

A Review - Segmentation and Feature Extraction of Bio-Medical Image for the Detection of Lung - Cancer

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ABSTRACT

Lung cancer is the main reasons of deaths in the world. Early lung cancer identification of increase the possibility of survival among people. The 2- year survival rate for lung cancer patients increase from 18 to 40%. If the lung cancer is identified in time, its early stage detection increases the chance of better treatment. In this Computed

Tomography (CT) pictures are utilized which can be more proficient than X-ray. Subsequently, a lung cancer detection by using CT image and detect the sign of cancer. In this study, MATLAB software has been used. The procedures, first image pre-processing, image segmentation and then feature extraction by using SURF technique. to get more efficient results by using various segmentation techniques are performed.

1. Introduction

Lung Cancer is one of the most sophisticated diseases and if not treated in the early stages, causes even death. It majorly falls into two categories namely Non-Small-Cell-Lung-Cancer (NSCLC) and Small-Cell-Lung-Cancer (SCLC) [1]. NSCLC is the major cause of lung cancer occurrence with almost 80 to 85 percent of cases being estimated. Thirty percent of these tumors originated in cells that comprise of body's cavities inner layer along with surfaces. This category generally persists in the external part of the lungs [2]. The detection process of Lung Cancer constitutes of three steps, namely, Segmentation, Feature Extraction, and Classification. This proposal is mainly concentrated into the segmentation methods and classification mechanism. The segmented output is directly proportional to the detection rate of the proposed system.

2. Lung Cancer Segmentation and Its Techniques

Identifying the exact region where cancer has to be detected is termed as segmentation. The accurate lung nodule segmentation is important and critical. It plays a significant function inappropriate diagnosis along with treatment for lung cancer [3]. The accuracy of segmentation precisely influences many conditions, such as the classification of lung nodules, malignancy in CAD for feature extraction. Different segmentation techniques for lung nodules from images are described below.

2.1. Thresholding

Thresholding operation primarily transforms the grey scale picture to binary picture. A threshold value is selected as per the type of image considered for processing. Its selection is dependent upon the boundaries and the size of an image [4]. This process considers two image levels, one is higher than the threshold and other is lower than the threshold.

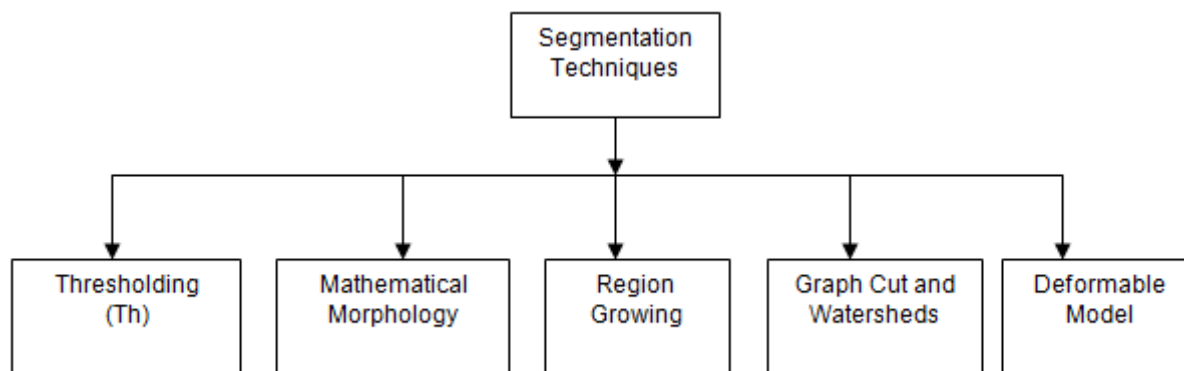


Figure 1 Different Segmentation Techniques

2.2. Mathematical Morphology (MM)

MM is a method which is utilized not only for the images but also for meshes and graphs. While working with MM, below are two things that should be considered [5]

- Image
- Structuring element

Structuring element is smaller as compared to an image; it can be according to the size, or can be bigger or rectangular in shape. It helps in image sliding and for the transformation process.

2.3. Region Growing (RG)

Region growing is also known as a pixel-based image segmentation procedure. It comprises preliminary seed points [6]. The regions are then developed from these seed points to adjoining points on certain criteria. This is a repetitive development for determining the adjacent seed point's pixels [7].

2.4. Graph Cut and Watersheds

Another prominent image segmentation technique is Graph Cut and Watersheds. Watersheds are utilized to primarily segment every nodule [8]. Model-based shape assessment is utilized to resolve anatomical attributes of all nodule types.

2.5. Deformable Model

It is a geometric object that can change its shape over time. Its deformation behaviour is directed by Variation Principles (VPs) and Partial Differential Equations (PDEs). It consists of deformable surfaces, deformable curves, and the deformable solids.[9]

3. Feature Extraction Techniques

The aim of feature extraction is to symbolize the authentic data in an alternate manner by computing some of the features or the properties that can differentiate one input pattern from other [10]. The features being extracted should offer the input characteristics to the classifier with the consideration of applicable image properties to a feature space. In this section, some of the feature extraction techniques are defined:

3.1. Principle Component Analysis (PCA)

PCA is considered as a statistical technique commonly utilized in statistics, signal processing and image processing for data dimension reduction for the data de-correlation. PCA is a technique with a sophisticated underlying mathematical principle for transforming different correlated variables in small variables known as principal components [10]. The aim of PCA is the reduction of observed variables (large dimensionality data space) to independent variables (small intrinsic dimensionality feature space) required to define the data economically. It represents the data in a novel coordinate system with the basis vectors that follows greatest variance modes in data. So, computation of novel basis vector is done for a particular data set [11].

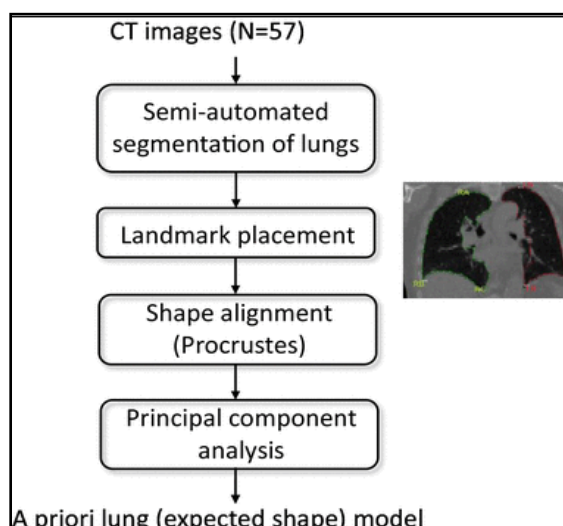


Figure 2 Principal Component Analysis

3.2. SIFT (Scale-Invariant Feature Transform)

For some object, their is a number of features and interesting points on the object could be extracted for providing the feature description of the object. There are numerous factors to consider when extracting these features. SIFT image features give features for a set of objects that are unaffected by many of the complexities encountered in other methods, such as object scaling and rotation [12]. While allowing objects to be identified in huge images, SIFT image features also permit for the identification of objects in numerous images of the same location taken from dissimilar locations within the environment [13].

- i. Scale-Space Extrema Detection
- ii. Key-point Localisation
- iii. Orientation Assignment
- iv. Key-point Descriptor

3.3. SURF (Speed Up Robust Features)

SURF is an originally restricted feature detector with the descriptor. It can be utilized for tasks such as object identification, classification or 3D reconstruction. It is partially stimulated by the SIFT descriptor. SURF descriptors have been utilized to a position as well as to identify the items [14]. SURF algorithm mainly works in three steps; feature extraction, feature description and feature matching [15].

- **Feature extraction:** In this step, the interesting points are detected automatically. The similar features are always extracted with respect to the viewpoint.
- **Feature description:** Every interest point consists of a distinctive description, which does not depend upon the feature rotation.
- **Feature matching:** The input image is matched to determine the genuine object.

4. Literature Survey

Palani and Venkatalakshmi [1] have proposed predictive modeling by utilizing fuzzy cluster related augmentation with a classification for anticipating the lung cancer ailment through persistent monitoring. Fuzzy clustering technique is utilized for effectual image segmentation. Furthermore, Fuzzy C-Means Clustering algorithm is utilized to classify the transitional section characteristics from the characteristic of lung cancer image. In this work, the Otsuthres holding technique is utilized for separating the transition area from lung cancer representation. Furthermore, the right edge picture along with the morphological thinning procedure is utilized for increasing segmentation presentation. An innovative incremental classification algorithm that integrates the current Association Rule Mining (ARM), the standard Decision Tree (DT) to temporal features along with the CNN is utilized. The operations were performed by utilizing the standard images that are possessed from the database along with the current health data being collected from a patient from IoT equipment. The outcome has demonstrated that the projected prediction model has attained the enhanced accurateness.

Lakshmanprabu [2] have presented OODN (Optimal Deep Neural Network) by feature reduction that has shown better classification in lung CT images as contrasted to other classification methods. The automatic lung cancer

classification method has reduced the manual labeling time and shuns away the user's mistakes. As per the machine learning methods, the researchers has achieved better performance in terms of accuracy and precision for recognizing the normal as well as abnormal lung images. As per the outcome being achieved, the research came out to be efficient for the lung images classification as per specificity, accuracy, and sensitivity with 94.56%, 96.2%, and 94.2% correspondingly. The level of accuracy has shown that the research is capable to achieve better results for cancer affected recognizing performance in CT images.

Nithila and Kumar [3] have developed a model of region-based active contouring. Variation level set function has been used for lung segmentation. Eventually, the parenchyma segmentation is significant for exact lung diseases diagnosis. From all images modalities, CT (Computed Tomography) is an establishment of the application of image analysis. The research has proposed an influential method termed as SBF-new SPF (Selective Binary and Gaussian filtering-new Signed Pressure Force) function for CT lung images segmentation.

The procedure has detected the external lung boundary and efficiently halts the contour at the blurry boundaries. The algorithm being proposed is being contrasted four varied active contour models. The experiments done for the experiments have shown the proposed method pros by means of accuracy and computation time.

Bhatia, S. Sinha [4] showed a strategy to detect lung cancer from CT scan using deep residual learning. The researchers have described a pipeline of pre-processing methods to underline lung cancerous regions and take the features using UNet and ResNet models. The feature set is fetched to many classifiers, viz. XGBoost and Random Forest, and the individual predictions are ensemble for predicting the possibility of a CT scan to be cancerous. 84% of accuracy is achieved in LIDC-IRDI than conventional methods.

5. Proposed Method

The proposed architecture is described in the following steps

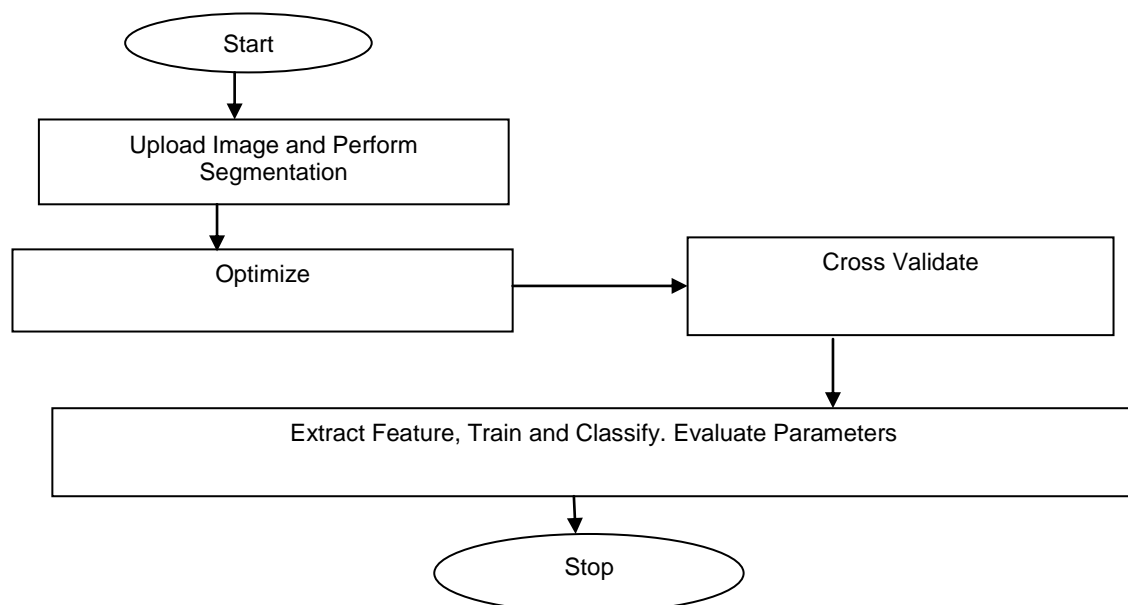


Figure 3 Proposed Workflow

- Upload Image
- Apply Segmentation
- Improve Segmented part using Hybrid Optimization
- Cross Validate
- Extract Features
- Train
- Classify and Evaluate Parameters.

6. Conclusion

This Review paper work deliberates the Lung cancer preamble. Initially, a preface of lung cancer has been given that also has mentioned the aim of research work. As this research deals with the lung cancer segmentation, so, after the introduction part, lung cancer segmentation with its techniques is explained. Subsequently, the feature extraction and classification algorithms are discussed that helps to identify the cancerous image.

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