IMAGE PROCESSING AND COMPUTER VISION-UE19CS333 BRAIN TUMOR DETECTION

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Abstract-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 ROT. The field of medical imaging is gaining importance with an increase in the demand for automated, reliable, fast and efficient diagnosis which can provide insight to the image better than human eyes. Brain tumor is the second leading cause for cancer-related deaths in men in age20 to 39 and fifth leading cause cancer among women in same age group. Brain tumors are painful and may result in various diseases if not cured properly. Diagnosis of tumor is a very important part in its treatment. Identification plays an important part in the diagnosis of benign and malignant tumors. A prime reason behind an increase in the number of cancer patients worldwide is the ignorance towards treatment of a tumor in its early stages. This paper discusses such an algorithm that can inform the user about details of tumor using basic image processing techniques. These methods include noise removal and sharpening of the image along with basic morphological functions, erosion and dilation, to obtain the background. Subtraction of background and its negative from different sets of images results in extracted tumor image.Plotting contour and c-label of the tumor and its boundary provides us with information related to the tumor that can help in a better visualization in diagnosing cases. This process helps in identifying the size, shape and position of the tumor. It helps the medical staff as well as the patient to understand the seriousness of the tumor with the help of different color-labeling for different levels of elevation . A GUI for the contour of tumor and its boundary can provide information to the medical staff on click of user choice buttons

***Index Terms*—Brain, CT, ROI , Contrast Adjust, Structural Element, Erosion, Dilation, Negation,Tumor Detection, Contour, C-label , GUI.**

I. Introducción

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. The driving force of this project is to create a transparent environment where medical staff and patient can work in complete cooperation to achieve better results. This transparent environmentwill help the patient to feel secure as they will understand the treatment-process choice, which inturn will help the medical staff to handle the situation in a calm order giving them more time tothink and work.

II. Motivation

A brain tumor is defined as abnormal growth of cells within the brain or central spinal canal.Some tumors can be cancerous thus they need to be detected and cured in time. The exact causeof brain tumors is not clear and neither is exact set of symptoms defined, thus, people may besuffering from it without realizing the danger.

As the medical practitioner and pathologist face various such types of problems in detecting tumor manually from the MRI image, so there is a need of an automatic detection process. Thus the main aim of our project is to design a framework for automatic detection of the tumor to obtain more accuracy from the imaging dataset which plays vital role in the diagnosis of tumors by using various image processing algorithm in MATLAB. This framework will hopefully help the pathologist to reduce the work-load and minimize human error while maintaining and improving the accuracy to detect the tumor.

The reasons for selecting CT images upon MRI images are as follows:

1.CT is much faster than MRI, making it the study of choice in cases of trauma and otheracute neurological emergencies. CT can be obtained at considerably less cost than MRI.

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3.CT is less sensitive to patient motion during the examination.

4.The imaging can be performed much more rapidly, so CT may be easier to perform inclaustrophobic or very heavy patients.

5.CT can be performed at no risk to the patient with implantable medical devices, such ascardiac pacemakers, ferromagnetic vascular clips and nerve stimulators.

The focus of this project is CT brain images tumor extraction and its representation in simpler form such that it is understandable by everyone. Humans tend to understand colored images better than black and white images, thus, we are using colors to make the representation simpler enough to be understood by the patient along with the medical staff.Contour plot and c-label of tumor and its boundary is programmed to give 3D visualization from 2D image using different colors for different levels of intensity. A user-friendly GUI is also created which helps medical staff to attain the above objective without getting into the code

III. Proposed System

The proposed system is MATLAB based application with an efficient graphical user interface. The medical practitioner has to scan the hard copy of 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.

Figura 1. Block Diagram

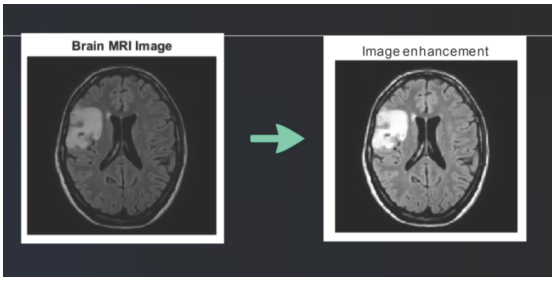
IV. Methodology Used

The detection and classification of tumor from MRI images are a challenging task because of the complex structure of the brain. The various stages include pre-processing(enhancement) of MRI images, segmentation of suspicious portion, feature extraction and finally the classification.-[fig2]

Figura 2. methodology

V. 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 regoins in the image called tiles. Each tile's contrast is enhaced. 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.



VI. 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

VII. 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 clustering is to partition a set of vectors into groups having similar values. in traditional clustering there are 0 clusters with means (or centroids). A least square error criterion is used to measure how close the data are to the clusters. the objective function is

J CM is the sum of all square errors for all clusters xi 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 distance. this criterion tries to make the degree of similarity high in the same cluster and low between the different clusters.

VIII. 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 elements (strel) used to process the image.

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

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

X. Literature review

- A robust segmenation 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 requires.
- 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.
- 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).

XI. Conclusion

MRI images are best suitable for brain tumor detection. In this study digital image processing techniques are important for brain tumor detection by MRI images. The preprocessing techniques include different methods like filtering, contract enhancement, Edge detection is used for image smoothing. The preprocessed images are used for post processing operation like threshold and then features are extracted using GLCM and classification is done by Artificial Neural Network where we have obtained 76.5 of accuracy when run on a dataset of 300 images in classifying tumor and non tumor images. This work help in detection of tumor which in turn save the precious time of doctor and pathologist to diagnose the tumor automatically in short span of time.