A REVIEW ON BRAIN TUMOR DETECTION FOR HIGHER ACCURACY USING DEEP NEURAL NETWORK AND MASK RCNN

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Abstract

The Brain is a vital organ (part) in the human body that controls memory, vision, thought, and touch. An abnormal cell growth inside the brain is called BRAIN CANCER. It is essential to detect the tumour early so that the patient can get appropriate treatment at earlier stages. This software will be utilized in the Image Processing technique to detect the brain tumour and classify the tumour as Glioma, Meningioma or Pituitary using Brain MRI (Magnetic Resonance Imaging). This software provides accurate results with a specific tumour location and will display the tumour' s features as well. The technique used here is Deep Learning which is Mask RCNN algorithm to detect the tumour in the brain and this algorithm will give more accuracy.

1. INTRODUCTION

The brain is the most significant and delicate portion of the human body, which is made up of various sections (organs). Abnormal cell development within the brain is the primary cause of brain cancer. Currently, doctors identify the tumour location by looking at the MRI (Magnetic Resonance Imaging) manually. These predictions are not very accurate, so to avoid this problem, there is software that works on using MRI images of the brain and image processing techniques to detect brain cancer. This software not just detects the tumour but also identifies the types of brain tumours like Glioma, Meningioma, and Pituitary. This will help the doctor to give the proper treatment to patients at an earlier stage. This software provides better security by allowing only authorized users to access this software, so that the patient's details are not available to unauthorized persons. This model consists of six steps. image acquisition, image pre-processing. Image Segmentation, Feature Extraction, Feature Comparison, and Results. This software displays the masked image of the brain tumour by highlighting the tumour location. This software also displays the features of the tumour like kurtosis, order, moment, center moment, normal moment, and entropy. We have used the Mask RCNN algorithm to detect brain cancer. Mask RCNN is a popular deep learning network in the computer vision field, for instance, segmentation. Deep learning algorithms give more accuracy when compared to other algorithms.

2. PREVIOUS WORKS

We have analyzed the various work of different authors. The abnormal presence of the cells in brain outcomes the tumour which leads to abnormality. By the prior noticing of the tumour the abnormality rate can be reduced. The MRI images can be used to early detect the tumour. We have come to know that CNN classifies the tumour. Convolutional Neural Network (CNN) identifies the location of the tumour based on MRI. So, they have proposed the model using Convolutional Neural Network (CNN) to determine the cancer in brain. Initially, the input as MRI images are used in deep learning, followed by the steps, Pre-processing, Segmentation, Feature Extraction, Feature Comparison. Due to the disvarient of tissue cells the tumour can vary notably by extracting the exact volume of the tumour using absolute method of segmentation. A great experience should be needed for the automatic separation of the tumour cell. They have implemented a tensor framework for the classification built using convolution network. The drawback of the accuracy in segmentation make us a way to develop a more accurate one radiologist are facing the difficulty in categorizing the data which are present in MRI images. The earlier model was time consuming and difficult for the radiologist to implement them. So, we have developed a software which results in high accurate in classifying and producing the outcome based on the characteristics by using Mask RCNN Algorithm.

3. METHODOLOGY

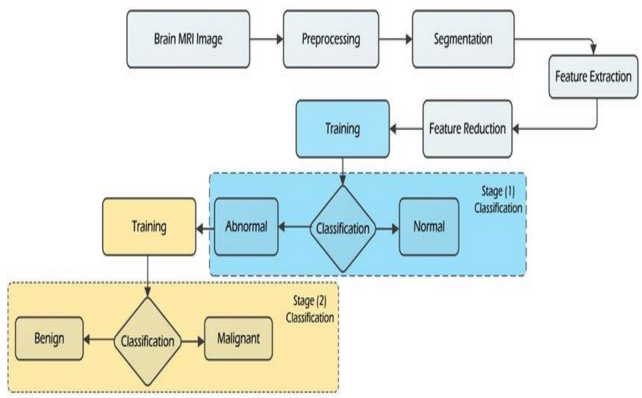

Figure-1: Methodology

Data Acquisition:

It is the first and foremost step in every process. We need to collect the available information's from the relevant locations. It is the process of collecting required information or data, converting it into meaningful structure and grouping it into the proper order. Here we have collected the Brain MRI images as an input.

Pre-processing:

Pre-processing is the most basic action performed on the input data, in which both the source and destination are have several. Such powerful images are identical to the scanner's original information, with a pixel intensity often expressed by an array of picture values. Even though spatial transitions of images (example: rotation, scaling, translation) are labelled among which was before methodologies. The main goal of this pre-processing is to remove the unwanted data and to improve the data quality.

There are 3 steps in preprocessing:

1. **Grayscale:**

It converts the normal input data into black and white image. Grayscale display the images using only three colors i.e., White, Black and Gray.

2. **Binarization:**

Binary pictures having only two values for each and every pixel i.e., 0 and 1. It will display the input data as binary values i.e., 0 and 1.

0 represents black color and 1or255 represents white color.

3. **Threshold:**

It will highlight the input data so that it will be helpful for the further steps.

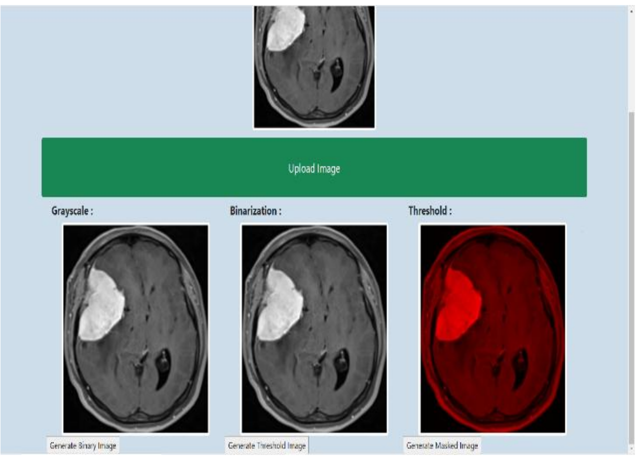

Figure-2: Pre-processing

Image Segmentation:

Image Segmentation is a method where a digital picture is split down into distinct groups small Sequence segments which assists in minimizing the intricacy of the image and make future processing or study of the image easier.

Segmentation in basic words involves giving names on images. A similar label is given to every pixel that belongs to the same group.

Feature Extraction:

It is difficult to work with large unwanted datasets so it is necessary to select the functional features and to remove the undesired features. This module makes further steps easier.

Feature Comparison:

In this step the extracted features are detected and classify the Brain tumor detection based on different characteristics.

Result:

This is the final step. The outcomes are then displayed as the final stage. Deep learning algorithms will produce more precise outcomes.

4. BRAIN TUMOR ARCHITECTURE USING MASK RCNN

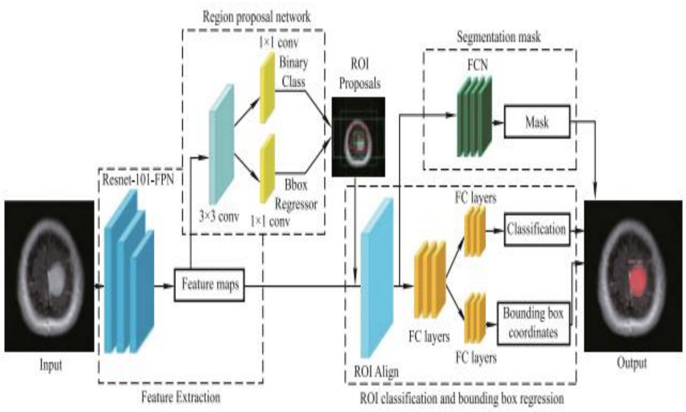

Figure-3: Architecture

Pre – Processing:

In Pre-processing MRI images which are taken as input are pre-processed. Pre -processing consists of three stages:

1. Noise Filtering: It is nothing but the removal of unbothered data to obtain the clean data.

2. OTSU Threshold: It is the process of calculating the measures for obtaining the pixel levels.

3. Background Subtraction:

In this stage it separates the foreground pixel from background.

Feature Extraction:

This is the stage where raw data is compressed to high manageable form like differentiating in height, weight and pattern of tumour. The result is further enhanced by RPN that extracts better features for processing.

Region Proposal Network (RPN):

The ROI's can be generated by feeding the features to RPN. To represent a bounding box of various sizes that is distributed all over the images can be obtained by a 3*3 Convolution layer which scans the images using sliding window. To identify the anchor contains back-ground or object binary classification of the image takes place. For setting IOU (Intersection Over Union) values the bounding box regression gives bounding boxes. IOU value greater than 0.7 can be identified as positive or else negative.

Bounding Box Regression and ROI Classification:

This stage takes the input from the ROI proposal and classifies the images deeper into tumour or non-tumour. Later enhances the size of bounding box. To specifically identify the tumour region based on location and size can be done by BBR. To obtain the correct length vectors of feature for the regions of arbitrary – size ROI Align layer is used.

Segmentation Mask:

The segmentation mask obtains the input from the ROI Align that is of the type of positive. It identifies the mask from the positive image during the training stage. The positive input obtained from the ROI Align is fed to the Fully Connected Network (FCN) and then the mask is identified. Finally, the output mask is obtained from the brain image.

5. DATASETS

MRI images are the source of input for our Project. The brain MRI images are collected from various hospitals. The data required for the training is MRI images containing Tumor and Non-Tumor MRI images. The MRI images pixel range from 0-255. The 0 can be considered as white and 255 can be considered as Black. Here we have attached some of the datasets images consisting of Tumor and Non-Tumor.

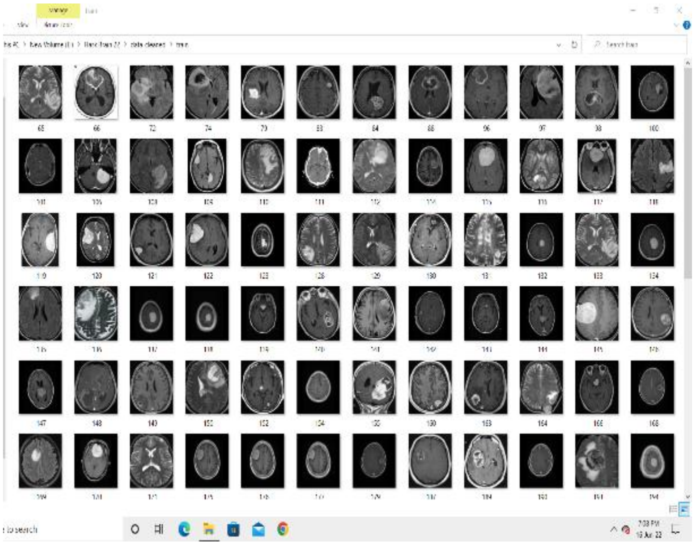

Figure-4: Tumour Datasets

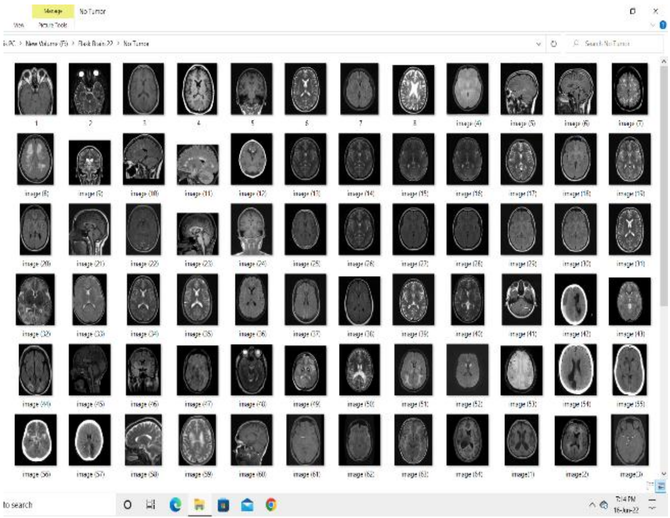

Figure-5: Non-Tumour Dataset

6. MASK RCNN ALGORITHM

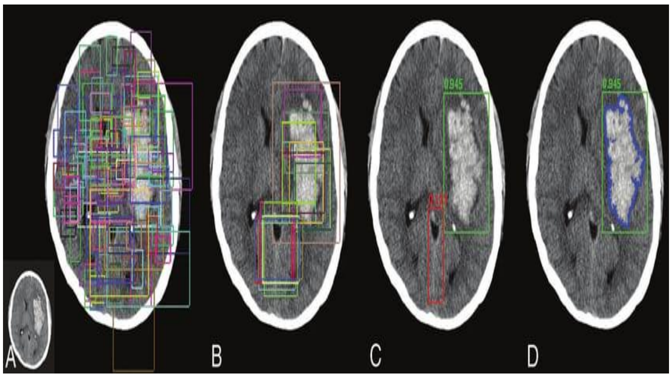

Figure-6: Algorithm Steps

Mask RCNN Process the brain MRI images in 4 Steps.

MRI images are provided as Input to the algorithm

STEP A: In this step Semantic Segmentation of the pixels in the brain MRI images takes place.

STEPB: In this step Classification and localization of the Preferred location of the MRI pixel images occurs.

STEP C: In this step more accurate preferred detection of the specified location takes place.

STEP D: In this step the specific location of the tumor is obtained as result.

7. RESULTS

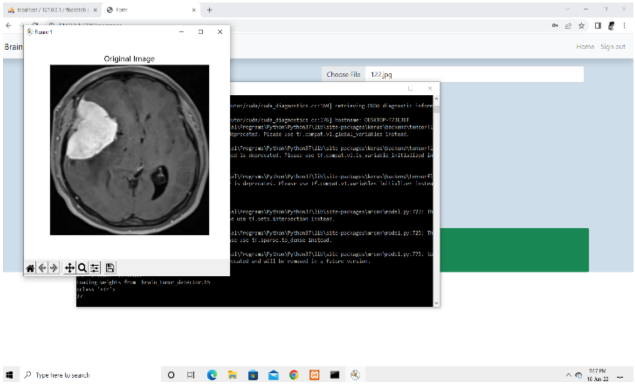

Figure-7: Displaying Original Image.

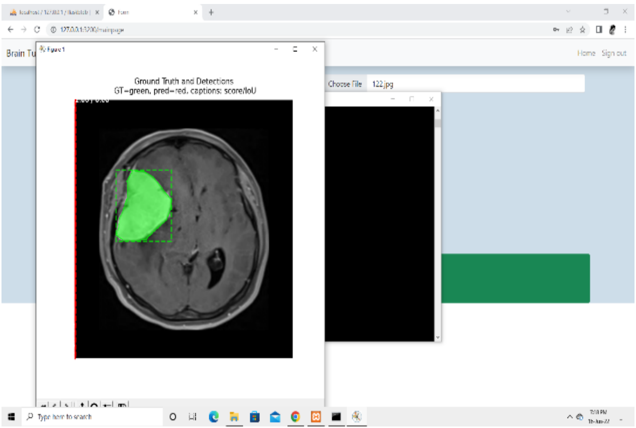

Figure-8: Displaying Masked Image.

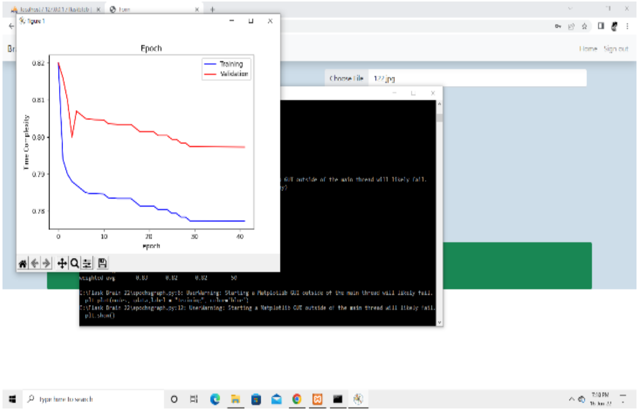

Figure-9: Epoch v/s Time complexity graph.

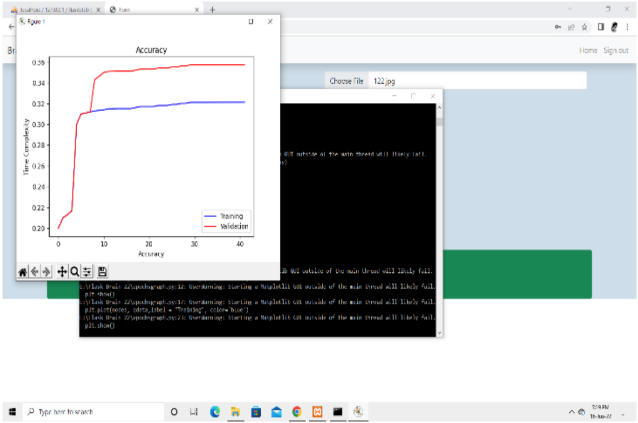

Figure-10: Accuracy vs Time complexity graph.

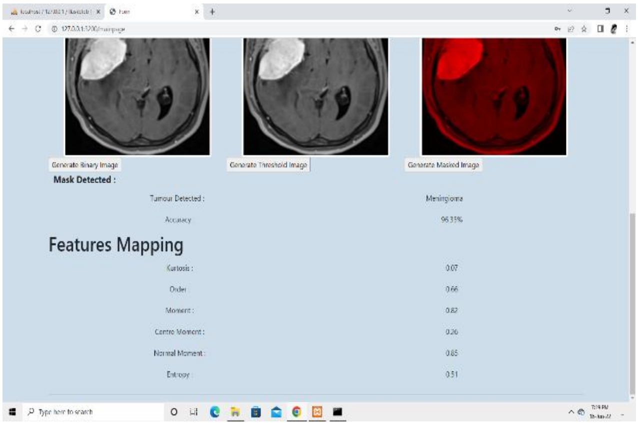

Figure-11: Displaying Accuracy and Features.

8. CONCLUSION

The tumour from the MRI images can be obtained from various techniques. One model gives higher accuracy and classification than the manual work. The MRI images are compared and then predicted the output based on the performance. The tumour and non – tumour images are used and compared to obtain the output. The precise and the accurate output can be obtained from the system. Our model detects the tumour and classifies the tumour as Glioma, Meningioma and Pituitary. The model outputs the features like order, moment and entropy. The segmentation process extracts the Region of Interest for the process. Further any implementation or Methodologies can be used to increase the performance. We think our model will help the society in more promising way for the future work.

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