www.rspsciencehub.com Volume 03 Issue 03S March 2021

INTERNATIONAL RESEARCH JOURNAL ON ADVANCED SCIENCE HUB
e-ISSN : 2582 - 4376
Open Access
RSP SCIENCE HUB
(The Hub of Research Ideas)
Available online at www.rspsciencehub.com

Special Issue of Second International Conference on Advancements in Research and Development (ICARD 2021)

An Automatic Segmentation of Lung Structure Using Active Contour Model and Fuzzy Clustering Algorithm

Jalal deen K[1], Ramesh Kumar R[2], Vadivel M[3], Annal Sheeba Rani E[4]
[1]Asst Prof (S.G), Department of ECE,Solamalai College of Engineering, Madurai, Tamilnadu, India
[2]Asst Prof, Department of ECE, Solamalai College of Engineering, Madurai, Tamilnadu, India
[3]Asst Prof, Department of IT, Excel Engineering College, Nammakal, Tamilnadu, India
[4]Asst Prof, Department of IT, Excel Engineering College, Nammakal, Tamilnadu, India
drjalaldeen8@gmail.com[1]

Abstract

The aim of this paper was to develop an active contour model based on a region and a Fuzzy C-Means (FCM) technique for lung nodule segmentation. In the end, the mortality rate is increased by detection and assisted diagnosis of nodules at an earlier stage. Computed tomography (CT) is the most sought after among many imaging modalities because of its image sensitivity, high resolution and isotropic acquisition. The suggested technique focuses on CT image acquisition, lung parenchyma reconstruction and segmentation of lung nodules. Using selective binary and Gaussian filtering with a new signed pressure force function (SBGF-new SPF) and clustering methods for nodule segmentation, parenchyma reconstruction can be used. The benefits of the proposed approach in terms of reduced error rate and improved measure of similarity are demonstrated by comparative experiments.

Keywords: CT, FCM, SPF, SBGF, SVM, ANN.

1. Introduction

Picture segmentation is a significant and challenging problem and essentially an initial stage in image processing, along with high-level image detection and realization such as object recognition, robot vision, and medical imaging. The aim of image segmentation is to classify an image into a group of different regions with similar and homogeneous features, such as color, tone, intensity or intensity. Several segmentation approaches have been developed and it is possible to compare references [1-3] with comprehensive surveys. As indicated by reference [1], the image segmentation methods can be divided into four groups: thresholding, clustering, edge detection and region extraction. In the image segmentation process, a clustering approach will be considered.The methods of image segmentation can be divided into four types: thresholding, clustering, edge detection, and extraction of areas. In this work, a Fuzzy-based clustering technique for image segmentation will be considered carefully and contrasted with the graph cut approach.

2. Data Analysis

The information was gathered from 14 medical centers and consists of 247 CXRs. All these images are 2048 x 2048 pixels in resolution and have a color depth of 12 routines for grayscale images, as shown in Fig. 1. Out of 247 CXRs and 154 abnormal CXRs, it has 93 regular CXRs. A single pulmonary nodule categorized into one of five phases of subtlety, ranging from extremely subtle to transparent, is part of the irrelevant CXRs. However, the lung shapes are hardly impacted by the nodules in the JSRT images. Inside the lung boundary, either the nodules are fine or they are so ambiguous that there are minor lung shape effects.

The advantage of the full JSRTdatabase is to train a type model for a typical ordinary lung. The segmentation masks created by the van are added to do so.

Fig. 1. Examples of normal CXRs in the MC data

Their SCR (Segmentation in Chest Radiographs) dataset contains the lung field masks created by humans designed for each CXR in the JSRT database as indicated by reference [4]. In Fig. 2, an abnormal CXR organized in the framework of the right and the left lung from the JSRT database as indicated in the SCR data.

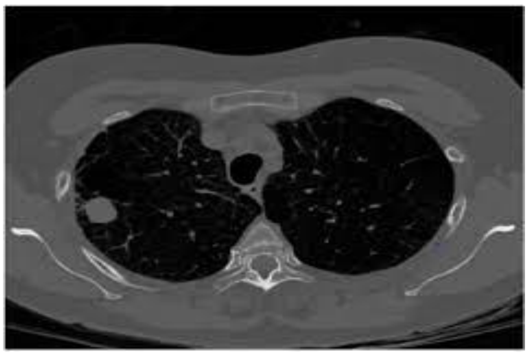

Fig. 2 An abnormal database

3. Methods and Segmentation

The executed lung segmentation methods and their comparison, extraction of features, and categorization are given in this section. Just in Fig. 3, with the multiple processing steps, the design of our system is expressed, while the following parts are addressed in more detail. Initially, this system segments the input lung CXR using a method of graph cut optimization combined with a lung model and compared with the Fuzzy based segmentation. It evaluates a set of features provided as input to a pre-trained binary classifier for the segmented lung model as indicated by reference [5,6]. Finally, the classifier output categorizes the CXR input by, for example, using decision rules and thresholds as a TB-positive event.

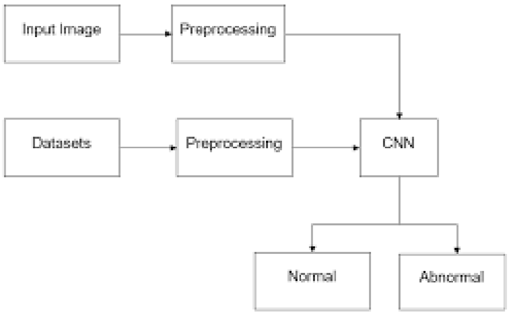

Fig.3 System overview

3.1 Graph cut Segmentation

Picture segmentation has a long way to go. Individuals can build reasonably impressive segmentation on an excessive collection of images by means of just a few basic grouping signals. A key meeting point is the use of the graph-based methodology behind this enhancement. For a Fig.4. image segmentation, the graph chart offers a decent, versatile design.It offers a suitable language to encode simple local segmentation indications and several efficient computational mechanisms from these simple local (pairwise) pixel similarities to obtain global segmentation. Methods for computational graph cutting can be very effective.

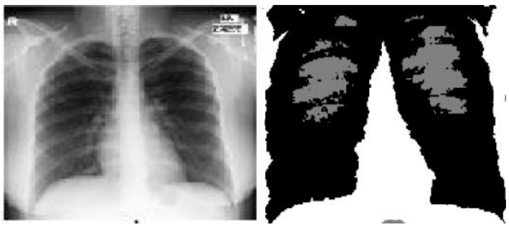

Fig.4 CXR and its calculated lung model.

Arithmetically we can trace the outcoming optimization problem as follows:

Let $f = \{f_1, f_2, \ldots, f_p, \ldots, f_N\}$ be a binary vector whose components correspond to foreground (lung region) and background label assignments to pixel $p \in P$, where P is the set of pixels in the CXR, and N is the number of pixels. According to our method, the optimal configuration of f is given by the minimization of the following objective function:

$$E(f) = E_d(f) + E_s(f) + E_m(f) \qquad (1)$$

where Ed, Es and Em represent the region, boundary, and lung model properties of the CXR, respectively. The boundary constraints between lung border pixels p and q are framed as follows:

$$E_s(f) = \sum_{(p,q)\in C} \exp\left(-(I_p - I_q)^2\right). \qquad (3)$$

This term utilizes the addition of pixel exponential intensity differences that characterize the cut. When the strength differences are maximized, the sum is negligible. A 2-D array that includes the likelihood that a pixel p is part of the lung field is the average lung model. In Fig.5.We define the requirement of the lung region with the aid of this model as follows:

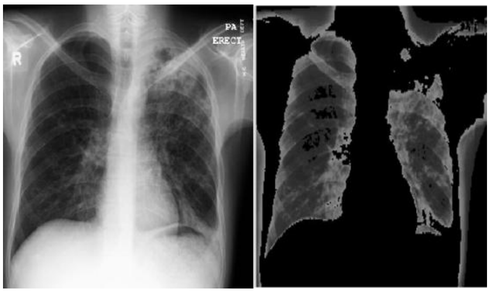

Fig.5 Result of Normal &Abnormal images

3.2 Fuzzy based Segmentation

Among the many fuzzy clustering methods, the Fuzzy C-means (FCM) algorithm is the largest standard and common method of image segmentation because it has good uncertainty characteristics and can retain significantly more information than hard segmentation approaches. In Fig.6. Fuzzy C-Means (FCM) is a clustering method that enables two or more clusters to rely on a single portion of data as indicated by reference [7,8].

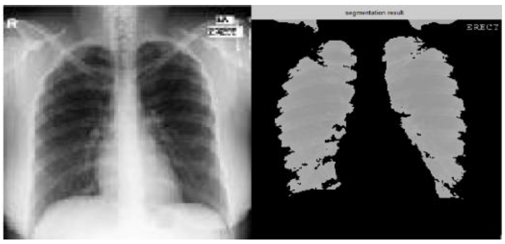

Fig.6 Fuzzy based Clustering method

The support vector networks, used for regression and classification analysis, are supervised learning models with related learning algorithms that diagnose patterns and scrutinize data. In Fig.7.a set of training examples are defined, each marked as pertaining to one of two categories, and an SVM training algorithm constructs a model that assigns new instances to one category or another and makes it a model.

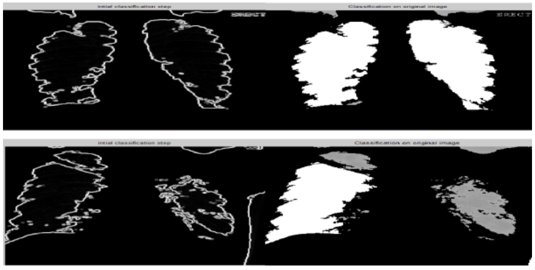

Fig. 7. Both normal & abnormal images

It is given in the original image as the input to the SVM classifier and the outcome of the classified image in the real ROI, which is shown in Fig. 7. The result of the Fuzzy-based segmentation followed by the feature descriptor is given in the original image as the input to the SVM classifier and the result of the classified image in the actual ROI, as shown in Fig. 8

It is considered as the initial image in the classification process that produces the perfect segmentation of input image as indicated by reference [8]. It may appeal to the screening techniques described in this study and yield the results of the classification (normal or abnormal) and their confidence values. Since we have coded many algorithms, such as segmentation, extraction of characteristics, and MATLAB code classification. Furthermore, we added a simple user interface that determines whether or not a given X-ray is regular.

The mis-classification rate for SVM is reduced by 8.9% in FCM segmentation mentioned in below Table no.1.

Table 1. Performance analysis of classifiers

Base SV	**accuracy**	**Resolution**
10	64.2%	53
20	73.6%	74
30	84.7%	85
40	95.8%	96

Conclusion

For automatic segmentation of lungs from CT scans, graph cut-based segmentation and fuzzy clustering-based segmentation are proposed in this paper. Since lung segmentation is a basic prerequisite for all lung parameters to be computed, the results of segmentation assist in the numerical analysis of lung parameters. In the FCM segmentation, the mis-classification rate for SVM is reduced by 8.9 per cent. This is determined after both the comparisons of results in the segmentation techniques (Graph cut based segmentation and fuzzy clustering-based segmentation). This leads to the comparison and inference of a better approach to segmentation in our work.

Credit author statement

Jalaldeen: Conceptualization Methodology, Analysis, Result.

Ramesh Kumar: Data collection, Writing- Original draft preparation.

Vadivel: Writing- Reviewing and Editing, Visualization.

Annal Sheeba Rani: Cited from References

References

Journals

[1]. Fu, S. K.Mui, J. K.: A Survey on Image Segmentation. Pattern Recognition, Vol. 13, 1981, pp. 3–16

[2]. Haralick, R. M.—Shapiro, L. G.: Image Segmentation Techniques. Comput. Vision Graphics Image Process., Vol. 29, 1985, pp. 100–132.

[3]. Pal, N.—Pal, S.: A Review on Image Segmentation Techniques. Pattern Recognition, Vol. 26, 1993, pp. 1277–1294.

[4]. Jalal Deen K, (2017)"Fuzzy-C-Means Clustering Based Segmentation and CNN-Classification for Accurate Segmentation of Lung Nodules" Asian Pacific Journal of Cancer Prevention, 2017, Vol. 18, no.7 pp.1869 – 1874.

[5]. S. Candemir, K. Palaniappan, and Y. Akgul, ―Multi-class regularization parameter learning for graph cut image segmentation, ‖ in Proc. Int. Symp. Biomed. Imag., 2013, pp. 1473–1476.

[6]. S. Jaeger, A. Karargyris, S. Antani, and G. Thoma, ―Detecting tuberculosis in radiographs using combined lung masks, ‖ in Proc. Int. Conf. IEEE Eng. Med. Biol. Soc., 2012, pp. 4978–4981.

[7]. C. Leung, Reexamining the role of radiography in tuberculosis case finding, ‖ Int. J. Tuberculosis Lung Disease, vol. 15, no. 10, pp. 1279–1279, 2011.

[8]. L. R. Folio, Chest Imaging: An Algorithmic Approach to Learning. New York: Springer, 2012.