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Lung Nodule Detection In Ct Images Using Acm Based Segmentation Method

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Abstract

A digital CT (Computed Tomography) image is used for segmentation of the lung region using Active Contour Model. By using active contour model, the lung boundaries are extracted with the gradient values. For the analysis of texture features in medical images, GLCM is the best one to find the spatial relationship of image and useful in calculating the grey level values. Using this values, feature sets are extracted. Support Vector Machine (SVM) perform stage classification and lung nodule detection. It also used to classify most difficult data points..

Keywords: ACM, GLCM, CAD, Lung segmentation.

1. Introduction

In all over the world, the most serious global health problem in human is cancer. In that, Lung cancer plays a most serious type of cancer causes of death in the world due to the malignant lung nodule. The survival rate of the people can be increased by the with the help of successful treatment of lung cancer by the lung nodule detection at early stages. Lung cancer can be inspected with the help of Computed Tomography images. To overcome this problem various lung nodule detection methods were in existence. Though many methods are in existence, the accuracy and sensitivity are the main factors that will show efficiency of a method. By using the CT images, it is very difficult to detect the nodule in lungs. Edge detection is used for the effective detection of countor in lung region Instead of segmentation to separate study region, Computer Aided Diagnosis (CAD) will transform it from spatial domain to transformed domain.

2.Literature Review

The binarization technique used to convert binary image and the features are extracted to train the neural network. This method very helpful for the differentiation of the cancerous and non-cancerous images with the efficiency of 95%.[1]

They proposed fast segmentation method and Random Forest[RF] classifier [2] method to segment and classify the images .To reduce false detective nodules , RF classifier is used compared to SVM classifier and acquire more area under the curve.

Along with region based active contour model, machine learning is integrated in image processing and the integration of the KNN and SVM with Chan-Vese method yields better efficiency and very less sensitive to parameter variations [3].

In this paper “Hierarchical Lung field segmentation with joint shape appearance sparse learning” [5] they proposed a joint shape and appearance sparse learning method. This method yields a accurate results for the image

segmentation region. The proposed local shape and appearance model provides better accuracy than conventional method.

For image pre-processing, they used median filter and Otsu thresholding techniques for image segmentation. GLCM used for feature extraction and ANN classifier used for the classification of stages [6].

technology to give the alert to the friends, relatives or parents in the form of message after the accident [4].

G. Suriya Praba Devi et al. developed an application which uses the GPS to locate the location and send the alert in the form of notification after the accident. [5].

3.Nodule Detection Stages

The CAD techniques using active contour model and support vector machine for lung nodule detection is shown in figure 1.

The first step is the image acquisition, which is the one to capture the images for the analysing. After the image capturing, image segmentation has to done using ROI technique. Image segmentation is the process of dividing the images into multiple groups. GLCM is used to extract the characteristics features of the images. The next step is the image classification. Here SVM model is used to classify the images.

The texture analysis plays an important role in image processing and its gives the content of the image i.e., spatial arrangement of intensities or colour of the selected region of the image. The gradient formulation with deformable contour is used to segment the lung images using active contour model

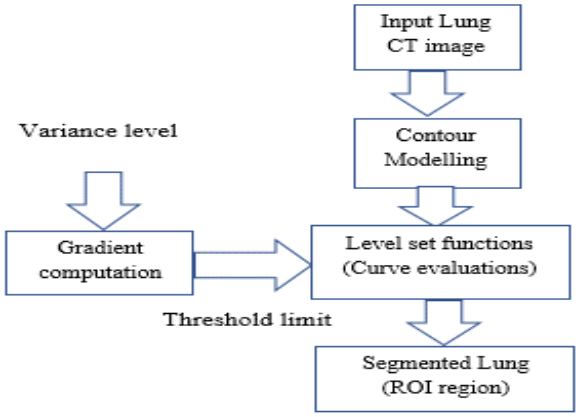

Fig 1. Proposed classification model

4.Dwt Transform

Discrete Wavelet Transform (DWT) is a signal processing tool based on sub-band coding. It is a fast computation method and is easy to implement. In DWT, the signals are decomposed into two sets. LPF are used to do Scaling function and HPF are used to perform Wavelet function.

Initially, it is used to decompose discrete time signals, later it is used in sub band coding and speech processing. For multiresolution in images, many improvements were made in these coding schemes. They are using the filter banks with the DWT.

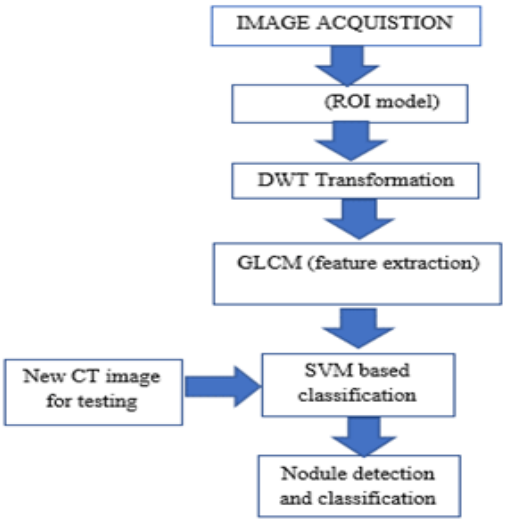

Fig 2. Block diagram of Active Contour Model

In CAD systems, texture features and geometrical feature are not sufficient to classify the images. So that, DWT is used to separate the texture features and geometrical features which is used to extract the feature set of particular region and then used to analyse. The GLCM features are extracted by a 2 level DWT transform from all decomposition band with sufficient Euclidean distance. In the case of images, the DWT is performed first row by row and then column by column. Different frequency components are evaluated from the wavelet coefficients. As a result, four sub images are generated from the given input image.

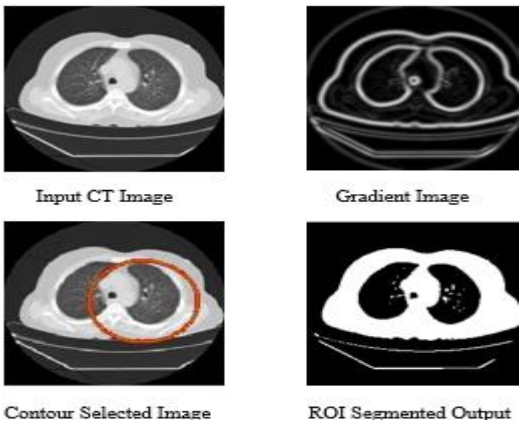

Fig 3. Image for Processing

5.Gray Level Co-Ocurrence Matrix

In order to identify the object or specific region of the image, texture analysis plays an important role. The GLCM has been used extract the characteristics of the image and formulated to obtain the statistical texture features from the GLCM. In the texture analysis, statistical features are extracted by calculating how the statistical distribution of intensities at specified position of the image. The texture feature uses the content of GLCM to give the measure of variation of intensity at the specific point. A GLCM is a matrix representation of the image with square dimension, where the number of rows and columns is equal to the number of Gray levels in the image.

The GLCM texture feature are Probability, variance Energy, Entropy, Contrast, Dissimilarity, homogeneity, Correlation, Auto correlation, Shade, and Prominence.

Given image consists of pixels, each with an intensity i.e, a specific gray level. GLCM texture finds a relationship between the reference and neighbouring pixels at a time. It explains the angular spatial relationship and distance over an image sub region of specific size. The GLCM provides a best method to enhance the image features and to define an image, tabulation of frequency of various combinations of brightness values which occur inside an image.

6.Feature Extraction

The Feature extraction is another important step in image processing after the segmentation process. It is used to extracting the most useful information from the large set of data pixels with better and accurate results. Feature extraction may be color, texture and shape feature. In this method, feature set will consist of various shapes and intensity value as a feature vector. The redundant data can be checked using the feature selection process that leads to a finite classification process. For the process of GLCM feature extraction, Gray-level pixel orientations can be considered. In this paper, both geometric features and texture features are extracted. For the classification of extracted image, SVM classifier is used.

7. Result And Analysis

A several experiments are conducted for the detection of lung nodule and classification of stages. To detect the nodule, we used the trained samples of various CT images with the help of DWT and SVM classifier. The trained sample will act as a input to the system. After that, segmentation of the input image has to done to extract the features of image, using GLCM.

To classify the input image, SVM classifier is used with various aspects of CT images with different size, shape and texture features. After image enhancement, gradient information present at the boundaries are found very clearly using active contour model.

Source Code Algorithm

Step 1: Input the test image to the system.

Step 2: the ACM can be used to segmenting the lung region from digital CT images.

Step 3: The image is used to isolate the geometrical information and texture feature which generates most appropriate feature set of selected region.

Step 4: Extraction of features from the input CT images and the training images.

Step 5: Classify the training image set and validation set from the image folders using SVM classification.

Step 6: After Classification, display the stages of the CT image.

In above figure represents by using discrete wavelet transform we can show as picture quality as the band1, band2, band3, band4 classification

Fig.4 Gradient CT image

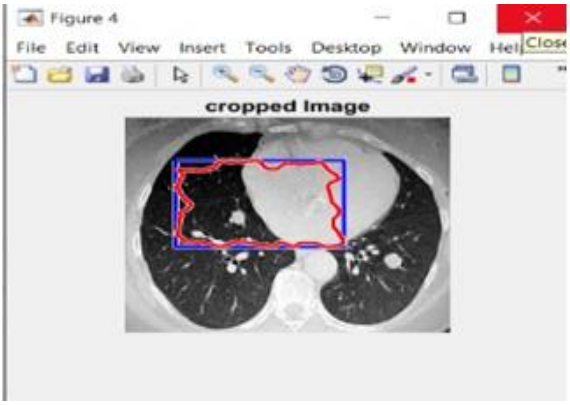

Fig.5. Contour selected images

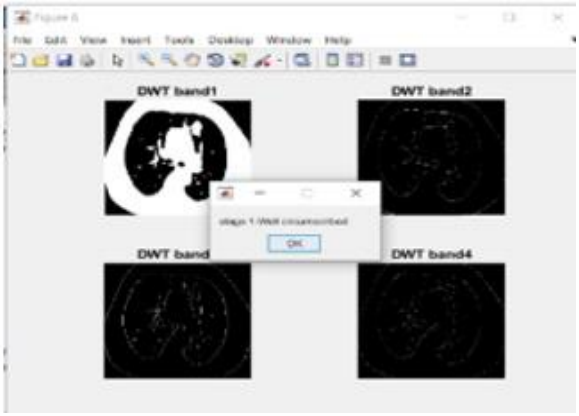

Fig.6 Output classified as abnormal Stage 1- well circumscribed image

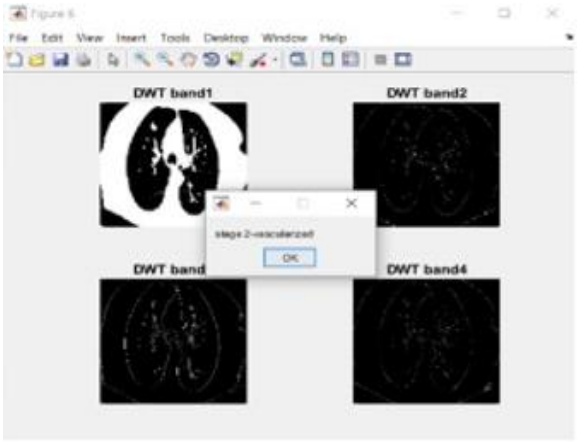

Fig.7 Output classified as abnormal Stage 2-

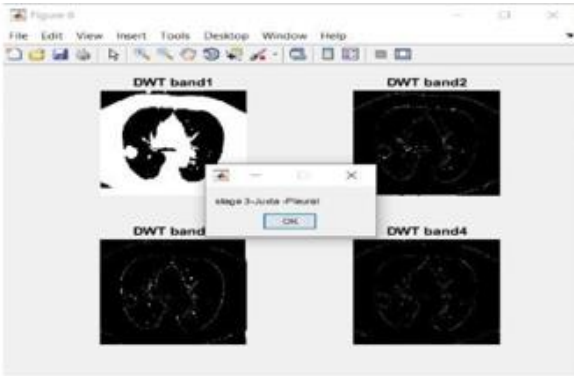

Fig.8 Output classified as abnormal Stage 3-Juxta-pleural image.

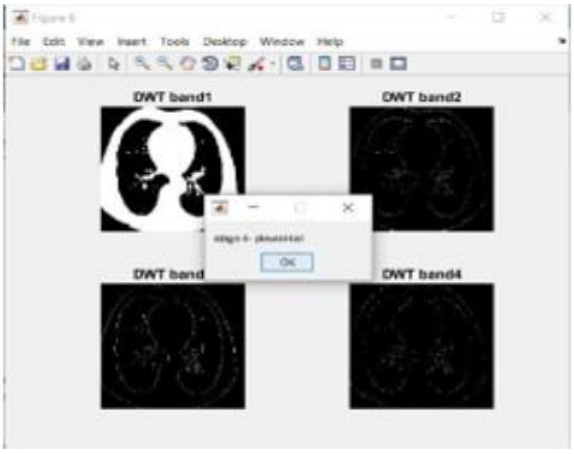

Fig.9 Output classified as abnormal Stage 4- pleural tile image

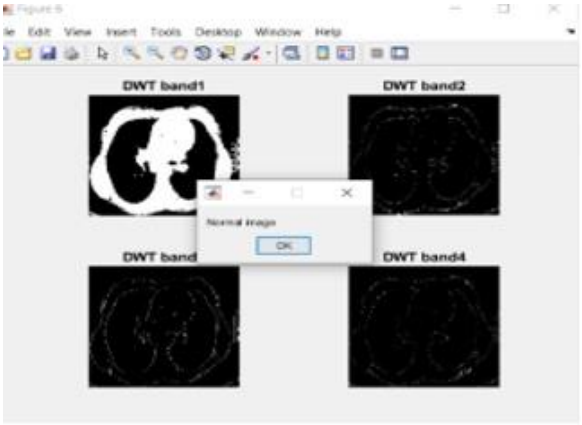

Fig.10: Output classified as normal image

8.Conclusion

In this paper, the ACM can be used to segmenting the lung region from digital CT images with the analysis of a CAD. By using GLCM we can extract the features using trained images. Generation of the Histogram of code words for all the training images in the image sets and extraction of the descriptors, then classify the images using the SVM classifier The texture features are extracted and it provides good accuracy.

In the future the methodology proposed will be tested using different classifiers such as neural networks, random forest or decision trees and with other transforms such as contour lets, edgeless and band lets. In future, there will be a chance to implement the work by just scanning the CT images with the mobile camera to detect the image and to estimate the nodule and of course to display the stages of lung by porting the trained model to mobile devices for real-time recognition purpose as implemented in a Mobile Application.

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