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IMAGE PROCESSING TEHCNIQUE FOR EXAMINING CT SCAN IMAGES FOR EARLY DETECTION OF LUNG CANCER

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Abstract: As the world's population grows, so does the number of people who are susceptible to high-risk illnesses and diseases. As a result, there is a strong need for health care. In the sphere of medicine, we have a critical need for technological advancement. Lung cancer is one of the most dangerous diseases among all malignancies, with significant fatality rates around the world. CT scans are used to diagnose lung cancer because they provide a precise view of the tumor in the body and track its progression. As a result, an image-processing-based lung cancer detection method is employed to classify the existence of lung cancer using CT scanned images. MATLAB was used throughout this investigation for all methods. We are aiming to get more accurate results by using CT images.

INDEX TERMS: CT (Computed Tomography) scan, Pre-processing, Segmentation, Feature Extraction, Lung Cancer Detection, Image Processing, Sobel Algorithm

Introduction: Many researchers presented a variety of solutions and problems for various phases of a computer-aided system to identify lung cancer in its early stages and provide information on the disease. The ability to extract meaningful and usable information from an image is provided by digital image processing. Cancer is a condition that causes abnormal cells to multiply and form a tumor. In comparison to other malignancies, lung cancer has a greater number of morality rates. When a cancer is diagnosed, the survival rate is determined by the timing and extent of the cancer's growth. When cancer is detected early on, people have a better chance of survival. Lung cancer, often known as ‘carcinoma,' is a type of cancer that results in the production of malignant nodules because of uncontrolled cell growth in lung tissues. Tobacco consumption and smoking are risk factors for the development of malignant lung nodules.

The major goal of this study is to use image processing techniques to detect lung cancer. CT scanned lung images of different cancer patients are taken from various hospitals. In this we have used different image processing techniques like pre-processing, image segmentation and feature extraction. Developing the algorithm, features like Entropy, contrast, and energy are extracted from all the images.

Methodology: Image acquisition, image pre-processing, image segmentation, image filtration and image dilatation, feature extraction, are the different image process involved in the study of identifying lung cancer using CT scans. MATLAB is used to complete every step of this project.

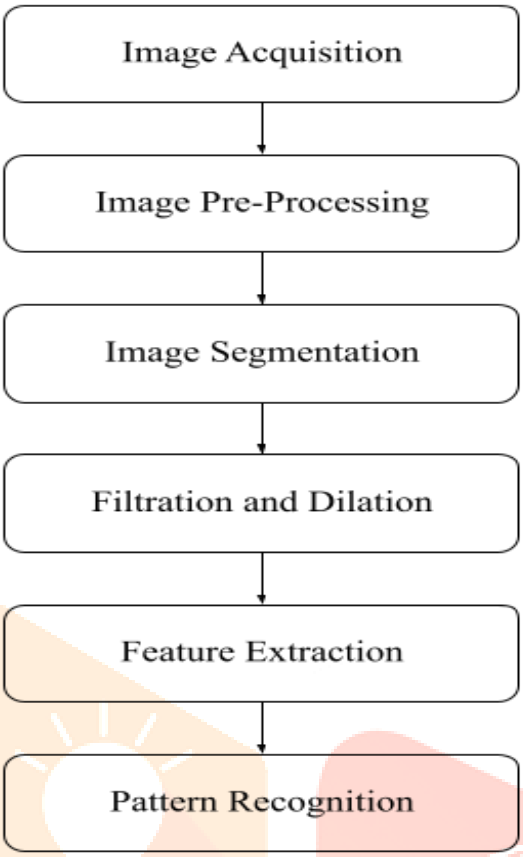

Figure 1: Flow chart

1) **Image acquisition:** To undertake the operations, the initial step is to obtain lung CT images of cancer patients from multiple hospitals. Computed Tomography (CT) pictures of patients with and without lung cancer will be taken. It might be as simple as being provided an image that has already been converted to digital format.

2) **Image Pre-processing:** Pre-processing is used to improve image data by removing undesired distortions or increasing specific visual features that are relevant for further processing and analysis. The method that we have used for pre-processing is "Histogram Equalization" this is a computer image processing technique for increasing image contrast and Histogram equalization also performs smoothening.

3) **Image Segmentation:** Image segmentation is a common technique in digital image processing and analysis that splits an image into many segments or zones, often depending on the properties of the pixels. Creating a barrier between the foreground and the background. In our work we have used Thresholding with "Sobel Algorithm" When we utilize matrix math to calculate areas of different intensities of an image, we call it edge detection. Extreme changes in pixel brightness usually indicate the edge of an item. We've discovered all the edges in an Image after detecting all the major variances in intensity.

4) **Image Filtration and Dilation:** In Image filtration and dilation we will be removing the noise in the image through filtration where we have used an image filter (IM Filter) to remove the noise. Pixels are added to the object boundaries via dilation. The maximum value of all the pixels in the neighborhood is the value of the output pixel. Dilation is utilized to enlarge an element A by employing a structural element B to expand the image pixels

a. **Image Filing:** fills holes in the binary image. A hole is a set of background pixels that cannot be reached by filling in the background from the edge of the image

5) **Feature Extraction:** Features are extracted using GLCM (Gray level co-occurrence matrix). Through GLCM we get textural features like Contrast, Energy, and Entropy. GLCM, also known as the grey-level spatial dependence matrix. The GLCM functions work by calculating how frequently pairs of pixels with specific intensity values and in a specified spatial relationship appear in an image, creating a GLCM, and then extracting statistical information from this matrix to find the texture of that image. Gray comatrix is a function used in MATLAB for feature extraction.
Contrast: Measures the local variations in the gray-level co-occurrence matrix.
Energy: Energy describes the provide sum of squared elements in the GLCM & Also known as uniformity or the angular second moment.
Entropy: Entropy means that is a measure of disorder or randomness, and hence a measure of uncertainty.

6) Pattern Recognition: In this paper the image is recognized and processed based on pattern recognition after the CT image is acquired. The corresponding image processing and feature value extraction is carried out. The process of classifying incoming data into objects, classes and categories is known as pattern recognition. Pattern recognition has different applications like image segmentation, object detection, radar processing and speech recognition. Here we will be identifying the CT image with its feature extraction values and then determine whether lung cancer is present or not in the processed CT image. This is one of the best methods to detect lung cancer in CT images

Results:

This process has been done through MATLAB, where here we have created a Graphical user interface (GUI) through MATLAB. The main functions include image display, image filtering, image edge detection and so on. There are also basic codes related to the development of MATLAB GUI. We have seen the best results through this work.

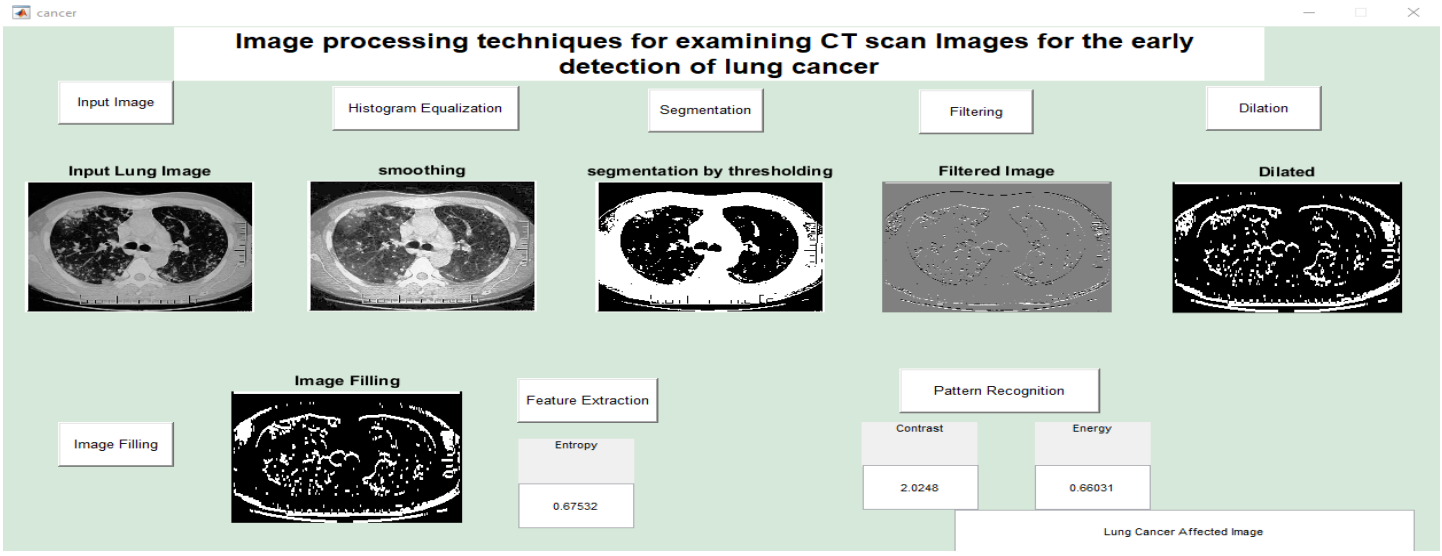

Figure 2: Simulation Image - 1

The above image shows all the steps involved in the process of Lung Cancer detection in CT image, it shows that the Entropy value= 0.67532; Energy value =0.66031; Contrast value= 2.0248 which says that it is a lung cancer affected image. Whenever the contrast value is greater than 2 it is a cancer affected image.

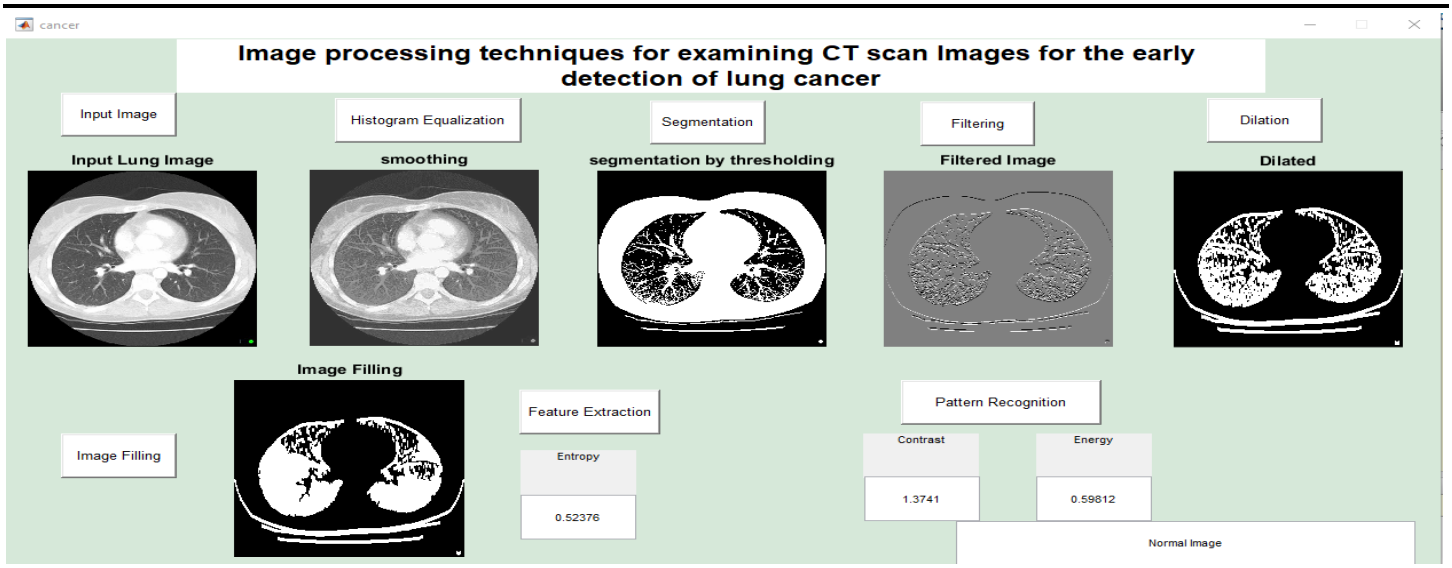

Figure 3: Simulation Image - 2

The above image shows the Entropy value= 0.80462; Energy value =0.59812; Contrast value= 1.3741 which says that it is a normal image. As the contrast value is not greater than 2 the above image shows that it is not a lung cancer affected image, it's just a normal CT image.

Conclusion: A system for automatic detection of lung cancer in CT images has been developed using image processing techniques. The adopted methodology performs well in segmenting and extracting features from CT images. Filtering technique was effective in eliminating impulse noise from the images without blurring the image; Thresholding with Sobel algorithm enables accurate results with segmentation. All the 3 textural features were extracted from the segmented region, and these features were considered by the classifier to classify whether the image is affected with lung cancer, or it is a normal image.

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