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Enhancement of Brain Tumor Detection on MRI Imaging Using AlexNet

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***Abstract*: Brain tumors are the second leading cause of cancer death in children under age 15 and the second fastest growing cause of cancer death among those over age 65. Brain tumor classification is a crucial task to evaluate the tumors and make a treatment decision according to their classes. There are many imaging techniques used to detect brain tumors. However, MRI is commonly used due to its superior image quality and the fact of relying on no ionizing radiation. Deep learning (DL) is a subfield of machine learning and recently showed a remarkable performance, especially in classification and segmentation problems. In this paper, a DL model based on a convolution neural network is proposed to classify different brain tumor types using two publicly available datasets. Alex Net is a deeper architecture with 8 layers which means that is better able to extract features. The former one classifies tumors into (meningioma, glioma, and pituitary tumor). The other one differentiates between the three glioma grades (Grade II, Grade III, and Grade IV).**

***Keywords*: Brain tumor, Deep Learning, Detection, Machine Learning, MRI, Prediction.**

1. Introduction

A brain tumor is a clump of irregular cells in the brain that forms a mass of unwanted cells. A brain tumor might be cancerous or non-cancerous. It can be diagnosed by Imaging modality such as CT, MRI imaging system. This tumor cells must be diagnosed accurately to show their characteristics of affecting the other cells. The cancerous cells may have given severe illness in the metabolic activities such as physiological psychological changes, neurological disorders, brain disfunction etc. As stated in WHO's report in early 2000s, fatal injuries by cancer is 6.2 million in worldwide. Most cancerous cells are referred to as malignant tumors, and people composed of specifically non-cancerous cells are called benign tumors. There are two types of brain tumors named as primary and secondary. Cancer cells that build from brain tissue are known as primary brain tumors, whereas tumors that spread from different organs to the brain are grouped as secondary brain tumors or metastatic. Brain tumors are categorized as four malignant stages which is called Grade I, II, III and IV. Benign brain tumor that consists cancer cells, can be removed. Benign brain tumors usually have an explicit side or edge. They do not expand to other parts of the body. However, benign tumors can induce serious health problems. Grade I and II are benign brain tumors. The other type of tumors, which is called as malignant brain tumor consists of cancer cells and it is also called as brain cancer. They are likely to grown up swiftly and can affect nearby normal brain tissues. This type of tumors can be a threat for life. Malignant brain tumors are in grade III and IV. Medical imaging is useful to diagnose the noninvasive possibilities. The various types of medical imaging technologies based on noninvasive approach like; MRI, CT scan, Ultrasound, SPECT, PET and X-ray. In the field of medical diagnosis systems (MDS), Magnetic resonance Imaging (MRI), gives the better results rather than Computed Tomography (CT), because Magnetic resonance Imaging provides greater contrast between different soft tissues of human body. For diagnosis of Brain tumor, the MRI images has to enhanced for proper detection and diagnosis. This algorithm elevates the process of enhancement in simplier way to detect brain tumor. This reduces the time and usage of several tools for enhancement.

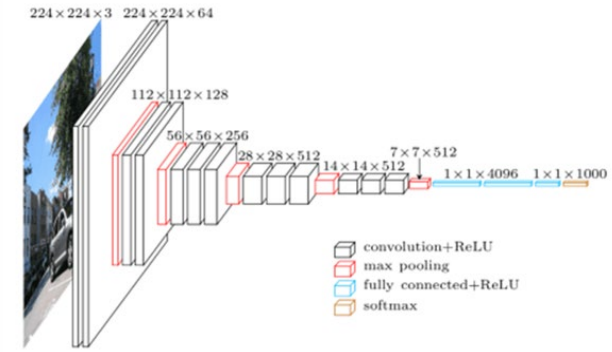

Fig. 1. Architecture of CNN model

2. Literature Review

Brain tumor is a type of tumor which is occur in the brain. It is of many types and size. By CNN technique the brain tumour image which imports from for the MRI machine is segmented by the process of AlexNet. It is the process of segmenting the MRI images quickly, accurately, properly, etc., when compare to the prior paper. AlexNet is the process of double segmentation method called max polling and convolution. Max pooling is the process of selecting the maximum value for retaining the most prominent feature and extracting the image

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in the original and sharp manner. Convolution is the mathematical operation on which two functions produces the third function which expresses how the shape of one is modified by the other. A brain tumor is of three types: Meningioma, Glioma, and Pituitary Where Glioma is the most aggressive type of tumor. Glioma is of three types Grade I, Grade II Grade III.

- Convolutional Neural Network for Image Detection and Recognition [1] Optical Character Recognition (OCR) is an automatic identification technology that is applied in different application areas to translate documents or images into analyzable and editable data.
- Brain Tumor Segmentation with Deep Neural Networks [2] fully automatic brain tumor segmentation method based on Deep Neural Networks.
- Classification Using Deep Learning Neural Networks for Brain Tumor [3] Deep Learning is a new machine learning field that gained a lot of interest over the past few years. It was widely applied to several applications and proven to be a powerful machine learning tool for many of the complex problems.
- Brain Tumor Segmentation and Classification from Magnetic Resonance Images: Review of Selected Methods [4] Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) scan are used for resection and examine the abnormality in terms of shape, size or location of brain tissues.
- Microscopic Brain Tumor Detection and Classification Using 3D CNN And Feature Selection Architecture [5] 3D convolutional neural network (CNN) architecture is designed at the first step to extract brain tumour and extracted tumours are passed to a pretrained CNN model for feature extraction.

3. Hardware Requirement

The main Hardware & Software components used in this system are:

- PC
- MATLAB

A. Personal Computer

Fig. 2. Personal computer

Personal Computer (PC): The PC is a multi-purpose microcomputer whose size, capabilities, and price make it feasible for individual use. Specification of 8GB RAM with updated MATLAB software. Faculty and academic staff who are licensed users may install and use MATLAB on their personally owned computers, on-campus, off-campus, and via remote access.

B. MATLAB

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include: Math and computation.

4. System Description

The main aim of the project is to process a MRI brain image by enhancing the tumor detection. The main program requires a input image as raw image taken using MRI imaging modality. It has to be a brain image for brain tumor detection. By running the main program in the MATLAB. The image is preprocessed and the output is displayed as it pop it out. By displaying many features as result such as tumor detection, shape of the tumor, size of the tumor, location, side, score map of scanned image, colour filled image, boundary of the tumor, segmented image, eroded image, type of tumor, input image.

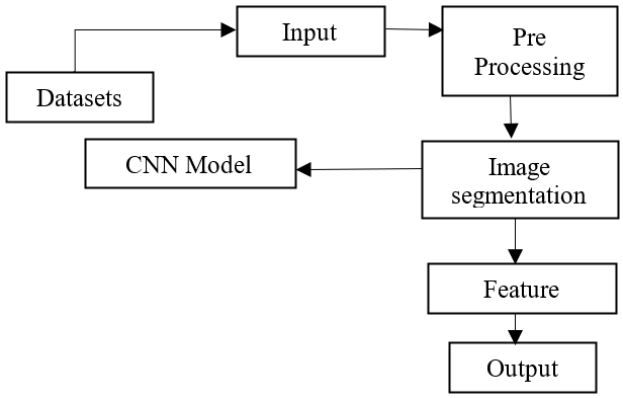

Fig. 3. Block diagram

Here Fig. 3, shows the block diagram of the system being processed. Then the accuracy is compared using different type of datasets. By calculating the analysis using the corresponding formulas regarding each feature by true positive, true negative, false positive, and false negative respectively. It can be featured for accuracy and precision of tumor detection.

5. Process

Fig. 4, flow chart shows the Process of MATLAB program: 1. Open the software and create the new script. 2. Enter the Program properly. 3. Run the program and check the errors if no error found the program will run and then. 4. Select the Input image. 5. Process the input image and the result will displayed. 6. Displayed the output. 7. End the program.

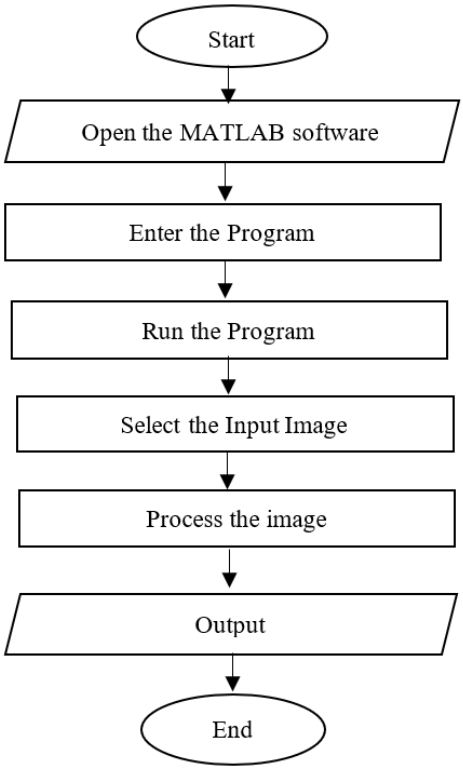

Fig. 4. Flow chart

6. Result and Discussion

This system makes deduction of brain tumor from MRI image is easier and user friendly. These coding can be used by doctors, technicians who are not to specilized to use software can also take advantage of this system to easier diagnosis process.

It makes the deduction of tumor is simple and less time to be consumed. It can be cost efficient not to buy or purchase several applications for each feature.

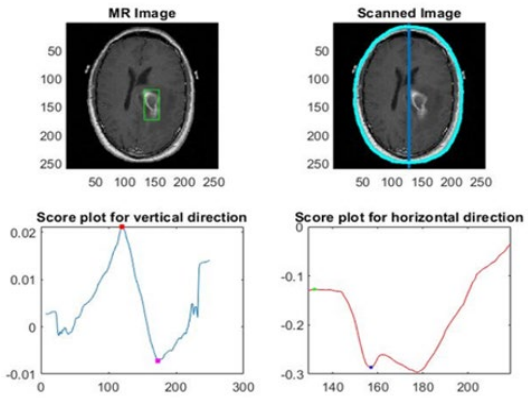

Fig. 5. Scanned images with score plot graphical representation

7. Conclusion

The enhancement of brain MRI images to make it simple in one coding for different features. To minimize several applications for features extraction it may made the system complex. Having higher advantage in healthcare to deduct the brain tumor images. The segmentation process is done using advanced methods such as Alex Net in CNN technique. It has complex algorithm to get the output simpler. The precision and accuracy are calculated using the certain formulas it shows the result as high accuracy level.

8. Future Scope

To further develop this project, we could include demographic details, print layout from this can able to give the result after the segmentation process. And also, we can develop this coding to increase the dataset which are as input. It eliminates the time to diagnose and to give instant treatment.

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