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# An Improved Lung Cancer Prediction System using Image Processing

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***ABSTRACT:*** ***Lung cancer is a disease that causes the cells present in the lungs which divide uncontrollably. This uncontrollable division of cells causes tumours which in turn decrease a person's respiration. Early identification and diagnosis will help people to seek treatment and recover soon. Tumours are an abnormal mass of tissue that results when cells divide more than they should or do not die when they should. Identifying lung cancer in its early stages is very difficult but knowing about its symptoms is quite easy. Symptoms may be similar to those of respiratory problems or infections and sometimes there may be no symptoms at all. In this work mainly deals with the lung cancer detection using image processing techniques were involving all the intermediate stages such as pre-processing stage, noise removal, processing stage, post-processing stage which finally gives output image after all those stages. Doctors can categorize tumour stage as initial or advanced based on patient CT scan report. The abnormal images are subjected to segmentation (threshold segmentation, watershed transformation) to focus on tumour portion. It mainly deals with image quality and clarity. Gabor filter algorithm plays a vital role for image enhancement in removing noise from an image. The ANN method gives us the best performance as it neglects the background and displays the required portion of an image that we need. This image processing technique is one of the most efficient way of detecting lung cancer.***

***Keywords:*** ***CT SCAN image, Gabor filter, image segmentation, threshold segmentation, watershed transformation, binarization.***

## I. INTRODUCTION

Our body is made up of very huge amount of cells. These cells together known as a Tissue. Number of tissues combine to form organ. Nucleus is also known as the functional unit of the cell since it performs all mandatory functions[1]. This functional part tells the cell when to grow, work, perform its tasks and die. If our cells follow all the above-mentioned processes we stay healthy and safe. When there are those abnormal changes in DNA as mentioned above, a gene mutates. As the instructions get mixed up in the DNA, in this case, mutated genes don't tend to work properly.

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In turn which leads our cells to divide and grow uncontrollably, which can lead to any type of cancers.Division of a cell into its daughter cells with the same genetic material is known as cell division shown in fig 1 [2].

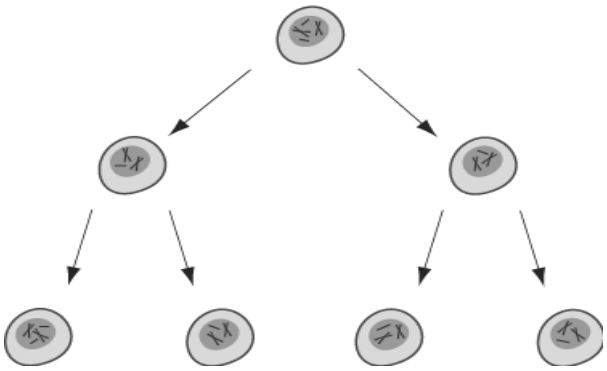


**Fig 1: Cell Division**

Generally, cancer starts in its respective cells. A group of cancer cells that grow vigorously and are responsible for the destruction of nearby tissue is a cancerous tumour.Cancerinitially starts in cells of lungs, which is known as primary cancer. In the chest portion, inside the rib case, there are two lungs one on other side. They are cone-shaped. The lungs are sponge-like structures and are delicate organs. The air we breathe inenters the nostrils through the windpipe. From the windpipe, it enters both the lungs. This air is rich in oxygen purifies the blood in the lungs. The sample lungs image is presented in fig 2 [3].

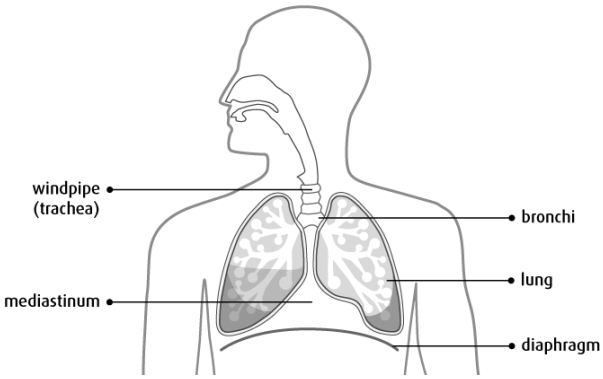



Fig 2: Lungs

Thetransformation of cells in the lungs leads to grow or behave abnormally and such type of changes causes tumours that are responsible for causing cancer.Sometimes these variations in lung cells can cause cancer and sometimes they can't [4].

Based on the cell type in which cancer starts, pulmonary cancers are commonly categorized or graded into two groups

1. Small cell lung cancer
2. Non-small cell lung cancer

**Non–small cell lung cancer:** Thisusually starts in the cells that are present on the outer part of the lung. It can also start in squamous cells which are flat and thin. These squamous cells cover the bronchi. Bronchi are the large airways that starts from trachea (also known as windpipe) and ends up entering into lungs[5].

**Small cell lung cancer:** It usually begins in bronchial cells in the middle of the lungs. Some other forms of cancer which occur in other parts of the body that are not lung related may also lead to primary lung cancer. In a very different or rare case cancers starts in pleura, the part that covers the lung which is considered as a rare lung cancer. Blood collects the waste material and carries to the heart through veins[6]. The heart pumps this impure blood to lungs and lungs will helps to purify this blood. There's oxygen in the air we breathe. This goes to the lungs as well. If the air in which we breathe includes toxins from cancer, small cell lung cancer may occur.

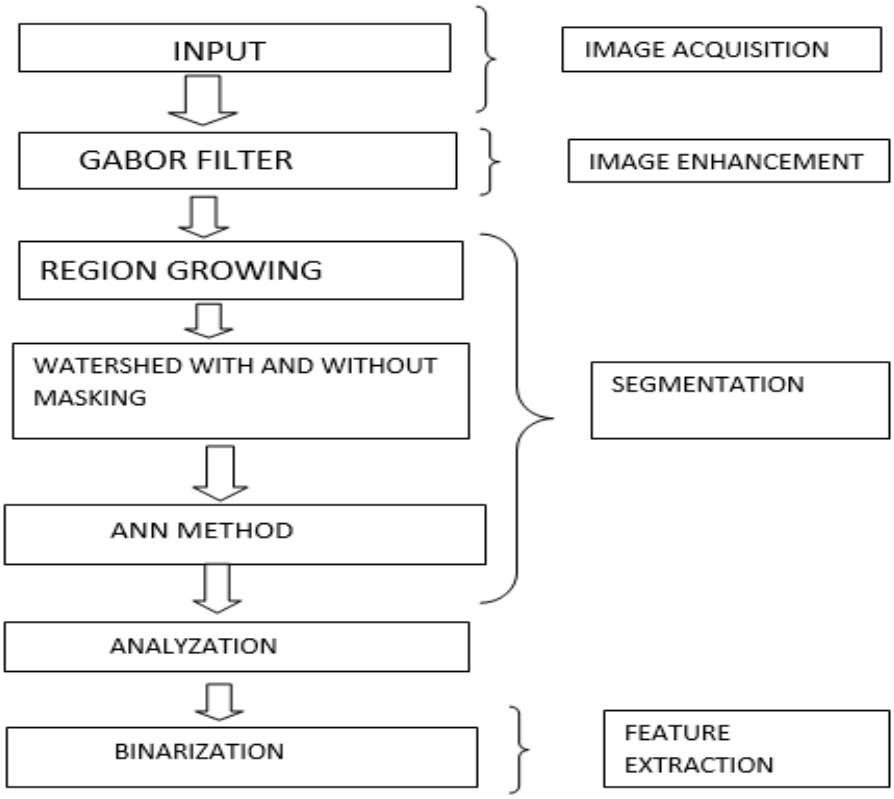



**Fig 3: Stages for output image**

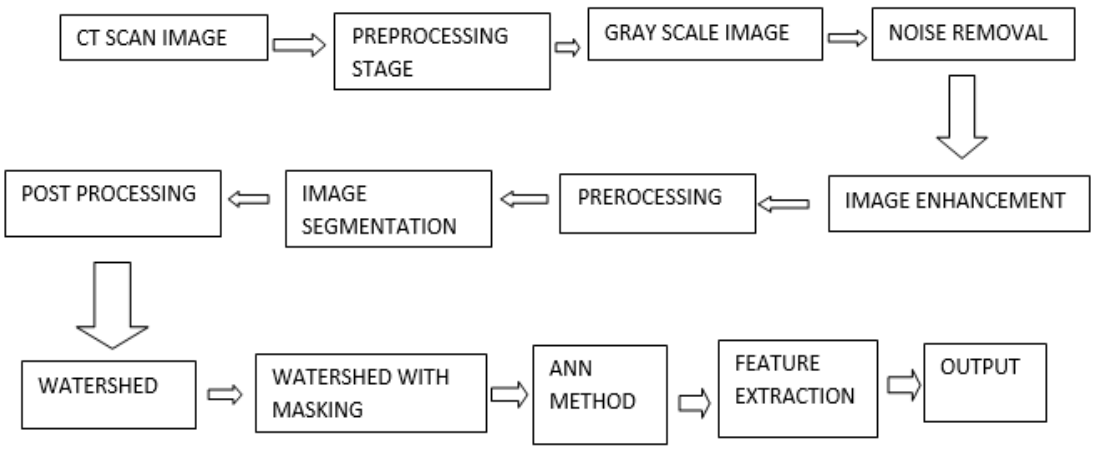



**Fig 4: Detailed Processing Stages for an Output Image**

## II. RELATED WORK

**1.Image Acquisitions:**

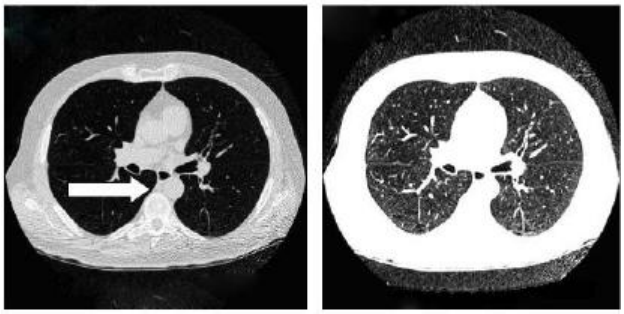
Initial stage in the image processing is image acquisition. It is a simple stage because, here the image exists in digital format. This stage involves pre-processing stage which results in greyscale image and noise removal. This stage has to be properly done in order to get better results after applying filters[7].

**2.Image Enhancement:**

It is one of the most important methods used by some techniques to enhance an image. This stage is used to get the details we want and focus on certain image areas such as changing brightness & contrast, tuning an image, etc. Such image enhancement techniques are therefore used to detect lung cancer beforehand. We use three types of techniques in this process, such as Gabor filter, auto enhancement method and Fourier transform techniques[8].

**Gaborfilter:**

It's a filter linear. Dennis Gabor called Gabor Filter is used to detect edges. Gabor filter representation is identical to the visual system of humans. 2D Gabor filter is a Gaussian filter function that is modulated by a sinusoidal function in the spatial domain. A 2D object is used in the process of detecting this disease, so use the 2D Gabor filter[9].



**(a) Original Image** **(b) Enhanced Image using Gabor filter**

**Fig 5: Enhanced image after applying gabor filter**

**Auto-Enhancement:**

It is a process of adjusting pixels such that it is useful for future analysis[10]. It is one of the most significant method which is used to enhance an image using the techniques mentioned. This stage is used to get the details we want and focus on certain image areas such as changing brightness & contrast, tuning an image, etc. methods of image enhancement are:

- Wiener filter for noise reduction
- Analogue filter
- Lattice phase equaliser
- Histogram equalisation
- Non-masking filter
- Unsharp mask filtering
- Mean filtering
- Mode filtering
- Median filtering

**Fast Fourier Transform Techniques:**

• Image Enhancement Fall into two categories:
Enhancement in spatial domain and frequency domain.

• After modifying the Fourier transform of the image, frequency domain techniques are used[11].

**Image Enhancement in the Spatial Domain**

Denoted by: g(x,y)=T[f(x,y)]

• f(x,y) : Input Image ,

**Image Enhancement In The Frequency Domain**

The model for filtering in the frequency domain G(u,v) = H(u,v)F(u,v) where F(u,v): the Fourier transform of the image to be smoothed H(u,v): a filter transfer function.

• There are several standard forms of lowpass filters (LPF). – Ideal lowpass filter – Butterworth lowpass filter – Gaussian lowpass filter

• T: Operator on Image g(x,y): Processed Image.

• T can also operate on a set of Images.

**Image segmentation:**

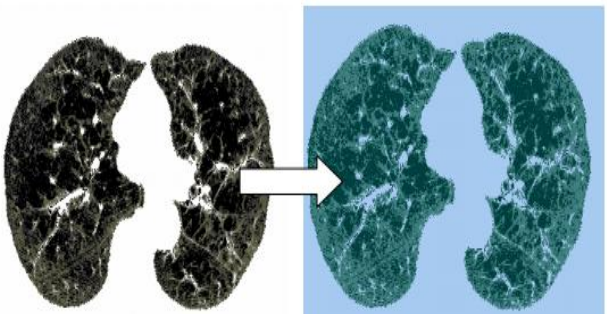
• It is very useful to find segmented or separated objects from the image

• In this technique, we divide the image into different segments where every image is similar to others. Some of the techniques are

1.Threshold method
2.Edge-based method
3.Region-based method
4.Clustering-based method
5. Watershed based method
6.Watershed with masking method
7.PDE and ANN-based method

**(a) Orginal image** **(b) enhanced image**

**Fig 6: output image after applying FFT techniques**



**(a)ehnancedbygabor** **(b)segmentedby watershed**

**Fig 7 Enhanced output image**

**ANN Method:**

The Artificial Neural Network-based segmentation is based on simulation of learning process for decision making. In this modern era, we have to segment the image such that it shouldn't consist of complex computations of gradient functions as in watershed with masking. This method neglects the background and gives an original image as output.

This network consists of a very huge number of nodes which consists of weights. This method is not dependent on PDE (partial differential equation). In this method, the problems are solved by converting them into networks.

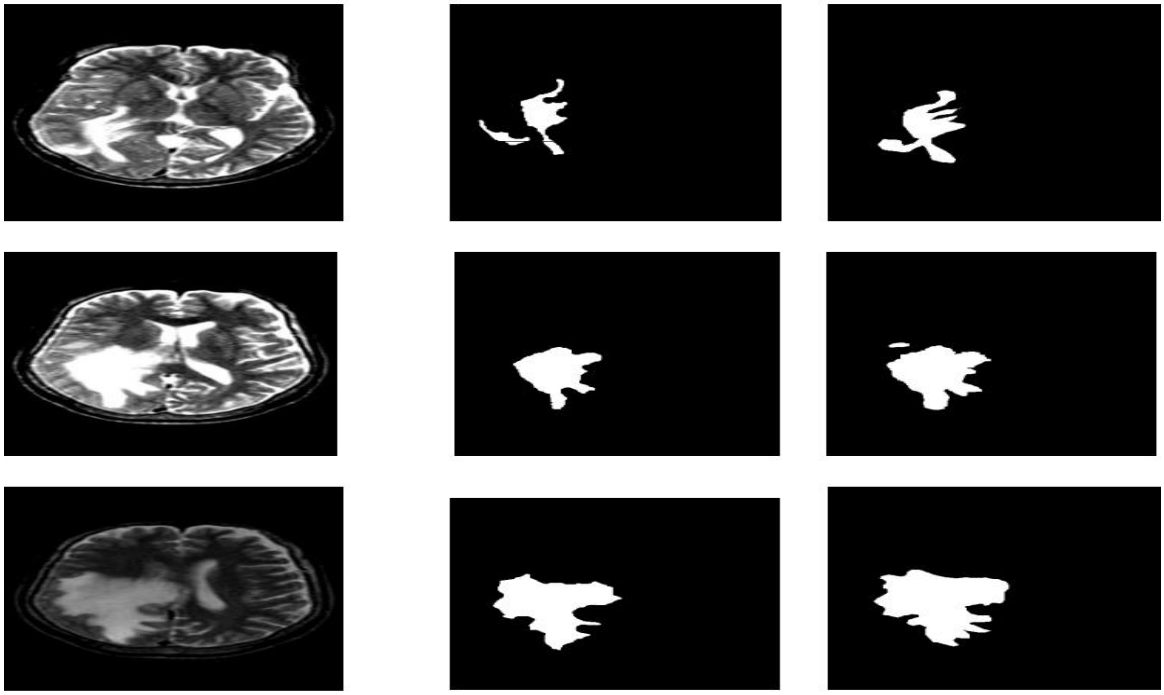


**Fig 8: output images by ANN method**

In this context, we mainly compare the output of the

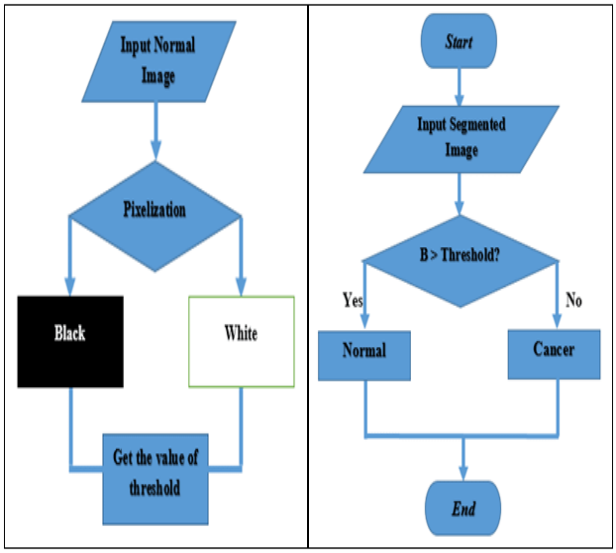



**Fig 9: Flow Chart**

images obtained by Gabor filter, watershed and watershed using masking methods with ANN-based method, which is highly useful.

**BINARIZATION: (feature extraction)**

Binarization is the method of switching the colors of pixel values to black and white. After we got the quantity of black and white pixels on the results of segmentation, we compared it to a threshold value to determine the lung's condition. The threshold value is derived from normal lung observations.

## III. CONCLUSION:

Four image segmentation methods for analyzing lung cancer have been implemented and evaluated, such as Marker Controlled Watershed with and without Masking, ANN method after Gabor filter application. The results show that in terms of segmentation results and response time, the ANN method gives us the best performance as it neglects the background and displays the required portion of an image that we need. ANN method is therefore suggestable in the segmentation stage of the image. In addition, we use a color attribute in the extraction stage to analyze lung cancer using binarizationEventually, from the CT scan image records, the binarization approach was successfully calculated with color based on the lung condition (normal or cancer).

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