Available online at http://www.advancedscientificjournal.com
http://www.krishmapublication.com
IJMASRI, Vol. 1, issue 10, pp. 323 -327, Dec. -2021
https://doi.org/10.53633/ijmasri.2021.1.10.012

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY ADVANCED SCIENTIFIC RESEARCH AND INNOVATION (IJMASRI)

ISSN: 2582-9130 **IBI IMPACT FACTOR 1.5** **DOI: 10.53633/IJMASRI**

RESEARCH ARTICLE

DETECTION OF LUNG CANCER USING IMAGE PROCESSING

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Abstract

This project constructs and assesses an image processing approach for lung cancer diagnosis in this study. Image processing techniques are frequently utilized for picture improvement in the detection phase to enable early medical therapy in a variety of medical issues. We suggested a lung cancer detection approach based on picture segmentation in this study. Image segmentation is a level of image processing that is intermediate. To segment a CT scan image, a marker control watershed and region growth technique is applied. Following the detection phases, picture augmentation with the Gabor filter, image segmentation, and feature extraction is performed. We discovered the efficiency of our strategy based on the experimental results. The results demonstrate that the watershed with the masking method, which has great accuracy and robustness, is the best strategy for detecting major features.

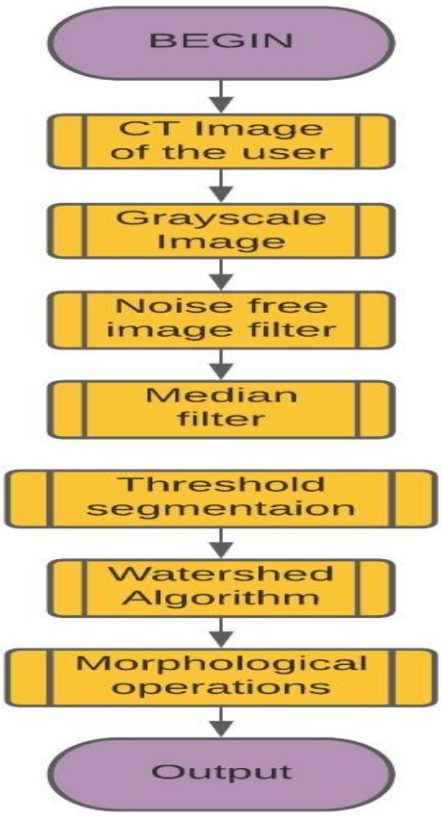
Keywords: Lung cancer, MATLAB, CT images, Distortion removal, Segmentation, Mortality rate.

Introduction

Cancer is one of the most deadly diseases that lead to death. The rate of new cases of lung and bronchus cancer was 53.1 per 100,000 men and women per year. The death rate was 36.7 per 100,000 men and women per year. These rates are age-adjusted and based on 2014–2018 cases and 2015–2019 deaths. Lung cancer is a condition in which aberrant cells develop and form a tumor. Cancer cells

can travel from the lungs to other parts of the body via the bloodstream or the lymph fluid that surrounds lung tissue. Because of the natural flow of lymph, cancer cells tend to spread into the center of the chest. When cancer cells move to other organs, this is called metastasis. The method of early cancer identification is crucial in preventing cancer cells from proliferating and spreading. Image processing is a technique for analyzing images at the most basic level, regardless of their quality. These actions do not improve the likelihood of picture information content, but if entropy is a factor, they lower it. It is critical to diagnose lung cancer at an early stage in order to reduce the high fatality rate. Particle emission tomography (PET) and computed tomography (CT) are used in the global lung screening program (CT).

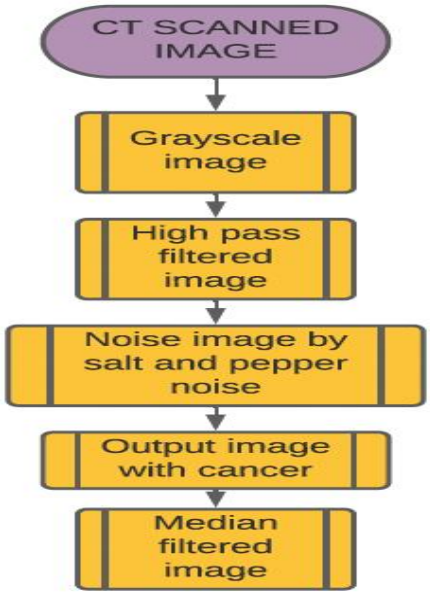
Methodology



The design is explained below as follows:

Input Image

For every sort of cancer, an image of the body's interior parts should be acquired first. CT scans, also known as X-ray computed tomography, employ X-rays to capture images from various angles and combine them to create cross-sectional tomographic images of specific sections of scanned tissues, allowing the individual to examine the status inside the body without the use of non-invasive treatments. In humans and other animals, the lungs are the most vital organs for respiration. Two lungs are positioned on either side of the heart near the backbone in mammals and the majority of vertebrates. Their job is to collect oxygen from the air and convey it to the bloodstream, as well as to release carbon dioxide from the bloodstream into the air. Humans have two lungs, one on each side. They are located within the chest's thoracic cavity. Because the right lung is larger than the left, it has to share a room with the heart. The lungs collectively weigh about 1.4 kg. The lungs are surrounded in a plural sac that allows the inner and outer walls to slide over each other without causing further friction. Each lung is encased in this sac, which also separates each lung into lobes.



Grayscale image

A grayscale image is a digital image in which each pixel's value is a unique sample, carrying only intensity or amplitude, in the computing world. This type of image, often known as white (highest intensity) and black (lowest intensity), is made up of only shades of grey. Grayscale images are created by measuring the intensity of light at each pixel in a single light spectrum band. A full- color photograph can likewise be used to obtain them. The reason for using a grayscale image is that even the smallest pixel intensity can help detect changes in the cells.

High pass filter

It passes all frequencies beyond a specified cut-off frequency while attenuating all frequencies below it, as the name implies. Sharpening photos with a high pass filter is common. When the brightness level of nearby sections is increased or decreased, the contrast between them is accentuated. A high pass filter uses a high threshold cut-off to extract visual information while excluding low-frequency input. The high pass filter's primary goal is to raise the amplitude of the median pixel in comparison to neighboring pixels.

Median filtering

It is a nonlinear digital filter that is used to reduce image noise. To detect an edge in an image, first, eliminate noise up to a certain threshold value, and then do edge removal. As a result, the median filter comes before the edge detector. Its key benefit is that it eliminates noise without removing edges. The median filter is similar to the averaging filter in that each output picture pixel is set to the average value of the input image's neighboring pixels. The Median filter reduces noise by being more sensitive to mean values and less sensitive to extreme values of pixels.

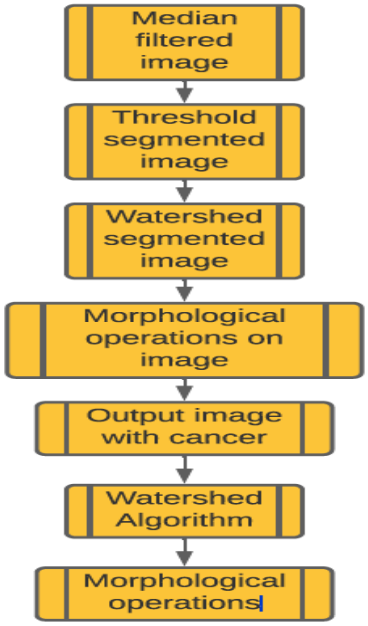
Threshold segmentation

One of the simplest segmentation approaches is threshold segmentation. Pixels are separated into groups based on their amplitude levels. There are several types of segmentation based on characteristics such as pixel threshold values, edge-based, region-based, clustering, and so on. It is also known as mapping, and it connects grayscale and binary images. Following this operation, the image is separated into simply two-pixel values: 0 and 1. When there is a dark structure on a light background in an image, thresholding can be used to distinguish the structure.

Watershed algorithm

A practical idea can be used to describe it. Consider a surface immersed in the lake with a hole at the bottom, so that water fills the hole and continues to fill it. If two similar surfaces are placed very close to one other, a point will be reached where the water will overlap and mingle from both surfaces.

Dams are only built at that point to keep the water from mixing. These dams are watershed lines, and surface separation can be accomplished by filling them with water. This algorithm can be implemented in a variety of ways. F.Meyer created the 'Meyer watershed algorithm,' which is now one of the most widely used watershed algorithms. Only grayscale images are affected by this technique.



Morphological operations

Mathematical morphology, according to Wikipedia, is a technique for evaluating segmented structures/images using random functions, set theories, and other methods. It is only applicable to digital photos. Binary morphological processes, for example, examine a specific grayscale image using simple, predefined shapes, determining how this shape fits into the image presented or what part of the image is lost as a result of this shape.

Gabor Filter

Dennis Gabor named the Gabor filter, which is a linear filter used for edge detection. Garbor filter representation is based on the human visual system. A 2D Gabor filter is a Gaussian filter function modified by a sinusoidal function in the spatial domain. A 2D image is employed in the cancer detection process; hence a 2D Gabor filter is used.

Result

We found a CT scanned image of a cancer-infected lung. Here are the steps:

1. The CT image is converted to the grayscale image to perform mathematical operations.

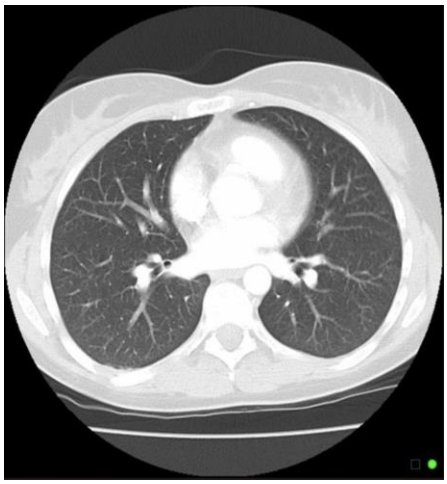


Fig.1 (Input image)

2. The image is then sent through a high pass filter to increase the information needed to do further mathematical calculations.

Fig.2

3. Median filtering is used in the study. To do this, we use salt and pepper noise to minimize image noise, resulting in reduced image distortion
4. Finally, the image is pre-processed by putting salt and pepper noise through a median filter, which removes all noise from the image while restoring the edges displayed

5. The watershed algorithm lies at the center of this procedure. It will identify the cancer-affected areas in the infected lung, allowing us to distinguish between cancerous and normal lung tissue.

Conclusions

The watershed algorithm lies at the center of this procedure. It will identify the cancer-affected areas in the infected lung, allowing us to distinguish between cancerous and normal lung tissue.

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