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Detection of Lung Cancer in Medical ImagesUsing Image Processing Techniques

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***Abstract*-- Lung cancer is the common cause of death among people around the world. Detection of lung cancer early is the survival chance of life is increases from 14% to 49% if disease is detected in time. Various methods developed by the earlier researchers which failed to produce accuracy in real time applications. Although Computed Tomography (CT) images are used mostly. To detect lung cancer present in the CT images. Hence we can use image processing methods Gabor filter and watershed segmentation for quick detection of lung cancer. In this study MATLAB have been used, in every procedures such as image preprocessing, processing and post processing have been discussed in detail.**

***Keywords*-- image segmentation, image enhancement, feature extraction, Gabor filter, watershed segmentation.**

I. INTRODUCTION

The highest rate of lungcancer is among all other cancers. In any form of thelungcancer breathing gets affected, here are some common forms of lung cancer types. As per World cancer report 2014 lung cancer is the most common cause of cancer-related death in men and women, and was responsible for 1.56 million deaths annually, as of 2012. The major causes of the lung diseases are smoking, inhaling the drugs, smoke and allergic materials. Computed Tomography (CT) used in detecting the extreme of the lung diseases. The analysis of the proposed method CT image is sufficient also the visibility of soft tissue is better.There are several types of lung cancer, and these are divided into two main groups: Small cell lung cancer and non-small cell lung cancer which has three subtypes: Carcinoma, Adeno carcinoma and Squamous cell carcinomas[1].Image processing techniques are widely used in several medical areas for image improvement in earlier detection and treatment stages, where the time factor is very important to discover the abnormality issues in target images, especially in various cancer tumors such as lung cancer, breast cancer, etc. Image quality and accuracy is the core factors of this research, image quality assessment as well as improvement are depending on the enhancement stage where pre-processing techniques are used based on Gabor filter within Gaussian rules [2].

MATLAB image processing toolbox based implementation is done on the CT lung images and the classifications of these images are carried out.Theperformance measures like the classification rate and the false positive rates are process [3].The main aim of this paper is to develop an efficient system which is able to detect lung cancer.

II. METHODOLOGY

In the proposed algorithm, enhancing the contrast of the input image through preprocessing method. It is done by first converting the input image to gray scale image. After enhancing the contrast of the image it is applied to Gabor filter to extract the feature contrast. The more usage of Gabor filter in image processing is texture analysis. Uncertainty Principle is used and provides precise time-frequency location. Spatial and frequency domain these filters can be operated and their impulse response is defined by a sinusoidal wave multiplied by a Gaussian function[4-5]. We can see the various steps of lung cancer detection in the following fig 1.

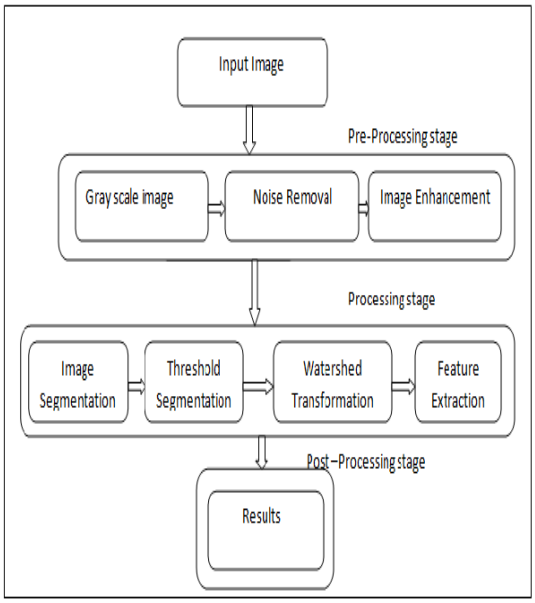

Figure :1 Lung Cancer Detection Steps

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The first stage starts with taking a collection of CT scan images from the Database (LIDC).Images are stored inMATLAB and displayed as a gray scale image. CT scans having low noise when compared to x-ray image and MRIimage [6]. So we can take the CT images for detecting the lung cancer. The main advantage of the computertomography image having better clarity, low noise on for the experimental purpose we can use CT images areexamined, and this CT scans were stored in database of images in JPEG/PNG image standards [7-9].

A. Preprocessing of Image

Image preprocessing is the process of the lowest level of the abstraction, to improvement of quality of image, it does not increase any other content of information.

Image preprocessing undergoes the various steps like smoothing, enhancement, and segmentation is done.Image enhancement is to improve quality of image for human viewers. canny edge detector [10-14] is adopted to find edge pixels due to its fast performance and suitability for real-time detection [15-16]. We obtain an image with enlarged edge regions which will be removed by masking.

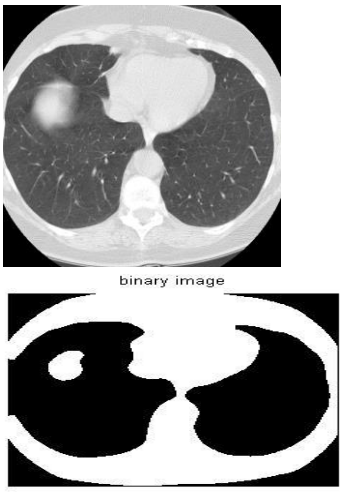


Figure 2: (a) Input image (b)Midian filtered image

i). Removal of Noise

The input image is a normal RGB image.The RGB image is converted into grey scale image because the RGB format is not supported in MATLAB. Then the grey scale image contains noise such as white noise, salt and pepper noise etc. White noise is one of the most common problems in image processing. This can be removed by using filter from the extracted lung image [17].

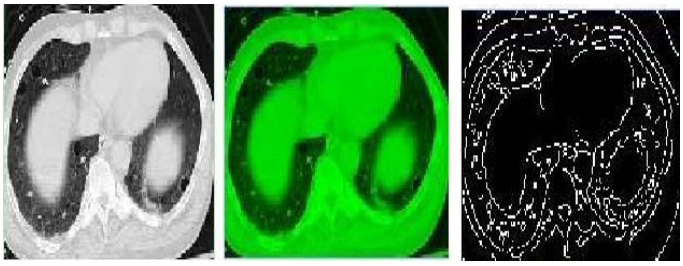
ii). Image Enhancement

Image enhancement is defined as the way to improve the quality of the image, so that the resultant image is better than the original one, the process of improving the quality of a digitally stored image by manipulating in MATLAB. It is quite easy, for example, to make an image lighter or darker, or to increase or decrease contrast. In the image enhancement stage we use Gabor filter enhancement technique [18]. Image processing techniques are widely used in several medical areas for image improvement in earlier detection and treatment stages, where the time factor is very important to discover the abnormality issues in target images, especially in various cancer tumors such as lung cancer, breast cancer, etc. Image quality and accuracy is the core factors of this research, image quality assessment as well as improvement are depending on the enhancement stage where low preprocessing methods are used based on Gabor filter.

Processing stages

B. Segmentation of Image

The goal of image segmentation is to simplify the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is used to locate objects and boundaries. Image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics [19]. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture;adjacent regions are significantly different with respect to the same characteristics[20].



(a) **(b)** **(c)**

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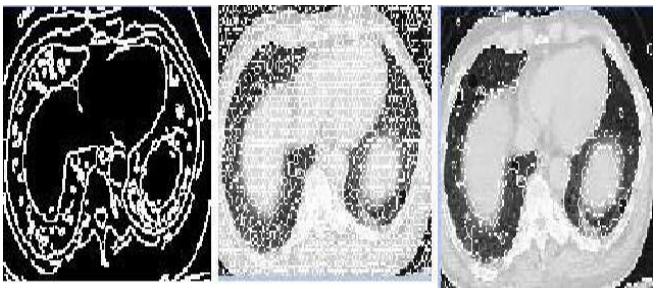


(d) (e) (f)

Figure 3: CT image segmentation steps a) Input image b) layer separation c)gray level intensity d)Edge detectione) morphology detection f) segmentation image

C. Feature Extraction of Image

In image processing the Image features extraction stage is very important in image processing techniques which using algorithms and techniques to detect and isolate portions or shapes (features) of an image. After the segmentation is performed on lung region, the features can be obtained from it and the diagnosis rule can be designed to exactly detect the cancer nodules in lungs. This diagnosis rules can eliminate detection of cancer nodules resulted in segmentation and provides better diagnosis. [21-23].

III. Results And Discussion

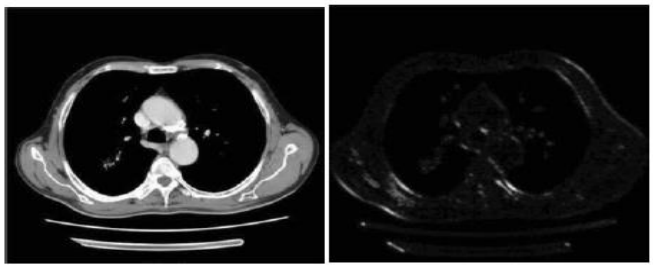
A. Threshold Approach

The simplest property that pixels in a region can share is intensity. So, a natural way to segment such regions is throughthreshold, the separation of light and dark regions. It creates binary images fromgrey-level ones by turning all pixels below some threshold to zero and all pixels about that threshold to one. If g(x, y) is a threshold version of f (x, y) at some global threshold 'T' that separates these modes [24].Then any point (x, y) for which f(x,y) > T is called any object point, otherwise it is back ground point. In fig4 (a) shows input image of lung cancer. Threshold segmentation is applied on the image which is shown in thefigure 4(b).This is the area with the intensity values higher than the defined threshold. High intensity areas mostlyComprises of cancer cell. So that by using threshold segmentation we can specify the location of cancer cell [25-26].

B. The Gabor filter

The Gabor filter was originally introduced by Dennis Gabor; we used it for 2D images.

The Gaborfunction has been recognized as a very useful tool in computer vision and image processing, especially for textureanalysis, due to its optimal localization properties in spatial and frequency domain, fig 4 shows the result.

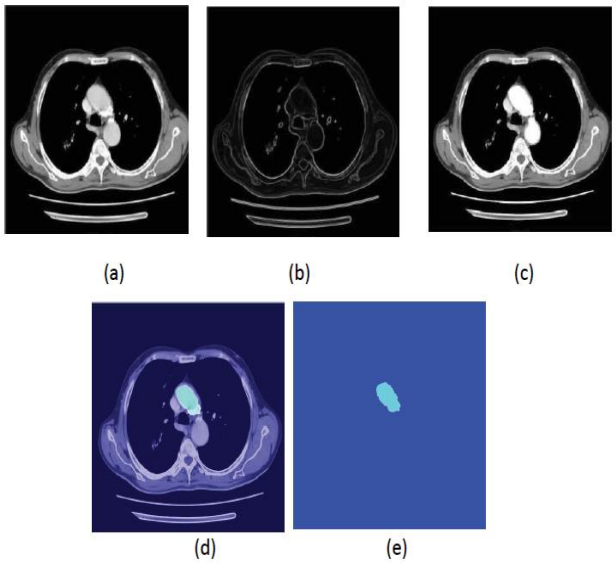


(a) (b)

Fig 4- The result of applying Gabor enhancement technique (a) Input image (b) Gabor image

C. Watershed Segmentation

The marker watershed method is applied to lung image. The result obtained by new method shows the clarityand detection of objects marked by image markers[27-30]. Two types of markers are used. External associated with thebackground and Internal associated with the objects of interest. The following figure 5 shows the output results. We can observe some values from the below shown in table1, and also it is related graph shown in figure 6.



(a) (b) (c)

(d) (e)

Figure 5 (a) Input image (b) Gradient image (c) Watershed applied to original image (d) Image with watershed segmentation (e) Segmented image by MarkerWatershed.

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Table-1
Image segmentation and experimental result.

Image	Thresholding approach	watershed segmentation
Image 1	77.16	83.91
Image 2	76.00	82.73
Image 3	75.41	81.50
Image 4	75.90	80.95
Image 5	81.21	83.77
Image 6	78.77	84.70
Image 7	80.77	85.27
Image 8	79.64	84.70
Image 9	79.43	84.53
Image 10	80.01	86.39

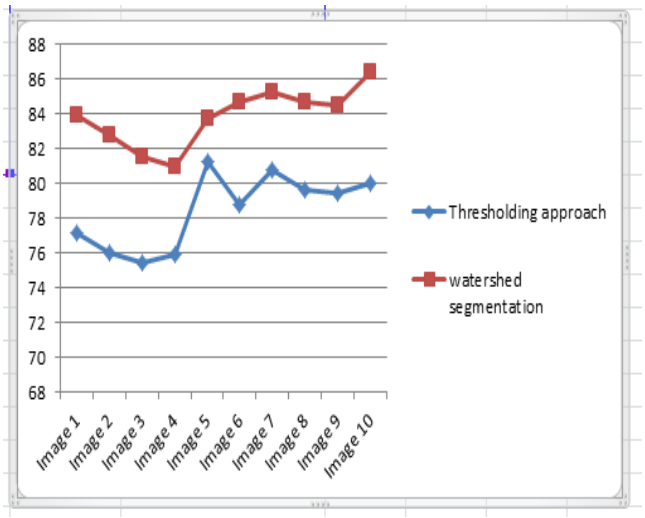

Figure 6: Accuracy of Threshold versus Marker watershed segmentation

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IV. Conclusion

In this paper, lung cancer detection in MRI, CT and Ultrasound image, we have studied the major image modalities through image processing techniques. We used watershed segmentation method and Gabor filter for preprocessing of images. Superpixel segmentation method was used as it gives higher output in comparison to other algorithms in this case due to difference in luminance of the three images.

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Dr. T. V. Rajini Kanth has obtained his Ph.D. degree in C.S.E. branch from Osmania University, Hyderabad in July, 2008 and M. Tech.(C.S.E.) degree from Osmania University, Hyderabad in January, 2001. His specialization area in research is “Spatial Data mining”. He obtained his PGDCS degree from HCU, Hyderabad in 1996. He received his M. Sc. (Applied mathematics) degree in the year 1989 from S.V. University, Tirupati as University Ranker. He is currently working as professor in CSE, at SNIST, Hyderabad. He worked as a Professor and Head, Department of IT, GRIET, Hyderabad from 2008 June to Oct 2013. Before that he worked as a Professor in CSE department, GRIET, Hyderabad since 2007 November. Prior to that, he worked as Asso. Prof. in VNRVJIET, Hyderabad where he joined in 1996. His total teaching experience is 23 years. His writings have appeared in numerous Professional conferences and Journals (International journals-29, national Journals-3, International conferences- 23, national conferences-1, **Total =56**). Under his guide ship **5** Ph.D. Research Scholars got awarded (**2- JNTUH & 3-ANU**). He has received seminar grants from AICTE and DST organizations. Reviewer for many International Conferences like ICACM-2011, ICACM-2013, ICRSKT, ITQM, ICCCT etc., He has also received UGC Project Grant as a Principle Investigator and AICTE project grant as Co-Principle Investigator. He is a Review Committee Member \ Editorial Board member for 18 International Journals namely **IJAEGT, IJAC, JDECS, IJEAT, IJAENT,** etc., He was an author for few books i.e Artificial Intelligence etc. His current research area interests include Image processing, Data Warehousing & Mining, Spatial data mining, web mining, Text mining and Robotic area etc. Presently guiding research students in the research areas like Spatial data mining, Web mining, image Processing and Text mining. He has conducted two International conferences namely ICACM-11, and ICACM-13 at GRIET, Hyderabad as Convener and also acted as session chair for many conferences like ICACT-08, ICRSKT-2014 etc. He was convener for Pragnya-08, a national level technical fest at GRIET. He also acted as a Nodal Officer for academics, TEQIP at GRIET, AP, India. Apart from that many National level ROBO workshops were conducted namely RoboTrix, eTrix, iTrix, LogiTrix, VisionTrix and Haptic Robotic arm in association with IIT Bombay and Technophilia etc. He guided around 60 projects at B. Tech. and M. Tech. level and also developed some of them as products like Emolument management system, Mobile based automation and gamming projects, Web crawlers project, Office automation projects, Vision based Robo projects and Stegonography projects, etc., His Robo projects were displayed at 2nd Annual IT summit held at HICC, Hyderabad and was appreciated by Hon. IT Minister Ponnala Lakshmaiah. He is presently guiding (supervisor & co-supervisor level) many Ph.D. scholars at various universities namely JNTUH, JNTUK, JNTUA and ANU. He was called for around 55 AICTE sponsored \ TEQIP workshops as resource person. He is Life Member in ISTE, CSI and a member in IEEE.