Image Processing and Computer Vision

UE19CS333

6th Semester, Academic Year 2021-22

Project Title:

Brain-tumor Detection

Team :

ASHWA

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Introduction

A brain tumor is a mass of cells that have grown and multiplied uncontrollable. Medical imaging plays a central role in the diagnosis of brain tumors.

MRI is a technique used in medical imaging which is considered to be the most efficient tool to analyze the internal structures of the body.

Problem is Brain tumours vary in size, shape, appearances, colour, location and orientation, which is precisely the reason why tumor segmentation is challenging.

The major drawback of manual detection is that it is time consuming and prone to human errors.

LITERATURE REVIEW

A robust segmentation algorithm using morphological operators for detection of tumor in MRI , 2015	*A seed region growing segmentation is used to detect the tumor.* ***Drawbacks:*** *Computationally expensive,* *Sensitive to noise.* *Human intervention is required.*
Brain tumor segmentation using thresholding, morphological operations and extraction of features of tumor, 2014	*Using thresholding and morphological operations brain tumor segmentation is carried out.* ***Drawbacks:*** *The threshold value used is global threshold, process needs human intervention.*
Comparison of standard image segmentation methods for segmentation of brain tumors from 2D MR images, 2009	*Otsu's thresholding method is the most suitable image segmentation method to segment a brain tumor*

LITERATURE REVIEW

Computer Aided System for Brain Tumor Detection And Segmentation, 2011	*Segmentation using global threshold value is a simple and time efficient technique.* *Drawback:* *The threshold value is chosen manually and less accurate*
Abnormal tissue extraction in MRI Brain medical images, 2011	*Expectation maximization algorithm is an iterative procedure to find maximum likelihood estimates of parameters in statistical model.* *Drawbacks:* *The algorithm is very complex. Same efficiency can be achieved with less complexity*
Efficient segmentation methods for tumor detection in MRI images, 2014	*Comparative study between three brain tumor detection methods (k-means clustering with watershed optimized k-means clustering with genetic algorithm and optimized c-means algorithm with genetic algorithm).*

OBJECTIVE

To build an efficient system for automating the process of detecting brain tumors which is less time consuming and more accurate than the manual system

The objective is to develop a real-time application which will take MRI scan of brain and patient details as input, Preprocess the image read from the database, Perform segmentation in order to detect the ROI and Extract the area and size of the tumor from ROI.

Problem Statement

Tumors are a group of abnormally differentiated cancer cells that can directly or indirectly damage and destroy healthy surrounding tissue. The present existing technology does not give any information about the tumor detection and classification.

The assessment of lesions is still performed manually. The major drawback of manual segmentation are time consuming and subjective of human decision. Manual assessment of pathological changes is too cumbersome for everyday clinical use and is leading to human errors.

Problem is Brain tumours vary in size, shape, appearances, colour, location and orientation, which is precisely the reason why tumor segmentation is challenging.

Proposed System

The proposed system system is a MATLAB based application with an efficient graphical user interface.

The medical practitioner has to scan the hard copy of the MRI scan and save the soft copy in the image database. The user has to follow steps of image processing, By choosing various options such as image enhancement, image segmentation etc.

After successful detection of tumor, it's features like tumor's size, area, perimeter will be displayed in output field as output.

The proposed technique gives promising results for completeness, correctness, accuracy and processing time.

PROJECT BLOCK DIAGRAM

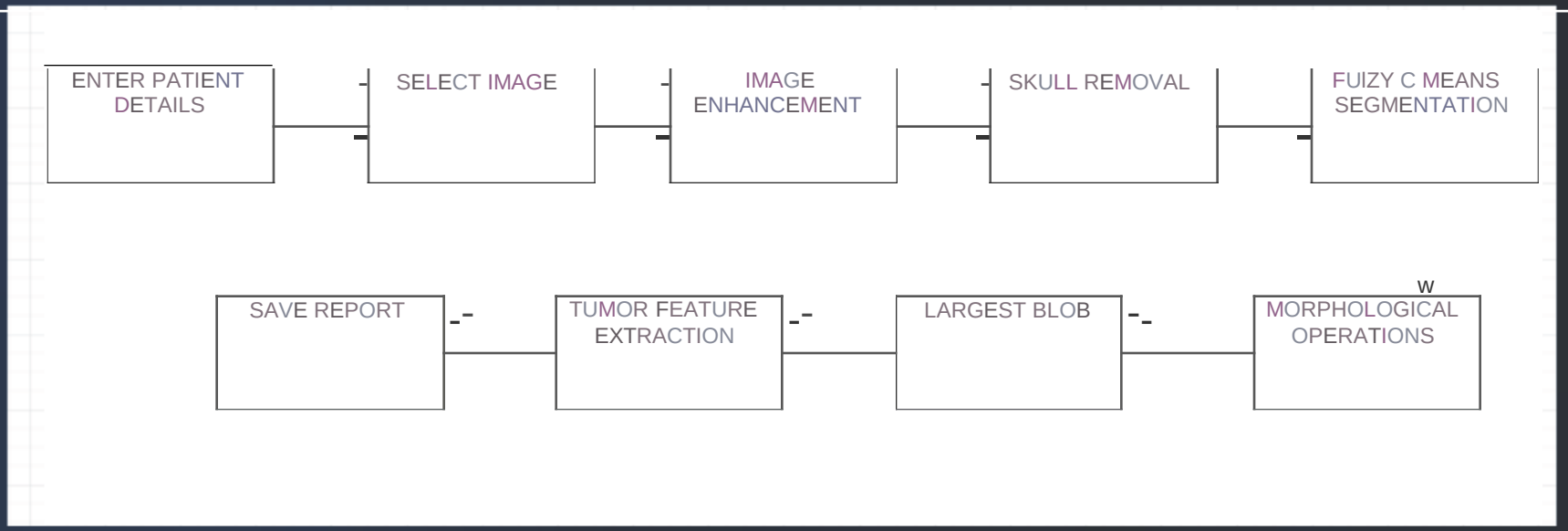
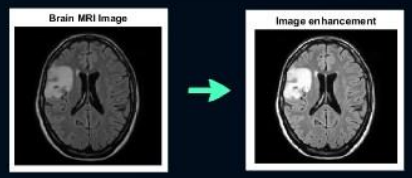


Image Enhancement

- The Histogram equalization is used to enhance the quality and contrast of image.
- As an alternative to histeq, contrast-limited adaptive histogram equalization (CLAHE) can be done using the adapthisteq function.
- While histeq works on the entire image, adapthisteq operates on small regions in the image, called tiles. Each tile's contrast is enhanced, so that the histogram of the output region approximately matches a specified histogram.
- To avoid amplifying any noise that might be present in the image, adapthisteq is used to limit the contrast, especially in homogeneous areas.



Brain MRI Image

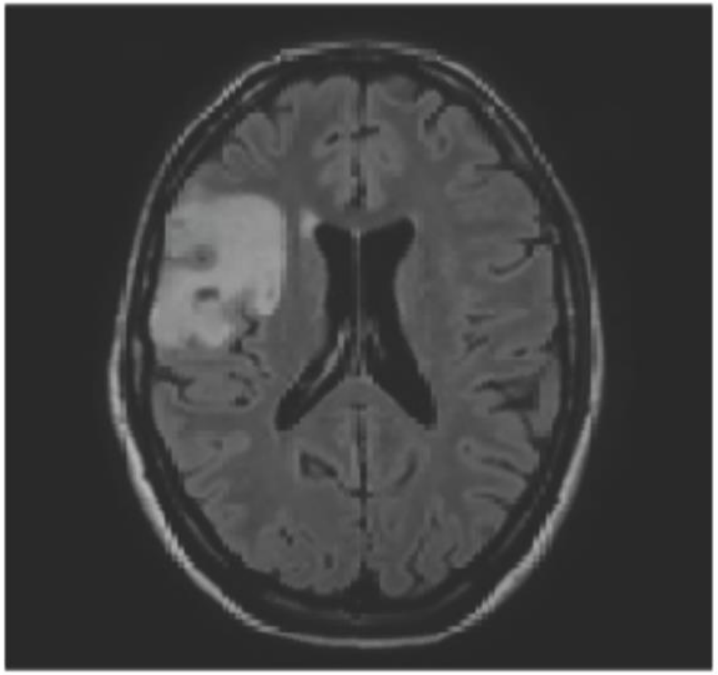
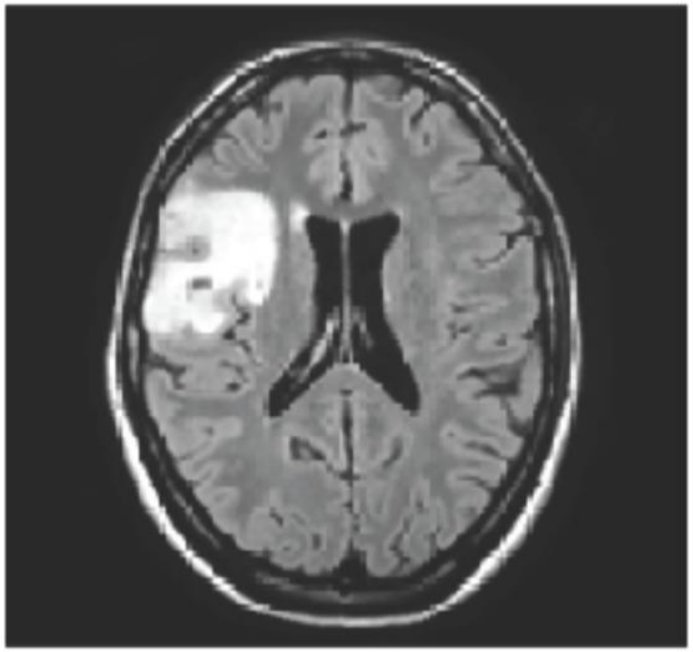


Image enhancement



SKULL REMOVAL

Cranium in the MRI has approximately same intensity as the tumor and it can interfere in the segmentation and thresholding step hence removing the skull in the enhanced image is essential.

This is done by putting a binary mask on the MRI

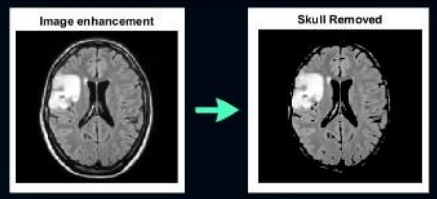
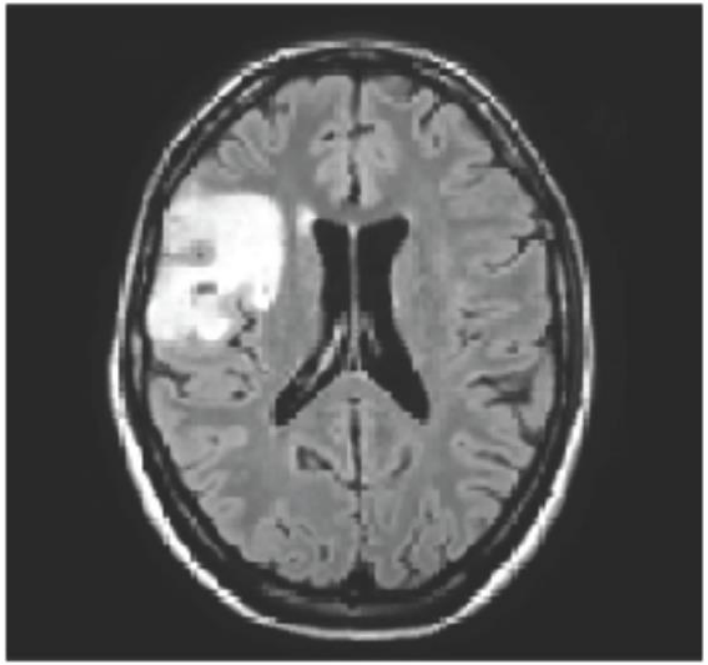
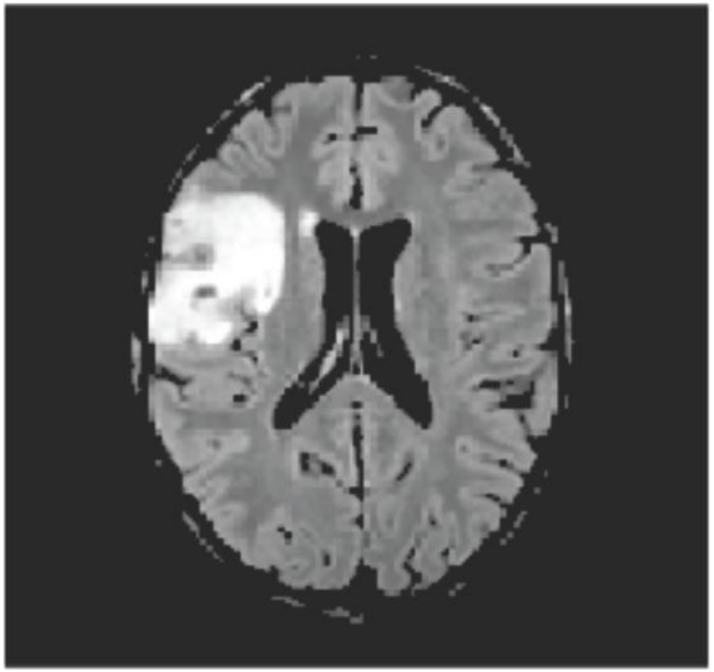


Image enhancement



Skull Removed



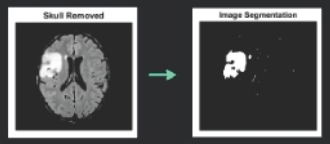
FUZZY C- MEANS SEGMENTATION

Fuzzy clustering (also referred to as soft clustering) is a form of clustering in which each data point can belong to more than one cluster most popular method used in image segmentation because it has robust characteristics for ambiguity and can retain much more information than hard segmentation methods.

The general problem in clusteri ng is to partition a set of vectors into groups havi ng similar values. In traditional clusteri ng, there are *c* clusters with means (or centroids) *mi,* m2, •. ., me. A least square error criterion i s used to measure how close the data are to the clusters. The objective function is

$$J_{CM} = \sum_{k=1}^{c} \sum_{j=1}^{n} \left\| x_j - m_k \right\|^2 \qquad (1)$$

J CJw is the sum of all square errors for all clusters. *xj* is a point in the image feature space, which is an object of data such as intensity value. *xi* and *mk* may have more than one dimensions. The norm operator 11·11 represents the standard Euclidean dis tance. This criterion tries to make the degree of similarity high i n the same cluster and low between the different clusters.



Skull Removed

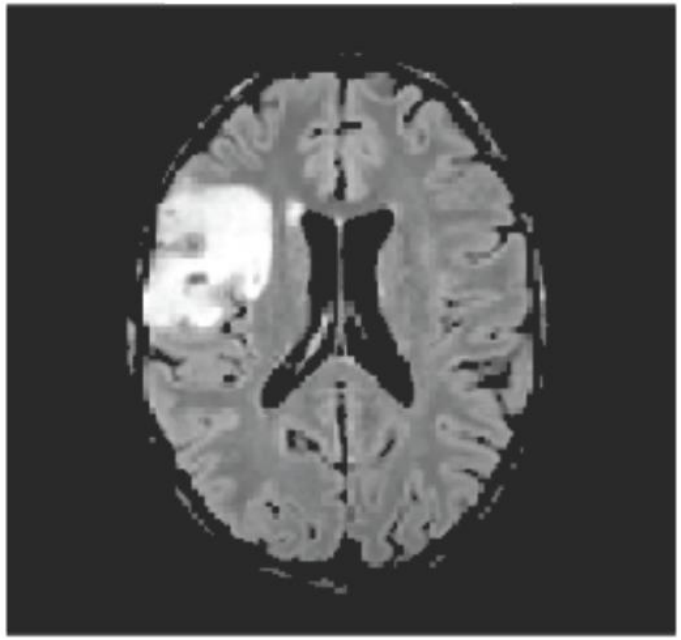


Image Segmentation

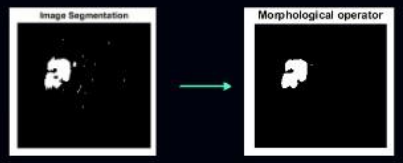
MORPHOLOGICAL OPERATIONS

After segmentation MRI contains some white components (clusters of pixels) which are not the part of tumor.

Morphological operations like erosion and dilation are used to remove these white components.

Dilation adds pixels to the boundaries of objects in an image, while erosion removes pixels on object boundaries. The number of pixels added or removed from the objects in an image depends on the size and shape of the structuring element (strel) used to process the image.

After this step final tumor image is left which can be used to extract features.



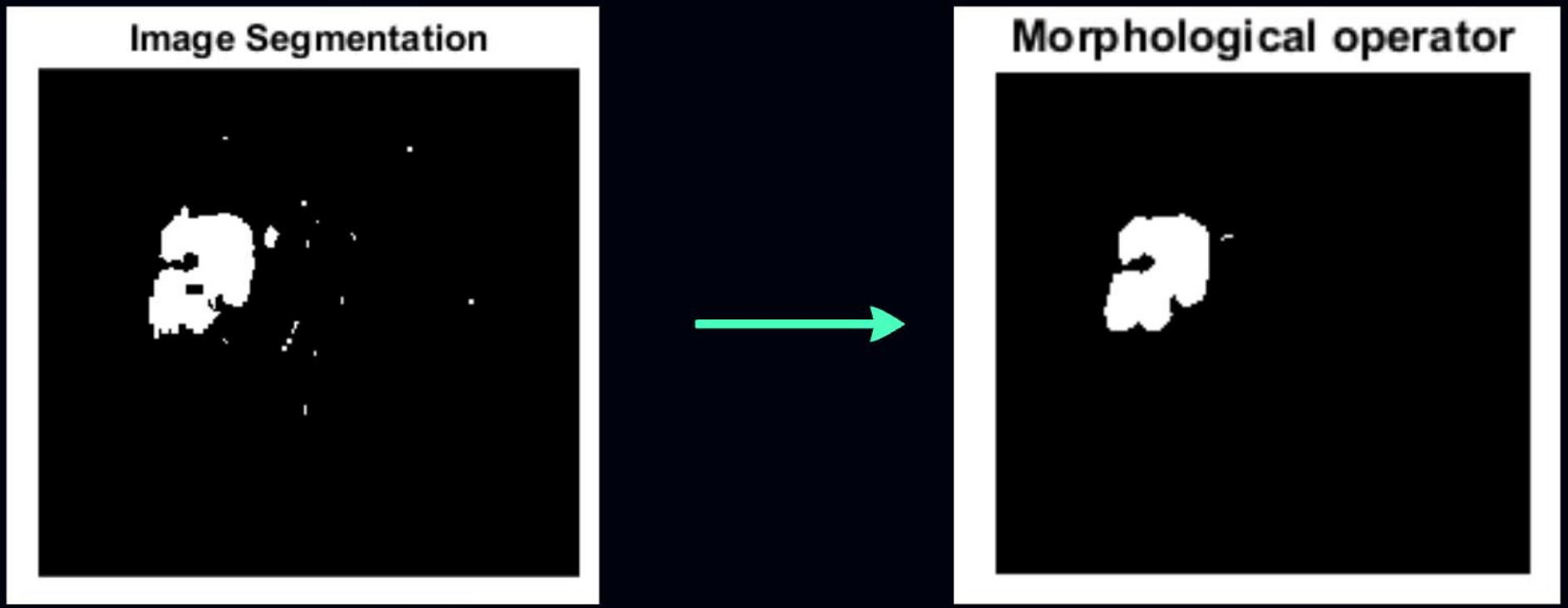


Image Segmentation
Morphological operator

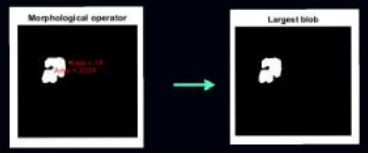
Tumor Extraction

The different blobs in the image after performing morphological operator are labelled using function bwlabel.

The area, centroid and perimeter of the blobs is calculated using regionprops function and the blobs are sorted according to the areas.

The area, perimeter and centroid of largest is displayed.

After segmentation and morphological operations of the MRI of healthy brain, no white components are detected, this mean no tumor detected.



Morphological operator

Largest blob

Thank You!!