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BRAIN TUMOR DETECTION USING DEEP LEARNING

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ABSTRACT

The human brain is that the major controller of the system. The brain may be a complicated organ that controls each method that regulates our body. The abnormal growth of cells within the brain ends up in a brain tumor. Brain tumors area unit the foremost common and dangerous unwellness, resulting in a awfully short expectancy in their highest grade. Generally, varied image techniques like X-radiation (CT), resonance Imaging (MRI) and ultrasound image area unit accustomed valuate the growth in a very brain. Specially, during this work, imaging pictures area unit accustomed diagnose tumors within the brain. but the massive quantity of information generated by imaging scan prevents manual classification of growth vs non-tumor in a very specific time. however it's some limitations (i.e., correct quantitative measurements area unit provided for a restricted range of images). Hence, trust and automatic classification schemes area unit essential to stop the death rate of humans. due to the massive spacial and structural variability of the brain tumor's close region, automatic brain tumor classification may be a troublesome task. In this work, automatic brain tumor detection is projected by victimization convolutional neural networks (CNN) classification. The deeper field of study style is performed by victimization tiny kernels. Experimental results show that the CNN achieves high accuracy with low quality and compared with the all alternative ways.

Keywords: Brain Tumor, Convolution Neural Networks.

I. INTRODUCTION

The brain is one of all the important organs within the physical body that consist of billions of cells. The uncontrolled division of cells results in the formation of an abnormal cluster of cells, which is also known as neoplasm. Brain neoplasms (brain tumor) are classified into two types: low grade (grade 1 and grade 2) tumors and high grade (grade 3 and grade 4) tumors. Benign brain tumors are low grade brain tumors that have been labelled as such. Similarly, high grade neoplasm is also referred to as malignant. neoplasm, benign tumor, nonmalignant tumor, nonmalignant tumor, nonmalignant neoplasm, tumor, tumor, or neoplasm isn't a cancerous tumor. Therefore, it doesn't unfold different elements of the brain. However, the malignant neoplasm could be a cancerous tumor. it spreads apace with indefinite boundaries to different regions of the body simply. It ends up in immediate death. Brain magnetic resonance imaging images are primarily used to detect neoplasms and to model their progression. This data is principally used for neoplasm detection and treatment processes. CNN is being used in this project to classify traditional and neoplasm brains. In CNN (convolutional neural network), convolutional is the name of a mathematical linear operation. The dimension of the image is reduced at every layer of CNN, but not the loss of knowledge.

II. METHODOLOGY

The human brain is sculptured by the victimization style and implementation of neural networks. It's completely different layers of neurons that are connected together. There'll be one input and output layer, whereas there could also be a range of hidden layers. The Convolution Neural Network (CNN) consists of an input layer, a convolution layer, a corrected long measure (ReLU) layer, a pooling layer, and an absolutely connected layer. Within the convolution layer, the given input image is separated into numerous tiny regions. Part-wise activation operation is meted out in the ReLU layer. The pooling layer is elective. Within the final layer (i.e., an absolutely connected layer is employed to come up with the category score or label score price supported by the likelihood middle zero to one. The CNN-based mostly neoplasm classification is split into 2 phases, like the coaching and testing phases. The quantity of pictures is split into completely different classes by

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victimization labels, like tumor and non-tumor brain images, etc. Within the coaching section, preprocessing, feature demand, and classification with loss operate to form a prediction model. Within the preprocessing, image resizing is applied to vary the size of the image. Finally, the convolution neural network is employed for automatic neoplasm classification. Below, you'll be able to see the design diagram for the project.

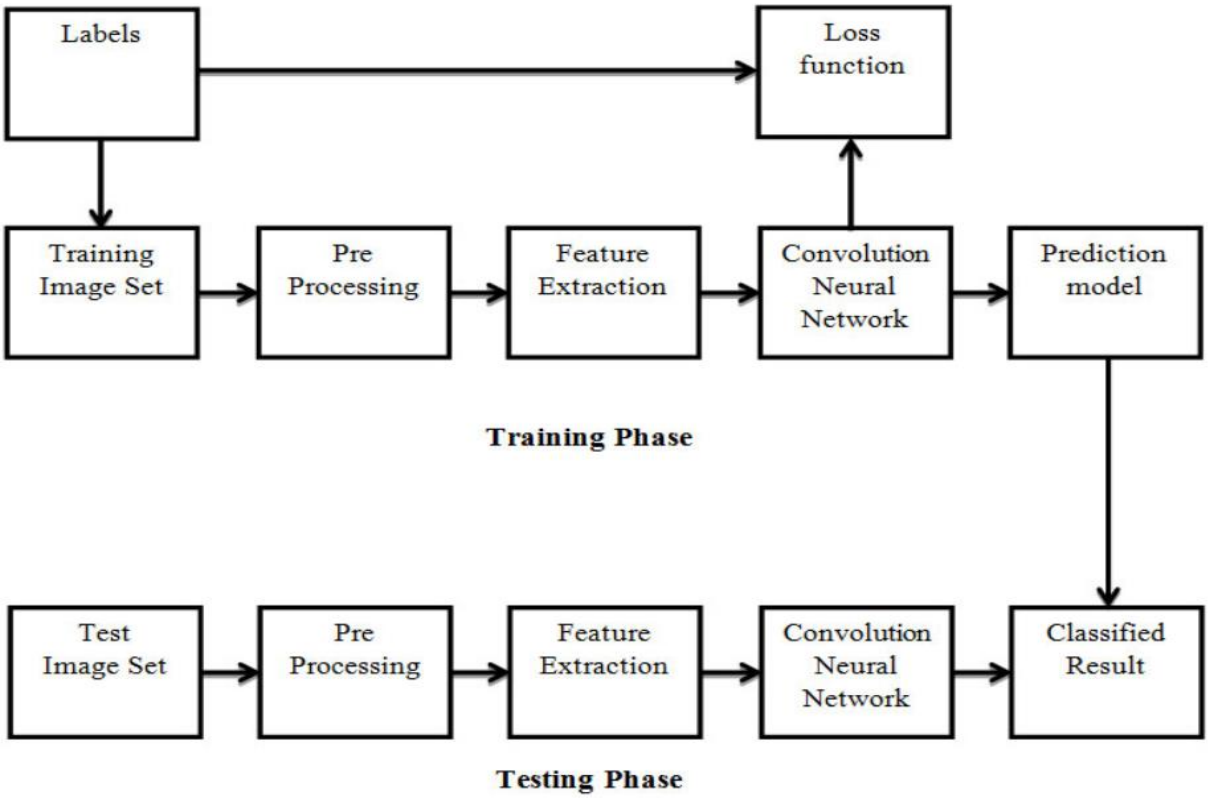
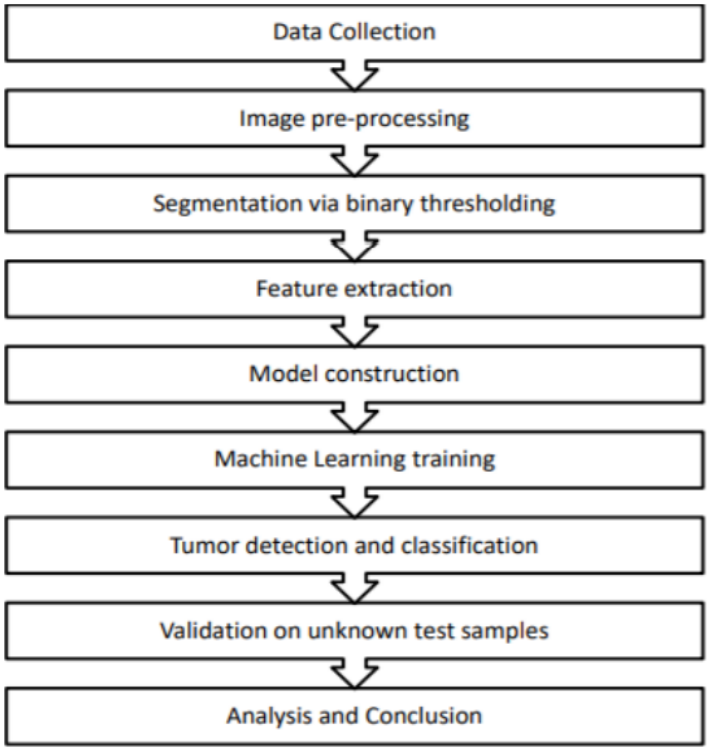


Figure 1: Block diagram of proposed brain tumor classification using CNN

Flowchart:



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III. MODELING AND ANALYSIS

MODULE 1: IMAGE PREPROCESSING AND IMAGE IMPROVEMENT

Image Pre-processing:

The Brain magnetic resonance imaging image dataset has been downloaded from Kaggle. The magnetic resonance imaging dataset consists of around 1900 magnetic resonance imaging pictures, as well as traditional, benign, and malignant ones. These magnetic resonance imaging pictures are taken as input to the first step. Pre-processing is an important and initial step in raising the standard of the brain magnetic resonance imaging image. The important steps in pre-processing are the reduction of impulsive noise and image resizing. Within the initial section, we tend to convert the brain magnetic resonance imaging image into its corresponding Gray-scale image. The removal of unwanted noise is completed by victimisation the reconciling bilateral filtering technique to get rid of the distorted noises that are present within the brain image. This improves the identification and, consequently, increases the classification accuracy rate. In an image processing process, image acquisition is completed by retrieving a picture from a dataset for the process. The image that's noninheritable is totally unprocessed. Here we tend to manipulate the image. Filters are primarily used in image processing to suppress high frequencies within the image's a non-linear filtering technique that will take away noise from the photographs.

It's a dual-purpose non-linear, noise-reducing smoothing filter for pictures. It replaces the intensity of every element with a weighted average of intensity values from nearby pixels.

Image Enhancement:

Image improvement could be a technique used to improve the image quality and physical property by victimising computer-aided software packages. This system includes both objective and subjective enhancements. Edge detection could be a segmentation technique that uses border recognition of strictly joined objects or regions. This technique identifies the separation of the objects. This system is employed in the main in image study to acknowledge the components of the image wherever a large variation in intensity arises.

MODULE 2: IMAGE SEGMENTATION

Image segmentation could be a technique for segregating the image into several components. The fundamental aim of this segregation is to create photographs that are straightforward to investigate and interpret with protective standards. This system is additionally wont to trace the objects' borders at intervals between photographs. This system labels the pixels according to their intensity and characteristics. Those components represent the complete original image and acquire its characteristics like intensity and similarity. Segmentation strategies have the ability to sight or determine the abnormal portion of the image that is helpful for analysing the scale, volume, location, texture, and form of the extracted image.

THRESHOLDING: Thresholding is the simplest technique of image segmentation. It's a non-linear operation that converts a grey-scale image into a binary image wherever the 2 levels are assigned to pixels that are below or on top of the desired threshold price.

MORPHOLOGICAL OPERATIONS: Morphological operations apply a structuring component to an associate degree input image, making the associate degree output image of identical size. In a morphological operation, the value of every element within the output image relies on a comparison of the corresponding element within the input image with its neighbours.

MODULE 3: IMAGE CLASSIFICATION AND CONVOULTION NEURAL NETWORK.

CLASSIFICATION is the best method for identifying images in medical imaging. Wherever one or more options exist, and each of those options belongs to one of many categories, all classification algorithms support image prediction. Associate degree automated and dependable classification method Convolutional Neural Networks (CNN) are used since they're sturdy in structure and help in distinctive each minute detail. A Convolutional Neural Network could be a Deep Learning algorithmic programme which may absorb an associate degree of input image, assign importance to various aspects/objects within the image, and be able to differentiate one from the opposite. The amount of pre-processing needed in a CNN is way lower as compared to alternative classification algorithms.

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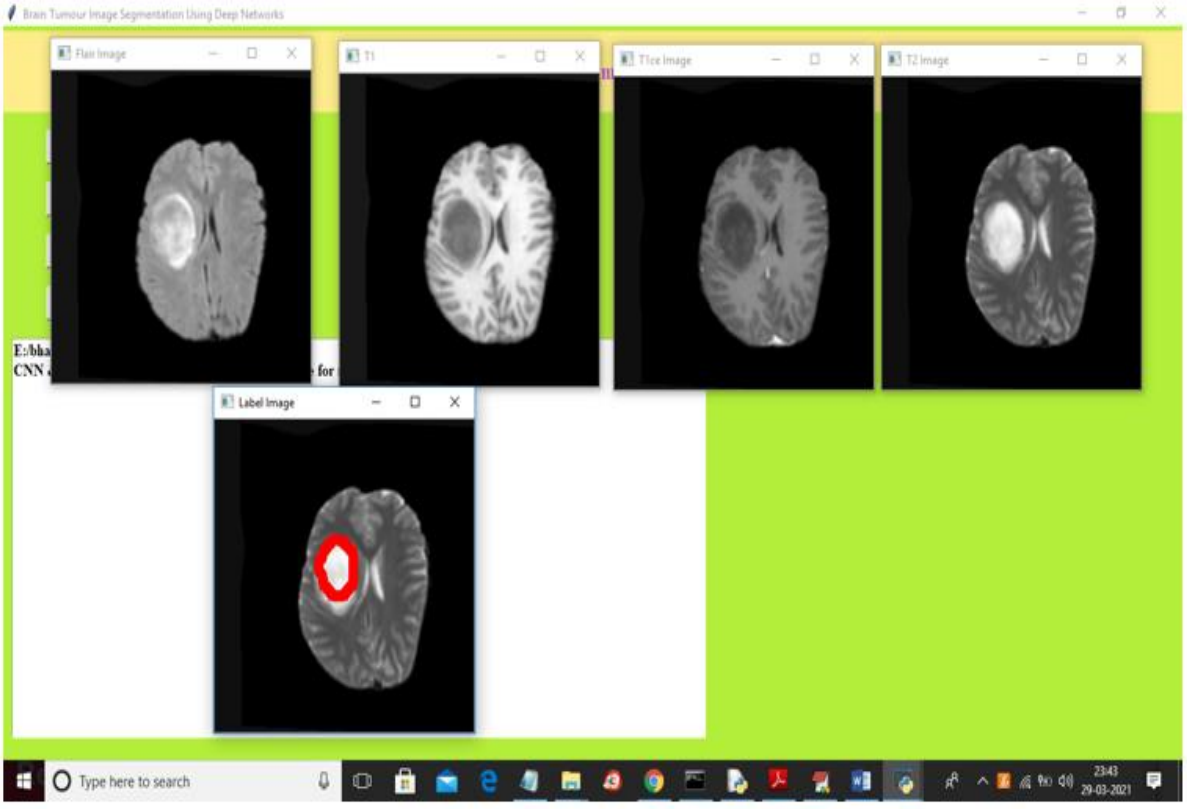
IV. RESULTS AND DISCUSSION

The dataset contains 2 folders for the purpose of training and testing. The "train" folder contains 2 sub-folders of HGG and LGG cases: 220 patients of HGG and 27 patients of LGG. The "test" folder contains brain images of 110 patients with HGG and LGG cases combined. There are five different MRI image modalities for each patient, which are T1, T2, T1C, FLAIR, and OT (Ground Truth of Tumor Segmentation). All these images are sized at 240x240, have a resolution of 1 mm3, and have the skull stripped. In the ground truth images, each pixel is labelled with zeros and non-zeros, corresponding to the normal pixel and parts of tumor cells, respectively.

Model construction:

```
def build_model(in_shape):
    xinput=Input(in_shape)
    x=ZeroPadding2D((2,2))(xinput)
    x=Conv2D(32,(7,7),strides=(1,1))(x)
    x=BatchNormalization(axis=3)(x)
    x=Activation('relu')(x)
    x=MaxPooling2D((4,4))(x)
    x=MaxPooling2D((4,4))(x)
    x=Flatten()(x)
    x=Dense(1,activation='sigmoid')(x)
    model=Model(inputs=xinput,outputs=x,name="Tumour_Detection_Model")
    return model
model=build_model((240,240,3))
model.summary()
```

Output Screen:



In above screen first 4 images are the input images and fifth image is the predicted label image with segmented parts around tumor area.

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Fig: Loss and Accuracy Vs Epoch plots of a CNN model

V. CONCLUSION

The main goal of this analysis work is to style an economical automatic tumor classification with high accuracy, performance, and low quality. To enhance the accuracy and scale back the computation time, a convolution neural network based mostly on classification is introduced within the projected theme. Additionally, the classification results are given as neoplasm or traditional brain pictures. CNN is one of the deep learning methods that uses a sequence of feed-forward layers. The input MR pictures are scanned from the native device using the file path and reborn into grayscale pictures. These pictures are preprocessed using an adaptative bilateral filtering technique for the elimination of noise that is contained within the first image. A binary threshold is applied to the denoised image, and a convolution neural network is applied, which helps in figuring

out the tumor region in the MR images. The train accuracy is 97.5% and the validation accuracy is 90.0%. The validation result had a best figure of 91.09% accuracy.

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