DAYANANDA SAGAR COLLEGE OF ENGINEERING

(An Autonomous Institution affiliated to VTU, Accredited with NAAC 'A' Grade)

PROJECT SYNOPSIS

DEPARTMENT	COMPUTER SCIENCE AND ENGINEERING			
TITLE OF THE PROJECT	NEUROLOGICAL DIAGNOSIS OF BRAIN TUMORS			
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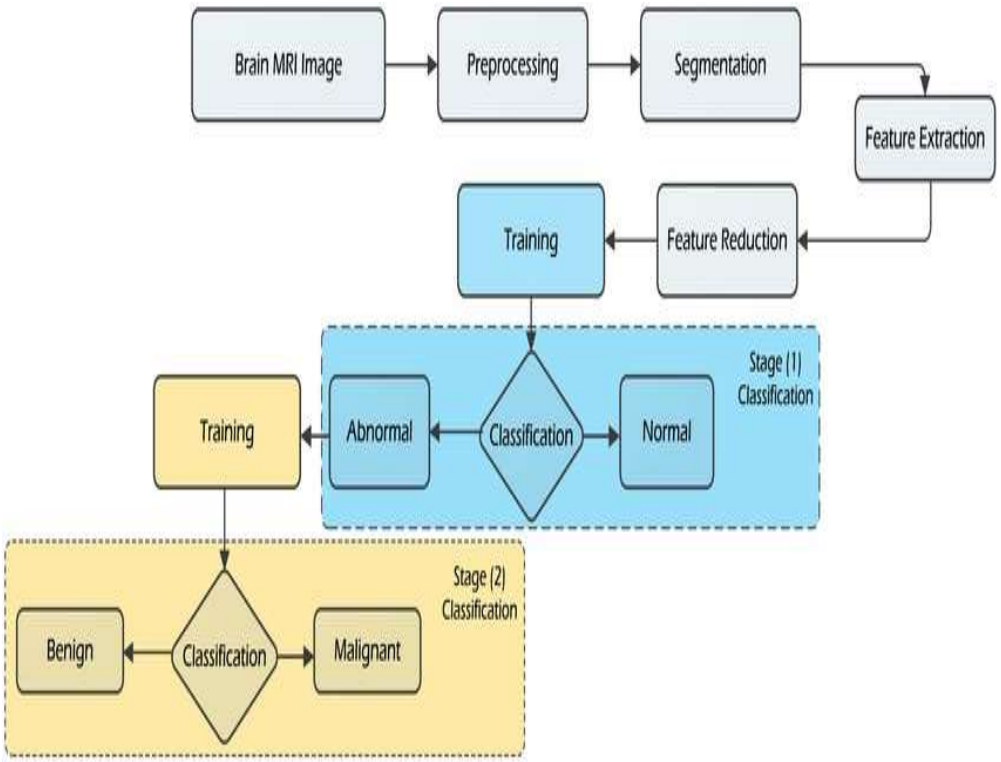
PROJECT TIMELINE (Tentative Start date-End Date)	Oct 2022 to June 2023			
PROJECT GUIDE	Keerthi S, Assistant Professor			
MOTIVATION	According to the survey, approximately 85 thousand people are getting diagnosed for brain tumors every year globally. Out of which, approximately, 15 thousand people are losing their lives. But the scary fact is that 25% of this death rate is due to late or improper diagnosis of the brain tumor. So a proper detection model if used efficiently can save thousands of lives every year, and this was the key factor which has driven us towards this project.			
PROJECT-DOMAIN	Machine Learning, Deep Learning, Web development			
INTRODUCTION	Brain is the command centre of the human nervous system. It's obvious to say, Brain is the highest product of biological evolution. Common symptoms of a brain tumor including nausea, headaches and vision problems might be the clueless start of a disaster. Brain tumors can sometimes be cured if caught early on.			

	Brain tumor is a condition when abnormal cells form within the brain. Tumors in other parts of the body represents uncontrolled cancer cell growth, while in brain, it represents the abandoned brain cell growth, benign(non-cancerous) or malignant(cancerous), which possess the necessity of early diagnosis of a brain tumor, which may reduce the risk of cells becoming cancerous. Benign tumors are similar and does not include any active(cancer) cells, while malignant tumors are heterogeneous and include active(cancer) cells. Choosing MRI for diagnosis comes with its potential properties, high resolution, contrast and clean separation of soft tissue. Detection of human brain abnormal structures by basic imaging techniques is challenging. An automated segmentation is a helpful solution for the exact segmentation of pathological and healthy tissues and to trace the boundaries between various tissue areas by pathological MRI signal analysis. Low-grade cancer tumors are gliomas and meningiomas. High-grade cancer tumors include astrocytoma and glioblastoma. Glioblastoma is a aggressive form of glioma, a IV grade glioma. So all glioblastomas are gliomas, but all gliomas are not glioblastomas. Different grades of glioma will have different kinds of cells and treatment strategies. Manual human brain tumor detection system uses thresholding and region growing techniques. But it is hard to detect the tumor, if the tumor is in secondary stage with manual human brain tumor detection system, so an automated segmentation method is the need of the day to accomplish the mission of saving billions of lives.
APPLICATION/S	• Conversion of the manual detection system into fully automated process • Since the whole model is implemented under a website, it gives access to upload the mri datasets remotely for diagnosis • Assists doctors in early and accurate diagnosis of brain tumors and helps in its treatment measures • Fastens the whole diagnosis process which saves millions of lives

	• The whole process is associated with the well defined User interface which makes it easier to handle cases • Along with the tumor prediction, the web output would provide the treatment analysis for that particular case which helps doctors a lot in taking proper treatment decision
SHORT LITERATURE SURVEY	**1. Brain tumor detection from MRI images using deep learning techniques** In this research work, the Convolutional Neural Network (CNN) was implemented, which drives an overall accuracy of 91.3% and a recall of 88%, 81% and 99% in the detection of meningioma, glioma and pituitary tumor respectively. Deep learning architecture by leveraging 2D convolutional neural networks for the classification of the different types of brain tumor from MRI image slices. In this paper techniques like data acquisition, data pre-processing, pre –model, model optimization and hyper parameter tuning are applied. Moreover the 10-fold cross validation was performed on the complete dataset to check for the generalizability of the model. **2. Convolutional neural network for brain tumor detection** Authors have published the paper quoting the essence of CNN in brain tumor detection. The convolution layer kernel is wrapped around the input sample to calculate several feature maps. Features are detected from input samples than represented by small boxes on the feature map. These maps are forwarded to the maximum collection layer, which preserves relevant features and discards the rest. The features of the max-pooling layer are converted to a one-dimensional feature vector in the fully connected layer, which is then used to calculate the output probability. **3. Brain tumor detection using Deep Learning Techniques** Medical image segmentation plays an important role in analysis of tumors from the magnetic resonance imaging(MRI). Many techniques have been proposed to detect tumors in MRI images. An overview and findings of some of the recent researches are presented here. In this

	paper it is seen that using FCN for brain tumor Magnetic resonance imaging segmentation not merely to detect the growth but also gives an improved description of the center and the ornamental growth. This method uses Glioma Brain Tumor Segmentation Networks in Magnetic resonance imaging and the process proposed is a mixture of Multiple different Convolution Neural Network architectures which makes use of Local and global knowledge of brain tissue to predict the label of each pixel, which helps to enhance result.
CHALLENGES IN THE CURRENT WORK	• In manual system it is hard to detect tumor if tumor is in secondary stage. • Detection of human brain abnormal structures using traditional or basic imaging techniques is challenging. • Very minor features extraction through the MRI images for early diagnosis of brain tumors seems difficult to achieve with current methods. • Risk of improper diagnosis by doctors. • Time-consuming process.
PROJECT PROBLEM STATEMENT	Diagnosis of a brain tumor is a repetitive and extensive task. Earlier diagnosis means earlier treatment which may have positive impact on patient quality of life, and even survival. Building an automated segmentation method for the exact segmentation of pathological and healthy tissues that comprise the MRI image with the optimized accuracy is the need of the day.
OBJECTIVES OF THE PROJECT	• Building an automated segmentation method for the classification of tissues either as abnormal or as healthy, facilitating the upgradation from manual human brain tumor detection to automated human brain tumor detection. • Optimizing the accuracy of segmentation. • Optimizing the feature extraction required for segmentation. • To accomplish the mission of saving millions of lives. • To build a single-click web-application for doctors, which reduces the overhead of overseeing the MRI images to doctors. • To provide clear diagnosis reports to doctors, which help them to take necessary treatment steps.

PROPOSED SOLUTION



Steps for Human Brain Tumor Detection :

An MRI image is considered.

i) **Pre-processing**:
Improving the quality of image by enhancing SNR ratio, removing unnecessary noise and underseen parts from the picture, improvement of visual look, smoothing the region's inner part and retaining its edges.

ii) Segmentation:
In the first stage, the pre-processed brain Magnetic Resonance Image will be transformed into binary image. A threshold value of 128 is set, pixel values greater than the cutoff are mapped as white, and lesser values are mapped as black. Segmentation of healthy and pathological tissues using SVM algorithm.

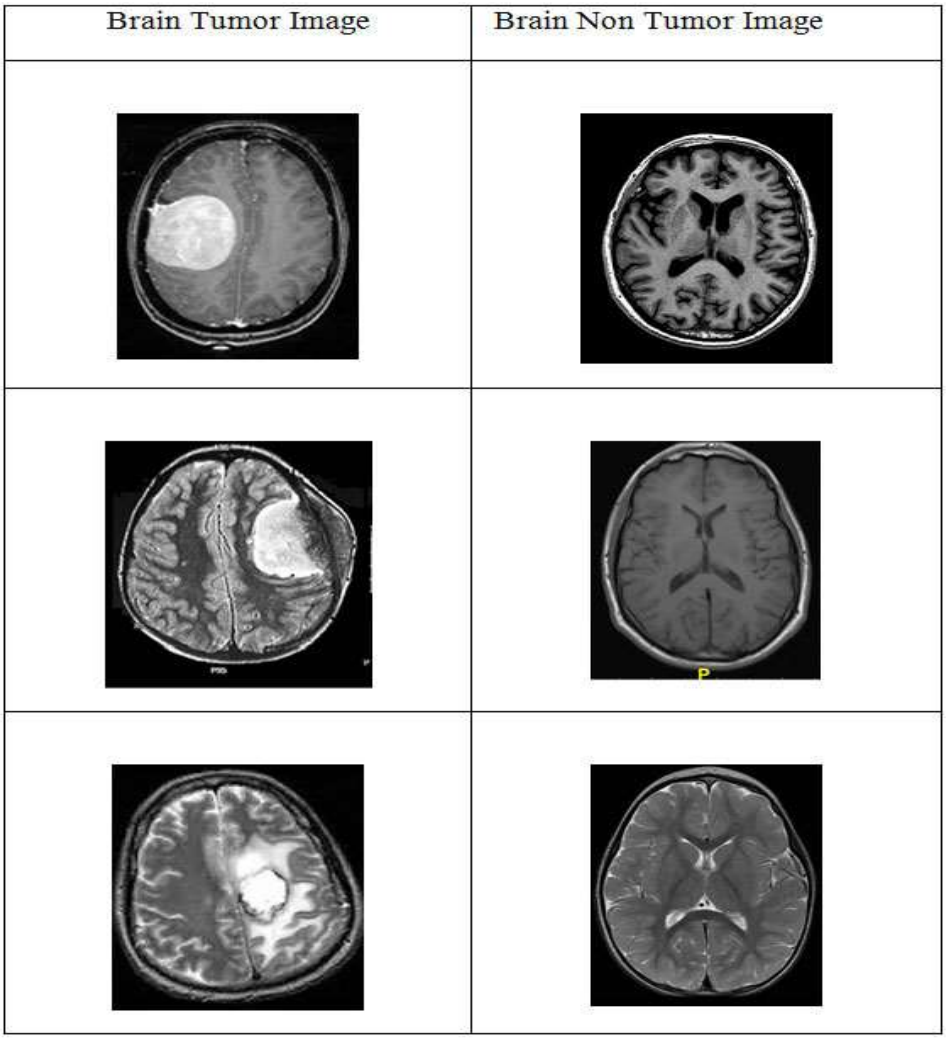
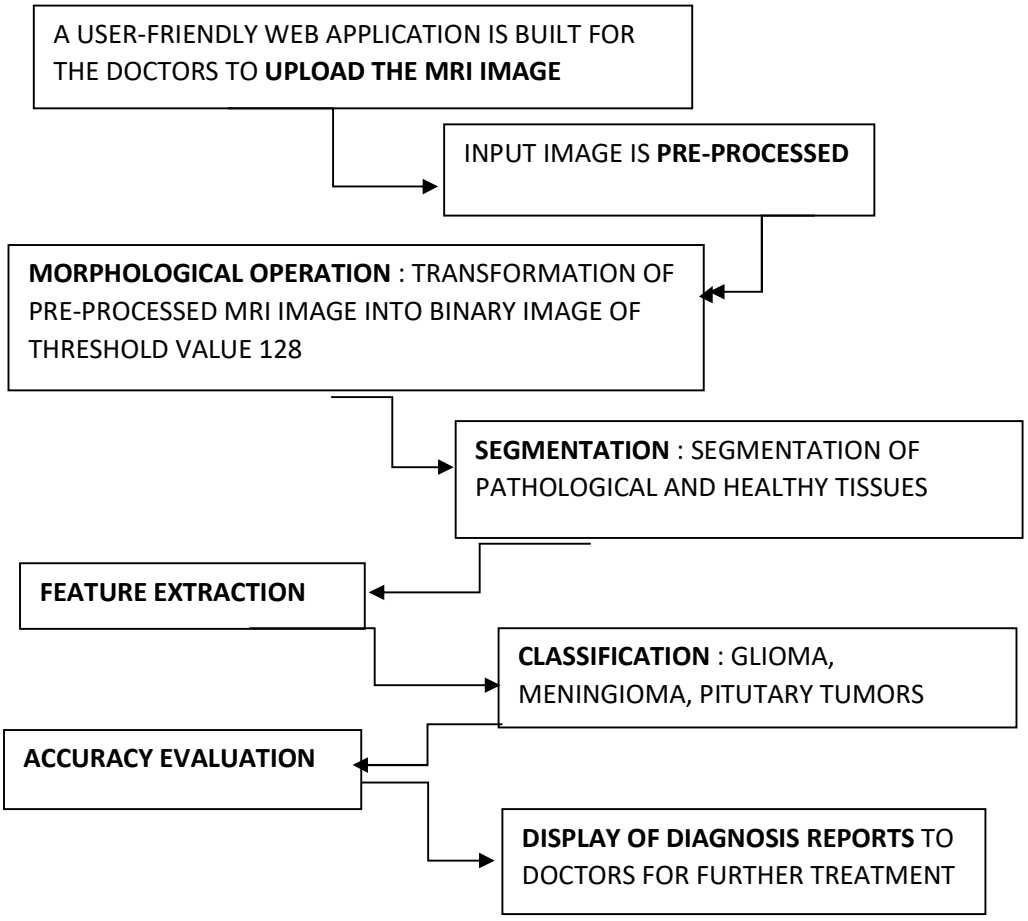


Figure 2: CNN based classified results

iii) Feature extraction:
Calculation of mean, standard deviation, entropy, skewness, energy, contrast, direction moment, correlation, coarseness and other superior-level image details

iv) Classification:
Classification of tumors into gliomas, meningiomas, pituitary tumors

v) Accuracy evaluation:
First by training the model with a huge training dataset and then testing the model with a huge testing dataset and improvising the model accordingly.

PLATFORM THAT WILL BE USED FOR IMPLEMENTATION (Name the hardware and Software tools and Development Environment that you will be using for implementation)	Software used: **Jupyter Notebook** for Machine Learning and Deep Learning implementation **Visual Studio Code** for Web development implementation **Postman** for API verification
	Programming Language: Python **Front-End Web development languages** : HTML5, CSS3, JavaScript, Bootstrap **Back-End Web development languages** : Node.js, Express.js, Mongoose, MongoDB
	Front End/Back End Tools : Visual Studio Code, Postman
Demonstration Details	

	A Combination of web development and deep learning techniques is used to find the solution for this problem. A web application is built for the doctors to upload the scanned MRI image of the subjected person. Deep learning analysis is done including the steps, pre-processing, morphological operation, segmentation, feature extraction, classification and finally accuracy evaluation of the designed model. The diagnosis reports will be displayed to the doctors to take further treatment steps.
ARE THERE ANY STANDARD DATASETS AVAILABLE	Yes https://www.kaggle.com/datasets/masoudnickparvar/brain-tumor-mri-dataset
CONCLUSION	So this was our proposal model, which shows high accuracy in detecting human brain tumors, the combination of web development and machine learning fields gives this project a greater scope which can be used beyond its intended purpose. As a part of future enhancements, rather than keeping the website solely for tumor detection purpose instead it can serve other medical field requirements like patient record maintenance, suggestions about the treatments etc..
REFERENCES	1. Brain tumor detection from MRI images using deep learning techniques 2. Convolutional neural network for brain tumor detection 3. Brain tumor detection using Deep Learning Techniques 4. Brain Tumor Detection Using Neural Network 5. Image Processing Techniques for Brain Tumor Detection: A Review 6. Application of Edge Detection for Brain Tumor Detection 7. Brain Tumor Detection based on Machine Learning Algorithms 8. An Efficient Brain Tumor Detection Algorithm Using Watershed & Thresholding Based Segmentation 9. A Segmentation based Automated System for Brain Tumor Detection 10. Brain tumor detection using deep neural network and

	machine learning algorithm 11. Brain tumor detection based on Naïve Bayes Classification 12. BrainMRNet: Brain tumor detection using magnetic resonance images with a novel convolutional neural network model 13. Fractal-based brain tumor detection in multimodal MRI