Multi-Filtered Image Approach For Detection Of Lung Cancer

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***Abstract*- This study proposes a cancer detection method using MATLAB. Image pre-processing, feature extraction, and classification are the three steps of the suggested method. On a CT scan of a patient with lung cancer, the suggested approach was evaluated. The proposed method can be further extended to detect other types of cancers by training the machine learning models on appropriate datasets. In conclusion, the proposed method provides an efficient and accurate way of detecting cancer using medical images.**

Keywords-Texture Frequency, Small Scale Analysis, Non-Linear Filtering and Post Processing

I. INTRODUCTION

Cancer is a term used to describe the disease that results from uncontrolled cellular growth and division. While some types of cancer cause rapid cell growth, others cause cells to grow and divide more slowly. Over 8.8 lakh people in India die each year from smoking cigarettes. According to 2021 report. Smoking is a major risk factor for cancer. Alcohol consumption can lead to physical inactivity, excess body weight and poor nutrition. Certain forms of cancer, such as leukemia, do not result in visible growths, while others can cause tumors. Various imaging techniques have been developed to detect cancer, including angiogenesis imaging, hypoxia imaging, apoptosis imaging, and endocrine tumor imaging.

Angiogenesis Imaging: Integrins, which are cell adhesion molecules, are crucial for the angiogenesis and metastasis of malignant cells. Integrins can bind to target molecules when the appropriate cancer sequence recognises them. Angiogenesis is the name of this process.

Hypoxia Imaging: According to research, it is preferable to identify hypoxia in cancer patients using non-invasive imaging and validated hypoxia markers. This kind of technique offers an accurate and confirmed measure of tissue hypoxia for tailored cancer treatment. According to studies, hypoxia imaging is more accurate at estimating a patient's chance of surviving a head and neck cancer diagnosis.

Apoptosis imaging: As cells divide during proliferation, the iron concentration is similarly divided, and the signal from each cell becomes weaker. Because the cells are vulnerable and vulnerable to destruction during apoptosis, apoptosis imaging to monitor cancer therapy can be essential. It has been shown that MRI can identify apoptotic cells both in vitro and in vivo, although more research is needed.

II. LITERATURE SURVEY

S. S. Lokhande et.al [1] it offers the most accurate way to identified the image's primary edge and also prevents oversegmentation. When compared to the thresholding algorithm, it provides 100% accuracy. As a result, segmentation is effective. When compared to other procedures, the outcomes from the suggested technique are quite encouraging.

K.Punithavathy et.al [2] texture analysis and FCM were used to construct an automatic lung cancer diagnosis system for PET/CT images. Pre-processing methods improve the cancer detection's precision. The search space is shrunk and accurate lung ROI extraction is made possible by morphological operations. The outcomes of our methodology show that a number of important texture features were obtained from the texture analysis. These features that are used as the FCM classifier's input aid in the precise diagnosis of lung cancer. The proposed methodology's results are encouraging, with a 92.67% total accuracy.

Bhagyarekha U. Dhaware et.al [3] used a input to evaluate the normality or abnormality of CT lung pictures. The procedure that has been used has been found to be helpful and it produces results that are more accurate and reliable than those indicated in the literature. Using 12 dissimilar statistical features, contrast, correlation, and variance, excellent accuracy has been achieved. Six separate and highly effective features are employed to invert various moments, cluster prominence, and cluster shade in order to increase accuracy and extract all 12 features.

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Sayali Satish Kanitkar et.al [4] the contacting items in the image are separated using the suggested marker-controlled watershed segmentation technique. It offers the most accurate way to identify the image's primary edge and also prevents over segmentation. When compared to the thresholding algorithm, it provides 100% accuracy. As a result, segmentation is effective. When compared to other procedures, the outcomes from the suggested technique are quite encouraging.

Bin Wu et.al [5] proposed the median filter and Wiener filter were used in the preprocessing of the CT images to get rid of noise. Second, using the Otsu thresholding approach, the preprocessed images were turned into binary images. Thirdly, body regions were recovered from the binary pictures, and GLCM was used to determine body region features (contrast, correlation, energy, and homogeneity). Finally, lung cancer detection models were created using features, BPNN, and SVM. It was concluded from the results that the model based on SVM was a promising tool for the recognition of lung cancer in its early stages, proving the theory presented above

III. Proposed Work

Image Segmentation: Matlab provides several tools for image segmentation, including thresholding, region growing, watershed segmentation, and active contours.
Matlab provides several built-in functions for image segmentation, such as the "regionprops" function, which can be used to extract properties of the different regions in an image.Image processing refers to the manipulation of an image to enhance its quality or extract useful information. Matlab offers a variety of image processing functions, such as "imread" for reading an image file, "imresize" for resizing an image, and "imfilter" for filtering an image.
Feature extraction: The technique of extracting important data or characteristics from a picture for additional analysis is known as feature extraction. For extracting properties like texture, colour, form, and edges, Matlab offers routines.
Image analysis and visualization: Matlab provides functions for analyzing and visualizing image data, such as histograms, scatterplots, and 3D surface plots.

Image recognition and classification: Matlab provides functions for recognizing and classifying images based on their features or properties.

It is increasingly popular in various medical fields, as they can help detect diseases earlier and improve treatment outcomes. Early detection is critical in ensuring timely and effective treatment for patients. Therefore, using image processing to improve the quality of medical images can be essential in improving outcomes. It is important to ensure that any use of these techniques is done. ethically. Overall, MATLAB provides a powerful set of tools and functions for image segmentation and processing, making it a popular choice for researchers and practitioners in this field

IV. METHODOLOGY:

The methods we used here are Image enhancement , Histogram equalization, Contrast stretching, Filtering Techniques, Image Segmentation, Thresholding , Region growing, Watershed Segmentation, Image feature extraction, Edge detection, Corner detection.

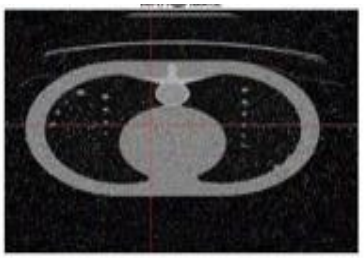
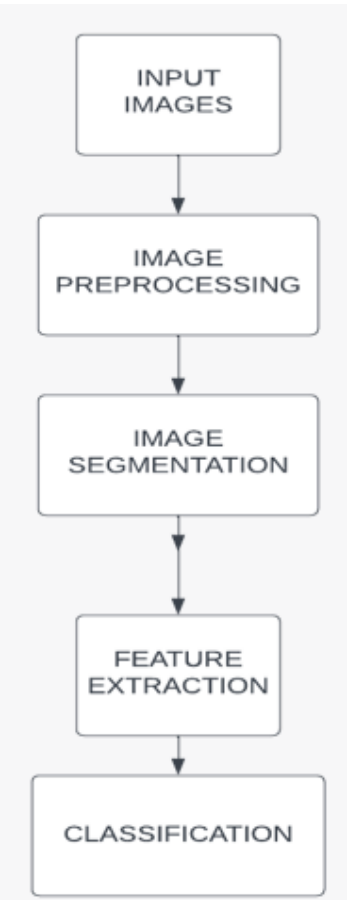


Fig 1. Input CT image

V. FLOWCHART



A. Preprocessing

Preprocessing the image is the first step, and it involves removing noise, scaling, cropping, and rotating the image. MATLAB has several built-in functions for preprocessing, such as imresize, imrotate, and imcrop.

B. Thresholding

Thresholding is a technique used to convert grayscale images into binary images. MATLAB has several thresholding functions, such as Gray thresh and binarize, that can be used to create binary images.

C. Edge detection

MATLAB has several edge detection functions, such as edge and canny, that can be used to detect edges.

D. Region-based segmentation

This method involves partitioning the image into regions based on the similarity of the pixels within the regions. MATLAB has several region-based segmentation functions, such as k means and watershed, that can be used to segment the image.

VI. RESULT AND DISCUSSION

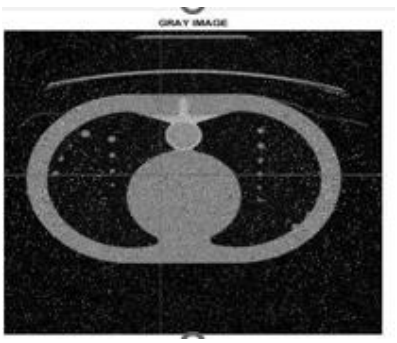
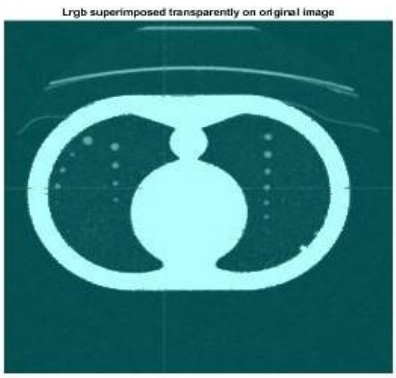


Fig2 . Gray Image



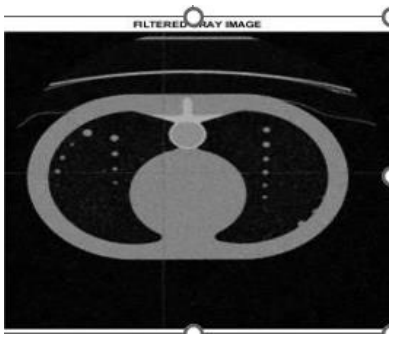


FIG 3.FILTERED GRAY IMAGE

Fig 4. Gradient Magnitude

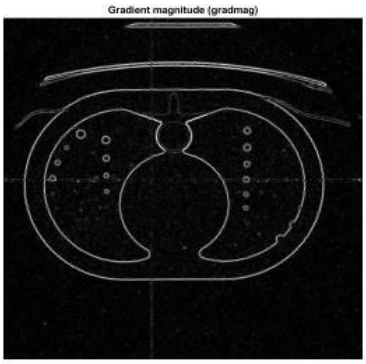


FIG 5. SUPERIMPOSED ORIGINAL IMAGE

Grayscale images are commonly used in image processing using MATLAB because they are simpler to process than colour images. Grayscale images have only one channel of information, which is the intensity or brightness of each pixel, while colour images have three channels representing the red, green, and blue colour components of each pixel. Grayscale images can be enhanced using various techniques such as contrast stretching, histogram equalization, and filtering. These techniques can help to improve the visibility of details in the image. Grayscale images can be segmented into regions based on their intensity values. This can be useful in identifying objects or features of interest in the image. It can be used to extract various features such as edges, corners, and textures. These features can be used to classify or identify objects in the image. The grayscale images can be compressed more efficiently than colour images because they have only one channel of information. This can be useful in reducing the storage and transmission requirements of the image.

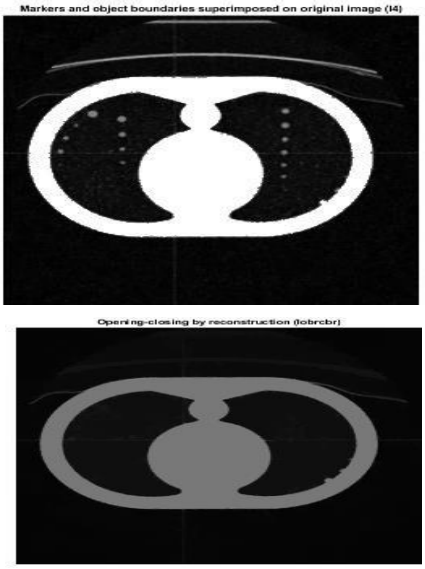


Fig.6.Opening and closing reconstruction image

A. GRADMAG

The gradient magnitude image is a useful tool for edge detection in image processing. In MATLAB, you can use the built-in function imgradient to calculate the gradient magnitude image of an input image.

VII. REGIONAL MAXIMA:

Regional maxima are local maxima in an image that are higher than all the neighboring pixels. The regional maxima can be used in various image processing applications, including image segmentation, feature extraction, and object recognition.

In MATLAB, the regional maxima can be identified using the imregionalmax function. The syntax for using this function is as follows:

maxima = imregionalmax (input_image, conn);

where input_image is the grayscale or binary input image, and conn specifies the connectivity of the pixels. The connectivity parameter can have a value of 4 or 8, depending on whether the algorithm considers only the four or eight nearest neighbors of a pixel, respectively.

The output of the imregionalmax function is a binary image where the value of 1 corresponds to a regional maximum and 0 otherwise. This binary image can be further processed to extract objects or features of interest.

For example, to extract the connected components of the regional maxima, you can use the bwconncomp function as follows:

cc = bwconncomp(maxima);

This function returns a structure containing information about connected components, such as the number of objects, the size of each object, and the pixel indices of each object.

Overall, the use of regional maxima can improve the accuracy and efficiency of various image processing applications, and MATLAB provides a convenient way to identify and extract maxima using the Imregionalmax function.

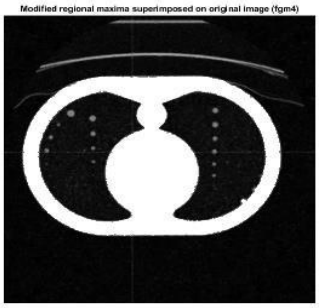


Fig.7.Modified regional maxima

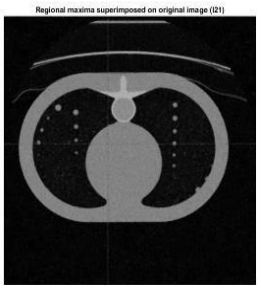
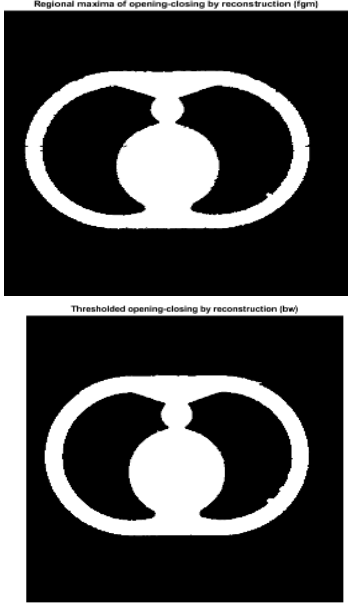


Fig 8. Regional maxima superimposed and threshold images



The watershed concept is a well-established concept in topography, and its application in image processing involves the use of watershed segmentation. This segmentation method identifies the dividing line with the least value, which corresponds to the rapid change in boundary. By treating the image as a plane with light pixels being high and dark pixels being low, the watershed transform can locate catchment basins and watershed edge lines in the image. However, one significant drawback of

this method is that it often leads to over- segmentation. To address this issue, morphological operations such as opening by reconstruction and closing by reconstruction are performed on the watershed segmented image to obtain a final segmented image.

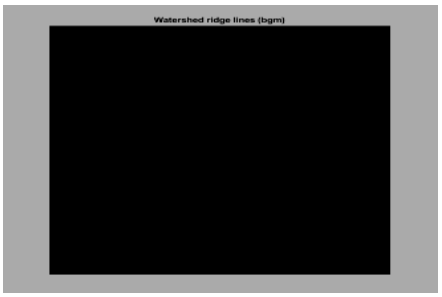


Fig.9.Watershed Image

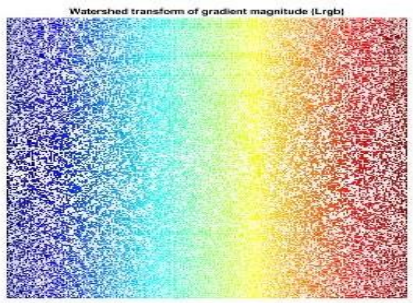


Fig 10. Watershed image of Gradient Magnitude

Image segmentation is the process of dividing an image into small regions or objects, which has numerous applications in various fields, including medicine. Thresholding is a powerful tool for converting a grayscale image into a binary image by assigning two levels (below and above a specific threshold value) to each pixel. The resulting binary image from thresholding segmentation occupies less storage space, processes faster, and is easier to manipulate compared to a grayscale image, which typically has 256 levels.

VII. CONCLUSION

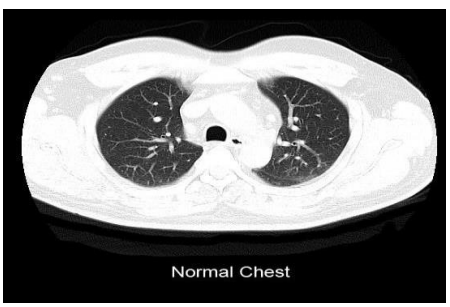


Fig 11. Normal Chest Vs Chest with Right Lung Cancer

Preventing lung cancer using medical imaging involves early detection through screening, which enables prompt treatment and better patient outcomes.

In conclusion, this study presents a lung cancer detection approach utilizing MATLAB, which involves image pre-processing, feature extraction, and classification techniques. The proposed method has been evaluated on CT images of lung cancer patients and has demonstrated high efficiency and accuracy. Furthermore, by training the machine learning models on relevant datasets, the proposed method can be expanded to detect other types of cancers. Therefore, this research provides a promising solution for lung cancer detection through medical imaging with significant potential for future clinical applications.

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