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RESEARCH ARTICLE OPEN ACCESS

Detection and Classification of Brain Tumor Using Machine Learning

Roshnadevi J. Sapkal, [1]Dr.Sharda L. Kore ,[2] Sonal M. Patil[3] Savita A. Itkarkar[4] Roma R. Jain[5]
Department of Electronics and Telecommunication Engineering
BharatiVidyapeeth'sCollegeofEngineeringforWomen,Pune-43

ABSTRACT
In this project, we propose a brain tumor segmentation andclassification method for multi-modality magneticresonance image scans. The data from multi- modal braintumor segmentation challenge are utilized which arecoregisteredandskullstripped,andthehistogrammatchingis performed with a reference volume of high contrast. Weare detecting tumor by using preprocessing, segmentation,feature extraction, optimization and lastly classificationafter that preprocessed image use to classify the tissue. Weperformed a leave one out cross validation and achieved 88Dice overlap for the complete tumor region, 75 for the coretumor region and 95 for enhancing tumor region, which ishigherthantheDiceoverlapreported

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I. INTRODUCTION

ThedetectionanddiagnosisofbraintumorfromMRI is crucial to decrease the rate of casualties. Brain tumor isdifficult to cure, because the brain has a very complex structureandthetissuesareinterconnectedwitheachotherinacomplicatedmanner.
Despitemanyexistingapproaches,robustandefficient segmentation of brain tumor is still an important andchallenging task. Tumor segmentation and classification is achallengingtask,becausetumorsvaryin shape, appearanceand location.
It is hard to fully segment and classify brain tumorfrommono-modalityscans,becauseofitscomplicatedstructure.MRI provides the ability to capture multiple imagesknownasmultimodalityimages,whichcanprovidethedetailedstructureofbraintoefficientlyclassifythebraintumor.shows differentMRI modalitiesof brain.

MOTIVATION: We get motivated of existing system.
Wehavetomatchuserobjectwithdatabaseimageusing Spatialgray level dependencies method. In that system first wehave pre-processing on those images then select featureextraction and compare brain with database and get theresult.
OBJECTIVE:Themainobjectiveofthissystemistodetectthe tumor and classify the tissue of tumor area. Using thepreprocessing, segmentation, feature extraction,optimizationandclassification.

II. NEEDOFPROJECT

The detection and diagnosis of brain tumor from MRI iscrucial to decrease the rate of casualties. Brain tumor isdifficult to cure, because the brain has a very complexstructureandthetissuesareinterconnectedwitheachotherinacomplicatedmanner.
Despite many existing approaches, robust and efficientsegmentation of brain tumor is still an important andchallenging task. Tumor segmentation and classification isa challenging task, because tumors vary in shape,appearance and location. It is hard to fully segment andclassifybraintumorfrommono-modalityscans,becauseofitscomplicatedstructure.

III. PASTWORK

Many research papers from reputed national andinternationaljournalsaresurveyedandfewarepresentedhere:
[1] Brain tumor detection and recognition from MRI scan.(2020)
This work proposes a fast and robust practical strategy to extract a brain tumor using patient's MRIscanimages of the brain. For this purpose, some tools are usedwhich include the basic concepts of image processing suchas noise removal

functions, segmentation andmorphological operations. To detect and extract a tumorfromMRIscan,aMATLABsoftwarecodeisimplemented

[2] ClassificationofBrainTumorsfromMRIimagesusinga Convolutional Neural Network. (2020)
More than one convolution layers with deep neuralnetwork is utilized for finding feature in neoplasm image.The utilization of diminutive kernels (3*3 or 5*5 size)sanctions designing a deeper design, besides having apositive impact against over fitting.The goal isclassification with segmentation of tumor part with thehelp of convolutional neural network and WatershedAlgorithm. In this paper the input to the system is
considered as brain scanned MRI image.

[3] IndividualPredictionofBrainTumorHistologicalGrading using Radiomics on Structural MR. (2018)
Thegoalwastopredicttumorgradeandcelltypeof individual patients using a radiomics study withRandom Forests. In a multiclass design, we obtain aglobal accuracy of 59.9% to predict tumor grade and53.4% to predict cell type. Converting the problem tobinary classification, we obtain an accuracy of 98.3% todistinguish between meningioma and glioma, and 84.5%to distinguish between low-grade glioma andglioblastoma.

[4] BraintumordetectionbasedonNaïveBayesClassification(2019)
In this paper, Naïve Bayes classification isutilized for recognition of a tumor region accurately thatcontains all spreading cancerous tissues. Brain MRIdatabase,preprocessing,morphologicaloperations,pixelsubtraction, maximum entropy threshold, statisticalfeatures extraction, and Naïve Bayes classifier-
basedpredictionalgorithmareusedinthisresearch.The goalofthis method is to detect the tumor area from differentbrain MRI images and to predict that detected areawhetheritisatumorornot.

[5] BrainTumorDetectionUsingMachineLearning(2020)
This paper discusses such a machine learning algorithmthat can write the user about the details of the tumorusing brain MRI. These methods include noise removaland sharpening of the image along with
basicmorphologicalfunctions,erosion,anddilation,to obtainthebackground.

IV. PROPOSED METHODOLOGY

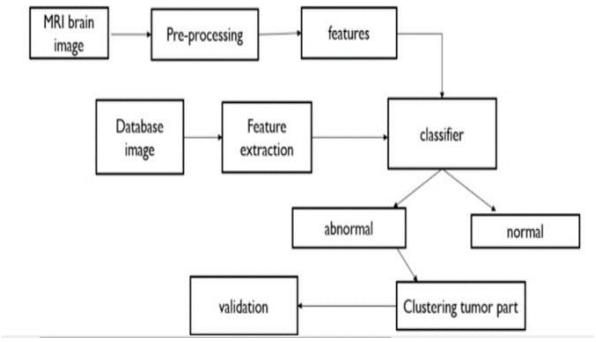
Presentsystemconsistsof

A. Software:

Operatingsystem:Windows10
CodingLanguage:Python
IDE:Spyder
Packages:Numpy,OpenCV,Tensorflow,keras,Matplotlib

B. SystemArchitecture

In this system first we are going to apply aninputimageofSoyabeanleavestothesystemthenitwillpreprocesstheimageandaccordingtodiseaseitwillde cide pesticide for particular disease and thisinformationissuppliedtopesticidesupplier.

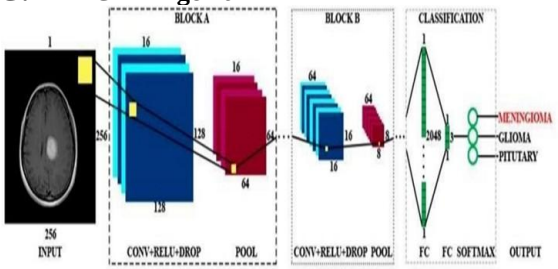


PREPROCESSING: - In our pre-processing the inputimage data is converted into meaningful floating-
pointtensorsforfeedingintoConvolutionalNeuralNetworks.Just for the knowledge tensors are used to store data,they can be assumed as multidimensional arrays. Atensor representing a 64 X 64 image having 3 channelswill have its dimensions (64, 64, 3). Currently, the datais stored on a drive as JPEG files, so let's see the stepstaken to achieve it. 1. Read the picture files (stored indata folder). Decode the JPEG content to RGBgrids ofpixelswithchannels.2.Convertttheseinto
floating-
pointtensorsforinputtoneuralnets.3.Rescalethe pixel values (between 0 and 255) to the [0, 1]interval(astrainingneuralnetworkswiththisrangegetsefficient).
FEATURE EXTRACTION: - When performing deeplearning feature extraction, we treat the pre-trainednetworkasanarbitraryfeatureextractor,allowingtheinputimagetopropagateforward,stoppingat
pre-specified layer, and taking the outputs of that layerasourfeatures.Doingso,wecanstillutilizetherobust,discriminative features learned by the CNN. We canalso use them to recognize classes the CNN was nevertrained on! Feature extraction is a part of thedimensionality reduction process, in which, an initialset of the raw data is divided and reduced to moremanageable groups. These features are easy to

process,but still able to describe the actual data set with theaccuracyandoriginality.

CLASSIFICATION CNN:- As in any other neural network, the input of a CNN,in this case an image, ispassed through a series of filters in order to obtain alabeled output that can then be classified. Thespecificity of a CNN lies in its filtering layers, whichincludeatleastoneconvolutionlayer.Theseallo wittoprocess more complex pictures than a regular neuralnetwork. Whereas the latter is well adapted for simple,well-centered images such as hand-written digits, theuse of CNNs in image analysis ranges from Face-book's automatic tagging algorithms, to objectclassification and detection, in particular in the field ofradiology. Convolutional Neural Networks specializedfor applications in image video recognition. CNN ismainly used in image analysis tasks like Imagerecognition,ObjectdetectionSegmentation.

C. CNNAlgorithm



A Convolutional Neural Network(ConvNet/CNN) is a Deep Learning algorithm whichcantakeinaninputimage,assignimportance(lear nable weightsandbiases)tovariousaspects/objects in the image and be able to differentiateone from the other. The architecture of a ConvNet isanalogoustothatoftheconnectivitypatternofNeuron sin the Human Brain and was inspired by theorganization of the Visual Cortex .Individual neuronsrespond to stimuli only in a restricted region of thevisual field known as the Receptive Field. A collectionofsuchfieldsoverlaptocovertheentirevisual area.

Algorithm step: - Step 1(a): ConvolutionOperation:-The first building block in our plan ofattack is convolution operation. In this step, we willtouchonfeaturedetectors,whichbasicallyserveast heneural network's filters. We will also discuss featuremaps, learning the parameters of such maps, howpatterns are detected, the layers of detection, and howthefindingsaremappedout.

Step 1(b): ReLULayer:-The second part of this stepwill involve the Rectified Linear Unit or ReLU. Wewill cover ReLU layers and explore how linearityfunctions in the context of 29 Convolutional NeuralNetworks.NotnecessaryforunderstandingCN N's,butthere's no harm in a quick lesson to improve yourskills.

Step2:Pooling:-

Inthispart,we'llcoverpoolingandwill get to understand exactly how it generally works.Pooling Layers section would reduce the number ofparameters when the images are too large. Our nexushere, however, will be a specific type of pooling; maxpooling.

Maxpooling-
Ittakesthelargestelementinthefeaturemap.

Meanpooling-
Ittakestheaverageofelementsinthefeaturemap.

Sumpooling-
Ittakesthesumofallelementsinthefeaturemap.

Step 3: Flattening: - This will be a brief breakdown oftheflatteningprocessandhowwemovefrompooledto flattened layers when working with ConvolutionalNeuralNetwork.

Step4:FullConnection:-

Inthispart,everythingthatwe covered throughout the section will be mergedtogether. With the fully connected layers, combinedthesefeaturestogethertocreateamodelforcla ssifyinginputimageintovariousclassesbasedontrainin gset.

D. SoftwareInformation

Python: Python is an interpreted, high-level andgeneral-purpose programming language. Created byGuidovanRossumandfirstreleasedin1991,Python' sdesignphilosophyemphasizescodereadabilitywithit snotable use of significant whitespace. Its languageconstructs and object-oriented approach aim to helpprogrammers write clear, logical code for small andlarge-scaleprojects.

Pythonisdynamicallytypedandgarbage-collected. It supports multiple programmingparadigms, including structured (particularly,procedural), object-oriented, and functionalprogramming.Pythonisoftendescribedasa" batteriesincluded" language due to its comprehensive standardlibrary.

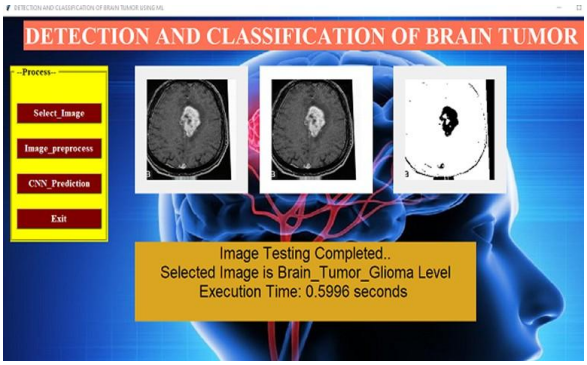
Pythoninterpretersareavailableformanyoperating systems. A global community of programmers developsandmaintainsCPython,afreeandopen-sourcereference implementation. A non-profit organization, thePython Software Foundation, manages and directsresourcesforPythonandCPythondevelopment. Python was conceived in the late 1980s by GuidovanRossumatCentrumWiskundeInformatica(CWI)inthe Netherlands as a successor to the ABC language(itselfinspiredbySETL),capableofexceptio

nhandlingand interfacing with the Amoeba operating system. ItsimplementationbeganinDecember1989.

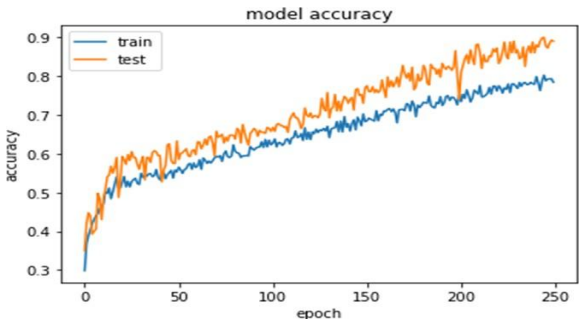
Anaconda: Anaconda is a free and open-source distributionofthePythonandRprogramminglanguage sfor scientific computing (data science, machine learningapplications, large-scale data processing, predictiveanalytics, etc.), that aims to simplify packagemanagement and deployment. The distribution includesdata science packages suitable for Windows, Linux, andmacOS. It is developed and maintained by Anaconda,Inc., which was founded by Peter Wang and TravisOliphantin2012.AsanAnaconda,Inc.product,it isalso known as Anaconda Distribution or Anaconda IndividualEdition.

Spyder: Spyder is an open-source integrateddevelopment environment (IDE) used in computerprogramming, specifically for the Python language. It isdeveloped by the Spyder project contributors. Spyderintegrates with a number of prominent packages in thescientific python stack, including NumPy, SciPy,Matplotlib,panda,IPython,,aswellasotheropen sourcesoftware. Spyder is cross-platform, with Windows,macOSandLinuxversions.

V. RESULT&OUTPUTS



TestandAccuracy:



VI. FUTURESCOPE

- Innearfuture, a database can be created fordifferent patients having different types of braintumorsandlocatethem.
- This application can be extended to accessibilityandusabilitythroughmobilephones.
- If this application is developed to analyze alltypes of MRI scans of same patient and result ofallscansareintegrated,itcansuggestappropriatetreat mentandmedicationaswell.

VII. CONCLUSION

In this proposed work different medical imageslikeMRIbrainimagesaretakenfordetectingtum or.Theproposed approach for brain tumor detection supportedconvolution neural network categorizes into multilayerperceptronneuralnetwork.The proposed approach utilizes a mixture of thisneural network technique and consists of several stepsincludingtrainingthesystem,pre-processing,segmentationand classification. In the future, we'll take an outsizeddatabase and check out to offer more accuracy which canworkonanysortofMRIbraintumor.

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