PROJECT PROPOSAL FOR MATLAB PROJECT

CST 382-3

Brain Tumor Detection

Shindujah Arudchelvan UWU/CST/17/054

Anne Susmitha Gunasekaran UWU/CST/17/057

Thenuja Ananthan UWU/CST/17/059

Department of Computer Science and Informatics

Computer Science and Technology

Uva Wellassa University

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Project Title

Brain Tumor Detection

Student Details

Registration No	Name	Degree program	Email	Contact No
UWU/CST/17/054	Shindujah.A	CST	cst17054@std.uwu.ac.lk	0765500557
UWU/CST/17/057	G.A.Susmitha	CST	cst17057@std.uwu.ac.lk	0763308521
UWU/CST/17/059	Thenuja.A	CST	cst17059@std.uwu.ac.lk	0778787440

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1. Introduction

1.1 Project Background

Brain tumors affect the humans badly, because of the abnormal growth of cells within the brain. It can disrupt proper brain function and be life-threatening. Benign tumors and malignant tumors are the two forms of brain tumors that have been recognized. Benign tumors are less hazardous than malignant tumors because malignant tumors grow quickly and cause injury, whereas benign tumors grow slowly and cause less harm [1]. Medical imaging is a technique that creates a visual depiction of the interior of the human body for medical purposes. It can also be used to diagnose non-invasive possibilities. MRI, CT scan, Ultrasound, SPECT, PET, and X-ray are examples of medical imaging technologies that use a non-invasive technique [2].

The scan combines high-speed X-ray technology with a computer in Computed Tomography (CT). The CT scanner rotates around the head, taking X-rays from all sides. The computer then creates a cross-sectional image of the brain by combining thousands of X-ray images. The MRI scanner generates comprehensive images of the brain tissue using magnetic fields and radio waves rather than x-rays. MRIs can produce two-dimensional or three-dimensional brain images. Before the scan, a dye called contrast medium may be injected into a vein in the arm to provide a crisper image. As a result, a tumor is characterized as abnormal tissue growth. A brain tumor is an abnormal mass of tissue in which cells grow and replicate uncontrolled, oblivious to the systems that normally control normal cells [3].

Magnetic Resonance Imaging (MRI) is a radiologic imaging technology that creates images of the architecture and physiological processes of the body in both health and disease [4]. Strong magnetic fields, radio waves, and field gradients are used in MRI scanners to create images of the inside of the body. MRI pictures of the brain include images of the tumor as well as grey matter, white matter, cerebrospinal fluid, and skull tissues, as well as noise. In medical image segmentation, image segmentation is critical in the stages leading up to object recognition [5]. Image segmentation aids in the automated diagnosis of brain diseases as well as qualitative and quantitative image analysis, such as measuring the accurate size and volume of a recognized region. Because tumors come in a variety of shapes, sizes, and appearances, accurate measures in brain diagnosis are difficult.

1.2 Problem Definition

Brain tumors are a diverse collection of neoplasms of the central nervous system that develop within or near the brain. Furthermore, the tumor's position in the brain has a significant impact on the patient's symptoms, surgical therapeutic alternatives, and the possibility of receiving a clear diagnosis. The location of the tumor in the brain also has a significant impact on the risk of neurological toxicities, which can have a negative impact on the patient's quality of life. Brain tumors are currently only diagnosed by imaging after the beginning of neurological symptoms. Even in those who are known to be at risk for specific types of brain tumors due to their genetic makeup, there are no early detection measures in place.

The World Health Organization updated histopathological classification methods in 1999, which are based on the tumor's assumed cell of origin and have been in use for over a century. Although they are satisfactory in many ways, they do not allow for accurate tumor behavior prediction in individual patients, nor do they guide therapeutic decision-making as precisely as patients and physicians would like. Current imaging techniques allow for precise anatomical delineation and are the primary means of determining whether neurological symptoms are caused by a brain tumor. There are numerous methods for detecting brain tumors. For brain tumor detection, we plan to employ morphological operation technique.

1.3 Project Aims/ Objectives

In this Project, the main objectives are to extract and detect brain tumor region in the MRI images using different methods and we calculate various parameters like area, perimeter of tumor region The sub-objectives of the research project are:

- Classifying MR Images as abnormal or normal.
- Finding suitable techniques that can do efficient tumor detection with accuracy.
  - Threshold and watershed Segmentation
  - Morphological operations to detect tumor region
- Finding tumor area and perimeter.
- Reduce the work load and minimize the human error while maintaining and improving the accuracy to detect the tumor.

2. Project Description

In this project, we describe the strategy to extract and detect brain tumors from the patient's MR scan image. We will use MRI Brain Images from the Kaggle website. We plan to detect the brain tumor region and calculate the area and perimeter of the tumor region based on the Image Processing approach. In order to denoising purpose, we plan to use an anisotropic Filter in this project. This preprocessing stage is used to remove unwanted region noise like personal information of patients which may present in MRI, removal of non-brain element images.

The tumor is formed by the uncontrolled multiplication of cell division. Numerous techniques were developed to detect and segment brain tumors. We plan to use watershed, thresholding segmentation for give a clear picture of the structure of the different brain, and morphological to extract the tumor region. This is an efficient algorithm that performs tumor segmentation and calculates features such as centroid, perimeter, and area from the segmented tumor. The work done here aids in the detection of cancers and the development of treatment plans for patients in the medical area.

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3. Methodology

The proposed methodology can be divided into three sections. First stage contains filtering technique which removes noise by Anisotropic Filter from the brain MRI image and then threshold and watershed-based segmentation which segments the region of the tumor from the filtered image using a structuring element. Third stage contains morphological operation which shows the location of tumor and detect the area and perimeter of tumor. For implementation we plan to use MATLAB. The steps of algorithm are given below.

1) Take MRI image of human brain as input.
2) Convert it to gray scale image.
3) Apply anisotropic Filter for noise removal.
4) Compute threshold segmentation.
5) Compute watershed segmentation.
6) Compute morphological operation
7) Finally, output will be a tumor region
8) Calculate area and perimeter of tumor region

Figure 1 shows the block diagram of working model,

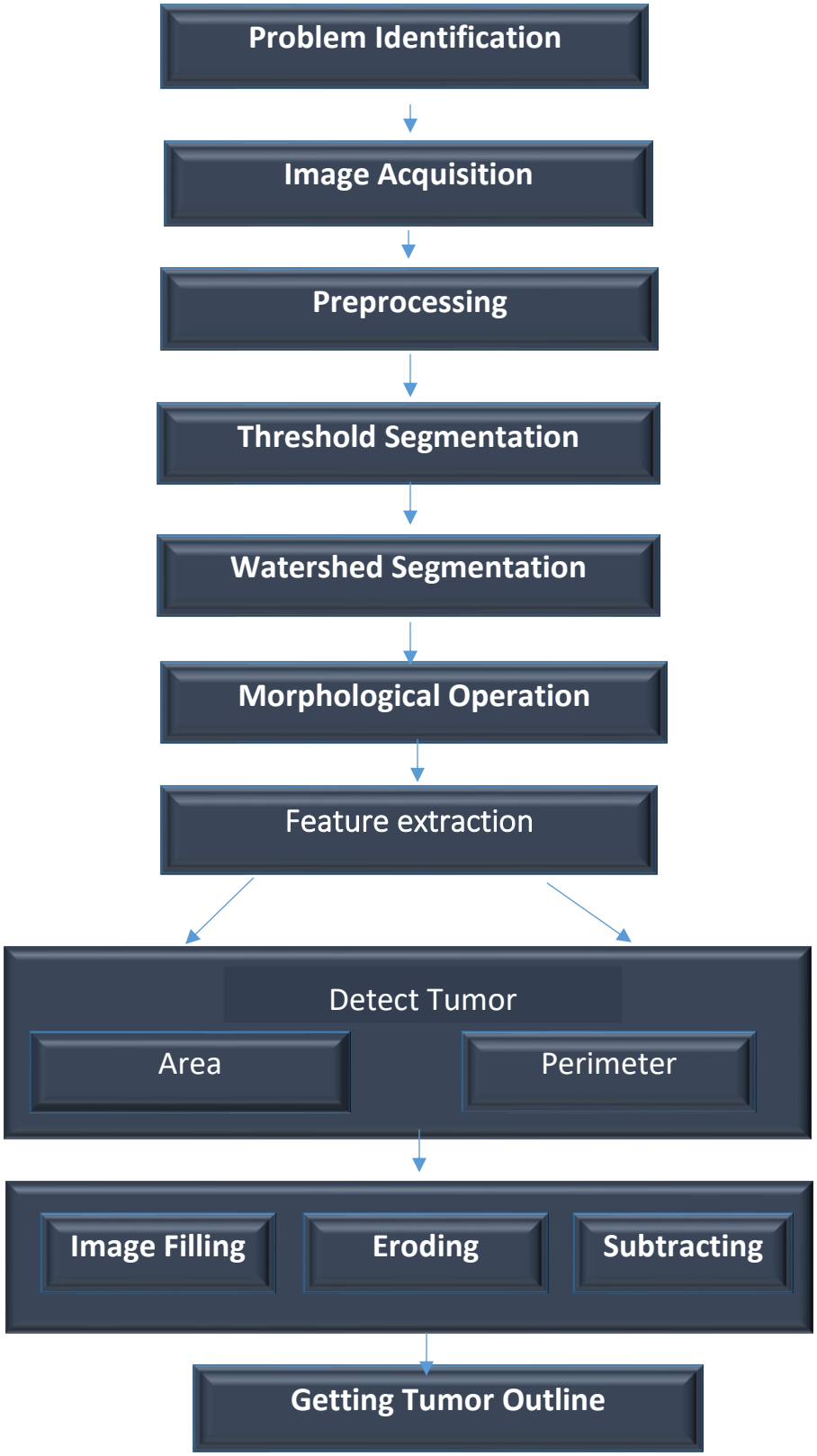
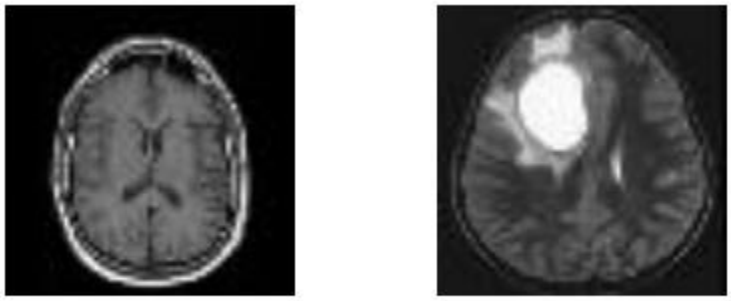


Figure 1: proposed diagram of brain tumor detection

1.Image Acquisition

We plan to use the dataset of abnormal MRI images are taken as input to detect the tumor. The input images are 256*256 pixels and 8-bit grayscale. We have used the MRI images from the website of Kaggle.



(a) Normal image (b) Abnormal image

Figure 2: Brain MR Images

2.Preprocessing

The main objective of filtering an image is to remove the noises on the digital images. The quality of the image is attacked badly by the noises. There are many ways to get rid of the noise in the image. Most of the image processing algorithms do not work well in the noisy environment. This is why we will use image filter as a pre-processing tool. Among various filter, we plan to use anisotropic Filter in this project for denoising purposes. This preprocessing stage is used for remove unwanted region noise like personal information of patients which may present in MRI, removal of non-brain element images.

3.Threshold Segmentation

The simplest method of image segmentation is called the thresholding method. This method is based on a clip-level (or a threshold value) to turn a gray-scale image into a binary image. The key of this method is to select the threshold value (or values when multiple-levels are selected). Image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyse. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. Each of the pixels in a region are similar with respect to some characteristic or computed property, such as colour, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristics. When applied to a stack of images, typical in medical imaging, the resulting contours after image segmentation can be used to create 3D reconstructions with the help of interpolation algorithms like Marching cubes.

4.Watershed segmentation

A gray-level image may be seen as a topographic relief, where the gray level of a pixel is interpreted as its altitude in the relief. A drop of water falling on a topographic relief flows along a path to finally reach a local minimum. Intuitively, the watershed of a relief corresponds to the limits of the adjacent catchment basins of the drops of water. In image processing, different watershed lines may be computed. In graphs, some may be defined on the nodes, on the edges, or hybrid lines on both nodes and edges. Watersheds may also be defined in the continuous domain. There are also many different algorithms to compute watersheds

5.Morphological operation

Morphology is an instrument to extract image features useful in the legation and recital of region shape such as boundaries, skeletons and convex hulls. For morphological operation structuring element is required. The structuring element used in practice is generally much smaller than the image often a 3*3 matrix. Morphological Opening is applied to the image after segmentation. The two important operations of morphology are:

a) Dilation: It works by object expansion, hole filling and finally adding all the disjoint objects and b) Erosion: It shrinks the object. Foreground pixel background is eroded away in the binary image by erosion operation.

Morphological Opening is applied to image (a) after converting it into binary image. To segment out the tumor location from the image it is required to create a Binary tumor masked window. Normally, higher intensities comparing with other surrounding tissues are held by an abnormal brain MR image. By putting the tumor mask on dilated brain MR image, the final image is obtained with detected tumor.

6. Feature extraction

Feature extraction is most important elemental tasks for recognizing images. There are different types of features to be used of image recognition such as visual features and statistical features of pixel. In this project we plan to calculate two features such as area and perimeter of pixel. They are very useful for the recognition of brain tumor images.

7. Area

Area is the summation of detected areas of pixels. Detected areas will be calculated using region props function in MATLAB which is measured a set of properties of image regions for each connected object in the binary image. So, this image will contain only two values either black or white (0 or 1). The binary image can be represented as a summation of total number of white and black pixels. So, area of the image is the total number of the pixels present in this area.

8.Perimeter

Perimeter is the number of pixels in the boundary of the detected object. It is measured as the sum of distances between every consecutive boundary points. Detected perimeters are also will be calculated using region props function in MATLAB.

4. Resources Needed

Hardware Requirement:

- Laptop/ Personal Computer
- Monitor

Software Requirement:

- MATLAB

5. Individual Contribution and Work Plan

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- Data collection
- Literature review
- Implement Methodology
- Implement morphological techniques
- Create Graphical user Interface
- Report Writing

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- Data collection
- Literature review
- Image acquisition and preprocessing techniques
- Train a data set
- Report Writing

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- Data collection
- Literature review
- Implement Segmentation techniques
- Feature Extraction to detect area
- Report Writing

6. Project Time-line (Gantt chart)

Activity	weeks													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Problem Identification														
Literature Review														
Data Collection														
Image acquisition, Preprocessing														
Create Methodology														
Analyse used techniques														
Start coding in Mat lab														
Testing completed project														

Table 1: Project Time-line

7. References

[1] W. Gonzalez, "Digital Image Processing", *2nd ed. Prentice Hall*, pp. 378, 2008.

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[3] C.Rajesh, C patil, Dr A S Balchandra, "Brain Tumor Extraction from MRI Images using MATLAB," *Int. J. Electronics, Communication & Soft Computing Science and Engineering*, vol. 2, pp. 166-175, 2012.

[4] Y Sharma,P Kaur, "Detection and Extraction of Brain Tumor from MRI Images Using K-Means Clustering and Watershed Algorithms," *Int. J. Adv. Comput. Sci*, vol.3, 2015.

[5] N Baraiya, H Modi, "Comparative Study of Different Methods for Brain Tumor Extraction from MRI Images using Image Processing," *Indian Journal of Science and Technology*, vol 9(4),2016.