

# A Segmented Morphological Approach to Detect Tumor in Lung Images

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## Abstract

Image processing is one of most growing research area these days and now it is very much integrated with the medical and biotechnology field. Image Processing can be used to analyze different medical and MRI images to get the abnormality in the image. This abnormality can be described in terms of tumor or the patch or scare on the human body. We are presenting such an approach to detect the tumor from the lung image. In this proposed approach we have applied a series of operations, first to enhance the image and then to detect the tumor from the lung image. In this proposed approach, First of all some image enhancement and noise reduction techniques are used to enhance the image quality, after that we have applied watershed segmentation and some morphological operations to get the desired result. The algorithm has been tried on a number of different images from different angles and has always given the correct desired output.

## Keywords

Contrast Stretching, Gabor Filter, Histogram Modeling, Morphological operations, Watershed Segmentation.

## I. Introduction

Lung cancer is the most common cancer which occurs for both men and women. According to the report submitted by the American Cancer Society in 2003, lung cancer would report for about 13% of all cancer diagnoses and 28% for all cancer deaths. The survival rate for lung cancer analyzed in 5 years is just 15%. If the disease is identified while it is still localized, this rate increases to 49%. However, only 15% of diagnosed lung cancers are at this early stage [1].<sup>1</sup>

The human lungs are the organs of respiration in humans. The main function of the lungs is to allow oxygen from the air to enter the bloodstream for delivery to the rest of the body [2]. Lung cancer is caused by uncontrolled cell growth in tissues of the lung. If left untreated, this growth can spread beyond the lung in a process called metastasis into nearby tissue and, eventually, into other parts of the body [10]. Lung cancer is of two types: NSCLC and SCLC. The NSCLC accounts for about 80% of lung cancers. There are different types of NSCLC. And SCLC accounts for about 20% of all lung cancers. Although the cells are small, they multiply quickly and form large tumors that can spread throughout the body. Smoking is almost always the cause of SCLC. It was formerly referred to as "oat-cell" carcinoma [3]. In this paper we use images in DICOM format which stands for Digital Imaging and Communications in Medicine. It is a standard that was developed to promote communication of digital image information. The standard is both a file format and a transfer protocol, and it is not tied to a particular manufacturer, hardware device, operating

system or software application. This is similar to other common formats such as JPEG image file.

## II. Literature Survey

Lung cancer was not known before the advent of cigarette smoking. It was not even recognized as a disease until 1761. Different aspects of lung cancer were described further in 1810. In Germany in 1929, physician Fritz Lickint recognized the link between smoking and lung cancer. Bhadauria and Dewal described that with the advancement in Computed Tomography technology it is widely used in diagnosing different diseases. The expanding volume of thoracic CT studies along with the increase of image data, supplements the need for CAD schemes to assist the radiologists. Mathematical morphology is a new mathematical theory which can be used to process and analyze the images [4]. Yamamoto et al., described LSCT technique which was mobile-type CT scanner mainly for the purpose of mass screening of lung cancer. With LSCT technique, one main complexity was raised in the image information to around 30 slices per person from 1 X-ray film [5]. Yeny Yim et al., described about Hybrid lung segmentation in chest CT images for computer aided diagnosis. The author proposed a system which consists of three phases to obtain lung region borders [6]. Zhi-Hua Zhou et al. described that Lung cancer is one of the most common and deadly diseases in the world. Detection of lung cancer in its early stage is the key of its cure [7]. Lin et al. described the method to diagnose lung cancer nodules on digitized chest radiographs, which was based on a parameterized two-level convolution artificial neural network and on a special multi-label output encoding procedure [8]. Kanazawa, Kubo and N described a system to detect the tumor candidates from helical CT images that extracted and analyzed features of the lung and pulmonary blood vessel regions and then utilized defined rules to perform diagnosis [9]. Armato *et al.*, described fully automated computerized technique based on two-dimensional and three-dimensional analyses of the image data obtained during diagnostic CT scans for the identification of lung nodules in helical computed tomography scans of the thorax [10]. Penedo et al. developed a system that employed an artificial neural network to detect suspicious regions in a low-resolution image and employed another artificial neural network to deal with the curvature peaks of the suspicious regions, which was used in the detection of lung nodules found on digitized chest radiographs.

## III. Methodology

Image processing is one of most growing research area these days. In the following we are proposing an effective scheme to detect abnormal formation of cells in the lungs. Here we present

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an approach that detects the tumor from the lung image. In this proposed approach we have applied a series of operations, first to enhance the image and then to detect the tumor from the lung image. First of all we take an image and then enhance the contrast of an image by using contrast stretching technique to adjust its contrast. After normalizing the image, we applied a series of steps to enhance the quality of an image and to remove the noise [10]. In this approach enhancement of an image comes first, the aim of image enhancement is to improve the interpretability of information in images for human viewers. Image enhancement techniques can be divided into two broad categories: Spatial domain methods, which operate directly on pixels, and Frequency domain methods, which operate on the Fourier transform of an image. When image enhancement techniques are used as pre-processing tools for other image processing techniques, then quantitative measures can determine which techniques are most appropriate. For enhancement first of all we applied Fast Fourier Transform. We applied Fast Fourier Transform (FFT) to enhance the image quality. Fast Fourier Transform is a method to calculate computations which are large enough. It works on divide and conquers approach; it breaks  $N$  input values into  $N/2$  values, so that it becomes easy to calculate [11]. After the application of FFT, we used another enhancement method named histogram modeling technique; this is the technique that can be used to improve the visual appearance of an image.

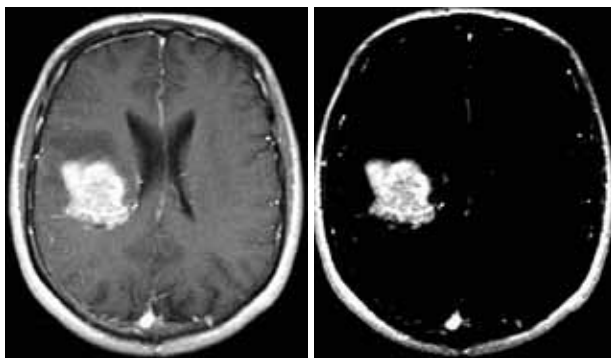


Fig. 1 : (a) Original image, (b) Image enhanced after FFT.

Histogram modeling is as a contrast enhancement technique which aims at enhancing the image with an uniform histogram. We applied Histogram Modeling on the FFT enhanced image with an objective to have a uniform intensity throughout.

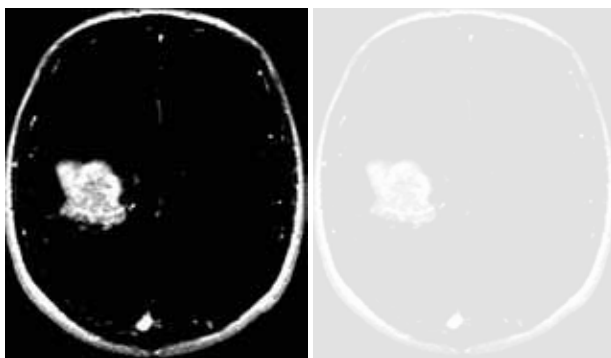


Fig. 2 : (a) FFT enhanced image, (b) Histogram Modelled image.

After we get uniform intensity values throughout the image by using histogram modeling technique we applied Gabor transform over the image that helps to determine the changing signal over

time.

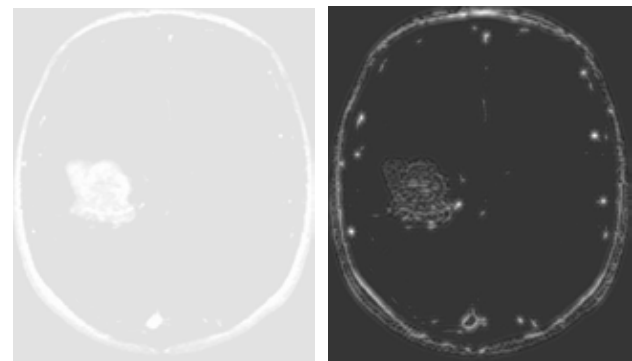


Fig 3 : (a) Histogram Modeled image, (b) Gabor Transformed image.

After enhancing the image by applying a series of techniques. We then filter the image and then thresholded and after that we applied a segmentation algorithm which segment the image's desired part, in this case the tumor which we wants to detect.

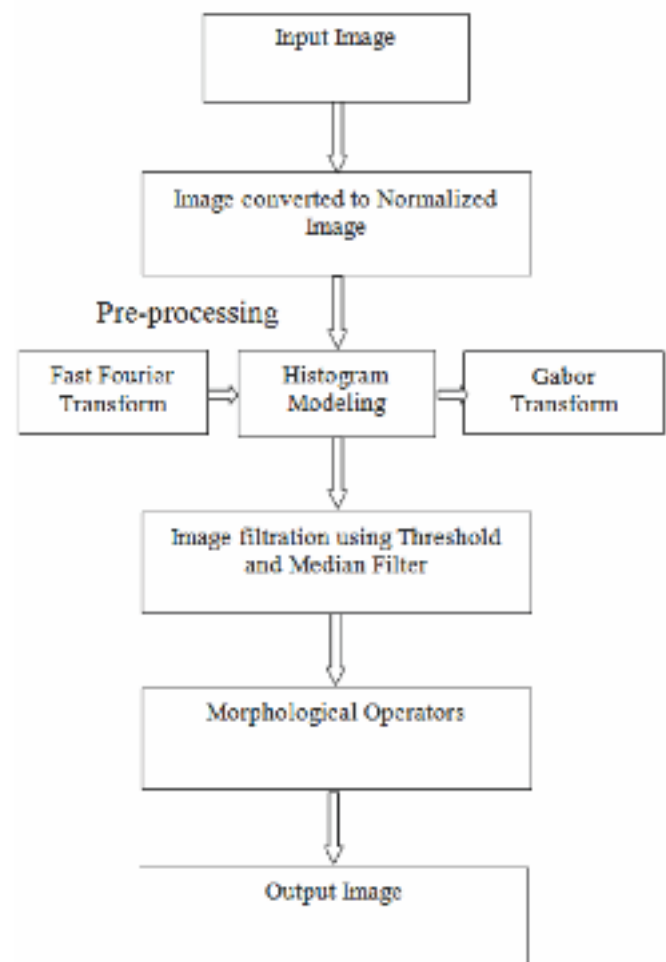


Fig. 4 : Tumor detection process in lungs.

The fig. above explains the complete methodology used to detect the tumor from a lung image.

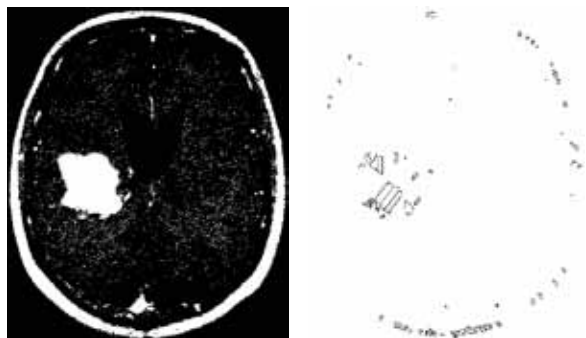


Fig. 5 : (a) Image after Threshold, (b) Image after the application of Watershed Transformation.

To segment the image we have used the watershed transformation algorithm. We applied watershed after Thresholding the image. Segmentation is the process of segmenting objects from the background. After segmentation of abnormal region using watershed we then applied a series of morphological operations [12]. Mathematical morphology is used to process and analyze images. It process images based on shapes. It apply structuring element to an input image and produces the output image of an equivalent size. First of all we applied Erosion and then Dilation, and after the application of these basic operations we apply the operations which are made by the combination of these basic operations such as opening and closing operations. Erosion erodes away the pixels of the image boundary, and Dilation adds the pixels to the image boundary. The number of pixels added or removed depends upon the size and shape of structuring element [13].

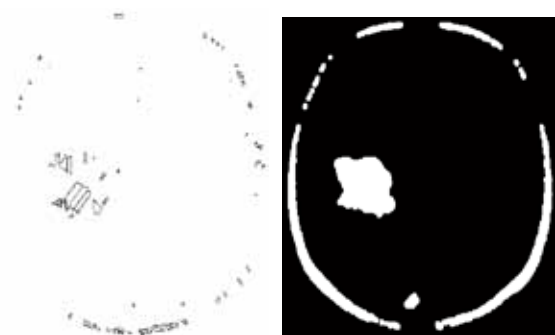


Fig. 6 : (a) Image after Watershed Transformation, (b) Image after the application of Morphological Operations.

After the application of morphology, we can easily distinguish between the source image which we take as input and the result image which comes as output. The output image clearly shows the tumor part with less blurring and noise.

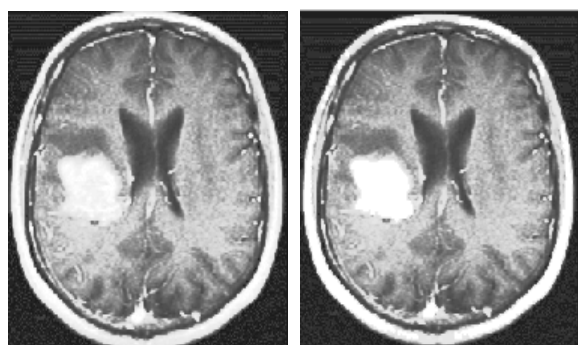


Fig. 7 : (a) Input image, (b) Output image.

#### IV. Conclusion and Future Work

In this proposed work we acquire the MRI lung image and perform the series of operations to enhance the image quality and to analyze and detect the tumor. In this approach we first convert the image to normalize image and then perform the Fast Fourier Transformation and Gabor filter to enhance the image. Some other filters like median filters are also applied to restore the image. After that watershed algorithm and the morphological operators are applied to derive the final result in which tumor is detected. After this the image is compared with actual source image and check the image quality. The process can be modified in future to implement on bit map images or some other format and to include different modalities by finding suitable thresholds for them as well.

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