ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare & Pharmascope Foundation Journal Home Page: www.pharmascope.org/ijrps

Lung cancer detection using Adaptive Bilateral Filter (ABF) techniques

Asuntha A*[1], Andy Srinivasan[2]

[1]Department of Electronics & Instrumentation Engg., SRM IST, Kancheepuram Dt., Chennai-Tamil Nadu, India
[2]Department of Electronics & Instrumentation Engg., Valliammai Engineering College, Kancheepuram Dt., Chennai-Tamil Nadu, India

Article History:

Received on: 15.03.2019
Revised on: 21.06.2019
Accepted on: 25.06.2019

Keywords:

Image processing, Adaptive Bilateral Filter(ABF), superpixel segmentation, SVM classifier and Particle Swarm Optimization(PSO)

ABSTRACT

Lung cancer plays a major role among the people who are affected with cancer. The major reason is the presence of nodule in a lung region. Early diagnosis of this nodule may decrease the severity also increase the life span of a patient. In this paper, a methodology is proposed to detect the lung nodule and nodule region using texture features. Various image processing techniques are used in this paper. CT images are taken as input over MRI because of its advantages over less exposure of radiation (Rivera *et al.*, 2015). The given input image is denoised by using adaptive bilateral filter and image contrast is improved by the histogram equalization technique. Superpixel segmentation is used for the segmentation process. A Simulation process has been done using MATLAB software.

*Corresponding Author

Name: Asuntha A
Phone: 9551925514
Email: asu.vero@gmail.com

ISSN: 0975-7538

DOI: https://doi.org/10.26452/ijrps.v10i3.1383

Production and Hosted by

Pharmascope.org

INTRODUCTION

Cancer has the highest mortality rate over the other causes of death. So far, people die due to lung cancer. So the death rate can be reduced if cancer has been diagnosed early with proper treatment. Cancer can be defined as the growth of unwanted and rapid growth of cells in a particular region if it is not diagnosed earlier; it may lead to death. Smoking, air pollution is the major cause for lung cancer. Cancer can classify into Non-small cell lung cancer and small cell lung cancer (Tartar *et al.*, 2013). Numerous ways to detect lung cancer; they are pattern recognition technique, by using artificial networks, by using image processing techniques. In this paper, we are using an image processing technique and algorithms to find the nodule lung region and a non-nodule lung region based on texture feature. The algorithms used are in terms of sensitivity and accuracy. The nodule present in the lung usually ranges from 5mm to 30mm in size. Nodule, which is above 30mm, will be considered as a cancerous region. The CT image is used as an input because it can form a 3D image of the chest, which provides higher resolution of nodules and tumours; also, the examination time will be very less. The given image goes under the preprocessing process, which includes denoising, image contrast enhancement, edge detection, superpixel segmentation, multi-level superpixel segmentation and further feature extraction will be done. Further steps will be explained in the next section.

MATERIALS AND METHODS

In this section, the methods used for the detection of lungs nodule and the features extraction of lung region to analyze the nodule and non-nodule of the lung has been explained briefly (Rivera *et al.*, 2015). The steps to detect lung nodule is given in Figure 1

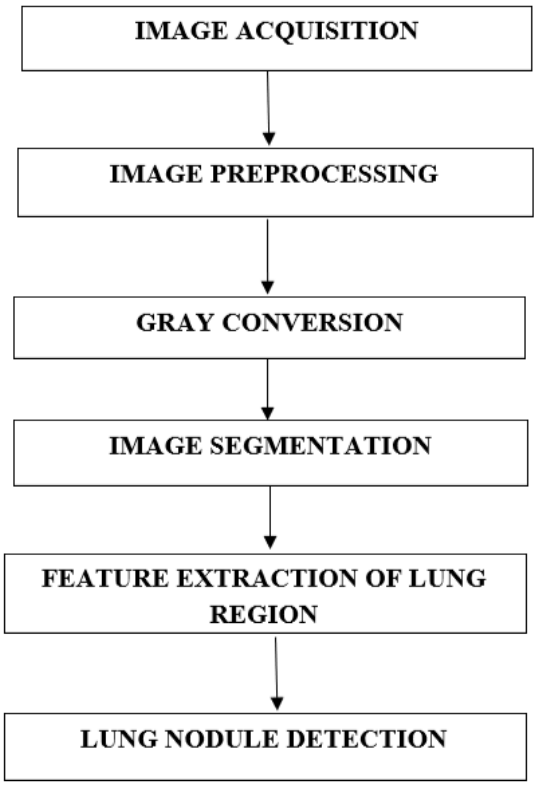

Figure 1: Block diagram of lungnodule detection

The data used for this paper includes 7 CT images, and the dimensional of the image is 512×512.

Image processing techniques:

Image Acquisition

CT images are most preferably used as input images because it has a high resolution over tumours and nodules. Lung images are collected from lung image database consortium image collection (LIDC). These images are in the form of DICOM later this can be converted into JPEG.

Image Preprocessing

This process involves denoising, image contrast enhancement, layer separation, grey conversion. The adaptive bilateral filter is used removing the noise in the input image because it has the ability to separate the noisy and non-noisy region and later the non-noisy region will be blurred, and filter techniques is applied to the only noisy region (Jing *et al.*, 2010). After that, the contrast of an image can be improved by applying histogram equalization technique; which smoothening the images and removes the blurriness. Since the image is formed by arranging pixels into rows and columns; so each pixel has an RGB value. So layer separation has been done in order to remove red and blue color and represent the image in green color to reduce complexity for the gray conversion.

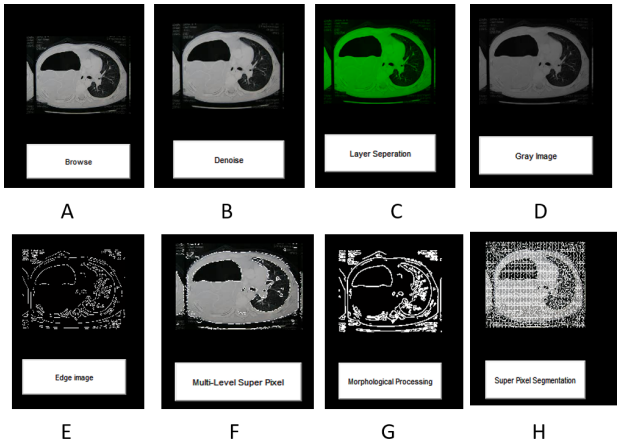

Figure 2: a)Browsed image, b)De noised using adaptive bilateral, c)Layer separation, d)Gray image, e)Edge detection, f)Multi level super pixel, g) Morphological processing, h)Super pixel segmentation.

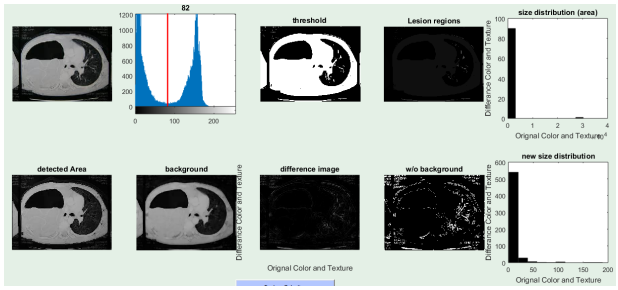

Figure 3: Feature extraction of a CT image

Gray Conversion

In this process, the colored image has been converted into grayscale images. Since grayscale images can be easily compared or processed than colored images because it has different RGB values.

Image Segmentation

Segmentation of an image is performed to separate the object and area of interest from an image in order to analyze the image properly. It may depend on several factors and the need of an application. For example, the pixels can be classified based on the anatomical region such as muscles, bones, blood vessels or based on the pathological region such as tissues, multiple sclerosis and cancer based on the

application. In this paper, superpixel segmentation is used for the segmentation process (Diciotti *et al.*, 2008). First image slicing algorithm is applied on a raw image; which extracts the lung region from the image with a certain degree of accuracy and sharpness.

For the better quality certain morphological process such as erosion, dilation removes the irrelevant details which may increase the difficulties to lung border extraction process. Proper analysis of an image can be done after the segmentation process since it can cut the boundaries and unwanted objects in a lung region. The output of segmentation will provide the set of segments that cover the entire image or a set of contours obtained from the image.

From the obtained output, there will be possibilities of a similar pixel in a given region in the context of properties like colour, intensity, textures etc. (Gori *et al.*, 2007). Also, the neighbourhood lying region may differ with the following characteristics.

Feature Extraction

Feature extraction of an image is an important stage which provides the final output by using various algorithms and techniques. Such techniques and algorithms can be used to detect and eliminate the undesirable portion or shape present in a lung region (Zhang *et al.*, 2013). Segmentation will be carried out first after that followed by feature extraction will be done. By using certain diagnoses rules, the cancer nodule in a lung region can be detected. Some of the features extracted in an image are followed by:

1. Size.
2. The shape of a nodule.
3. Image contrast.
4. Area of interest.
5. Calcification.

For a better analysis of an image, certain steps has to be followed. They are

1. To eliminate the false nodules present in a lung region.
2. To eliminate the nodule size less than the threshold value.
3. To remove the isolated pixels, consider being noise in an image.

Feature Classification

Followed by the feature extraction, feature classification will be done. In this paper, Particle Swarm Optimization(PSO)for optimization and Support Vector Machine(SVM) classifier is used for the classification process.

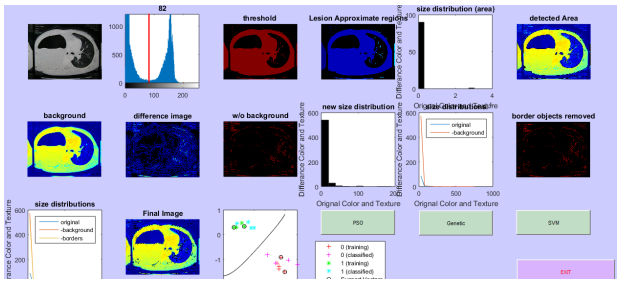

Figure 4: Feature selection of a CT image

1. **PSO Optimization**

PSO is also known as particle swarm optimization method which is used for multilevel threshold segmenting of an image. The threshold problem in an image can be solved by using the principle of PSO (Rivera *et al.*, 2015). PSO is a population-based optimization algorithm which is obtained after the simulation of social behavior of birds in a flock. This method looks for the optima by updating generations after initializing with a group of random particles. Every particle distance will be adjusted based on its personal position and also the distance from the best particle swarm throughout the search space. The closeness of the particle can be obtained by using a fitness function which relies on the optimization method. PSO can also be used to find the appropriate target of an image in accordance with a fitness function by finding the appropriate values of threshold.

2. **SVM classifier**

SVM is also known as a support vector machine; it is one of the classifier method used to analyze the data and recognize patterns for the classification purpose. This algorithm will be initiated by talking a set of input and predicts for each given input the specified class among the two choices available which makes it non-probabilistic binary linear classifier (Zhang *et al.*, 2013). For mapping the given data into a different space use kernel function such as polynomial, BF, quadratic, Multilayer perceptron (MLP). It can also be used for the classification of complex boundaries.

RESULTS AND DISCUSSION

In the first step, we got an image from LIDC and converted from DICOM to JPEG file, then for preprocess-

ing, we used an adaptive bilateral filter for denoising, image contrast enhancement, layer separation, and gray conversion. In the third stage, superpixel segmentation has used for segmentation, features like threshold and size distribution were taken for feature extraction, Particle Swarm Optimization is used for optimization technique. Finally, the cancerous and non-cancerous nodule were classified with the help of SVM classifier. From the result, SVM classifier has the highest accuracy while detecting the lung nodule.

CONCLUSION

In this paper, we have developed a proposed method for classifying the benign and malignant pulmonary nodules. The proposed method achieved better segmentation performance than that of the traditional segmentation model. The advantage of the proposed method was that it could automatically segment various types of pulmonary nodules by using Adaptive Bilateral Filter. In the future, we will further improve the classification performance of pulmonary nodules and optimize the proposed model.

REFERENCES

Diciotti, S., Picozzi, G., Falchini, M., *et al.* 2008. 3-d segmentation algorithm of small lung nodules in spiral ct images. IEEE Trans. Information Technology in Biomedicine, 12(1):7–19.

Gori, I., Fantacci, M. E., Martinez, A. P., Retico, A. 2007. *An automated system for lung nodule detection*.

Jing, Z., Bin, L., Lianfang, T. 2010. Lung nodule classification combining rule-basedd and svm. In Li, K., Tang, Z., Li, R., Nagar, A. K., Thamburaj, R., editors, *Bio-inspired computing: Theories and applications (bic-ta), 2010 ieee fifth inter- national conference on*, pages 1033–1036, Tasmania, Australia. IEEE.

Rivera, A. R., Castillo, J. R., Chae, O. 2015. Local directional texture pattern image descriptor. Pattern Recognition Letters, 51:94–100.

Tartar, A., Kilic, N., Akan, A. 2013. Classification of pulmonary nodules by using hybrid features.

Zhang, F., Song, Y., Cai, W., Zhou, Y., Shan, S., Feng, D. 2013. Context curves for classification of lung nodule images. In Souza, P., Engelke, U., Rahman, A., editors, *Digital image computing: Techniques and applications (dicta), 2013 international conference on*, pages 1–7, Hobart, Tasmania. IEEE.

