International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 7, July - 2014

# Lung Cancer Detection using Morphological Segmentation and Gabor Filtration Approaches

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***Abstract* - Image processing techniques have been widely used in medical areas for quality achievement, assessment and improvement, where enhanced images based on pre-processing techniques such as Gabor filter within Gaussian rules are input of reliable segmentation technique to delineate the abnormal structure. Following the segmentation principles, an enhanced region of interest in the diagnostic object is used as a basic foundation of feature extraction for abnormality analysis. In this paper we present recent developments in the field of image segmentation and analyse various segmenting techniques and their suitability in medical imaging where images are very complex and it is very difficult to define exact boundaries of the normal and abnormal tissues.**

***Keywords - Cancer Detection, Image processing, Feature extraction, Enhancement Watershed, Masking.***



## INTRODUCTION

Lung cancer is also called cancer of the bronchus which is produced as a result of uncontrolled growth of the lung tissues, especially the cells which line the air passages. The resulting cells will not develop into healthy ones; they divide to form tumours which are considered as the main cause of death from cancers [1]. Lung cancer is a disease of abnormal cells multiplying and growing into a tumour. 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 lungs is toward the centre of the chest [2]. Metastasis occurs when a cancer cell leaves the site where it began and moves into a lymph node or to another part of the body through the blood stream. Cancer that starts in the lung is called primary lung cancer. There are several different types of lung cancer, and these are divided into two main groups: Small and non small cell lung cancer. The resulting cells will not develop into healthy ones; they divide to form tumours which are considered as the main cause of death from cancers. The symptoms begin to appear after almost a long period which explains why the cancer is difficult to detect. Lung cancer is one of the most serious cancers in the world, with the smallest survival rate after the diagnosis, with a gradual increase in the number of deaths every year. Survival from lung cancer is directly related to its growth at its detection time. The earlier the detection is, the higher the chances of successful treatment are. [3]. The purpose of this paper is to find the cancerous cells present in the CT images of lung and give more accurate result by using various enhancement and segmentation techniques such as threshold and watershed transform.

## METHODOLOGY

Image processing is one of most wide spread research area these days. In the following we are proposing an effective scheme to detect abnormal formation of cells in the lungs based on image segmentation processes. Here we present this proposed approach we have applied a series of operations, first to enhance the image using iteration adjustment and hybrid filtering and then segment the object of interest to detect the tumor from the lung image. The aim of image enhancement is to improve the interpretability of information in images for human viewers. Image enhancement techniques are used as pre-processing tools for other image processing techniques Figure 1. A normality of lung images will be indicated according to object segmentation of region of interest extraction, i.e. comparison of general features of lung images.

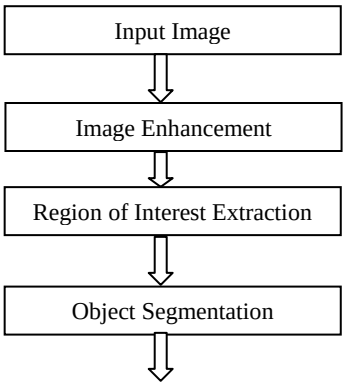


Figure 1. Lung cancer image segmentation processes

## IMAGE ENHANCEMENT

The main objective of image enhancement is to provide better input for other automated image processing techniques. Image enhancement techniques can be divided into two broad categories: Spatial and frequency domain methods. Unfortunately, there is no general theory for determining what "good" image enhancement is when it comes to human perception. If it looks good, it is good. However, when image enhancement techniques are used as pre-processing tools for other image processing techniques, the quantitative measures can determine which techniques are most appropriate [4]. Gabor filter was used to enhance lung images according to the comparison results of FFT and Gabor filtration that given in [5]. Image presentation based on Gabor function constitutes an excellent local and multi-scale decomposition in terms of logons that are simultaneously (and optimally) localization in space and frequency domains [6]. A Gabor filter is a linear filter whose impulse response is defined by a harmonic function multiplied by a Gaussian function. Because of the multiplication-convolution property (Convolution theorem), the Fourier transform of a Gabor filter's impulse response is the convolution of the Fourier transform of the harmonic function and the Fourier transform of the Gaussian function [7]. Figure 2 shows (a) the original image and (b) the enhanced image using Gabor Filter.



(a) Original Image (b) Gabor Enhancement

Figure 2. The result of applying Gabor enhancement technique

## REGION OF INTEREST EXTRACTION

Here our concentration was on the lung region as region of interest to simplify the representation of an object into something that is more meaningful and easier to analyze. It is important to separate regions of interest from other parts of the image to be account as white background to concentrate on object itself for partitioning into normal and abnormal parts. Lung regions segmentation from the background based on morphological operations as following diagram Figure 3.

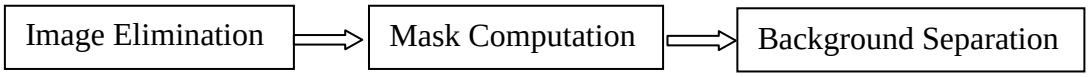


Figure 3. Region of interest extraction diagram

The following are the steps adopted for implementing lung region of interest segmentation from filtered images.

Step 1: Eliminate image that comes up as X by Y by 3 dimensions into X by Y.
Step 2: Image mask computation based on diffusion and erosion process.
Step 2-1: Contrast enhancement of eroded image.
Step 2-2: Find mask based on Otsu threshold.
Step 2-3: Remove small objects from binary image.
Step 3: Mask image erosion and holes filling for background separation figure 4.

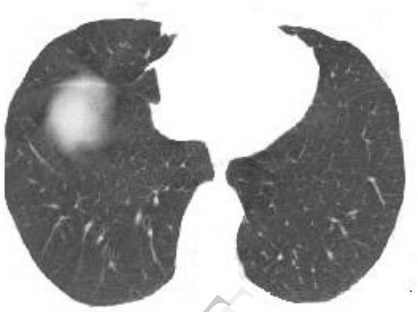

Figure4. Region of interest segmentation

## OBJECT SEGMENTATION



In general image segmentation is the process of dividing an image into multiple parts. This is typically used to identify objects or other relevant information in digital images. Our concentration was on lung nodules segmentation, global thresholding and morphological operations had been the core of this process [8, 9]. The segmented nodules are used for feature extraction as future step in the detection system. In this section we used extracted region of interest image to locate objects and boundaries in given image. Our proposed algorithm is based on the following steps:

Object Segmentation Algorithm:
Input

- ROI extracted image

Initialization:

- Adjust image intensity values.
- Image Filtration.

Processing

- Compute a global threshold level.
- Convert image to binary based on threshold level.
- Define structure elements.
- Erode binary image.
- Erode eroded image.
- Find perimeter of objects in eroded image.

Output

The segmented object within image.

Figure 5. shows the results of object segmentation algorithm.

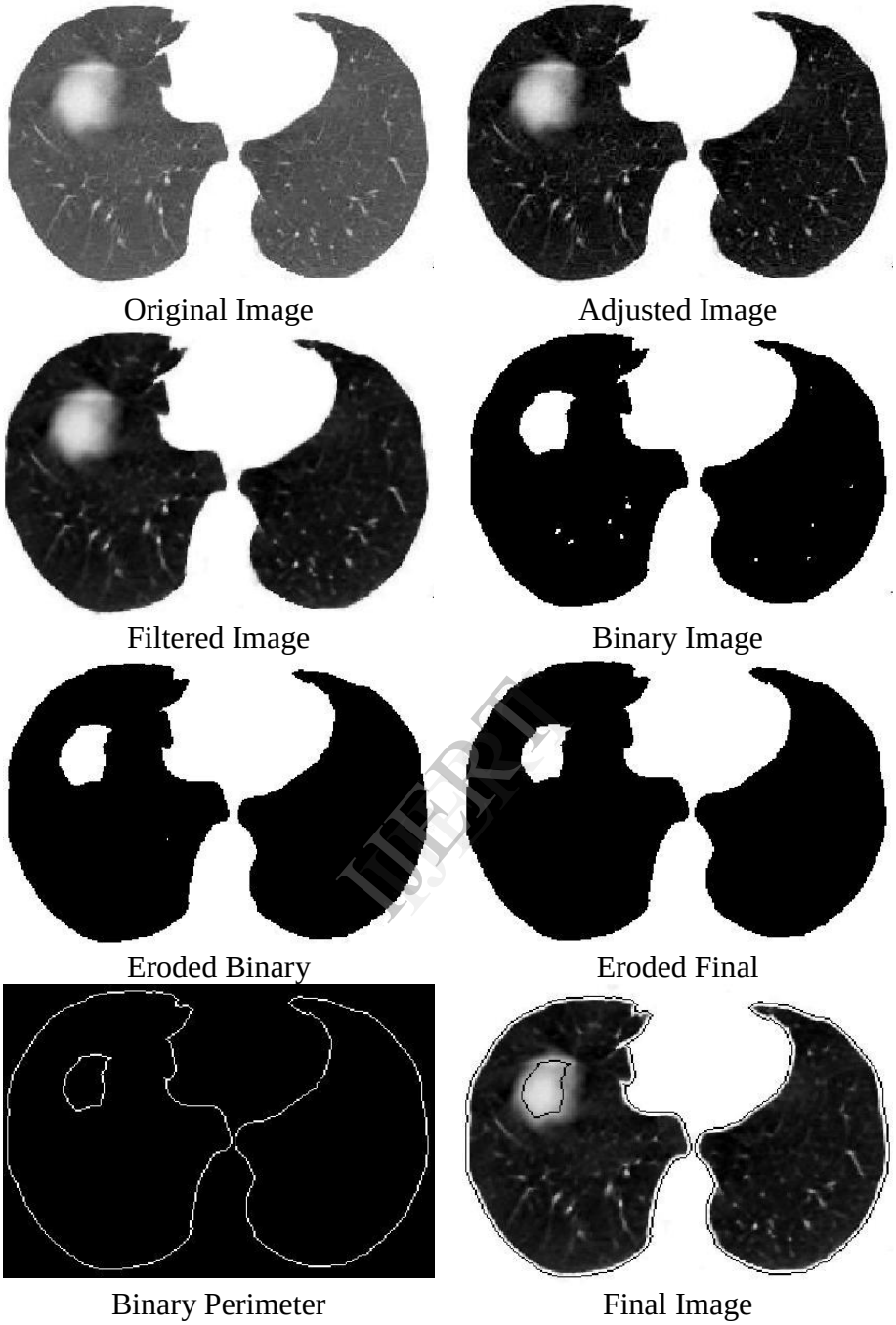


Figure 5. Object segmentation algorithm results

## CONCLUSIONS

According to the stage of discovery of the cancel cell in the lungs, lung cancer is the most dangerous and widespread cancer in the world, so early detection process of the disease plays a very important and essential role to avoid serious stages and distribution percentages.

The main idea of this work is to detect and segment lung nodule for the future classification as cancerous and non-cancerous cells. Thus the lung CT images were subjected to various

processing steps to get extracted features for classified systematic future usage. Our future work will be concentrated on identifying the effective features for fuzzy means classification.

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