International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 07 | July - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Segmentation of Lung Tumors by Using SVM Classifier with Fuzzy Clustering Algorithm

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Abstract— Tuberculosis is considered the main health threat in several parts of the world. This is the primary infectious disease causing this disease. When untreated and undiagnosed, there is a high mortalityrate in patients.Thismethodincludes an automatic method to recognize tubers. This approach requires automated tuberculosis identification techniques to reduce problematic illnesses. Extraction of the lung region is first performed using the Graph Cut segmentation system. We develop a collection of properties including textures, shapes, etc. in this area of the lung. You must use an SVM to identify X-rays as normal or abnormal. The systematic system proposed for analyzing TB segmentation provides better performance than the graph cut segmentation method.

***Index Terms*— ANN, Segmentation, fuzzy, graph cut, SVM.**

I. INTRODUCTION

Image segmentation is an important and challenging issue, essentially the first step in image analysis, including high-level interpretation of images and the realization of object recognition, robot vision, medical images, and more. The purpose of image segmentation is to divide an image into a series of separate areas with the same and homogeneous properties such as color, color tone, intensity, and texture. Several segmentation methods have been established and a thorough investigation can be linked to reference [1-3]. As shown in reference [1], image segmentation methods can be divided into four types: thresholding, clustering, edge detection, and region extraction. Clustering techniques are considered during the image segmentation process. Image segmentation methods can be divided into four types: thresholding,clustering, edge detection, and region extraction. This paper presents a fuzzy-based clustering technique for image segmentation. We carefully considered it and compared it to the graph cut approach.

II. IMAGE PROCESSING

Data are collected from 14 medical centers and consist of 247 CXRs. The size of all these images is 2048 x 2048 pixels, and the color depth of the grayscale image is 12 routines, as shown in Figure 1. Of the 247 CXRs, there are 93 normal CXRs and 154 abnormal CXRs. A subset of abnormal CXRs consist of a single lung nodule that falls into one of five subtle levels, from very subtle to obvious. However, in JSRT images, the shape of the lungs is largely unaffected by the nodules [4]. Nodules are fine or very vague within the boundaries of the lungs and therefore have a slight effect on the shape of the lungs.

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

The advantage of a complete JSRT database is that it trains a typical normal lung shape model. This uses the segmentation mask provided by van

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[5]. Their SCR (Chest X-ray segmentation) dataset contains artificial lung field masks developed for each CXR in the JSRT database. In Figure 2, an abnormal CXR organized in the context of the right and left lungs from the JSRT database, as shown in the SCR data.

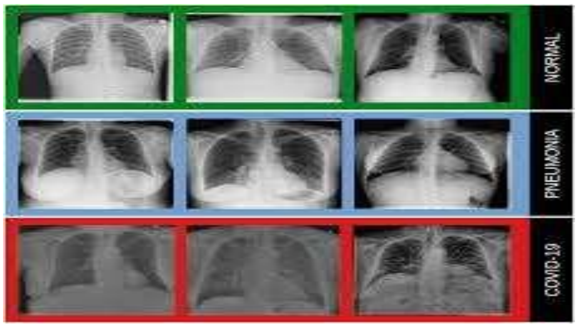

Fig. 2 Detection of lung cancer on CT image

III. METHODS AND MATERIALS

This section describes the lung segmentation methods performed and their comparisons, feature extractions, and classifications. Figure 3 represents the architecture of the system at various processing stages, which will be discussed in more detail in the next section. First, the system uses a graph cut optimization technique in combination with a lung model to segment the input lung CXR and compare it to fuzzy-based segmentation [6]. For a segmented lung model, evaluate a set of features given as inputs to a pre-trained binary classifier. Finally, the output of the classifier classifies the input CXR as

TB positive, for example using decision rules and thresholds.

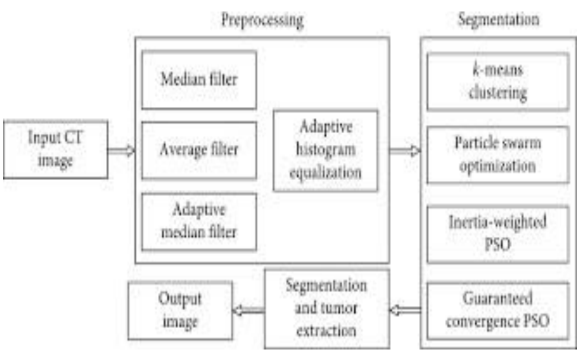

Fig.3 Lung cancer detection by using image segmentation

IV. METHODS AND SEGMENTATION

4.1 Graph cut Segmentation

Image segmentation has emerged a long way. By means of just a few simple grouping cues, individuals can able to create relatively impressive segmentation on an excessive set of images. In Fig.4 behind this improvement, a foremost meeting point is the usage of the graph-based technique. Graph chart delivers a fair, flexible construction for image segmentation. It delivers a suitable language to encode simple local segmentation cues, and a lot of powerful computational mechanisms to extract global segmentation from these simple local (pairwise) pixel similarities. Computationally graph cut methods can be very effective.

Fig.4 CXR and its calculated lung model.

Arithmetically we can trace the outcoming

optimization problem as follows: Let

$f = \{f_1, f_2, \dots, f_p, \dots, f_N\}$ 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:

$$E(f) = E^d(f) + E^s(f) + E^m(f) \qquad (1)$$

$$\sum_{(p,q)\in C} \qquad (3)$$

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:

This term uses the addition of the exponential intensity differences of pixels describing the cut. The average lung model is a 2-D array that includes the probabilities of a pixel p being part of the lung field. In Fig.5.with the help of this model, we describe the necessity of the lung region as follows:

Fig.5 both normal & abnormal images.

4.2 FUZZY BASED SEGMENTATION

Fuzzy C-means (FCM) algorithm is the greatest standard and popular method in image segmentation among the several fuzzy clustering methods, since it has vigorous characteristics of uncertainty and can maintain extremely more information than hard segmentation approaches [7]. In Fig.6.Fuzzy c-means (FCM) is a process of clustering, which permits single portion of data depend on two or more clusters.

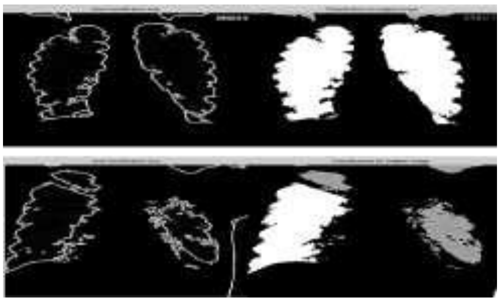

Fig.6 Fuzzy based Clustering method (normal image & abnormal image

The support vector networks are supervised learning models with related learning algorithms that diagnose patterns and scrutinize data, used for regression and classification analysis [8]. A group of training examples is specified, every marked as relating to one of two categories, an SVM training algorithm constructs a model that allocates new instances into one category or the other, and making it a non-probabilistic binary linear classifier.

Fig. 7. The initial and resultant Classified image of the predicted method (both normal & abnormal images)

It is given as the input to the SVM classifier and the outcome of the classified image in the real ROI in the original image, which is shown in Fig. 7. The result of Fuzzy based segmentation followed by the feature descriptor is given as the input to the SVM classifier and the outcome of the classified image in the real ROI in the original image, [9] which is shown in Fig. 8. It is considered as the initial image in the classification process that produces the perfect segmentation of input image.It can appeal the screening methods defined in this work and yield the classification results (normal or abnormal) and their confidence values. Because we coded several algorithms, such as segmentation, feature extraction, and classification in MATLAB code. We further added a straightforward user interface that specifies whether a given X-ray is normal or not. The mis-classification rate for SVM is reduced by 8.9% in FCM segmentation.

TABLE I
Performance analysis of classifiers

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

5. CONCLUSION

Graph cut based segmentation and fuzzy clustering-based segmentation is proposed in this paper for the automatic segmentation of lungs from the CT scans. As lung segmentation is a basic requirement to compute all parameters of lungs, the segmentation results help in the numerical analysis of the lung parameters. The mis-classification rate for SVM is reduced by 8.9% in the FCM segmentation. This is computed after both the performance comparisons in the segmentation techniques (Graph cut based segmentation and fuzzy clustering-based segmentation). This leads to compare and conclude the better segmentation approach in our work.

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