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BRAIN TUMOR DETECTION USING DEEP LEARNING

Under the guidance of SATYANARAYANA
CH.Anandini[1], M.Suraj[2], B.Mounika[3], B.Prajwal [4].
Computer Science Engineering, Siddhartha Institute of Technology and Sciences, Narapally.
Email: anandinichennupati2002@gmail.com

1. ABSTRACT

The main regulator of the humanoid system is the human brain. Brain tumors occur when cells grow and divide abnormally, and brain tumors occur when cells continue to grow. Computer vision is important in human health because it eliminates the need for human judgment to produce accurate findings. The most reliable and safe magnetic resonance imaging (MRI) techniques are CT scans, X-rays, and MRI scans. MRI can identify small objects.
Our article will focus on the various ways that brain MRI can be used to diagnose brain diseases. In this work, we use preprocessing. Rules often include image data preprocessing, modelling, training, and prediction. Then, tumor regions were reliably identified using a convolutional neural network (CNN) segmentation algorithm. We will guess whether theperson has a mental illness or not.
I hope the project is planned to be better than its competitors.

KEYWORDS

Brain tumor, Magnetic resonance imaging, Convolution Neural Network

INTRODUCTION

The techniques and methods of creating visual representations of the inside of the body and the functionof the body or tissue for diagnosis and treatment are known as pain imaging. Medical imaging aims to reveal the underlying structure of skin and bones, as well as to diagnose and treat diseases. Medical imaging also produces information about normal anatomy and anatomy that can identify abnormalities.

Medical imaging processing is the use of computers to process images. This study includes many technologies and processes such as image acquisition, storage, presentation, and communication. This system is designed to identify and control the disease. This process creates information about the structure and function of thebody, making it easier to identify abnormalities. Methodsinclude electrical and electronic imaging using radiation (X-ray and gamma), ultrasound, magnets, oscilloscopes, as well as thermal and isotopic imaging. There are many other techniques that can be used to gather information about body functions and functions.

This process has many disadvantages compared to editingto create images. Editing digital photos using a computer is one way of processing photos. Technology has many advantages such as adaptability, adaptability, data storageand communication.

With the development of many image scaling algorithms,images can be saved efficiently. The process has many rules executed simultaneously between images. Differentsizes of 2D and 3D images can be created.

2. PROBLEM STATEMENT

Our research focuses on the automatic identification and classification of brain tumors. MRI or CT scans are oftenused to examine the anatomy of the brain. The aim of thisstudy is to identify tumors on MRI images of the brain. The main reason for detecting brain tumors is to aid in diagnosis. The aim is to develop an algorithm that can detect tumors by combining different techniques to create a reliable method for detecting tumors in MR brain images.

Use filtering, erosion, dilatation, thresholding and tumor identification techniques such as edge detection.
The aim of this project is to remove tumors from MR brain images and explain them in a way that everyone can understand. The purpose of this study is to provide some important information for the convenience of the users, especially the health personnel who treat the patients. Theaim of this project is to create an algorithm that will generate images of tumors obtained from MR brain images. Finally, we use a convolutional neural network todetermine whether MR brain images contain tumors.

LITERATURE SURVEY

A. Sivaramakrishnan And Dr. M. Karnan "A Novel Based Approach for Extraction Of Brain Tumor InMRI Images Using Soft Computing Techniques," International Journal Of Advanced Research In Computer And Communication Engineering, Vol. 2,Issue 4, April 2013.

A. Sivaramakrishnan et al. (2013) [1] proposed an efficient and creative finding of the brain tumor location from an image utilizing the Fuzzy approach grouping method and histogram equalization. Image disintegration is performed by using primary factor evaluation to lower the extent of the wavelet coefficient.The predicted FCM clustering technique accurately removed the tumor area from the MR images.

Li, Shutao, JT-Y. Kwok, IW-H. Tsang and Yaonan Wang. "Fusing images with different focuses using support vector machines." IEEE Transactionsonneural networks 15, no. 6 (2004): 1555-1561.

J.T. Kwok et al. [7] delivered wavelet-based photographfusion to easily cognizance at the object with all focal lengths as several vision-related processing tasks can be carried out more effortlessly when wholly substances within the images are bright. In their work, Kwok et al. investigated different datasets, and results show that the presented work is extra correct as it does not get suffering from evenness at different activity stages computations.

M. Kumar and K. K. Mehta, "A Texture based Tumor Detection and automatic Segmentation using Seeded Region Growing Method," International Journal of Computer Technology and Applications, ISSN: 2229- 6093, Vol. 2, Issue 4, PP. 855-859 August2011

In this study, Kumar and Mehta [8] proposed the texture-based method. They emphasized the impact of segmentation if the edges of the tumor tissue are not sharp. Because of the edges, the performance of the suggested technology may produce unexpected results. The texture evaluation and seeded region method were carried out in the MATLAB environment.

S. Li, J.T. Kwok, I.W Tsang, and Y. Wang, —Fusing Images with Different Focuses using Support Vector Machines, Proceedings of the IEEE Transaction on Neural Networks, China, November 2007.

Edge detection, picture segmentation, and matching aredifficult to achieve in optical lenses with large focal lengths, according to Li et al. [13]. Many techniques for this mechanism have already been offered by researchers, one of which is wavelet-based picture fusion. A discrete wavelet frame transform (DWFT) anda support vector machine (SVM) can be used to improvethe wavelet function. The authors of this research experimented with five sets of 256-level pictures.

3. MODULE DIVISION

This provides the architecture of the system we will install. It consists of six steps, starting with the extractionof input images from the data, followed by image preprocessing, image enhancement, image segmentation using binary thresholding, and brain tumor classification using a convolutional neural network. Finally, the output will be displayed when all the above operations are complete. Each module is different in its own way. Everystep matters.
This design also includes collecting data for testing and training. The data used is from Kaggle and contains around 2000 images used to test and train the system.

BRAIN TUMOR IMAGE CLASSIFICATION USING CONVOLUTIONAL NEURAL NETWORK

While classification is the best way to analyze images, Convolutional Neural Network (CNN) is a deep learningmethod that uses input images, gives importance to various features/objects in the image, and compares themwith each other to understand the difference. It can capture spatial and temporal aspects of the image and canbe trained to better understand complex images.
For this step, we need to import Keras and other

packages that we will use while installing

- CNN, import the following packages:
- The array is used to initialize the neural network.
- Convolution2D is used as a convolution forimageprocessing. Layer
- MaxPooling2D is used to add layers.
- Flatten is a function that converts a list of coordinatesinto a single column that is passed to the entire link layer.
- Dense adds all layers to neural networks.

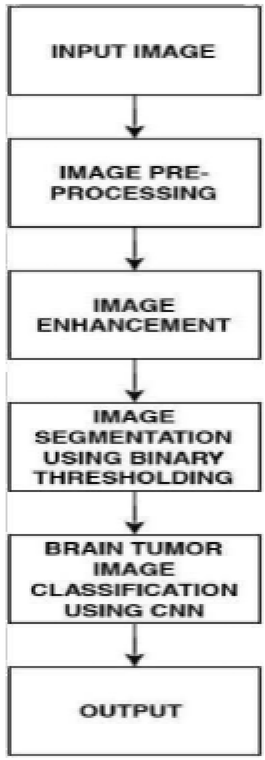


IMAGE PREPROCESSING AND IMAGEENHANCEMENT

Kaggle has provided a dataset of Brain MRI images for download. About 1,900 MRI scans, benign and malignant, make up the MRI database. The MRI scan was used as the input of the first step. An important and first step in improving the caliber of brain MRI imaging is preprocessing. Impulse noise removal and image enhancement are the preprocessing steps. MRI images of the brain are initially grayscale images like this in the early stages. An adaptive bias filter approach is used to remove unwanted noise and distortions present in brain images. This improves classification accuracy and improves diagnosis.

IMAGE ACQUISITION FROM THE DATASET

Image acquisition in image processing involves locating an image in a dataset and retrieving it for processing. It isthe first step in the workflow sequence because processingcannot take place without an image. The captured image is entirely unprocessed.

Here, the image is processed using the local device's file path.

FROM ONE COLOR SPACE TO ANOTHER,CONVERT THE IMAGE:

OpenCV can give a numerous color-space conversiontechniques which is more suitable in ourcase.

The function cv2.cvtColor(input_image, flag) is usedtoconvert an image's color, and flag specifies the conversion method. In our job, we turn the original image into a grayscale version.

FILTERS

Filters are mostly employed in image processingtoreduce the high frequencies in the image.

IMAGE IMPROVEMENT

Image enhancement is a technique that uses computer- aided software to improve image quality and sensitivity. This method combines objective and subjective improvements. This method uses both local and global operations. The district input pixel values determine how the local processes work. Spatial and transform domain approaches are two different types of image enhancement.While the transform technique first works on Fourier and then the spatial technique, the spatial approaches operate directly at the pixel level.

A segmentation method called edge detection involves boundary recognition of closely related objects or regions.This method identifies the items' discontinuity. This method is mostly used to analyse images andidentify the areas of the image where there is a significant change in intensity.

THRESHOLDING

The simplest technique for segmenting images is thresholding. The process of turning a greyscale image into a binary image, where the two levels are allocated to pixels with values above or below the set threshold value, is a non-linear operation. We employ the cv2.threshold() method in Open V.src, thresh, maxval, type[dst], cv2.threshold This function applies fixed-level thresholding to a single- channel array to remove noise. It compares input values tothe set threshold value, and returns the computedthresholdvalue and thresholder image. There are several types of thresholding supported, such as thresh, maxval, type, andcv2.THRESH_BINARY.

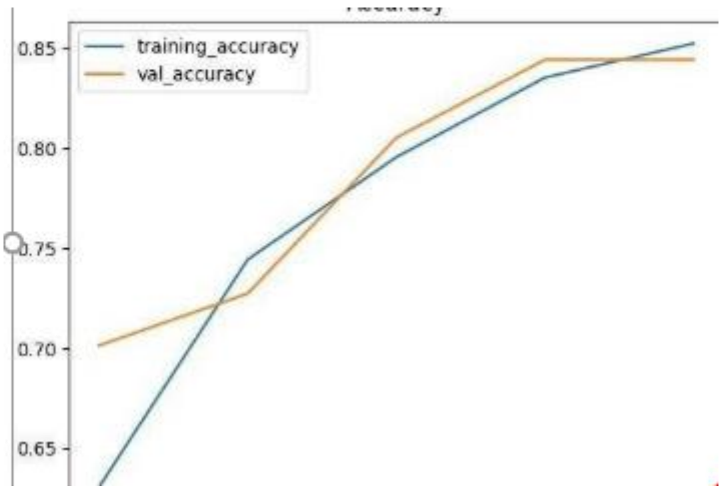
MORPHOLOGICAL OPERATIONS

Structural elements are used along with morphological processes in the input image to produce an output image of the same size. When performing a morphological operation, each output pixel's value is determined by comparing it to its neighbors in the input image. Along with segmentation approaches, morphological methods are also employed. On binary images, morphological activity is typically carried out. It performs operations depending on the shape and offers a variety of image processing techniques. In this suggested study, two morphological procedures are used: erosion and dilation. Erosion and dilation operations are both carried out by us.

Opening and closure are the two primary phases of the erosion and dilation morphological procedure. The MRI binary picture is opened as the initial step. The primary task of the opening procedure is to connect a small groupof pixels to a gap that is present between objects.

Following the bridge's installation, dilatation was used torestore the erosion to its original size. When a binary picture is opened, the future openings of the same structured elements do not change that image.
Add layer thickness with sigmoid function as output method. To optimize the weak model during training, write the model with binary cross entropy loss and Adam optimizer. The training process consists of feeding the training data to the model in bulk.

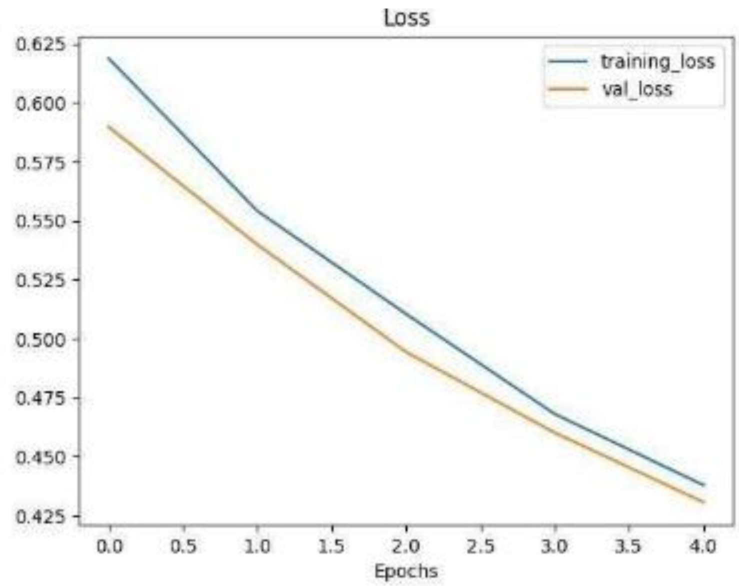
4. ARCHITECTURE



The brain detects patterns using the EfficientNet model, which combines EfficientNet's powerful processing capabilities with deep learning techniques. The process includes data preparation, design, training and reasoning.Data preparation begins with data from brain MR images, each filled with one or more tumors. The data is divided into training and test sets. Use advanced techniques such as resizing and normalization to sharpenand improve model performance.

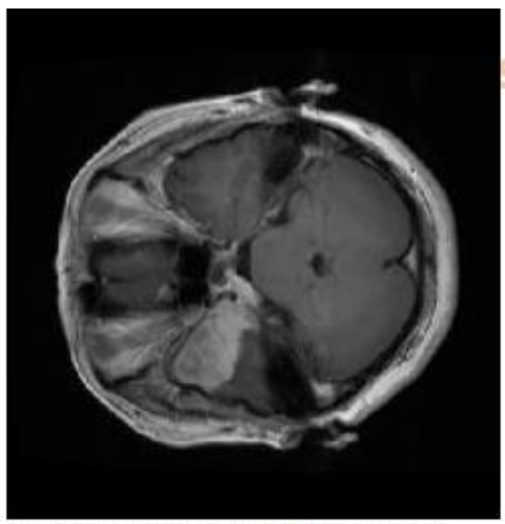
EfficientNet models are used as the backbone for feature extraction. EfficientNet is a combination of neural network architecture that provides high accuracy with few flaws. It uses integration to balance depth, width andresolution to optimize working patterns. The EfficientNetmodel is optimized for brain diagnostics. Load the pre- trained model and transform the output layer into a binary classification function. The model learns to extract the content of the image and classify it as tumor or non-tumor. Learning isdone overtime, information is repeated many times.
After training, evaluate the model using the prepared testdata to evaluate its performance on unseen data. Metrics such as accuracy and loss are calculated to evaluate the model's effectiveness in detecting brain tumors. Thus, thetraining model can be used to predict the presence of tumors in new MRI images of the brain.The model takesthe input image, preprocesses it by resizing and normalizing it, and converts it to the EfficientNet architecture. The model then assigns a probability score representing the probability of having a tumor in the image.

5. PLOT GRAPHS

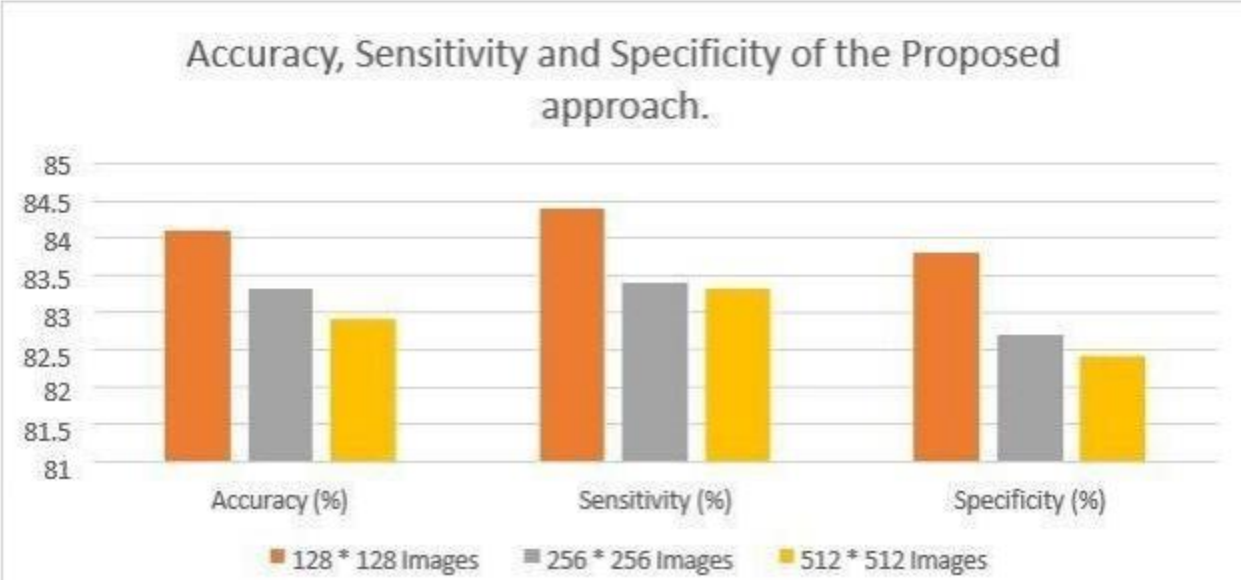


6. EXPERIMENTAL RESULTS

Sample Input:



Predicted Output: Yes Observed



Represents the performance of the proposed CNN

A Different set of Images	Accuracy (%)	Sensitivity (%)	Specificity (%)
128 * 128 Images	84.1	84.4	83.8
256 * 256 Images	83.3	83.4	82.7

Represents the Accuracy, Sensitivity, and Specificity of the

proposed approach for different sets of images.

7. PERFORMANCE MEASURES

Performance evaluation criteria, such as True Positive and True Negative, have been used to evaluate the suggested algorithm. The first one indicates how frequently the suggested algorithm can identify a damaged region as being damaged, while the second one indicates how frequently the proposed algorithm can identify a non- damaged region as being non-damaged. Additionally, the False Positive (FN) and False Negative (FN) indicate how frequently the proposed algorithm fails to correctly identify the damaged region, while the latter designates how frequently the proposed algorithm fails to recognize the non-tumors region as non-tumors regions.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

$$Specificity = \frac{TN}{TN + FP}$$

$$Sensitivity = \frac{TN}{TP+FN}$$

8. CONCLUSION

We propose a computational method to segment andidentify tumor cells using convolutional neural networks.Using the source data, read the MR image from the local device and convert it to a grayscale image. These images were preprocessed using a two-dimensional filter technique to remove noise found in the original image. The noise-free images are binary thresholded and segmented using a convolutional neural network to aid inthe identification of tumors in MR images. The proposedmodel has an accuracy of 84% and gives good results witherror-free and reduced computation time.

9. FUTURE SCOPE

Extinction shows that the plan requires extensive trainingto obtain more accurate findings; In medical imaging, obtaining medical information is time-consuming and sometimes not available. The plan can be further enhanced with collaborative untrained algorithms that can identify anomalies with less training data, and self- learning algorithms that will help improve the accuracy ofthe algorithms and reduce the computation time.

10. REFERENCES

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