Lung Cancer Detection with fusion of CT and MRI Images Using Image Processing

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***Abstract*— among all other types of cancer, Lung Cancer is one of the most common causes of death throughout the world. It is necessary to get proper treatment on time, to reduce death rate of people in the world.. In the Lung cancer detection system, we have detected various stages of cancer by using Support vector machine classifier (SVM). The watershed segmentation is used in this system which is the most effective segmentation technique. Using MATLAB software, we have designed Graphic User Interface (GUI) and it is used to perform all the processes of the system. Our goal is to obtain more accurate and precise results of the different stages of cancer by using various techniques.We have performed the fusion of CT and MRI scanning. This technique improves the quality of the data. Thus, we get the appropriate stage.**

***Index Terms*- FUSION, CT, MRI,PSNR, MSE, WATERSHED SEGMENTATION, SVM, GUI.**

I. INTRODUCTION

In various types of Cancers, the rate of Lung Cancer is increasing gradually. Even after the diagnosis the survival rate of this cancer is less. If the cancer is detected earlier the chances of survival of lung cancer patient is more. The type of lung cancer is depended on the cellular characteristics like non small nodule and small nodule. To know the correct status of lung cancer we define the four stages as per its intensity. Staging is based on tumour size area and lymph node location. Presently, fusion of CT-MRI are said to be more effective than X-ray in detecting and diagnosing the lung cancer. The earlier the detection is, the higher the chances of successful treatment. Mostly lung cancer causes in males and females, it is caused by cigarette smoking, alcohol consumption etc.

The purpose of this paper is to find the early stages of lung cancer and more accurate result by using different techniques like fusion, enhancement and segmentation process.

II. LITERATURE SURVEY

Previously most of the cancer detection techniques depends on human experience by observing the image of CT-scan. It will be a false detection of lung cancer stage.

Using Image Processing we can quickly and accurately detect tumor of cancer. Using Image Processing effective techniques we collect information from complex medical images.

In fusion technique [10], the important features of multiple original images are combined together to obtain the required information in a Fused Image. In medical application there are various ideas to improve the contents of image form CT and MRI like CT image scans the denser tissues and MRI scans the soft tissues, so by combining relevant information of both images, we get appropriate information of fused image. This technique also improves the quality of the fused image.

We use segmentation process to extract information from CT Images. There are various segmentation method like Region base segmentation, Data Clustering, Edge base segmentation, threshold, Histogram, optimization technique [12], various Denoising Filters techniques [13], adaptive techniques [14], Boundary detection [11] , Segmentation is used to make the partition or segment the in different region due to that interest is spatially contiguous and pixels within region are homogeneous. Image Segmentation applied in several of different fields like pattern recognition, Image compression and image retrieval. The drawbacks of above segmentation methods are time consumption is more and less accurate, To overcome this problem Watershed Segmentation Technique is to be applied, It use to separate various region in an Image using Watershed lines.

III. BLOCK DIAGRAM

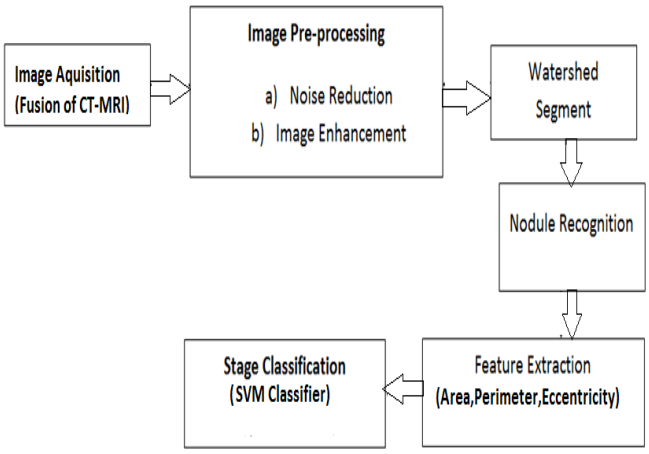

Fig.1 Lung Cancer Diagnosis Process

In the above block diagram there are main three process used throughout the report; Pre-processing, feature extraction and finally the classification process. MATLAB is used in every process made throughout the project.

Firstly, we acquired the CT and MRI Images from a database, further that we fused both the images which help to

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combine the related information from a set of images into a single image in which the fused image contains more information than any of the input image, This technique improve the quality of data. Images contain the various kinds of noise so we apply the operation of noise reduction. Using Image Enhancement Process we adjust the digital image to get more suitable results for display or further image analysis. It makes image more appropriate to find out main characteristic from the image. Using watershed Segmentation we find watershed line in an image in order to separate the various region in an image, Due to that we easily find out nodule in the lung. we also get its particular information about maximum roundness and area in particular range, from that we easily found status of defected nodule in the lung. For the identification of different stages of defected nodule we used Support Vector Machine (SVM) Algorithm.

IV. ALGORITHM

Basic algorithm which follows the all the step throughout the report is as follow:-

1) Start
2) Image Acquisition-

In Image Processing, Image acquisition is always the first step to acquire the images from the database.

3) Image Pre-Processing –

Basically Image Pre-Processing follow the several step to increase the reliability of the images and several filters to reduce the noise present in the images.

A) Noise Reduction-

It seems that in CT-MRI images somewhere contain the Salt and Pepper Noise, so to remove that noise median filter is more efficient than other filters.

B) Image Enhancement-

Image Enhancement is the process to adjust the digital image because of that we get more suitable result display or further image analysis.

4) Segmentation-

Segmentation is used to make the partition or segment the in different region; here throughout the report we proposed the watershed Segmentation. The main purpose of watershed segmentation is to find the 'watershed lines' in an image in order to separate the distinct regions.

5) Nodule Identification-

To identify the nodule from different segmented region it is necessary to satisfy the criteria of maximum roundness and area in particular range, which is identifying with the help of SVM Algorithm.

6) End

SVM Algorithm:-

SVM is to create a hyper plane between two data sets, it separate two class of data. For best result data points of any class has largest distance from hyper plane.

Support Vector Machine (SVM) Algorithm:

1) Start
2) Classification-

SVM classifier is used to classify the linear and non-linear regions.

3) Linear separable-

A line can be drawn to separate the affected and non affected regions in the 2-D Image.

4) Non -Linear separable-

In non linear, we can separate the affected portion or region by drawing non linear shape.

5) End

V. FEATURES EXTRACTION

It is very essential stage in image processing. By using Watershed technique and SVM algorithm, we detect the features and separate various desired portion of the normality's and abnormalities present in the image.

These extracted features can be classified on the basis of area, perimeter and eccentricity.

A) Area:

It is the actual number of all pixels present in the tumor portion. The sum of all 1 binary bit pixels represents the area of defected region. It is a scalar value.

B) Perimeter:

It is the actual number of all pixels which are interconnected on the edges of the tumor and it is the sum of all 1 binary bit pixels which are present on the outline of the nodule.

C) Eccentricity:

The roundness or matric value or irregularity index or circularity is to less than one for other shape and one for circular shape.

VI. THE PERFORMANCE EVALUATION CRITERIA

The two different quantitative measures are calculated on the basis of the filtering methods –

1) Peak signal to noise ratio(PSNR)
2) Mean square error (MSE)

PSNR is the ratio of the maximum possible power of the signal and power of corrupting noise which affects the fidelity of its representation. If the value of PSNR is high it means Signal To Noise Ratio is higher. It is expressed in logarithmic scale.

$$PSNR=10\log_{10}\frac{(2^k-1)^2}{(MSE)}\ dB$$

Where, k=number of bits required represent one pixel

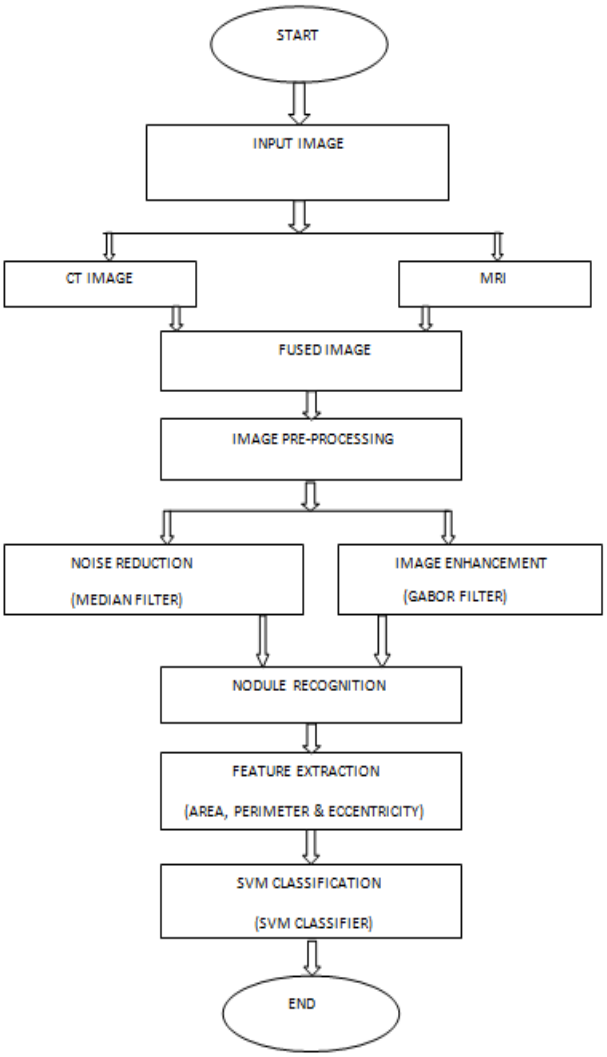
$L=2^k$(L=number of gray levels)

MSE is the cumulative squared error between the original image and compressed image. The lower the value of MSE, the lower is the error occurred.

$$MSE = 1/MN\ (I(x,y)- I'(x,y))$$

The Mean Square Error (MSE) and the Peak Signal to Noise Ratio (PSNR) is the two error metrics used to Compare image quality.

VII. FLOW CHART



VIII. CONCLUSION

Lung cancer is one of the serious disease due to this more people are tends to death so it is essential to identify lung cancer cell and serious stages. It is necessary to get proper treatment on time, to reduce death rate of people in the world. Image processing area is continuously emerging. We have applied various techniques such as fusion, enhancement, Watershed segmentation, SVM algorithm; to reduce death rate of Lung Cancer.

IX. RESULT

A. GUI-

GUI stands for Graphic User Interface. A GUI can have many components and GUIDE provides a way of specifying which callback should run in response to a particular event such as Noise reduction, Enhancement, Watershed Segmentation, and Classification for a particular Image.

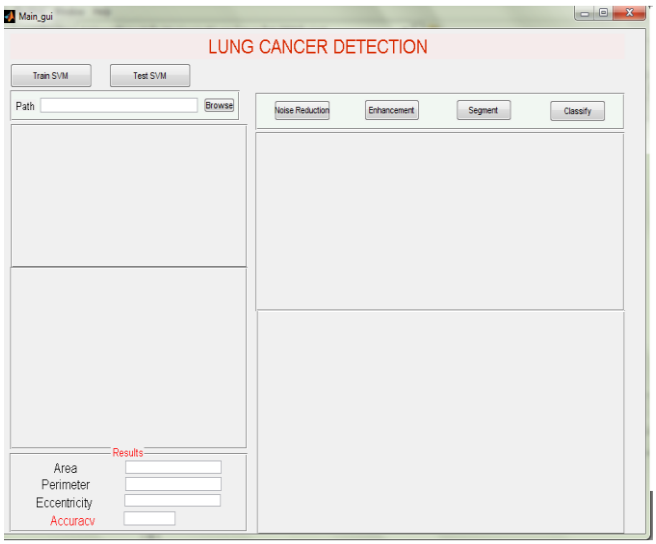


Fig.2 GUI

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B. Final Result-

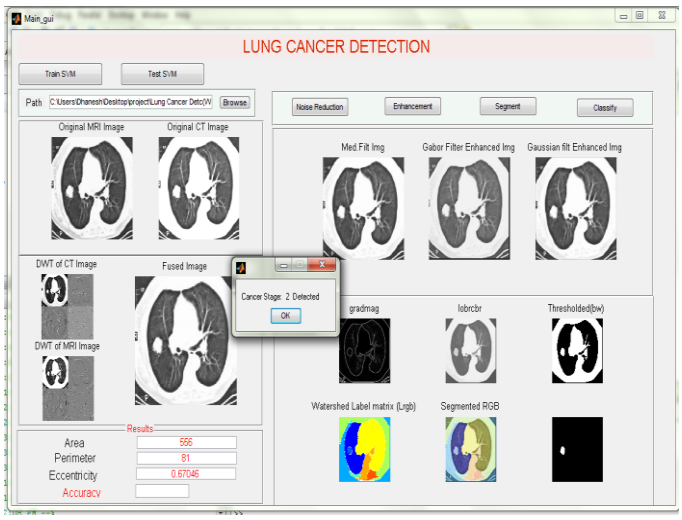


Fig.3 Output of Detected Stage

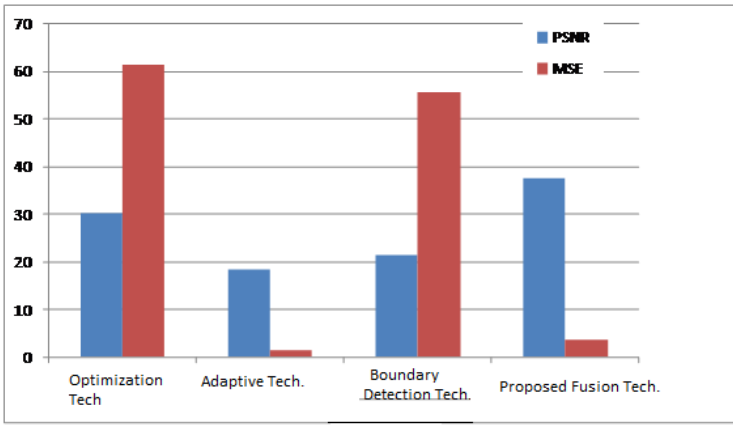
C.Results of Feature Extraction-

	Parameters	Values
Sample 1	Area	556
	Perimeter	81
	Ecentricity	0.67046

D.Comparison of proposed technique with conventional techniques-

Sr. No.	Method	PSNR	MSE
1.	Optimization Technique	30.2570	61.5146
2.	Adaptive Technique	18.50	1.350
3.	Boundary detection	21.34	5573.9
4.	Proposed Fusion Technique (Watershed Segmentation & SVM)	37.6368	3.692

E.Comparison of Proposed technique with Conventional techniques Graphically-



If the value of PSNR is high it means Signal to Noise Ratio is higher. Higher PSNR indicates that the reconstruction is of higher quality. PSNR is most easily defined via the mean squared error (MSE). It is expressed in logarithmic scale.

As we know, we required higher PSNR and lower MSE .So after comparing our Proposed Technique with Conventional Technique it will found that the value of PSNR is high and Value of MSE is lower than other so it will be proved that our Project is more efficient with high accuracy which is 90.9091

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Biography:-

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