Lung Cancer

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Abstract – Lung cancer has become the leading killer of humans stricken with invasive cancer, affecting husbands to wives, friends to neighbors as it is air bourne and causing suffering for many families. Early detection of cancer is one of the important step in treat the decease. According to author prevention is better than cure, basede on that image processing methods are widely used in recent times, for earlier detection and treatment stages. The objective of this work is study of lung cancer images that are collected form different hospitals where the treatment is going on and focuses on early stage lung cancer detection. Lung cancer is prominent cancer that states large number of deaths of more than a million in every year. It makes sense that need of detecting the lung lymph nodule at early stage in computer tomography medical images to detect the occurrence of cancer at early stages, the requirement of procedures, methods and techniques are increasing. There are number of methods and techniques available but none of them provide a better accuracy of detection. One of the techniques is content based image retrieval computer aided diagnosis system (CAD) for early detection of lung nodules from the chest computer tomography (CT) images. The optimization of algorithm allows doctors to identify the lumps present in the CT lung images in the early stage.

Keywords::- *Enhancement, Segmentation,Feature extraction, Binarization , Filtering etc.*

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1. Introduction

This disease is difficult to detect in its early stages, and treatments for lung cancer in its later stages provide a poor prognosis: Those with stage IV non-small cell lung cancer—the most common type—have an estimated 1 percent survival rate five years after diagnosis. The other type of lung cancer—small cell lung cancer—is even more aggressive. There are various types of cancers i.e. lungs cancer, Breast cancer, blood cancer, throat cancer, brain cancer, tongs cancer, mouth cancer etc. Lung cancer is a disease of abnormal cells multiplying and growing into a tumor. Lung cancer is of disease of abnormal cells multiplying and growing into a tumor. Cancer cells can be carried away from the lungs in blood, or lymph fluid that surrounds lung tissue. Lymph flows through lymphatic vessels, which drain into lymph nodes located in the lungs and in the centre of the chest. Lung cancer often spreads toward the centre of the chest because the natural flow of lymph out of the lung is towards the centre of the chest

The exact cause of lung cancer is still being investigated. Certain risk factors shown to play a major part in causing the cells to become cancerous. The main causes for lung cancer include exposure to air pollution , smoking, and genetics. Lung cancer symptoms are included below.

List of Lung Cancer Symptoms

- Cough (chronic, recurrent)
- Fatigue
- Weight loss
- Shortness of breath or wheezing
- Coughing up phlegm that contains blood
- Chest pain

2. Techniques to detect lung cancer

Screening for lung cancer is usually accomplished using three methods.

a) **Physical Exam**

A physical exam will look for signs of wheezing, shortness of breath, cough, pain and other possible signs of lung cancer. Depending on the advancement of the cancer, other early signs of lung cancer symptoms may include a lack of sweating, dilated neck veins, face swelling, excessively constricted pupils, and other signs. The physical exam will also include the patient's history of smoking and a chest X-ray.

b) **Sputum Cytology Exam**

A sputum cytology exam involves a microscopic examination of a patient's mucus (sputum).

c) **Spiral CT Exam**

This method of CT scanning builds a detailed image of the body's internal workings. Inside a spiral CT machine, detailed images are taken of the relevant parts of the

 ISSN: 2454-4248
459 – 462

patient's body. Those images are then linked to an X-ray machine to create 3D images of the patient's internal organs. These images may reveal potentially cancerous tumors. A study by researchers suggested that people aged 55 to 74 years old who had smoked at least one pack of cigarettes a day for 30 or more years may benefit from a spiral CT study of the lungs. At best, the screening methods find about 30% of lung cancers leaving the bulk (about 70%) cancers of lung undetected. In addition, some test results are not clearly diagnostic which can lead to patient concerns and possibly unnecessary biopsies or surgeries.

Figure 1.Lung Cancer Diagnosis

Figure 2. CAD algorithm examine

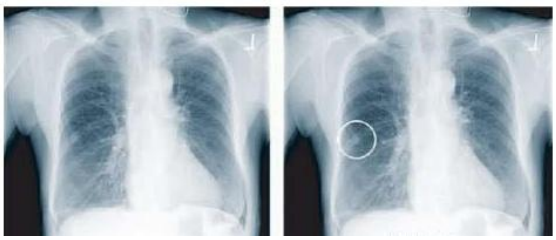


Figure 3. Before and after using On Guard

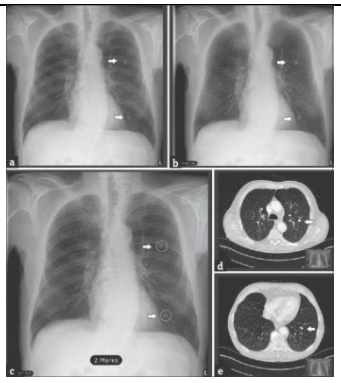


Figure 4. CAD algorithm examine

The imagechecker CAD algorithms examine the complete set of CT images generated during scanning and search for findings with features suggestive of a solid lung nodule. On Guard 1.0 and OnGuard 5.1 computer-aided detection (CAD) technologies are works with standard chest x-rays to increases the detection of pulmonary nodules and reduce the rate of false positives.

3. Methodology

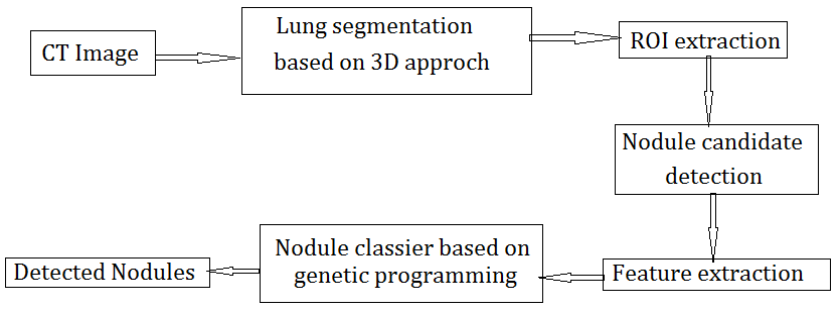


Figure 5. Flow chart of pulmonary nodule detection

The rank order of cancers for both males and females among Mumbai in 2010 indicated that were 396 cases of lung cancer accounting for (7.9%) of all newly diagnosed cancer cases in 2010. Lung cancer affected 267 (11.5%) males and 59 (2.5%) females with a male to female ratio of 5:1 with a lung cancer ranked second among females. It consists of few stages. The first stage starts with taking a collection of CT images (normal and abnormal) from the available database from IMBA home. The second stage applies the several techniques of image enhancement, to get

 ISSN: 2454-4248
459 – 462

a best level of quality of clearness. The third stage applies image segmentation algorithms which play a effective role in image processing stages, and the fourth stage obtains the general features from enhanced segmented image which gives indicator of normality or abnormality of images. Lung cancer is the most dangerous and widespread cancer in the world according to stage of discovery of the cancer cells in the lungs, so the process early detection of the disease plays a very important and essential role to avoid the serious advance stages to reduce its percentage of distribution.

3. Image Enhancement

Image enhacement is the process of sharpening or smoothen the image. It improves the image quality and remove the noise from the image.It provides the better input for the digital image processing. Image enhancement belongs to image preprocessing methods. Objective of image enhancement – process the image (e.g. contrast improvement, image sharpening ,…) so that it is better suited for further processing or analysis

Image enhancement techniniques classified into two main parts:

1.Spatial domain methods- which directly operates on a pixel of a digital image.

2.Frequency domain method-which operates on a fourior transform of a image. it is the low level processing technique. Image enhancement methods are based on image quality. No mathematical criteria are used for optimizing processing results. In the image enhancement stage following three techniques are used: Gabor filter, Auto-enhancement and Fast Fourier transform techniques

3.2 Gabor filter

The Gabor filter was originally introduced by Dennis Gabor; we used it for CT images. In image processing a **Gabor filter**, named after a dennis gabor, is a linear filter used for texture analysis, which means that it basically analyses whether there are any specific frequency content in the image in specific directions in a localized region around the point or region of analysis In the spatial domain, a 2D Gabor filter is a Gaussian kernel function modulated by a sinusoidal plane wave.The Gabor function is a very essential tool in computer visibility and image processing, especially for texture analysis, due to its optimum locali ation property in both spatial and frequency domain.Image representation based on the Gabor function produce an excellent local and multiscale decomposition in terms of logons that are simultaneously localization in space and frequency domains.A Gabor filter is linear filter whose impulse response is defined by a harmonic function multiplied by a Gaussian function. Because of the multiplication-convolution property, the Fourier transform of Gabor filter's impulse response is the convolution of Fourier transform of the harmonic function and the Fourier transform of Gaussian function.Frequency and orientation representations of Gabor filters are similar to those of the human visual system, and they have been found to be particularly appropriate for texture representation and discrimination. In the spatial domain, a Gabor filter is a Gaussian kernel function modulated by a sinusoidal plane wave. The filter has a real and an imaginary component representing orthogonal directions. The two components may be formed into a complex number or used individually.

Before

After applying gabor filter

3.3 Fast fourior transform

Fast Fourier Transform technique operates on Fourier transform of a given image. The frequency domain is a space in which each image value at image position F represents the amount that the intensity values in image "I" vary over a specific distance related to F. Fast Fourier Transform is used here in image filtering (enhancement). Table 1 shows a comparison of the three mentioned techniques used for image enhancement. According to the values shown in the Table 1, we can conclude that the Gabor Enhancement is the most suitable technique for image enhancement.

3.3 Auto-enhancement

Auto enhancement methos is based on the subjective observation and stastical operation.In this operation such mean and variance are calculated. The enhancement percentage in this research was equal to 38.025%.

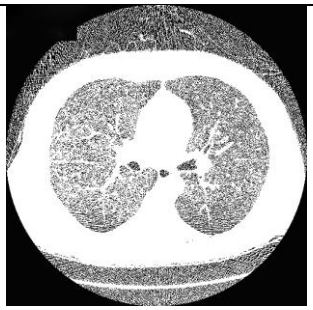
 ISSN: 2454-4248
459 – 462

Table 1 Comparision of various filter results

Gabor filter	Auto-enhancement	FFT filter
80.735%	38.025%	27.51%

Original Image

Enhanced by Gabor



Enhanced by FFT

Conclusion

An image increases technique is discussed for earlier disease detection and treatment stages of lung cancer; the time factor was taken in account to find the abnormality issues in target images. Image quality and accuracy is the core factors of this analysis, image quality assessment as well as enhancement stage were adopted on low pre-processingtechniques based on Gabor filter within Gaussian rules.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 and image quality percentage and mask-labelling with high and efficient accuracy and strong operation.Using the CAD algorithm applications is also shown high sensitivity but must also determined high specificity to ignore cost-intensive, inconvenient, or even harmful follow-up procedures to rule out misclassified lung Cancers.The current protocols for nodule detection report many false positives, requiring substantial improvements in the technology and its applications prior to clinical application of CAD in the practice of lung cancer screening.

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