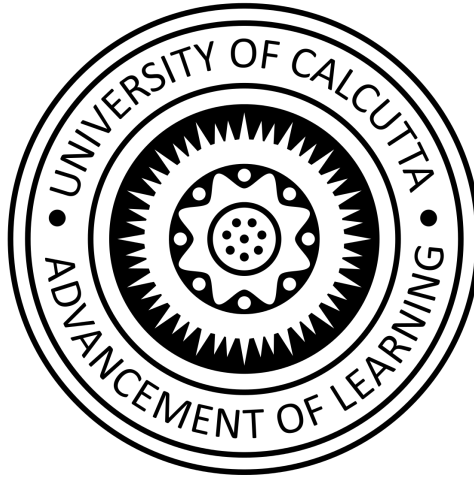


# Brain Tumor Detection



Department of Computer Science  
Gurudas College  
Calcutta University  
24/07/2021

*Detection of tumorous cells using machine learning models*

Submitted in partial fulfillment for the requirements for the degree Bachelor of Science  
(Honors) in Computer Science.  
Academic Year: **2018-2021**

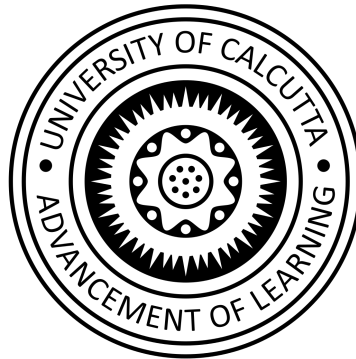
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**Supervisor:** Kajari Bhattacharjee

# Certificate



Department of Computer Science  
Gurudas College  
Calcutta University

This is to certify that the project entitled "Brain tumor detection using Machine Learning models" is a bona fide work of **Shoptorshi, Brahmajit, Rajarshi** and **Bhargav** submitted to Gurudas College, University of Calcutta; in partial fulfillment of the requirement for the award of the degree "Bachelor of Science (Honors)" in Computer Science.

Supervisor:

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**Kajari Bhattacharjee**

Principal:

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**Dr. Mausumi Chatterjee**

Department  
Head:

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**Srijeeta Chakraborty**

# Acknowledgement

I would like to express my special thanks of gratitude to our supervisor **Kajari Bhattacharjee**, teachers of our department **Sonali Gupta** and **Srijeeta Charkraborty** ( current department head ); as well as our principal ma'am **Dr. Mausumi Chatterjee** who gave us the golden opportunity to do this wonderful project on *Brain tumor detection*, which has also helped us in doing a lot of research and we came to know about many new things.

We are really thankful to them.

Secondly we would like to thank the incredible authors of the research papers in our references/citations for providing us with the information.

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# Brain Tumor Detection

Using various machine learning models to detect brain tumor.

## Abstract

Tumors are cancerous or non-cancerous mass or growth of abnormal cells in brain. Tumors can start in brain, or cancer elsewhere in the body can spread to brain. There are many way to control the occurrence of these abnormal cells. A tumor can be denoted as a malformed mass of tissues wherein the cells multiply abruptly and ceaselessly, that is there is no control over the growth of the cells.

The process of Image segmentation is adopted for extracting abnormal tumor region within the brain. In the MRI (magnetic resonance image), segmentation of brain tissue holds very significant in order to identify the presence of outlines concerning the brain tumor. There is abundance of hidden information in stored in the Health care sector. With appropriate use of accurate data mining classification techniques, early prediction of any disease can be effectively performed.

The project examines list of risk factors that are being traced out in brain tumor surveillance systems. Also the method proposed assures to be highly efficient and precise for brain tumor detection, classification and segmentation. To achieve this precise automatic or semi-automatic methods are needed. The project proposes an automatic segmentation method that relies upon *CNN (Convolution Neural Networks)* , *VGG 16* and *Resnet 50* , determining small 7 x 7 kernels. By incorporating this single technique, segmentation and classification is accomplished. CNN (a ML technique) from NN (Neural Networks) wherein it has layer based for results classification.

Various levels involved in the proposed mechanisms are:

1. **Data collection**
2. **Pre-processing**
3. **Average filtering**
4. **segmentation**
5. **feature extraction**
6. **CNN (or any other model) via classification and identification. By utilizing the DM (data mining) techniques, significant relations and patterns from the data can be extracted. The techniques of ML (machine learning) and Data mining are being effectively employed for brain tumor detection and prevention at an early stage.**

# Introduction

## Domain Description

1. **Neurological Examination:** It is a series of test to measures the function of the patients nervous system and also his/her physical and mental alertness.
2. **Machine Learning:** Machine learning approaches address these problems by mainly using hand-crafted features (or pre-defined features). As an initial step in this kind of segmentation, the key information is extracted from the input image using some feature extraction algorithm, and then a discriminative model is trained to recognize the tumor from normal tissues. The designed machine learning techniques generally employ hand-crafted features with various classifiers, such as random forest, support vector machine (SVM), fuzzy clustering. The designed methods and features extraction algorithms have to extract features, edge-related details, and other necessary information—which is time-consuming. Moreover, when boundaries between healthy tissues and tumors are fuzzy/vague, these methods demonstrate poorer performances.
3. **Brain Scan:** Brain scan is a picture of the internal structure of the brain. A specialized machine takes a scan in the same way as a digital camera takes a photograph. Using computer technology, a scan compiles an image of the brain by photographing it from various angles. Some types of scan uses contrast agent (or contrast dye), which helps the doctor to see the difference between normal and abnormal brain tissues.

MRI (Magnetic Resonance Imaging): It is a scanning device that uses magnetic field and computer to capture images of the brain on films. It does not use x-rays. It provides pictures from various planes, which permits doctor to create a three-dimensional image of the tumor. The MRI detects signals emitted from normal and abnormal tissues, providing clear images of almost all tumors.

## Motivation

The motivation is to develop a software with better segmentation capability for use in medical imaging to detect diseases like brain tumor. Image segmentation has been identified as the key problem of medical image analysis and remains a popular and challenging area of research. Image segmentation is increasingly used in many clinical and research applications to analyze medical imaging datasets; which motivated us to present a snapshot of dynamically changing field of medical image segmentation.

CT (Computed Tomography), MRI (Magnetic Resonance Imaging), PET (Positron Emission Tomography) etc. generates a large amount of image information. With the improved technology, not only does the size and resolution of the images grow but also the number of dimensions increases. In the future, we would like to have algorithms which can automatically detect diseases, lesions and tumors, and highlight their locations in the large pile of images.

The motivation of this work is to increase patient safety by providing better and more precise data for medical decision.

## Scope of Work

### Deliverables

- Working program to take an MRI scan as input and predict presence of tumorous cells with  $\geq 90\%$  accuracy.

## **Scope**

- The working program has external dependencies ( libraries ) and it's expected to have a them installed for the program to work.

## **Timeline**

- **April 27, 2021** Project Assigned
- **May 2, 2021** Project finalized by supervisor, and group is divided into groups of two.
- **May 3, 2021** Data collection started.
- **May 12, 2021** Project Repository created and coding is started.
- **July 7, 2021** Coding is finished, documentation is started.
- **Just 21, 2021** Documentation complete.

## **Reports**

- Constantly updating and pushing code to repository.
- Both teams staying in touch with each other to keep up with each others progress.
- Report back to supervisor every once a week.

# Background

Natarajan [1] proposed brain tumor detection method for MRI brain images. The MRI brain images are first preprocessed using median filter, then segmentation of image is done using threshold segmentation and morphological operations are applied and then finally, the tumor region is obtained using image subtraction technique. This approach gives the exact shape of tumor in MRI brain image. Joshi [2] proposed brain tumor detection and classification system in MR images by first extracting the tumor portion from brain image, then extracting the texture features of the detected tumor using Gray Level Co-occurrence Matrix (GLCM) and then classified using neuro-fuzzy classifier. Amin and Mageed [3] proposed neural network and segmentation base system to automatically detect the tumor in brain MRI images. The Principal Component Analysis (PCA) is used for feature extraction and then Multi-Layer Perceptron (MLP) is used to classify the extracted features of MRI brain image. The average recognition rate is 88.2% and peak recognition rate is 96.7%. Sapra [4] proposed image segmentation technique to detect brain tumor from MRI images and then Probabilistic Neural Network (PNN) is used for automated brain tumor classification in MRI scans. PNN system proposed to handle the process of brain tumor classification more accurately. Suchita and Lalit [5] proposed unsupervised neural network learning technique for classification of brain MRI images. The MRI brain images are first preprocessed which include noise filtering, edge detection, then the tumor is extracted using segmentation. The texture features are extracted using Gray-Level Co-occurrence Matrix (GLCM) and then Self-Organizing Maps (SOM) are used to classify the brain as normal or abnormal brain, that is, whether it contains tumor or not. Rajeshwari and Sharmila [6] proposed preprocessing techniques which are used to improve the quality of MRI image before using it in an application. The average, median and Wiener filters are used for noise removal and interpolation based Discrete Wavelet Transform (DWT) technique is used for resolution enhancement. The Peak Signal to Noise Ratio (PSNR) is used for evaluation of these techniques.



# Methodology

As per literature survey, it was found that automated brain tumor detection is very necessary as high accuracy is needed when human life is involved. Automated detection of tumor in MR images involves feature extraction and classification using machine learning algorithm. In this paper, a system to automatically detect tumor in MR images is proposed as shown in Figure 1

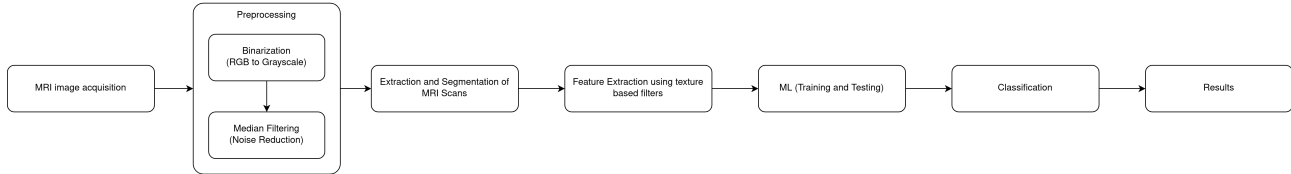


Figure 1: Proposed Methodology

**Image Acquisition:** The MRI brain images are acquired and are given as input to pre-processing stage. The sample brain MR images are shown in figure 2.

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