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# Brain Tumor And lung cancer Detection Using Segmentation & Morphological Operators

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## ABSTRACT
Medical Image processing is a fast growing and demanding field. In recent years the image process mechanism are used widely in several medical areas for improving earlier detection and treatment stages, in which time factor is very important to detect the disease in the patient as possible as fast especially in various tumors such as lung cancer, brain tumor. So the Early detection of tumor is a challenging task as symptoms appear in the advanced stages of tumor. Brain tumor and lung cancer is a serious life-threatening diseases. Tumor detection helps to find the location and size of tumor. Brain tumor and lung cancer detection mainly involves four stages namely Image pre-processing, Image segmentation, optimization and feature extraction. In this paper we proposed an efficient method for tumor detection based on segmentation and morphological operators. Segmentation method is used to separate the tumor area from background and then morphological operators are applied to detect the tumor in the Magnetic resonance imaging (MRI) and cancer cell in computerized tomography (CT) scan.

**Keywords :** Tumor Detection, MRI, CT scan, Segmentation, Morphological Operators.

## I. INTRODUCTION

Brain tumor and lung cancer are the most serious health issues facing today in the world. The Mortality rates of these diseases are highest among all other, so the early detection of the disease will increase chances of successful treatments.

**Tumor** is the word which is synonym for a word neoplasm. Tumor is formed by a abnormal growth of cells which is something totally different from cancer. Tumors are classified into three types

1. Benign Tumor [non-cancerous]: These tumors grow does not expand throughout the body.
2. Pre-malignant Tumor [pre -cancerous stage].
3. Malignant Tumor [cancerous]: These tumors grow worse with the passage of time and ultimately results in death of a person.

**Brain Tumor** is a group of abnormal cells that grow inside of the brain or around the brain. Tumors can directly destroy all healthy brain cells. It can also indirectly damage healthy cells by crowding other parts of the brain causing inflammation, brain swelling and pressure within the skull. The complex brain tumor can be separated into two general categories: Depending upon the tumor origin, primary brain tumors are the tumors that arrays from the cells in the brain or from covering of the brain. A secondary or Metastatic brain tumor occurs when cancer cells spread to the brain from a primary cancer in other part of a body.

**Lung cancer** is a disease of abnormal cells multiplying and growing into tumors. Cancer cells can be carried away from the lung in blood or lymph fluid. That surrounds lung tissues. Lymph flows through lymphatic vessels which drain into lymph nodes located in the lungs and in the center of the chest because the natural flow of the lymph out if the lungs is towards the center of the chest. Metastasis occurs when cancer cells leaves the site where it began and move into lymph node or to another part of the body through the blood stream.

The aim of this paper is to detect tumors and cancer cells present in the brain and lung images by segmentation and morphological operators.

**A. Image Acquisition**: Images are obtained using MRI scan and CT scan and these scanned images are displayed in a two dimensional matrices having pixels as its elements. These images are stored in MATLAB and displayed as a gray scale image. A gray scale image is a data matrix whose value represents shades of gray. The entries of gray scale matrix have integer or intensity values in range 'o to 255', here '0' shows total black color and '255' shows pure white color. The lung CT images having low noise when compared to scan image and MRI image. MRI scan of brain of patient suffering from tumor shows some region having high intensity, but MRI image involves some noise also. So we take CT images for lungs for detection of cancer cells and MRI images for brain to detect the exact location of tumor. Different formats of digital images like.JPG, .PNG etc, have been used for storing scanned images.

**B. Preprocessing**

In this phase image is enhanced in the way that finer details are improved and noise is removed from the image. Most commonly used enhancement and noise reduction techniques are implemented that can give best possible results. Enhancement will result in more prominent edges and a sharpened image is obtained, noise will be reduced thus reducing the blurring effect from the image. In addition to enhancement, image segmentation will also be applied. This improved and enhanced image will help in detecting edges and improving the quality of the overall image. Edge detection will lead to finding the exact location of tumor. Following steps will be followed in the preprocessing stage

a) **Noise Removal**: Many filters are used to remove the noise from the images. Generally gray scale image contains noises such as white noise, salt and pepper noise etc, white noise is one of the common problem in image processing these noise can be removed by using various kinds of filters having different characteristics. There are two types of filters 1) Linear filter 2) Nonlinear filters

Linear filters can also serve the purpose like Gaussian, averaging filters. For example average filters are used to remove salt and pepper noise from the image. In this paper we used Median filter which is nonlinear filter used to remove the noise from input image. Median filter is also used to remove the noise like salt and pepper and weighted average filter is the variation of this filter and can be implemented easily and give good results. In median filter value of pixel is determined by the median of the neighboring pixels. This filter is less sensitive than the out liners. After noise removal, the next step is to enhance the image. So the next section explains the various enhancement techniques

b)**Image Enhancement** : Image enhancement defined as a way to improve the quality of image, so that the resultant image is better than the input image.Enhancement will result in more prominent edges and a sharpened image is obtained. Sharpening of the image can be achieved by using different high pass filters. As now noise is been removed by using different low pass filters, we need to sharpens the image as we need the sharp edges because this will help us to detect the boundary of the tumor.

In this paper we used Gaussian high pass filter is used to enhance the boundaries of the objects in the image. Gaussian filter gives very high rated results and used very widely to enhance the finer details of the objects.

C. **Processing**:

1) **Image Segmentation**: In computer vision, segmentation refers to the process of partitioning a digital image into multiple segments. Image segmentation is typically used to locate objects and boundaries in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with same label share certain visual characteristics. The result of image segmentation is a set of segments that collectively cover the entire image or a set a contour extracted from the image. Each of the pixels in a region is similar with respect to some characteristics or computed property, such as color, intensity, texture. All image processing operations generally aim at a better recognition of objects of interest, i.e. at finding suitable local features that can be distinguished from other and from the background. The next step is to check each individual pixel to see whether it belongs to an object or not. This operation is called segmentation and produces a binary image. A pixels has the value one of it belongs to the objects otherwise it is zero. After segmentation, it is known that which pixel belongs to which object. Brain tumor segmentation from MRI images and lung cancer cell detection from CT scan image is an interesting but challenging task in the field of medical imaging.

**D. Post-Processing:**

In processing segmentation is done using following methods.

1) **Threshold Segmentation**: Threshold segmentation is one of the simplest segmentation methods. Thresholding is useful in discriminating foreground from the background. By selecting an adequate threshold value, input gray scale image is converted into a binary format. The binary image should contain all the essential information about the position and shape of the objects of interest (foreground). The advantage of obtaining a binary image is that, it reduces the complexity of the data and simplifies the process of recognition and classification. Some common methods used under this segmentation include maximum entropy method and k- means clustering method for segmentation.

In this paper we used maximum entropy method for threshold segmentation.

2) **Watershed Segmentation**: It is one of the best methods to group pixels of an image on the basis of their intensities. Pixels falling under similar intensities are grouped together. In watershed segmentation markers are used, a marker is connected to component belonging to an image. The marker include the internal markers, associated with the background. separating touching objects in an image is one of the more difficult task in image processing operations. The marker based watershed segmentation can segment unique boundaries from an image. It is a good segmentation technique for dividing an image to separate a tumor from the image. Watershed is a mathematical morphological operating tool. Watershed is normally used for checking output rather than using as an input segmentation technique because it usually suffers from over segmentation and under segmentation.

For using watershed segmentation different methods are used. Two basic principle methods are given below: 1) the computed local minima of the image gradient are chosen as a marker. In this method an over segmentation occurs. After choosing marker region merging is done as a second step; 2) Watershed transformation using markers utilizes the specifically defined marker positions. These positions are either defined explicitly by a user or they can be determined automatically by using morphological tools.

3) **Morphological Operators**: After converting the image in the binary format, some morphological operations are applied on the converted binary image. The purpose of the morphological operators is to separate the tumor part of the image. Now only the tumor portion of the image is visible, shown as white color. This portion has the highest intensity than other regions of the image.

Mathematical morphology is defined as a tool for extracting image components that are useful in the representation and description of region shape, such as boundaries, skeletons etc. There are two fundamental morphological operations: a) Dilation b)Erosion.These are defined in terms of union and intersection of an image with translated shape called as structuring element.

Dilation: Dilation is operation that grows or thickens objects in image. The specific manner and extent of this thickening is controlled by a shape referred as structuring element. Toolbox function 'imdilate' performs the dilation.

Erosion: Erosion shrinks or thins objects in binary image. As in dilation, the manner and extent of shrinking is controlled by structuring element. Toolbox function 'imerode' performs the erosion.

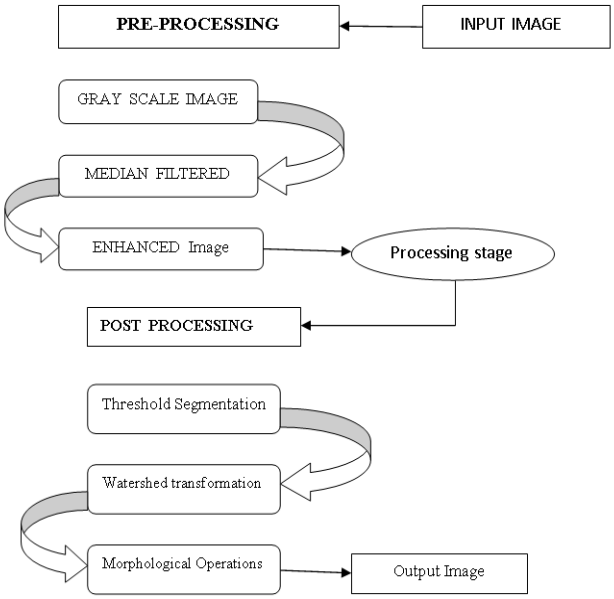


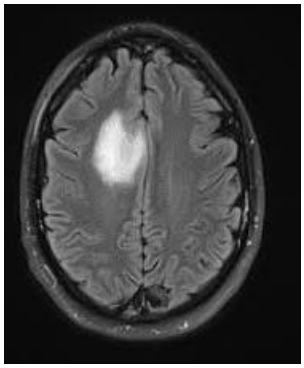

**Figure 1.** Tumor Detection Process

## II. EXPERIMENTAL RESULTS

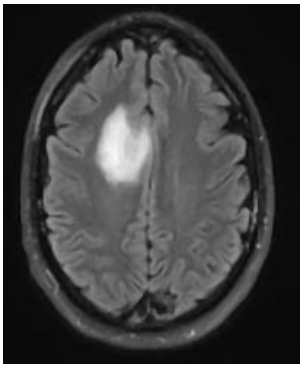
The work has been done in the MATLAB software with various images taken from the internet source. In the previous section we have shown techniques used to detect tumor and explained theoretically and those techniques are applied to image in the next section. In the next section we have shown that techniques are applied to MRI image of image and CT scan image. The techniques applied are filtering, enhancement, segmentation and morphological operators and output images are clearly shown below with each their technique name which are obtained by using MATLAB operation.

A. BRAIN MRI IMAGE

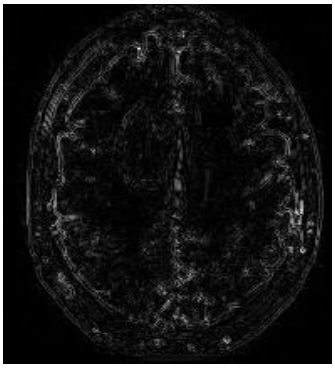
original image of Brain



Median filter



Gaussian filter



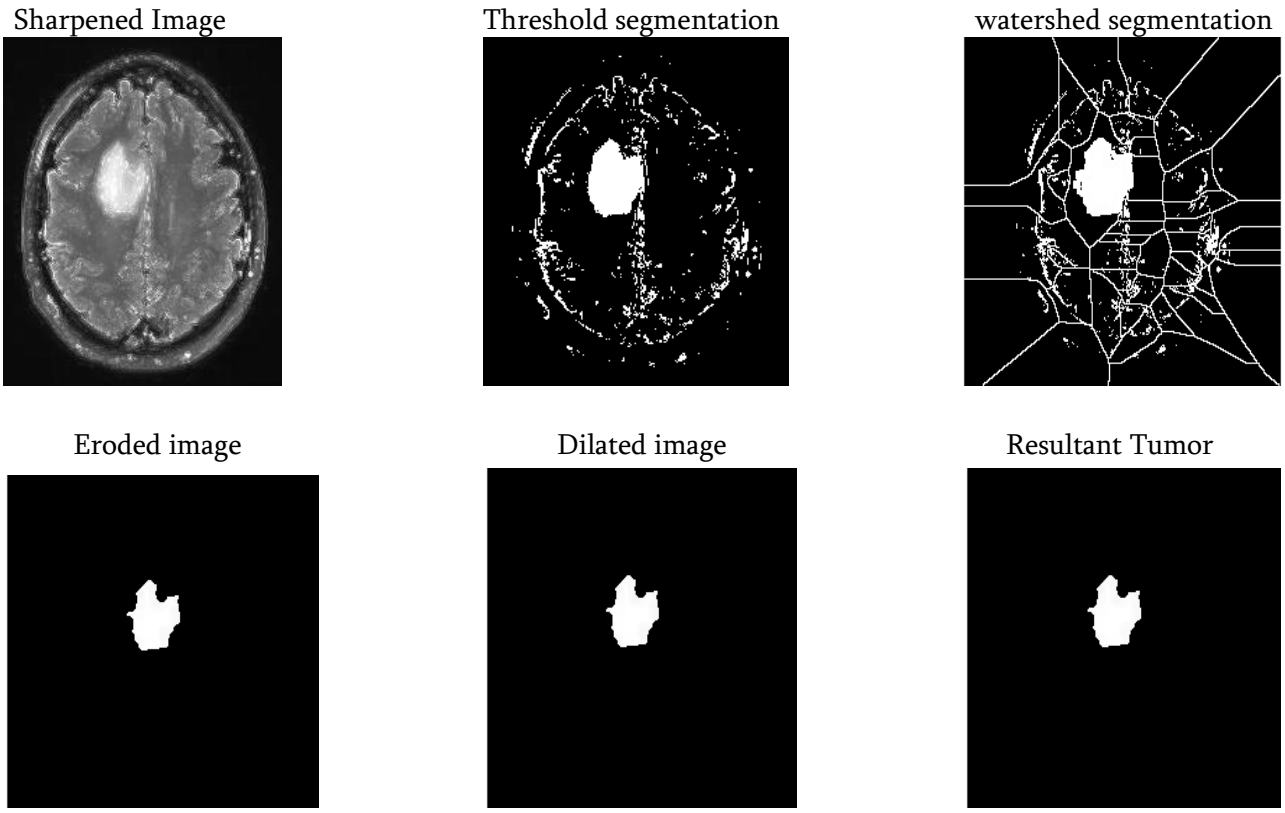
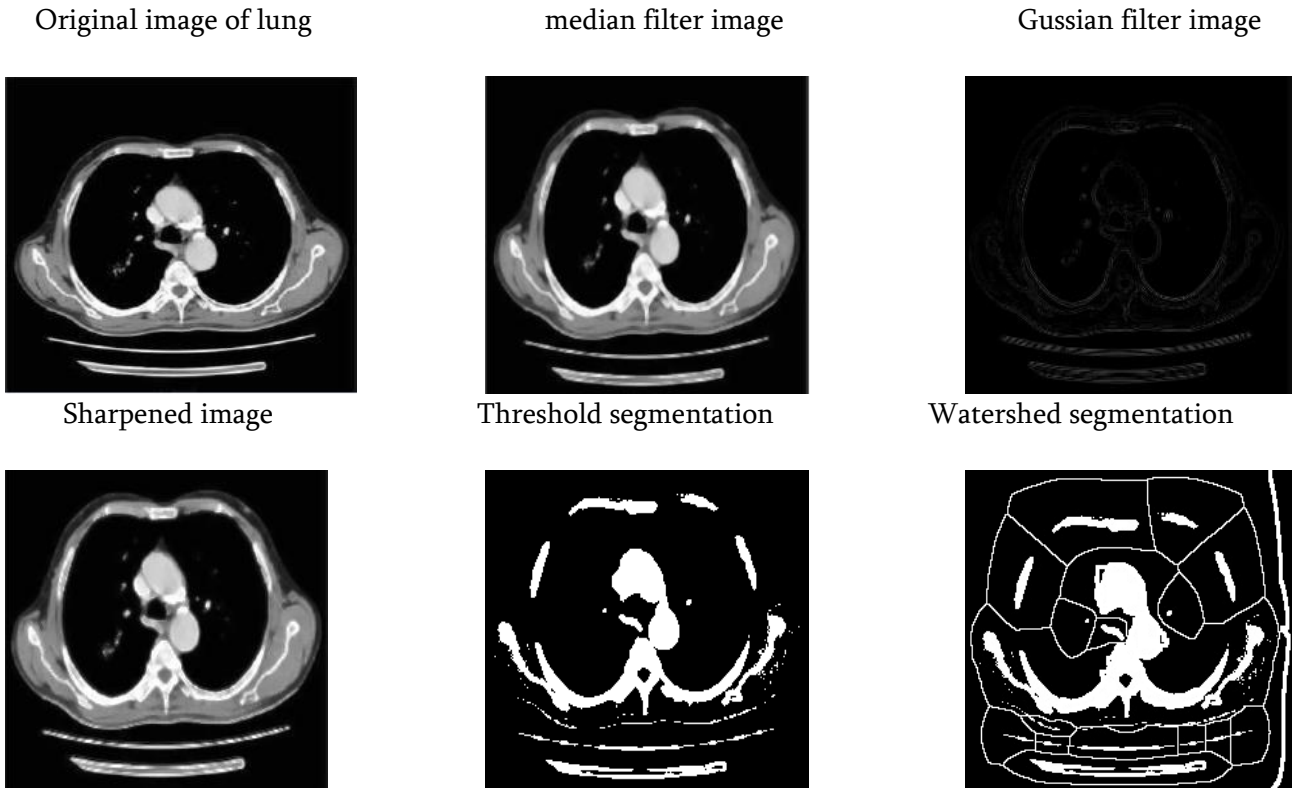



Fig.2 Results of our proposed method on input MRI Image of Brain

B. CT IMAGE OF LUNG



Dilated image Eroded image Resultant image

Fig.3 Results of our proposed method on input CT Image of Lung

## III.CONCLUSION

From the previous section it can be seen that the results obtained are much accurate and clear. Accuracy obtained in final step; they are numerous methods providing best results were chosen. In this Work we applied our proposed technique to detect brain tumor and lung cancer cell using Image processing techniques. The results of our proposed method are better compared to previous research methods. By using our proposed method we can obtain exact size and location of tumor in the given input Image. The proposed method is easy to understand and execute.

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