Abstract - Worldwide cancer is the fifth reason for death therefore detection and treatment of cancer having great significance because of wide spread episodes of diseases, reoccurrence after treatment and high death rate. There are different types of cancer in which lung cancer is at third position for death factor. Particularly lung cancer is started from lung and further growing if it is not diagnosed early. The cancer which is started from some other organ and travels to lung is not treated as liver cancer. Lung cancer is consisting of the malignant hepatic growths called cells over lung or inside lung. Hence early detection of liver cancer is challenging task in practical radiology. There are number of computer aided diagnostic (CAD) techniques proposed based on different image processing approaches for the lung cancer cell detection. The current approach for the lung cancer detection has been described in this research with the use of CT lung images along with the method of replaced log Gabor filter for the improvement of image, then image segmentation is performed by using region growing algorithm, the features like texture and gradient are extracted using GLCM and image gradient techniques. Based on the extracted features the detection of lung cancer is performed. Also the image pre-processing method is used to improve the accuracy performance of detection.

Keywords - Cancer Detection, CT images, Features Extraction, Log Gabor Filter, Lung Cancer, Lung Cell

I. INTRODUCTION

Now days, Cancer becoming the major threat for human being health and its number of patients increasing word wide due to the global warming, even if there are new therapies and treatments proposed by research doctors, but level of cancer defines the ability of its cure. Peoples are suffering from the various kinds of cancers [female & male]. In this paper we are focusing on lung cancer in human, rest all cancers are out of scope of this paper. Large number of human population is affected by the lung cancer. For the cause of the lung cancer there are various kinds of reasons like the X-Ray. For human’s, lung cancer is most common cancer, and it has been increasing since from last decade [1]. The early detection of lung cancer helps to completely cure it through the treatment. Through the self exam early detection has been done which is evolves in every month by women. This process is refereed as lung cancer early detection. However currently many hospitals and doctors uses the mammography test and resulted as effective technique for lung cancer early detection [2].

The aim of this test is to perform early detection of lung cancer using characteristic masses detection as well as micro calcifications as these characteristics are considered as most important factor of lung cancer [3]. Mammography test is performed by undressing the patient higher area ahead of X-ray machine. Additional each respiratory organ is compressed among 2 plates so as capture 2 photos of every lung with the use of the X-ray pulse. With the exception of the mammography test, there has been some additional strategies used for early lung cancer detection like pc power-assisted detection (CAD), blood tests, clinical lung test etc. Recently use of CAD based mostly detection techniques use is increasing within which image process ideas has been used on input photos from X-ray for automatic detection of lung cancer with its level. This sort of approach saves many time and efforts needed from the doctors. Image process is that the physical technique that is applied to convert the lung image signal into the physical image [4].
The image signal is additionally referred to as digital image signal, and output of this method is either physical image or its connected characteristics. Lung cancer detection is wide range of research in which different researchers preparing their research articles and proposing the new techniques and solutions for lung cancer detection with practical evaluation using the image processing concepts. CAD based techniques are composed of several steps to detect the early detection of lung cancers such as image acquisition, image preprocessing, image segmentation, feature extraction and finally detection using classifiers [5].

In this paper, we are presenting the novel approach of detecting the lung cells using complete steps of image processing. For segmentation we are introducing the new region growing method which is efficient and widely used as compared to other techniques of image segmentation. Image acquisition is done by taking input medical images of lung from X-ray machines such as CT. In our case we are using the publically available research CT dataset images. Next stage is preprocessing input image with the use of conversion after image acquisition has been done, filtering & resizing [6]. For making image smoother for the process of segmentation & removing the noises this operation has been done. After the pre-processing we are using the modified Log-Gabor fitter method for image quality enhancement. This paper is focusing on efficient and robust lung cells detection for lung cancer images. Image segmentation is nothing however extracting totally different components of digital image. Main aim of image segmentation is to alter the illustration of original image to a different image that is appropriate for any image analysis. several image process which is basis on the applications uses the image segmentation as core conception for analysis [7]. The performance of image process applications is depends on correct image segmentation strategies additionally. There are several alternative image segmentation ways conferred up to now by various researchers like morphological operations, binarization, threshold primarily based, histogram primarily based, region growing etc.

In this paper we introduced segmentation method which is based on existing growing segmentation technique. As image segmentation allows locating the objects and their boundaries in original image, the objective is to locate the lung cells area more accurately. In section II, the literature review study of different methods presented. Algorithm & design has been presented for proposed system In section III. In section IV, the current simulation results, performance metrics are discussed. Finally the conclusion and future work presented in section V.

II. RELATED WORKS

In this section, we are discussing the cancer detection techniques with different set of objectives by authors.

In [1], author presented FCM as one of the most applicable fuzzy clustering algorithms. Nevertheless, this paper mentions two limitations with the methods: a predefined number of clusters which have to be given in advance and the FCM property which can be get stuck in sub-optimal solutions.

In [2], author attempted to evaluate the diagnostic power of a fuzzy classifier and a marker panel for the detection of lung cancers in comparison to asbestosis patients at high-risk of developing lung cancer. After all the negative predictive value calculated to 94.8% & positive value has been 77.7%. Conclusion: With the fuzzy classifier and a marker panel, a reliable diagnostic tool for the detection of lung cancers in a high risk population is available.

In [3], author proposed a genetics-based machine learning approach that performs feature extraction on data from a lab to help increase the classification performance of an existing classifier. The classifier was built using the data from a different laboratory which uses the same protocols, while learning about the shape of the fractures between data that motivate the bad behaviors.

In [4], author presented the study which was compared the diagnostic performances of artificial neural networks and LR (multivariable logistic regression) analyses for differentiating between type of nodules (malignant and benign) in lung on CT scan images. For this purpose, morphologic features such as size, margins, contour, internal characteristics on images and the
patient’s sex, age and history of bloody sputum were considered. At the end, ANNs outperformed LR models in both clinical and discrimination usefulness.

In [5], author presented the analysis of medical image with artificial neural networks are presented. These techniques are illustrating: (1) how a known NN (neural networks) with fixed structure and training procedure could be applied to resolve the problem of a medical imaging; (2) how medical images could be processing and analyzing by using NN (3) how NN could be expanded rather to resolve this problems. At the end, a comparing between many neural network applications is done.

In [6], author introduced the two segmentation methods, FCM (Fuzzy C-Mean) and HNN (Hopfield Neural Network) clustering algorithm. These two methods are designed to classify the image of X pixels among Y classes. The results showed that the HNN segmentation results are more reliable than FCM clustering.

In [7], they presented the study on importance of detection of lung cells using the different steps such as Image Enhancement stage, Image Segmentation stage and Features Extraction stage etc.

In [8], author proposed the new toboggan based growing automatic segmentation approach (TBGA). This method is composed of TBGA for Lung cancer image segmentation.

In [9], they presented the use of image segmentation in lesion segmentation which is needed for monitoring and quantifying lesion. It had also illustrated the k-means clustering method which is an iterative technique that is used to partition an image into clusters in which there is choice of k clusters along with the types of clustering that is hierarchical clustering and partitioned clustering. It has also given the description over the region growing segmentation which is partitioning of an image into homogeneous connected pixels. Each pixel in the region is similar due to some property such as color and texture.

In [10], they proposed an image clustering method called fuzzy C-means with edge and local information (FELICM), which decreases the edge degradation by adding the weights of pixels within local neighbour windows. They had used the canny edge detection for edge extraction, adaptive threshold values. It had been shown that the proposed method could be directly applied without using the filters. This approach has delivered the better results with respect to fuzzy c means clustering method and mean shift approach. The experiments show that the proposed FELICM method is insensitive to the isolated regions and more accurate edges than FLICM.

In [11], they proposed an overall search over the topic clustering based color image segmentation and novel approaches to FCM algorithm. This paper described two techniques namely K-means clustering and fuzzy c-means (FCM) clustering for better segmentation results. The benefits of Spatial Fuzzy C-means (SFMC) which overcomes the limitation of conventional FCM towards noisy image have been discussed. Thresholding by Fuzzy C-means (THFCM) approach solves the problem of existing method to determine a threshold for excellent segmentation.

In [12], they proposed analysis of color images using cluster based segmentation techniques. It has discussed the various segmentation techniques like thresholding, edge-based detection, region based detection and clustering. The main illustration is based upon the color image segmentation using k-means, fuzzy c-means and clustering and corresponding results have been compared.

III. METHODOLOGY

In this paper, we are presenting the main approach and algorithms for efficient lung cancer cell detection using the modified Log-Gabor filtering technique, region growing segmentation method and GLCM feature extraction technique. In this section, we are presenting the algorithms and architecture of proposed approach. Figure 1 is showing the complete architecture diagram of proposed method from input to output steps.
Based on above diagram, below are different algorithms involved in our process. For image preprocessing proposed algorithm using combination of different image quality improving filters and binarization. The purpose of this algorithm is to get healthy image for performing next methods and get accurate results of lung cancer detection

**Step 1: Image Acquisition**
1. Photos of Lungs are generated through the X-machines.
2. Photos of Lungs are then electronically converted into image format to further process.

**Step 2: Preprocessing**

**Algorithm 1: Preprocessing Algorithm**
1. RGB to Gray Conversion
2. Resize Image to 512 * 512 size.
3. Apply the median filtering to noise removal
4. Return the pre-processed image

**Step 3: Image Enhancement**

**Algorithm 2: Modified Log Gabor Filter**
1. Input pre-processed image
2. Apply the modified Log Gabor filter.
3. Log Radial Gaussian
4. Log Angular Gaussian
5. Log Gabor filtering
6. Return enhanced image

**Step 4: Image Segmentation**

**Algorithm 3: Region Growing Method**
1. Input enhanced image
2. Perform gradient extraction
3. Perform gradient values combining using the below equation to get gradient vector Gval.
   \[ Gval = \frac{1}{1+(OutX+OutY)} \]
4. Gval is in radians; hence it is converted to values of degrees in order get orientation information of image pixels.
5. Input image is divided into number of grids GRi.
6. Setting the threshold values for intensity and orientation in variables Ti and To respectively.
7. For every GRi do
8. Histogram Hi computation of each pixel Pj over grid GRi.
10. Searching the frequent histogram.
11. Selection of any pixel $P_j$ related to searched histogram,
12. Assigning that pixel information seed point (SP) which is having $I_p$ [Intensity value] and $O_p$ [Orientation value],
13. Check the constraint such as intensity and orientation constraints for neighbouring pixel.
14. If constraints satisfied, then region is grown, else next GRi grid is taken for further processing.
15. Returned Segmented Image

**Step 5: Feature Extraction**
1. Input Segmented Lung Image
2. Extract GLCM Features
3. Extract Gradient Features
4. Combine both features FR.
5. Return FR.

**Step 6: Detection and Measurement**
1. Load training data features
2. Apply Classification
3. Detect cancer or not
4. Measure performance results.

### IV. RESULTS

The proposed approach is simulated using the well know image processing tool called MATLAB. We have collected the 200 lung CT images which are combination of cancerous and non-cancerous. There three core parameters which we used to measure the performance of proposed technique against the previous method such as:

$$Precision = \frac{TP}{TP + FP} \quad (1)$$

$$Recall = \frac{TP}{TP + FN} \quad (2)$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \quad (3)$$

**Table 1: Comparative Analysis for Detection Accuracy**

<table>
<thead>
<tr>
<th>Techniques</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anita chaudhary [6]</td>
<td>79.44</td>
</tr>
<tr>
<td>Proposed Method</td>
<td>89.67</td>
</tr>
</tbody>
</table>

**Table 2: Comparative Analysis for Precision Rate**

<table>
<thead>
<tr>
<th>Method Name</th>
<th>Precision (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anita chaudhary [6]</td>
<td>81.83</td>
</tr>
<tr>
<td>Proposed Method</td>
<td>90.2</td>
</tr>
</tbody>
</table>
Table 3: Comparative Analysis for Recall Rate

<table>
<thead>
<tr>
<th>Method Name</th>
<th>Recall (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhagyashri G. Patil</td>
<td>81.24</td>
</tr>
<tr>
<td>[11]</td>
<td></td>
</tr>
<tr>
<td>Anita chaudhary [6]</td>
<td>80.22</td>
</tr>
<tr>
<td>Proposed Method</td>
<td>89.56</td>
</tr>
</tbody>
</table>

The performance of proposed approach is showing the more efficiency and improvement as compared to previous methods in terms of precision, recall and accuracy rates.

V. CONCLUSION AND FUTURE WORK

In this paper, we designed the modified Log-gabor filtering based image enhancement technique which helps to improve the cancer detection accuracy and performance. Apart from this we designed the pre-processing algorithm; image segmentation method (based on region growing and Thresholding) techniques. For detection purpose we have used the texture and gradient features. For future work we suggest to work on efficient feature extraction and multi-class classifiers for lung cancer image detection.

REFERENCES