

# Study of Preprocessing and Segmentation Techniques of Lungs CT Images

<sup>1</sup>Hitesh Pathak, <sup>2</sup>Manoj Kumar Pandey, <sup>3</sup>Jagandeep Kaur

<sup>1</sup>Student M.Tech. ECE, <sup>2</sup>Assistant Professor, <sup>3</sup>Assistant Professor

<sup>1</sup>Department of Electronics and Communication Engineering,  
Amity University Haryana, India

**Abstract:** Detection of any disease in its early stage helps in reducing the amount of death rate. Several medical areas are using image processing techniques for better visibility of output images. These techniques give improved image output so that detection and treatment can be easily done. In this paper, comparison between different preprocessing techniques and different segmentation techniques has been done for different CT scan images. Preprocessing techniques include median filter, gabor filter and wiener filter. Basically, these filters are used for noise removal. Segmentation techniques include thresholding and k-mean clustering. Segmentation is done to change the representation of an image into an image which is more meaningful and can be analyzed easily. The early detection of lung cancer disease is directly proportional to the survival rate of a person.

**Keywords:** Median filter, Gabor filter, Wiener filter, Thresholding, K-mean clustering.

## Introduction:

Now days a person can suffer from any kind of deadly disease due to environmental changes. One such type of disease is lung cancer which can be curable or non curable depending on its stage. Stage can be early, middle and last which depends on the size of the cancer nodule that grows inside the lungs. To minimize the death rate occurring due to lung cancer, several methodologies are used to detect the symptoms in its early stage.

Lung cancer is mainly caused due to smoking and chewing of tobacco. As the people belonging to the age group of 20-40 smoke regularly, the percentage of persons suffering from this disease is quite high. In this particular age group, passive smoking also leads to the development of cancer in appreciable high figure. According to a report published in Nov 2017 by Berkeley Earth science Research Group, breathing in Delhi air is equivalent to smoking 44 cigarettes a day. Therefore, in metropolitan cities like Delhi, exposure to high amount of PM 2.5 is the major cause of cancer.

In this paper, a comparison for processing and segmentation of two different types of CT-scan images has been done individually to get the better output images. The usage of filters such as median, gabor and wiener comes under preprocessing of an image while k-mean clustering and thresholding comes under segmentation process [1] [3] [4]. The different formats of images used are jpeg and dicom [1-6]. Jpeg images are directly accessible while dicom images are not. They are converted to readable format using “dicomread” command in matlab.

## Literature Survey:

Digital image processing techniques are widely used in medical and research areas to detect the disease at early stage. The review of papers related to topic as follows:

Pooja R. Katre et.al used the dicom format as input image which is readily available in online database [1]. It was first converted to readable format as these files are not directly accessible. Median filter was used for smoothing and high boost filter was used for image enhancement.

Ratih Wulandari et.al used the axial plane lung CT-scan as input image which can be directly accessible [2]. Erosion and dilation were used as preprocessing techniques. Before preprocessing techniques, the gray level was recorded to create template of cancer color.

Prionjit Sarker et.al used the dicom image format from the database TCIA [3]. Erosion and dilation along with opening and closing processing techniques were used. K-means clustering algorithm was used for segmentation purpose.

Anjali Kulkarni et.al used the dicom image format taken from the online database (LIDC) [4]. Median filter was used for image smoothing and gabor filter was used for image enhancement. Marker based water segmentation was the segmentation technique.

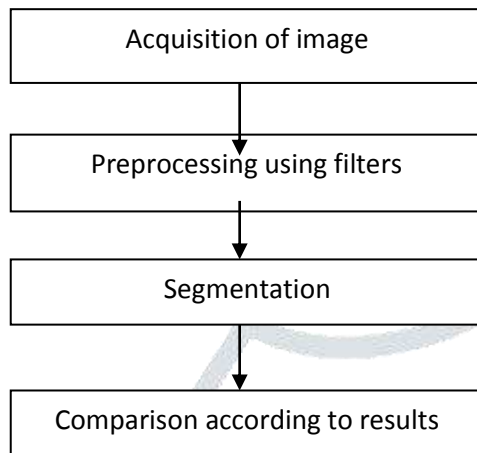
Shraddha G. Kulkarni et.al used the dicom image format taken from the online database (ELCAP) [5]. Gaussian filter was used for image smoothing and anisotropic filter was used for image enhancement. Watershed technique was used for segmentation.

## Methodology:

The proposed system contains four steps starting from acquisition of lung CT-scan images. The block diagram of proposed system is shown in Figure 1. Two different formats of images are taken as input. These formats are jpeg and dicom. Preprocessing techniques include smoothing and enhancement of images by applying different types of filter such as median filter, wiener filter and gabor filter. The second essential step is segmentation which involves processes like thresholding and k-mean. A comparison has been shown in Table 1 and Table 2 for preprocessing and segmentation techniques respectively.

The image is processed by the following steps:

1. Acquisition of image.
2. Preprocessing of CT-scan image.
3. Segmentation of image
4. Comparison



**Figure 1: Block diagram**

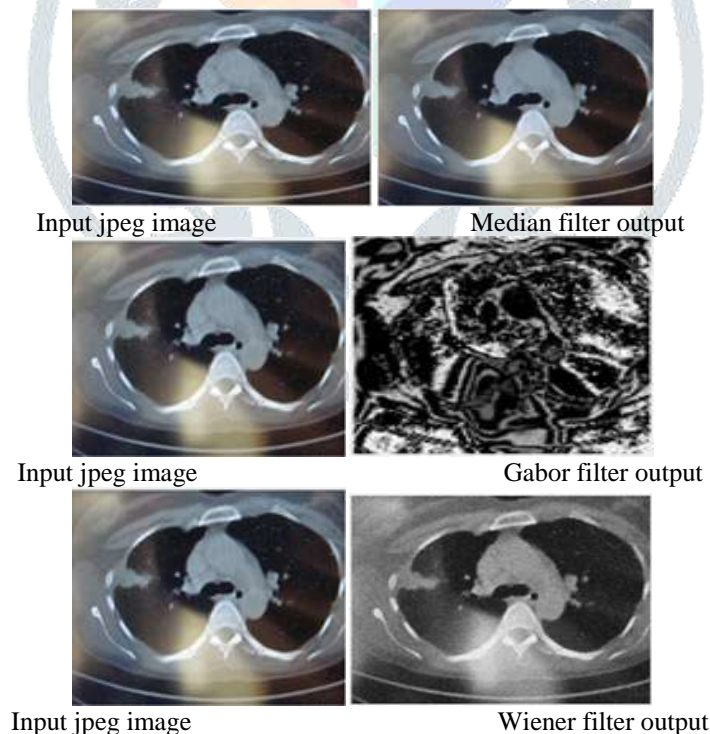
**Acquisition of image:** The first step is to read an input image. Two image formats jpeg and dicom are taken and then processed one by one.

**Preprocessing using filters:** Preprocessing uses filtering techniques like median filtering, wiener filtering and gabor filtering.

**Segmentation:** It is the process of partitioning an image into multiple segments so that it can be meaningful and easily analyzed.

**Result:**

The output of jpeg and .dcm images is different for each of the processing techniques which is shown below:



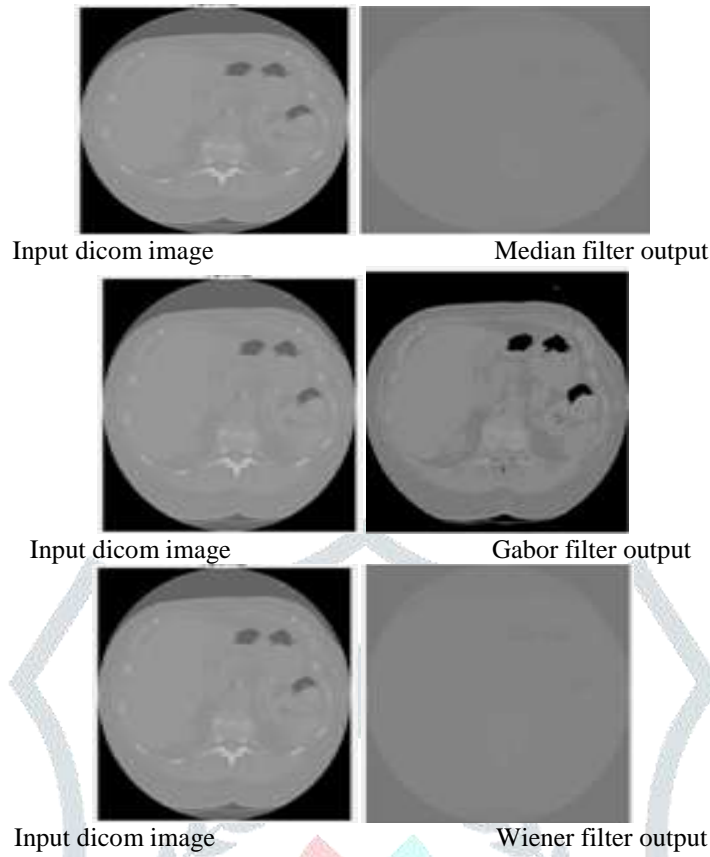
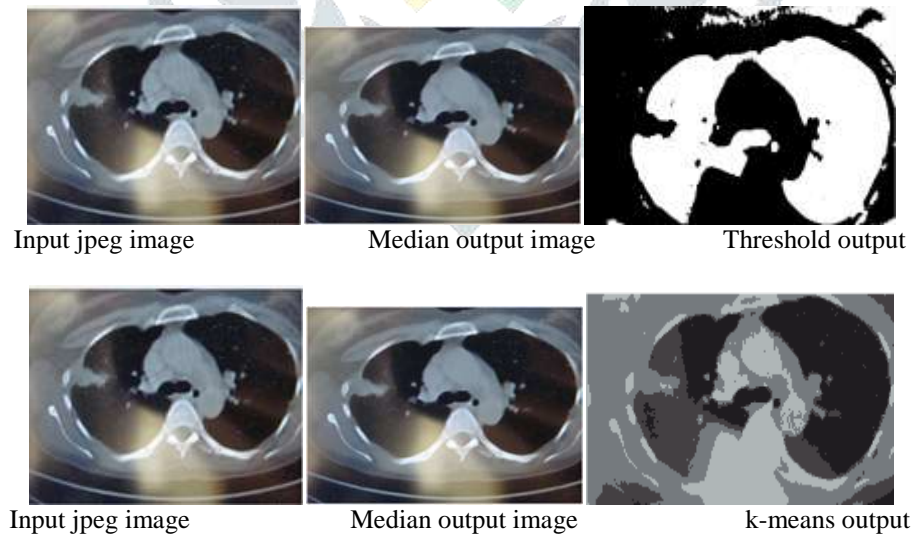


Image Format	Filter Used		
	Median Filter	Gabor Filter	Wiener Filter
Jpeg	Good visibility	Worst output image	Hazy output image
dicom	Unclear output image	Good visibility	Unclear output image

**Table 1. Comparison of different preprocessing techniques for different image formats**

Similarly, the output is different for each of the segmentation technique.



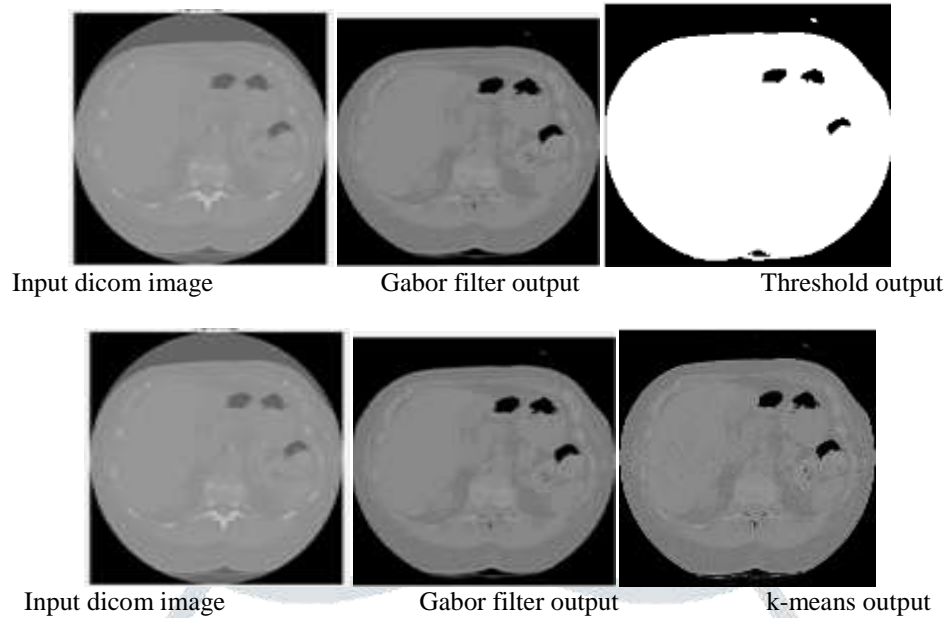


Image Format	Segmentation Technique Used	
	Threshold Output	K-means Output
jpeg	Not fully segmented	Fully segmented
dicom	Not fully segmented	Fully segmented

**Table 2. Comparison of different segmentation techniques for different image formats**

#### Conclusion:

Cancer is a deadly disease mainly found in men and women falling in the age group of 20-40. The lung cancer nodules can be easily detected in the early stage if a system uses the best image processing techniques for preprocessing and segmentation and thus the life of a person suffering from cancer can be saved. It can be seen from the comparison Table 1 that median filter has the best output for jpeg format and gabor filter has the best output for dicom image. Similarly, it can be observed from Table 2 that K-mean technique is best suited for segmentation process.

#### References:

- [1] Pooja R. Katre and Dr. Anuradha Thakare, Detection of Lung Cancer Stages using Image Processing and Data Classification Techniques, 2017 IEEE 2nd International Conference for Convergence in Technology (I2CT).
- [2] Ratih Wulandari, Riyanto Sigit and Setia Wardhana, Automatic Lung Cancer Detection Using Color Histogram Calculation, 2017 IEEE International Electronics Symposium on Knowledge Creation and Intelligent Computing (IES-KCIC).
- [3] Prionjit Sarker, Md. Maruf Hossain Shuvo, Zakir Hossain and Sabbir Hasan, Segmentation and Classification of Lung Tumor from 3D CT Image using K-means Clustering Algorithm, 2017 IEEE 4th International Conference on Advances in Electrical Engineering (ICAEE).
- [4] Anjali Kulkarni, Anagha Panditrao, Classification of Lung Cancer Stages on CT Scan Images Using Image Processing, 2014 IEEE International Conference on Advanced Communication Control and Computing Technologies (ICAC-CCT).
- [5] Shraddha G. Kulkarni and Sahebrao B. Bagal LUNG CANCER TUMOR DETECTION USING IMAGE PROCESSING AND SOFT COMPUTING TECHNIQUES 2016, International journal of science technology and management.
- [6] Ritika Agarwal, Ankit Shankhadhar, Raj Kumar Sagar , "DETECTION OF LUNG CANCER USING CONTENT BASED MEDICAL IMAGE RETRIEVAL," 2015 5th International Conference on Advanced Computing and Communication Technologies