International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 04 | Apr 2021 www.irjet.net p-ISSN: 2395-0072

LUNG CANCER DETECTION USING CT SCAN IMAGES

KHEVNA VASANI[1], AYUSHI SHAH[2]

[1] *Student, Dept. of Biomedical Engineering, L.D. College of Engineering, Ahmedabad, Gujarat, India*
[2] *Student, Dept. of Biomedical Engineering, L.D. College of Engineering, Ahmedabad, Gujarat, India*

Abstract – *Lung cancer is a malady caused by the involuntary proliferation of cells within the lung tissue. Symptoms could be similar to those of respiratory problems or infections and typically there may be no symptoms at all. Early detection of cancerous cells within the lungs is indispensable as they provide oxygen to and excrete out carbon dioxide from the body. Fatality rate are often reduced by early detection and treatment of the disease. The method of early detection of cancer plays crucial role in preventing cancerous cells from multiplying and spreading. Lung cancer has been attracting the eye of medical and sciatic communities in the latest years as a result of its high prevalence allied with the challenging treatment. In recent years the image processing algorithms are widely used in various medical areas in order to enhancing the earlier detection and treatment stages, during which time factor is extremely important to diagnose the disease within the patient. However, CT scan imaging is best imaging technique in the medical field, it's difficult for doctors to interpret and diagnose the cancer from CT scan images. The main purpose of this project is to develop a CAD (Computer-aided Diagnosis) system using MATLAB for detecting the initial carcinoma nodules using the lung CT scan images.*

Key Words: **Lung Cancer, Cancerous Cells, CT Scan, CAD, MATLAB etc.**

1. INTRODUCTION

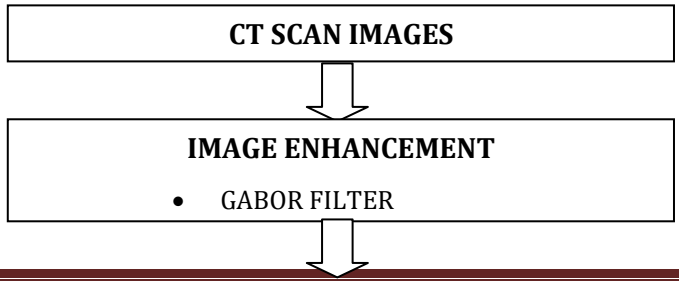
CANCER is one among the most severe health issues within the world. Lung cancer is that the leading reason behind cancer deaths world. Carcinoma cancer cells have defects like autonomy of growth signals, insensitivity to growth-inhibitory signals, limitless replicative potential, and tissue invasion and metastasis among the regulatory circuits that govern normal cell proliferation as well as homeostasis. It takes a series of mutations to create a cancer cell. Carcinoma arises from abnormal growth of epithelial cells in the lung. The clinical manifestations of lung cancer are usually varied. Patients are sometimes asymptomatic in the early stages of the disease. The lack of symptoms is especially true for lung cancers that originate in the periphery of the lungs. Approximately 5% to 10 % of patients with lung cancer does not show symptoms at the time of examination. These cancers are generally detected during evaluation for an unrelated health issues or on a chest radiograph performed for preoperative evaluation. More effective screening such as low-dose spiral computed tomography (CT) scanning that gives detailed information because of the sections of CT images structure, may allow for improvement in the potential to diagnose this disease at an earlier stage. Cancer that begins from the lungs is termed as primary lung cancer. Cancer that spreads to the lungs from another place in the body is termed as secondary lung cancer. Human lung cancer is categorized into two main histopathological groups: non-small cell lung cancer (NSCLC) and small-cell lung cancer (SCLC). In the biomedical field, the examination and diagnosis of the lung CT image by field experts are a sensitive process that need time and high qualification. The subjective examination leads to variability among the observers. For these reasons, computer-based systems are required. The diagnosis process is supported by utilizing existing technological means and software. Thus, the cost and diagnosis effort can be notably reduced. Image processing techniques have been proven efficient to detect tumor cells. MATLAB is an optimum image processing software that can be used for the same. The first stage starts with collecting the CT scan images (normal and abnormal) from the open-source database. Several image enhancement techniques improve visual quality of an image. The third stage applies image segmentation algorithms which plays an effective role in image processing stages, and the fourth stage gives an indicator of normality or abnormality of images.

1.1 Aims and Objectives

1) Performing Image segmentation following the Image Enhancement using various available techniques.
2) Detection of possible cancerous lung nodule locations, from enhanced segmented images.
3) Analysis and comparison of different algorithms to procure most suitable techniques.

Hence, reducing required time for analysis and improving the quality of diagnosis. Consequently, minimizing the frequency of biopsies for lung cancer detection.

1.2 Flow Diagram



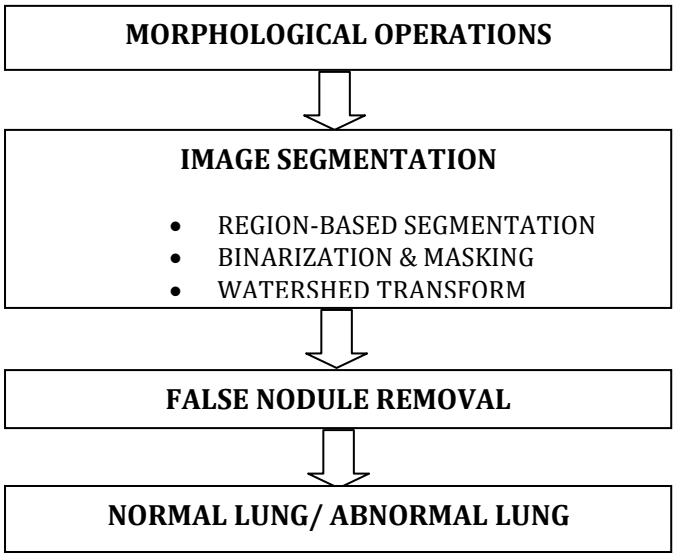


FIGURE 1: Lung Cancer Detection Steps

2. METHODOLOGY

A set of CT scan images are obtained from the Lung Image Database Consortium (LIDC) archive is used in this analysis.

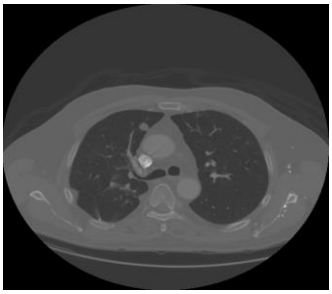


FIGURE 2: Input Image

The first step is pre-processing of the image to remove noises that may be embedded in CT Images at the time of image acquisition process which aids in false detection of nodules and mainly includes the image enhancement techniques. Gabor filter is implemented in the image enhancement stage which is a linear filter used for various purpose such as edge detection, texture analysis, feature extraction, etc. Gabor filters are band-pass filters which allows particular band of frequencies while rejecting the unwanted frequencies. A Gabor filter is a sinusoidal signal modulated by a Gaussian wave of particular frequency and orientation.

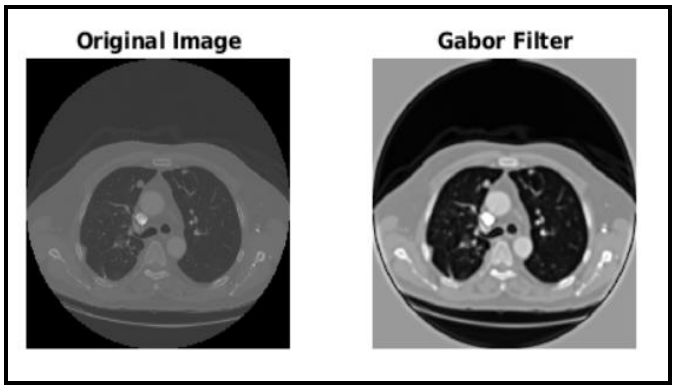


FIGURE 3: Gabor Filtering

The processed image is then segmented using region-based segmentation technique. The main purpose of the segmentation technique is to modify the representation of an image so that it is easier to analyze. Morphological operations are performed namely erosion and dilation followed by reconstruction on enhanced image.

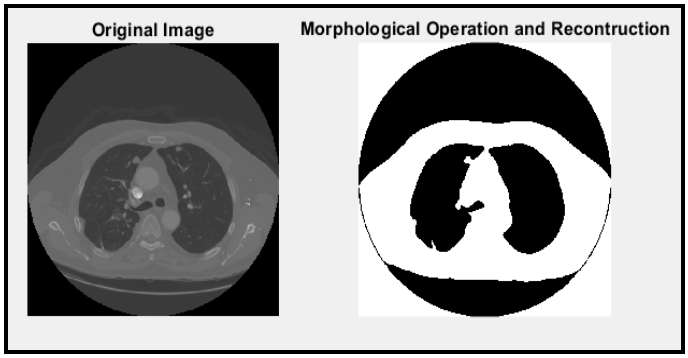


FIGURE 4: Morphological Operation and reconstruction

Later binarization is performed and active contour algorithm is then applied to the binarized image which is a region-based segmentation technique. Active contour uses energy forces and constraints for segregation of the pixels of interest from the image for further processing and analysis. Active contours without edges uses two energy forces. The first force is to shrink the contour and the second force is to expand the contour. These two forces get balanced only if the contour reaches the boundary of our region of interest.

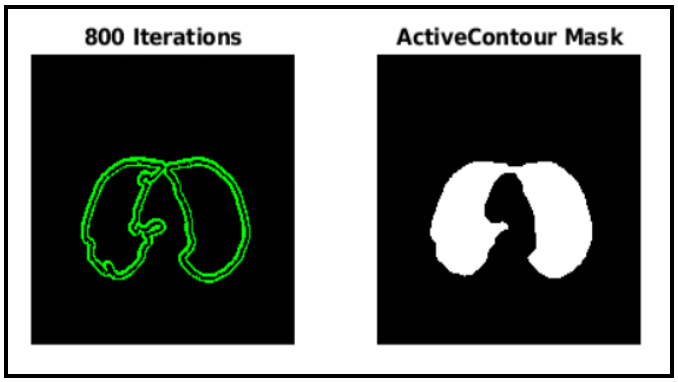


FIGURE 5: Active Contour Mask

Binarization technique is applied following the active contour, and is dependent on the fact that the number of black pixels is much greater than white pixels in normal lung images. If the number of the black pixels of a CT scan input image is greater that the threshold value then it indicates that the lung image is normal, otherwise, if the number of the black pixels is less than the threshold value, it indicates that the image is abnormal and the nodules might be present in the image.

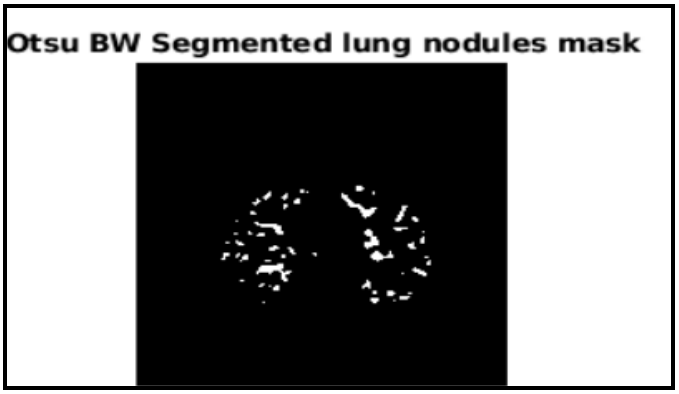


FIGURE 6: Binarization and masking

Later Watershed Transform is performed. The watershed transform is a region-based segmentation technique. Watershed refers to a ridge which divides areas drained by different river systems. The idea for this method comes from geography: It's that of a landscape or topographic relief which is flooded by water. Watersheds are the divide lines of the region of interest of rain falling over the region. Another method is to imagine the landscape being immersed during a lake with holes pierced in local minima. Catchment basins will fill up with water starting at these local minima and dams are built at points where water coming from different basins meet. When water level reaches the highest peak in the landscape the process is terminated. This way, the landscape is partitioned into regions or basins separated by dams, called watershed lines or just watersheds.

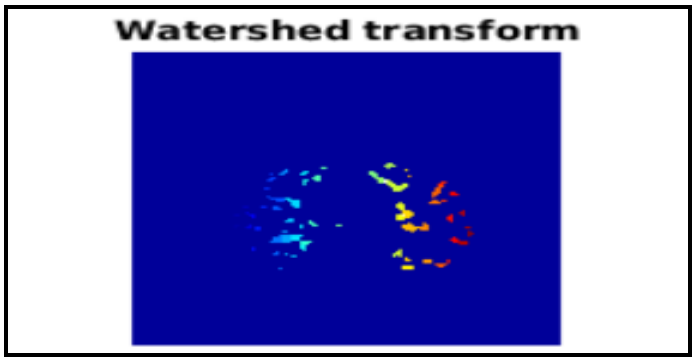


FIGURE 7: Watershed Transform

3. RESULT

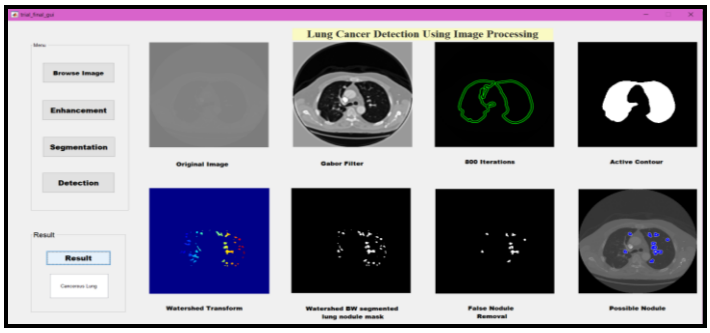


FIGURE 8: GUI of designed system (Example 1)

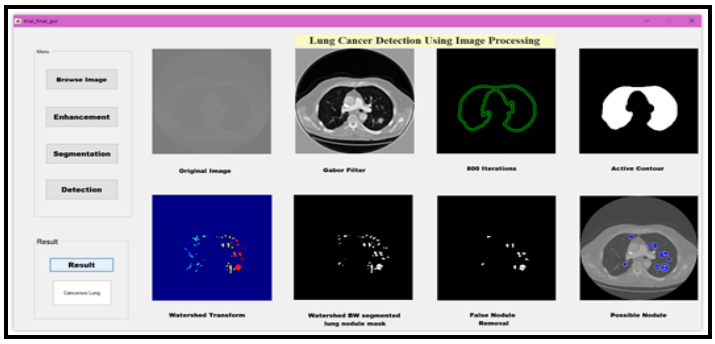


FIGURE 9: GUI of designed system (Example 2)

4. CONCLUSION

This project developed a CAD system using image processing techniques for the detection of lung cancer using CT scan images. The development of this project started with the acquisition of lung CT scan images. Later, image enhancement techniques inclusive of Gabor filter was applied and analyzed in accordance with varying parameters. In addition to this, segmentation techniques, namely thresholding with binarization, erosion, region-based segmentation and watershed transform were also applied and analyzed. To conclude, project fetches segmented regions that can be possible lung nodules which can further be classified for lung cancer nodule detection. This detection ameliorates accurate diagnosis of lung cancer for better and early-stage treatment.

REFERENCES

[1] D Kalyani, C Raghavendra, K Rajendra Prasad, "An Improved Lung Cancer Prediction System using Image Processing" , International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8, Issue-4, November 2019

[2] Roy, T., Sirohi, N., & Patle, A. "Classification of lung image and nodule detection using fuzzy inference system." International Conference on Computing, Communication & Automation. DOI: 10.1109/CCAA.2015.7148560.

[3] Ignatious, S., & Joseph, R. "Computer aided lung cancer detection system." Global Conference On Communication Technologies (GCCT), DOI: 10.1109/GCCT.2015.7342723.

[4] Jeyaprakash Vasanth Wason & Ayyappan Nagarajan "Image processing techniques for analyzing CT scan images towards the early detection of lung cancer", DOI: 10.6026/97320630015596

[5] Sangamithraa, P., & Govindaraju, S. "Lung tumour detection and classification using EK-Mean clustering." International Conference on Wireless Communications, Signal Processing And Networking (Wispnet). DOI:10.1109/WiSPNET.2016.7566533.

BIOGRAPHIES

Ms. Khevna Vasani is pursuing her Bachelor's in Biomedical Engineering at L.D. College of Engineering, Ahmedabad.

Ms. Ayushi Shah is pursuing her Bachelor's in Biomedical Engineering at L.D. College of Engineering, Ahmedabad.