A Soft Computing technique for Detection of Brain cancer Through MRI Images Using a Convolutional Neural Network

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Abstract: Brain cancer due to tumor is one of the deadliest brain diseases that has caused several losses of lives. Benign or malignant are the types of tumor. Humans had developed many techniques to counter the disease and to detect it, MRI (Magnetic Resonance Imaging) has been the most vital discovery by human to detect the presence of tumor accurately. More accurate and precise detection of tumor is necessary for further treatment. Brian has different segments for which accurate segmentation of brain is important for treatment of patient. Since many year researchers have developed many techniques for detection of brain tumor but as the human error may occur the soft computing methods has considered as an important one. We moved on to Convolutional Neural Network (CNN) which is implemented using Keras and Tensorflow because it yields to a better performance than the traditional ones in classification. In our work, CNN gained high accuracy which is very compelling.

Keywords*: Brain tumor, classification, Convolutional Neural Network, Magnetic Resonance Imaging, Segmentation, Tumor Detection, Keras, Tensorflow.*

1. Introduction:

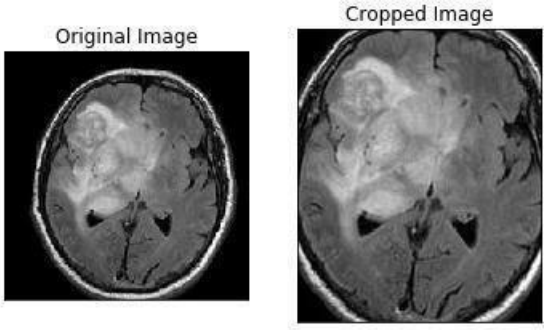
We live in a modern world and we often see that the disease rate has increased in large number. A tumor is one of the most dangerous diseases that can occur on any part of the body, i.e. an abnormal condition of the body or a lump on one part of the body. The most dangerous tumor is the brain tumor, where the tumor is located in the brain and is very difficult to treat. These diseased cells also affect healthy brain cells. It can be considered as

primary or secondary type. Malignant tumor is a non-cancerous type. Malignant tumor is the second most common type of cancer cell. Malignant mass is very dangerous to health. It is very difficult to find a brain tumor and its types. In the field of medical diagnosis, medical image data is very important. To get a medical diagnosis, we need to take details of medical photos. Commonly used images are CT scan, X-ray and MRI. To determine the structure of the internal brain, the brain scan uses a medical procedure. MRI is the most commonly used brain scan because of its high resolution. MRI contains a wealth of information about brain structure and shows abnormalities in brain cells. There are many innovative methods for machine learning and in-depth reading for image processing. Alone, we must use Support Vector Machine (SVM), Neural Network or other related models. There are many learning programs available, such as ANN, PNN, KNN, C4.5, and multi-layer Perceptron, each with its advantages and disadvantages. According to the film category, in-depth study models are widely used for a single reason. Its structure represents complex relationships.

Over the past few years, in-depth study has managed to get a lot of importance and attention. The method used by visualization neural networks (CNN) to visualize an image. It competes with other recently developed methods. CNN is a collection of neurons of readable weight and intelligence. CNN is used to achieve better image classification by avoiding pre-processing and to automatically learn complex features. TensorFlow library supports CNN, RNN and other related neural network models developed by Google. Tensorflow is the most widely used library in the field of image recognition, speech recognition, and other in-depth learning algorithms. Launched by Google in 2015, it is an open source Python library that facilitates the use of in-depth learning patterns for tenserflow, design, construction and training. Tensile flow shows statistical calculations such as graphs with edges and nodes. The edges of the graph represent the data flowing from one unit to another node the central nervous system, that includes the brain & spinal cord, is responsible for the activity of our body parts. A brain tumor is an abnormal growth of cells in the brain. The tissue grows from the main cancer or elsewhere in the body and spreads to the brain called metastasis. Primary tissues may have malignant growths or malignant tumors. The main task of proper diagnosis and treatment is to divide brain images into standard images and tumor images. Manual analysis of brain images to determine the presence of a plant is challenging and time consuming. Therefore, mechanistic specific methods are based on research. Convulsive neural network plays an active role in image processing functions such as classification and property classification, because its structure automatically learns image components from continuous low to high level. Learning transition is an in-depth learning process where the learning process begins from the models already learned to solve another problem without starting from scratch. Learning transfer is possible through the use of pre-trained models already trained in a large database on the bench. In medical imaging, where large amounts of training data are not available, transfer practice can be used effectively.

2. Methodology:

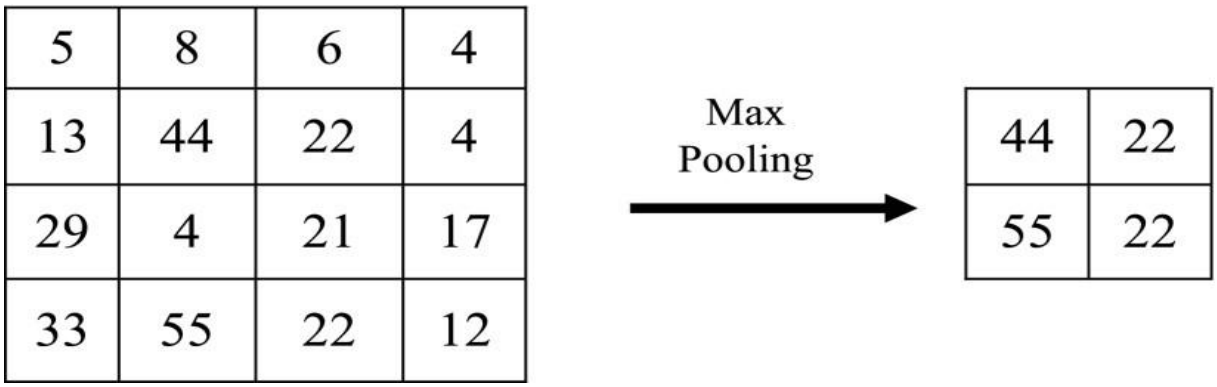
Cropping the MRI Scans In order to normalize the data, first, the images need to be cropped



A. Convolutional Neural Network (CNN)

The CNN consists of series of convolutional and pooling layers, followed by fully connected layers and activation layer. The convolution layer is employed for filtering operations and pooling is used to reduce the dimensionality. CNN is trained through back propagation with gradient descent.

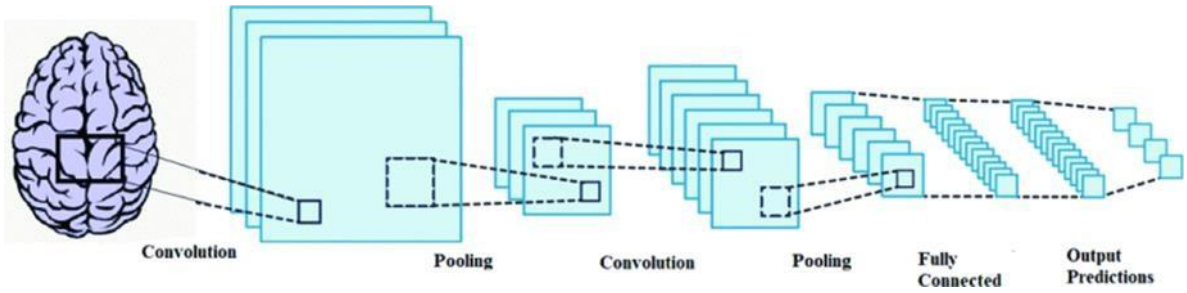
The 2 stages of the CNN are the feed forward stage and back propagation stage. within the feed forward stage, the input pictures are fed to the network. every Convolution layer in the network contains of a group of freelance filters and every filter is convolved with the image to get feature maps.



Filter weights are randomly enabled, and output is calculated. Network output is compared to the desired output using the loss function to calculate the error rate. Based on the error rate, in the rear campaign, the weights are updated. This process is repeated for sufficient repetitions. The convolutional layer is followed by a pooling layer whose function is to reduce the calculation cost by reducing the size of the feature map. For example, the Max pooling layer replaces the four-digit block with the maximum number in the block as shown in fig. An activation function such as a rectified linear unit (REL) is applied after the collision, which increases the training speed. Expressed in ReLU activation function

The output of the convoluted and pooling layers represents the highest-level characteristics of the input image. A fully connected layer uses these features to classify input images into

different grades. It uses the SoftMax activation function in the output layer, which assigns probabilities to each class.



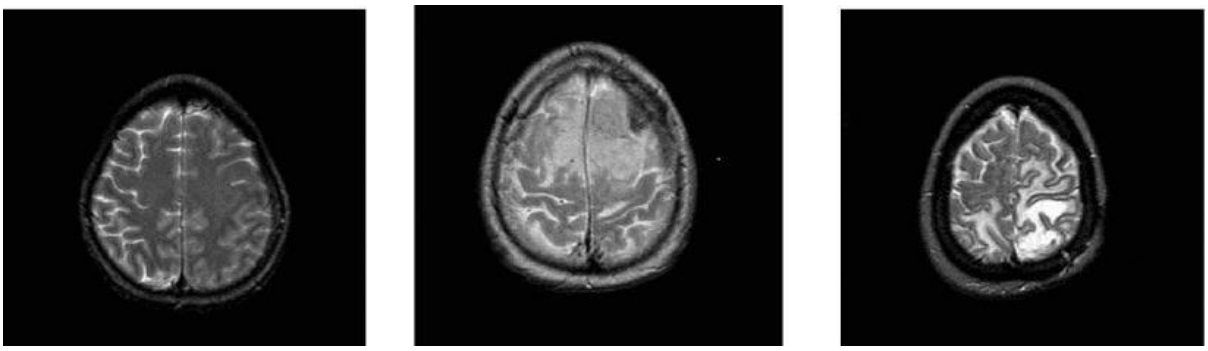
CNN Architecture

B. Sequential Model

Sequential APIs allow us to create layer-by-layer models for most problems. This is limited because it does not allow you to create models that share layers or have multiple inputs or multiple inputs.

Alternatively, the functional API allows you to create very simple models, because you can easily define models that combine more layers than the previous and next layers. In fact, you can link layers (literally) to another layer. As a result, it is possible to create complex networks, such as Siamese networks and other networks. It has epochs for the calculatio and improving the accuracy by adjusting its parameter through no. of epochs.

The number of epochs is the number of passes completed through the training dataset. The size of a batch must be one or more and equal to or less than the number of samples in the training dataset. The number of ages can be set to an integer value between one and infinity



Training dataset images

3. Results and Discussion:

The proposed five-layer method gives us better results for tumor detection. Convention, Max Pooling, Flatten and Two Dense Layers are the proposed five-layer CNN models. Data improvements were made before the model was set up because the CNN translation was

unstable. Based on the partitioning of the dataset we evaluate the performance in this way. We meet 82.98% accuracy with an 80:20 participation ratio.

Using TensorFlow I used a model for classification to train and test the model. The model gave 82% accuracy over 30 epochs. Accuracy can be further enhanced by using more training images. The sequential model is easy to use and is suitable for more accurate identification of brain tumor image classification.

Model accuracy: 82.35%

Using CNN

4. Conclusions:

This project is made successfully using CNN model classification problem (to detect whether the patient has a tumor or not) and Computer Vision problem (to automate the process of brain cropping from MRI scans). The output accuracy is much higher than 50% bottom-line (random guesses). Though, Accuracy can be increased to larger extend using huge number of training images in the dataset and by tuning the parameters of model. The focused intention behind the project is to identify detection of brain tumor as early and precisely from the images taken as an input and to get the highly accurate results about the tumor using Convolutional neural network.

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