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Brain Tumor Detection using Convolutional Neural Networks

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Abstract - *Now a day's issue of brain tumor automatic identification is of great interest. In Order to detect the brain tumor of a patient we consider the data of patients like MRI images of a patient's brain. Here our problem is to identify whether tumor is present in patients brain or not. There are many previously implemented approaches on detecting these kinds of brain tumors and improving the detection accuracies. In this paper, we estimate the brain tumor severity using Convolutional Neural Network approach which gives us accurate results.*

Key Words: *Convolutional Neural Networks (CNN), Magnetic Resonance Imaging (MRI), Gliomas, Brain Tumor.*

1. INTRODUCTION

Gliomas are the dangerous brain tumors, found in grown-ups, with highest death rate [1]. These tumors begin from the internal bit of human brain. That makes them very not the same as metastatic tumors. Low Grade Gliomas (LGG) not the same as metastatic tumors. Low Grade Gliomas (LGG) gliomas [1], [2]. Computer help is highly evolved in clinical organizations because of the way that it could improve the result of analysis such a space where the ill-advised negative cases must be at a low rate. The twofold reading of MRI is exorbitant and henceforth a superb programming to help people in clinical establishments is of incredible intrigue now a days. In Conventional strategies human onlookers identify the highlights of the tumor. In order to improve the exactness of the current framework, a mechanized symptomatic framework with some anatomical highlights are actualized. Robotized symptomatic framework is created to improve the precision. Exact segmentation is an essential segment in the treatment getting ready for additional assessment and medical procedure. Manual segmentation takes sensible time and precision will be less and it prompts bury and intra rater blunders. Programmed segmentation is required because of this reason [1], [3].

Programmed segmentation gives the data about the encompassing tissues around the tumor [4]. This is because of the intensity variation happening among the same groupings. Segmentation in MRI utilized in treatment checking and gaining up prominence with progress in picture guided surgical methodologies. Laying out of tumor contours is an essential advance. This technique depends on CNN and learn highlights that are explicit to gliomas detection and segmentation.

2. BACKGROUND AND RELATED WORK

In [5], the brain tumor classification is performed by using Fuzzy C-means (FCM) based segmentation and SVM and DNN based classification is carried out. This resulted in high computational period and low accuracy. The proposed method thus consisted of using CNN.

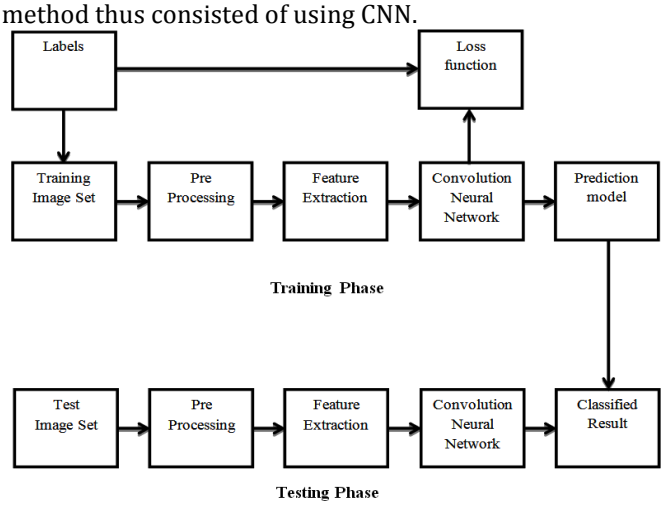

Fig-1: Block diagram of proposed system

In [6], this research discussed the pre-processing consisting of intensity and batch normalization.

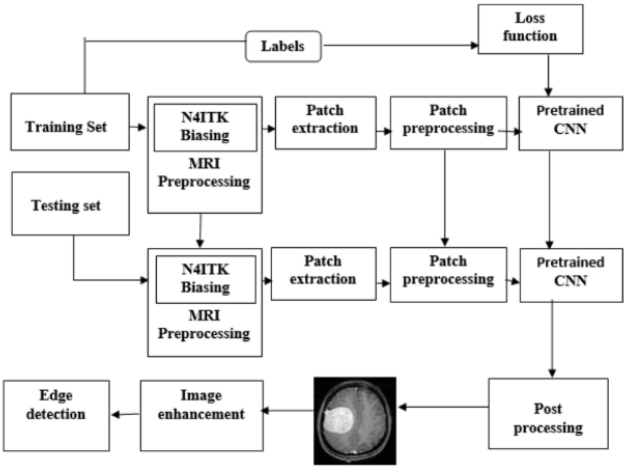

Fig-2: Overview of proposed system

It used bias field correction in CNN based method for the segmentation of brain tumors for MRI images. These images have a obstacle of intensity inhomogeneity (different intensity ranges for same sequences), which is avoided using NLTK. Median filters and Gaussian filers are also used. Clustering and segmentation process is completed after patch

pre-processing. Image enhancement using PCNN method is done along with Canny edge detection and edge detection using wavelet transform method.

In [7], the primary objective of this research work is to construct a prototype for economical brain tumor classification and segmentation with high accuracy and low complexity. Marker based Watershed algorithm and Global thresholding are used for brain tumor segmentation. The training accuracy obtained is 98% along with a high validation accuracy and low validation loss.

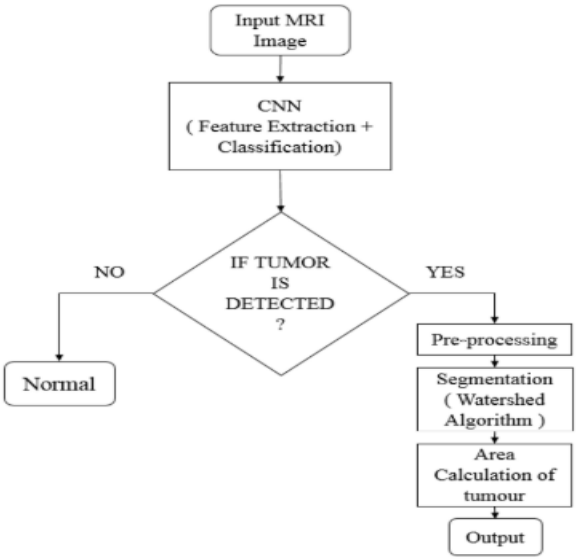

Fig-3: Flowchart of proposed system

In [8], a mechanized technique is utilized to recognize and arrange MRI pictures. This technique depends on the Super Pixel Technique and the classification of every Super Pixel. Extremely randomized trees (ERT) classifier is contrasted and SVM to arrange every super pixel into tumour. The outcomes show the great execution of this strategy utilizing ERT classifier. In [9], the system is divided into 2 parts, first part focuses on the feature extraction through FNNN, where several classic CNN architectures are applied to the 2D slices and try to achieve end-to-end predication to abandon fully connected layers. The architecture is denoted as encoder-decoder architecture. The second part applies loss functions like bootstrapping loss, Dice loss, etc.

3. PROPOSED METHODOLOGY

The main stages involved in this method are Data Collection, Pre-processing and detection via neural network. Generally, accurate semi-automatic and automatic methods are required for detection. For these reasons, fully automatic segmentation system using CNN is used.

3.1 Data Collection

As our system is mainly focusing on detection of brain tumor, we gathered our data as MRI images. The dataset obtained consisted of 159 images in which tumor is present and 99 images in which tumor was not present.

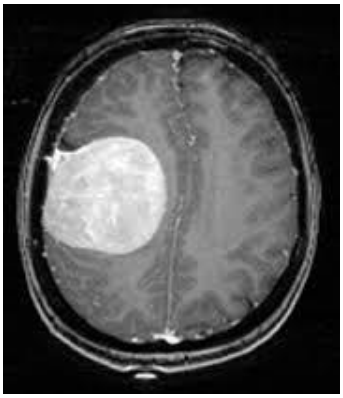

Fig-4: Input Image

3.2 Pre-processing

The primary target is to improve image highlights needed for additional processing. Here, the input image is converted into grayscale image for all the further pre-processing purposes. The image is then thresholded and further erosion and dilation is applied to the thresholded image. This image is used to extract the contours and extreme points.

3.3 Convolutional Neural Network

CNN is utilized to get better result [11], [12]. The signal convolved with kernels to get include map [13], [14]. Past layers are interconnected with weights of the kernel. To upgrade the qualities of information image by back propagation calculation. Since feature maps of all units shared by the kernels. It will serves to reduces over fitting. Each data of neighbourhood is taken by utilizing kernels. Kernel is a major source of context information. Activation function is applied to the output of neural network

- Convolutional Layers

  Objective of the convolution layer is to take or extract the features from the input [image], just the part of picture is link to the following convolution layer.

- Padding

  Padding is incorporating a zero layer outside the input volume so the data on border won't be lost and we can get a similar dimension of output as input volume. Here we are using zero padding.

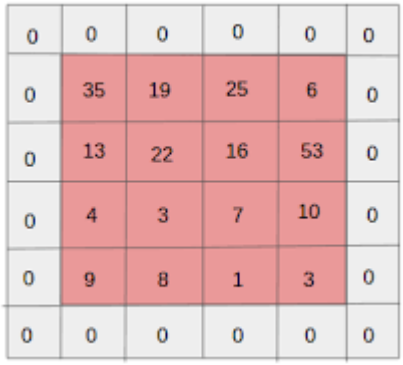

Fig-5: Example of Zero padding

- Activation Function

  Non- linear activation function ReLU (Rectifier Activation function) is used to provide accurate results than classical sigmoid functions.

  f (𝑥) = max(𝑥, 0) 1

- Pooling Layer

  It is used for combining spatially nearby features. Max-pooling is generally used to join features. It decreases the dimension of input image and controls over-fitting.

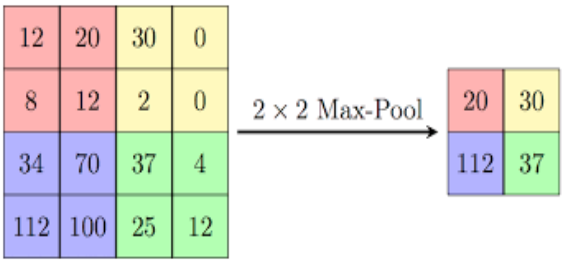

Fig-6: Example of Max Pooling

- Full Connected Layer

  Finally Fully Connected layer gives the classified image based on training data set.

3.4 Testing

The following image is the output snapshot of testing image outputting the detection of tumor.

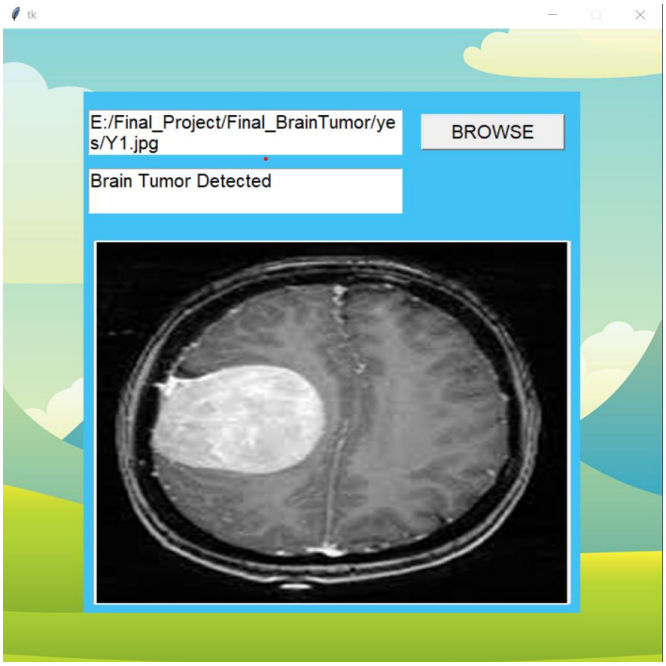

Fig-7: Output image indicating detection of Brain Tumor

4. CONCLUSION

In this paper, we presented the idea of detecting Brain tumor using Convolutional neural network. The principle objective of this research work is to structure a effectively programmed brain tumor classification with high accuracy, performance low complexity. Another objective is to build up a system to help with brain tumor detection which operates in the same line of work as a physician, considering his experience and knowledge. The system was successful in providing a response as in if the tumor is present or not. The intuition behind implementing this idea was to help the surgeons to precisely detect the presence of a tumor.

5. FUTURE SCOPE

In future this technique can be used for detection of tumors in brain or other organs like lungs, breast, skin, etc. The software can be modified for early detection of tumors which can help in patients recovery. The future work will consist of the automatic symmetry axis detection and the more precise extraction of the tumor based on current results. The attention in the future work will also be paid on automatic detection of the image containing the brain tumor and searching for the relations between neighboring slices. The automatic detection of tumors can be beneficial for computerized laser surgeries. It will be fascinating to keep growing progressively versatile models for different kinds of brain tumors following a same line of work introduced here. Further development in the field can cause a great impact on medical industry.

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