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# Brain Tumor DetectionwithVGG-16 Model

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**ABSTRACT**

A brain tumor is a life-threatening neurological condition caused by the unregulated development of cells inside the brain. Brain tumor can be very unforgiving to all age groups. The patient's survival rate is usually very less, if they are not treated properly. Braintumorsaccountfor85%to90%ofallprimarycentral nervous system (CNS) tumors. Most ofthe times, survival rates decrease significantly with the age. While the anatomy of brain is more complex than any other vital organ, It becomes very crucial to find outthechancesofpeopledevelopingbraintumorinlaterstagesoflife.The segmentation, diagnosis, and isolation of contaminated tumor areas of brain from magnetic resonance (MRI) images is a prime concern. However, it is a very tedious and more time-consuming process that radiologists or clinical specialists must undertake and it soley depends on their performance and their expertise. In this paper, the different traditional and hybrid ML models were built and analyzed in detail, to classify the brain tumor images without any human intervention.Thefigureoffindingbraintumorinanindividuallifetimeis1inevery100[4].

Keywords : BrainTumorClassification,VGG-16CNNModel

## I. INTRODUCTION

A disease is defined as a disorder of function during a living being. If we drill down the definition, it is defined as a disorder of structure or function within the division of cells during a living organism. If a disorder of unnatural mass is developed within the cerebrum of a brain, we call it a brain tumour. Brain tumors are of various types and might be dangerous now and then, and glioma is that the most typical style of nonpermanent or treatable tumor. Glioma will be classified into two types, namely High-Grade Gliomas (HGG) and Low-Grade Gliomas (LGG). LGG could be a slow-spreading tumor, while HGG could be a rapidly growing tumor, which explains why HGG may be a fatal disease. those that are diagnosed with HGG and who are aged between 20–44 years have a survival rate of 19% with treatment after 14 months of diagnosis, supported a recent survey of the central system (CNS) [1] on a Canadian population from 2009–2013.

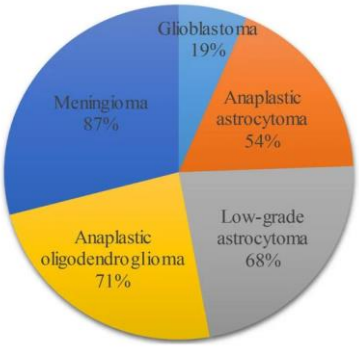
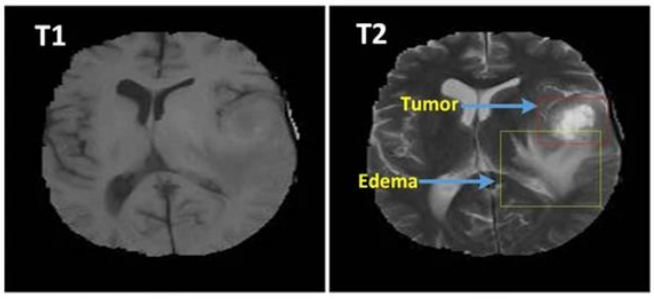
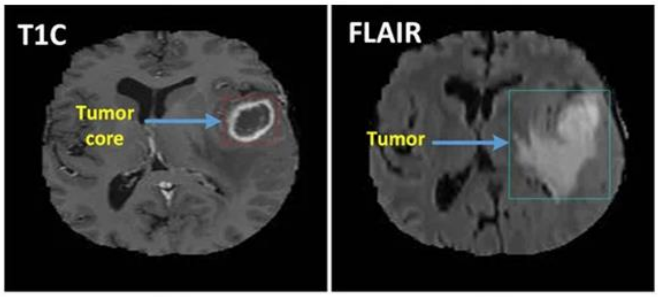



Figure 1 shows the distribution of survival rates between differing types of brain tumors.

Though there are many medical imaging modalities available to differentiate the characteristics of brain tumors, resonance images (MRIs) are the foremost commonly used medical imaging modalities because of its advantage of visual analysis and its flexibility within the domain of computer-aided analysis of medical images. It plays an important role at many stages of the clinical work flow for population screening; the role of MRI modalities will build within the coming future thanks to developments within the domain of study methods along the lines of cost effectiveness and accuracy. With the assistance of MRIs, tumors may be differentiated into different grades of gliomas. Among the most recent high-tech technologies, MRIs may be considered one amongst the foremost advanced techniques wont to characterize brain tumors for diagnosis and evaluation. Accurate identification of tumor distance may be considered a critical phase of varied neuroimaging studies [2]. the categories of MRI modalities are clearly outlined in Figure 2. They [3] focused their experimental analysis on the fully annotated neoplasm segmentation (BraTS) challenge 2013 data set using the well-defined training and testing splits, thereby allowing us to check directly and quantitatively a good form of other methods. Deep learning (DL) and Convolutional Neural Networks (CNN) stood at the middle of of these developments in brain MRI image analysis and computer interventions and proved their adoption to be a successful execution to drive for continuous improvements.




(a) (b)




(c) (d)

Figure 2. the various tumor types with different shapes in four resonance images (MRI) sequences: (a) T1 MRI sequence, (b) T2 MRI sequence with tumor type edema, (c) T1C MRI sequence with core tumor, and (d) Search Results Web results Fluid attenuation inversion recovery (FLAIR) sequence showing the bottom truth of a tumor.

Convolutional networks were inspired by biological processes [4,5] therein the connectivity pattern between neurons resembled the organization of the animal visual area. Initially, Artifical Neural Network (ANN) was wont to study the info from digital images, but so as to try to to so, the domain experts or the researches need to manually decide and extract features from the digital images and to feed it to the ANN. CNN came to the rescue in eliminating the cumbersome manual work of deciding the features. CNN is one among the foremost remarkable kinds of ANN that's inspired by natural visual recognition phenomenon [6]. There are innumerable applications of CNN within the field of image classification and pattern recognition [7]. The architecture of CNN was introduced within the late 80 s [8]. After the introduction of CNN, it had been improved by LeCun within the late 90s [9], but the introduction of the ConvNet architecture [10] within the 21st century has taken CNNs to a unique level, with a slip rate of 15.3% as compared to standard computer vision (CV) techniques [11]. CNN has made huge impacts within the medical imaging domain [12] and plenty of other fields like computer vision, digital image processing, and computing. because of its multilayered

architecture, CNN is that the most well-liked technique employed for image analysis although there are many deep learning algorithms introduced over the past decades [13,14,15]. the same as ANN, CNN also uses an adaptive approach to be told spatial hierarchies of features through back propagation, but unlike ANN, CNN doesn't have fully connected neurons for all the layers and it's only the last layer as fully connected layer. CNN consists of multiple building blocks, like convolution layers, pooling layers, and fully connected layers [16]. The convolution layer is answerable for feature extraction, which makes it special compared to ANN; this layer is usually accountable for convolution operation and activation function.

## II. SYMPTOMS

Brain symptoms varies depending on type size Some signsarefollows:

1. Headache Severe headache is a common symptom in aboutmorethan50percentpeople.Continuouspressureis beingprovided by tumour in brain to sensitive nerves blood ves-sels. following are some kind of headache: a). Having a sharppain in head, unlike migraine. b). Accompanied by vomiting. c).getsworsewhilecoughingandchangingpositions.

2. Seizures Brain tumours can interfere with presented elec-trical signal swhich result inseizures. It'sactuallyfirstsign of tumour mostly people having brain tumour experienced itonce.

3. Memory Lossand Confusion Due to tumourinfrontal lobe, memoryproblemsoccur. Which can effect in decision making and results in confusion. Following are so meproblems:

a). Difficulty in concentrating and get easily distracted.

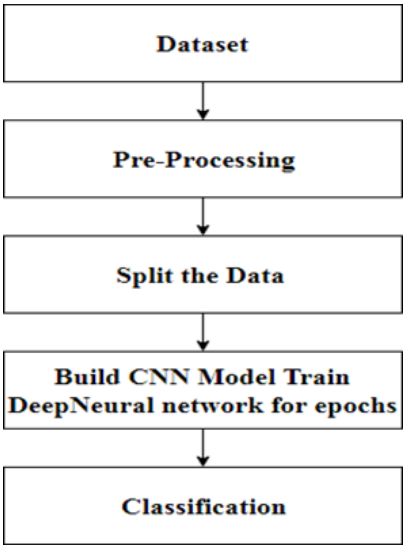
b).Memory issues, planning issues, multitasking issues. These arethe result of vitamin deficiencies, medications, or emotional disorders.

5. Fatigue Fatigue ismorethanfeelingalittletiredoncein a while.Following are some signs: a). completely exhaus-tion,overallweakness,troubleinsleeping.Cancerousbrai ntumour result in fatigue.they are also side effect of cancertreatment.

6. Depression Depression is the mostly observed symptom inbraintumourpatients.Followingaresomeproblems:a). longerlastingfeeling of sadnessin patients,thanthenormal ones.b).interest losing,lackof energy or showingless energeticinsomething. c). insomniad). suicidalthoughts orfeelingworthlessness

7. Weaknesswhile body isfightingwith braintumour,it'sobvious that one feels weakness in body,some tumours cancause tingling in hands feet.Weakness can also be cause bycancertreatments,multiplesclerosis,diabeticneuropa thy.

## III. PROJECTOBJECTIVE

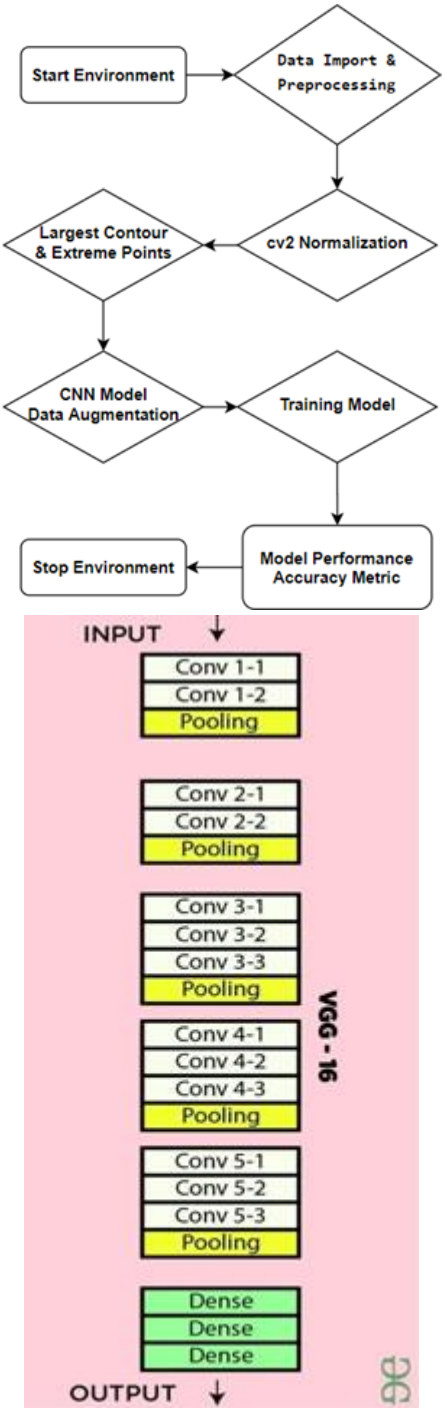



The main motivation behind Brain tumor detection is to not only detect tumor but it can also classify types of tumor. So it can be useful in cases such as we have to sure the tumor is positive or negative, it can detect tumor from image and return the result tumor is positive or not. This project deals with such a system, which uses computer, based procedures to detect tumor blocks and classify the type of tumor using Convolution Neural Network Algorithm forMRI images of different patients.The soul purpose of this

report to classify random Magneticresonance imaging (MRI) scan on the basis of presence oftumoron aImageTargetby training aCNN-ModelusingVGG-16 model architecture (also called OxfordNet). We usedaccuracy as a measure to justify the model performance whichcanbedefinedas:

## IV. METHODS

A. Flowchart




B. Normalization

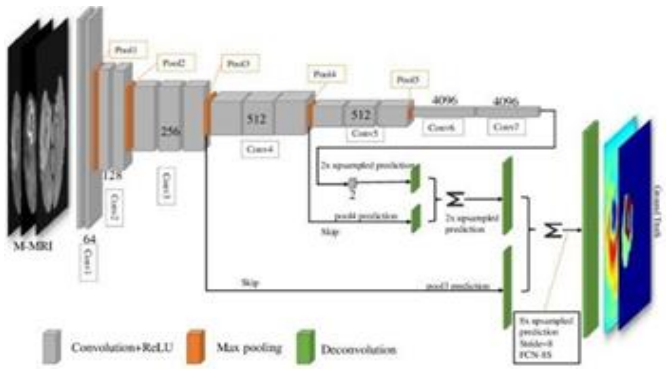
Sinceourdatasetiscomprisedofimagesofdifferentdimension,hue andsaturation of colors, tobring theimageinto a range of intensity values i.e. better for later training themodel meaning statistically it follows a normal distribution.The actual intensity distribution is graphed along the meanvalue of all images which should be determined with highconfidencelevel.Traditionally,cv2libraryisusedtosupportawiderangeofoperationinnormalization.

C. ContourandextremityofanImage

Contours are the shape determined by cv2 operation basedonchangingintensitiesofimagematrix[8].Theyholdsa Region of Interest(ROI) where the main information of theimagelies,in ourcase,wewant toanalysejust theregionof MRI enclosed within the Skull for tumor detection. Whilethecontoursarecorrectlydetected,wecanalsopointtheextremities of the images present in the dataset for clearlyassign coordinates to CNN Model for less computation andmoreaccuracate.

D. CNNModel

Convolutional Neural Network (CNN) is a deep learningnetworkusedforclassifyingimages.Thebasicpremisebehind CNN is using predefined convolving filters to identify patternsinimageedges, part sofobjects and the build on to this knowledge to detect complete objects like automobiles, animals, human being etc[10]. VGG16 is a convolutional neuralnetwork architecture named after the Visual Geometry Groupfrom Oxford, who developed it.




E. Data Augmentation

When wedon'thaveenoughtotrainmodels,wecanapt for data augmentation where a single image is multiplied withrandom crop and rotation. It helps the CNN model to provideenoughdatawithoutactuallycollectingnewdatat otrainitself. Here, we also make use of this strategy that enables tosignificantly increase the diversity of our data available fortraining models. It involves operations like cropping, padding,andhorizontalflipping.

## V. CONCLUSION

Brain Tumor is very critical in our society. It should be detected nascent stages to begin treatment as early as possible for the subject to recover faster. Other researchers(see [1],[2]) are also suggesting techniques which require large datasets while our model is using data augmentation for work as efficient as large datasets. Using VGG16 along with data augmentation is faster and use less computation processing power and obtain similar accuracy in detecting brain tumor. This model has been tested with different datasets consisting of high definition photos and give faultless results. This project is practically aimed towards a social cause and developement of medical sector and helps to create a system which will help patients to its fullest.

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