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Predicting the Multiple Sclerosis Lesions of Brain Using Convolutional Neural Network

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ABSTRACT*:* Brain lesions identification is really challenging task in early stages of life. But now it became advanced with various machine learning and deep learning algorithms, now a day's issue of brain lesions automatic identification is of great interest. In Order to detect the brain lesions of a patient we consider the data of patients like MRI images of a patient's brain. Here our problem is to identify whether lesions is present in patient's brain or not. It is very important to detect the lesions at starting level for a healthy life of a patient. There are many literatures on detecting these kinds of brain lesions and improving the detection accuracies, the segmentation, detection, and extraction of infected lesions area from magnetic resonance (MR) images are a primary concern but a tedious and time taking task performed by radiologists or clinical experts, and their accuracy depends on their experience only. So, the use of computer aided technology becomes very necessary to overcome these limitations and estimate the brain lesions severity using Convolutional Neural Network algorithm which gives us accurate results

KEYWORDS: MS Lesion Detection, Convolutional Neural Network, Gaussian Filters, MRI Images.

I. INTRODUCTION

With the improvement of modern medical standards, medical imaging technology plays an increasingly important role in daily medical diagnosis and medical research. Therefore, research on medical diagnostic image data is very important. As a ms lesion disease with frequent occurrence and complexity, brain ms lesion has become a key research topic in the medical field. The diagnosis of brain ms lesions is usually based on imaging data analysis of brain ms lesion images. Accurate analysis of brain ms lesion images is a key step in determining a patient's condition. However, the accumulation of doctors' personal medical knowledge, differences in experience levels, and visual fatigue can affect the correct analysis of image results.

Magnetic Resonance Imaging (MRI) can provide information on the shape, size, and position of human tissues and organs without high ionizing radiation. The images obtained are very clear and precise. MRI greatly improves the diagnostic efficiency and provides a good guide for lesion localization and surgical treatment, brain lesion occurred when the cells were dividing and growing abnormally. It is appearing to be a solid mass when it diagnosed with diagnostic medical imaging techniques. There are two types of brain lesion which is primary brain lesion and metastatic brain lesion. Primary brain lesion is the condition when the lesion is formed in the brain and tended to stay there while the metastatic brain lesion is the lesion that is formed elsewhere in the body and spread through the brain.

The symptom having of brain ms lesion depends on the location, size and type of the lesion. It occurs when the lesions compressing the surrounding cells and gives out pressure. Besides, it is also occurring when the lesions blocks the fluid that flows throughout the brain. The common symptoms are having headache, nausea and vomiting, and having problem in balancing and walking. Brain lesions can be detected by the diagnostic imaging modalities such as CT scan and MRI. Both of the modalities have advantages in detecting depending on the location type and the purpose of examination needed. In this paper, we prefer to use the CT images because it is easy to examine and gives out accurate calcification and foreign mass location the CT image acquired from the CT machine give two-dimension cross sectional of brain. However, the image acquired did not extract the lesions from the image. Thus, the image processing is needed to determine the severity of the lesions depends on the size.

II. RESEARCH METHODOLOGY

Process of implementation undergoes in 5 basic steps.

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A. Image Acquiring:

The Primary Phase is acquiring images. After the Images collection, the obtained images have to be prepared with a wide range of vision. First capture the input images from available source with uigetfile and imread python inbuilt functions.

B. Pre Processing:

The images which are collected are subjected to pre-processing. In Pre-processing stage basic steps are image resizing and applying Gaussian filters for a perfect input clear image for easy identification of an image, it is very difficult to process an image. Before any image is processed, it is very significant to remove unnecessary items it may hold. After removing unnecessary artefacts, the image can be processed successfully. The initial step of image processing is Image Pre-Processing [3], pre-Processing involves processes like conversion to gray scale image, noise removal and image reconstruction. Conversion to grey scale image is the most common pre-processing practice [1]. After the image is converted to gray scale, then remove excess noise using different filtering methods.

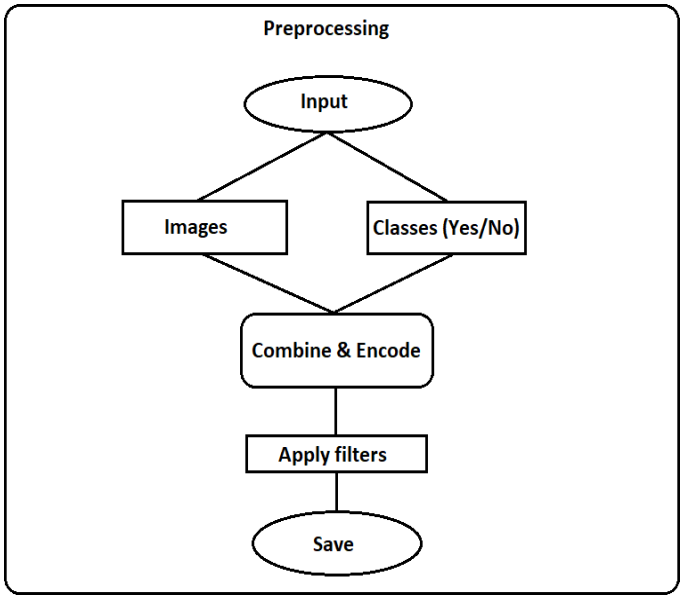

Fig.1. Pre-processing

C. Segmentation :

In this stage of implementation, Pre-processed images will be segmented digitally into various pixels. We do this segmentation for an image is to modify its representation to have more clarity to study and analyse the images, segmentation of images is important as large numbers of images are generated during the scan and it is unlikely for clinical experts to manually divide these images in a reasonable time. Image segmentation refers to segregation of given image into multiple non-overlapping regions.

D. Feature Extraction :

In the feature extraction process, we can implement the effective texture operator which labels the pixels of an image. Here we extract the features and characteristics of Images for easy detection of brain lesion.

Feature extraction [8] is an important step in the construction of any pattern classification and aims at the extraction of the relevant information that characterizes each class. In this process relevant features are extracted from objects/ alphabets to form feature vectors. These feature vectors are then used by classifiers to recognize the input unit with target output unit. It becomes easier for the classifier to classify between different classes by looking at these features as it allows fairly easy to distinguish.

E. Classification :

In Classification stage, Convolutional neural networks algorithm is used for classification of brain images. Convolutional Neural Network is also called as ConvNet. It is a deep machine learning algorithm which is used in analysing the Image. CNN uses many multilayer perceptions designed to get a less pre processing time [7].

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These are also called as Space invariant or Shift invariant artificial neural network. Convolutional networks they are enlivened by natural procedures and are varieties of multilayer perceptron's intended to utilize negligible measures of pre-processing. They have wide applications in picture and video acknowledgement, recommender frameworks and preparing.

Algorithm for CNN based Classification
Step 1: convolution filter is applied in the first layer.
Step 2: The filter sensitivity is minimized by smoothing the convolution filter that is by sub-sampling.
Step 3: The activation layer controls the signal transfer from one layer to other layer.
Step 4: training period is being fastened by employing RELU (rectified linear unit).
Step 5: The neurons in proceeding layer is associated with each neuron in the next layer.
Step 6:at the time of training, Loss layer is appended in the end to provide a feedback to NN (neural network).

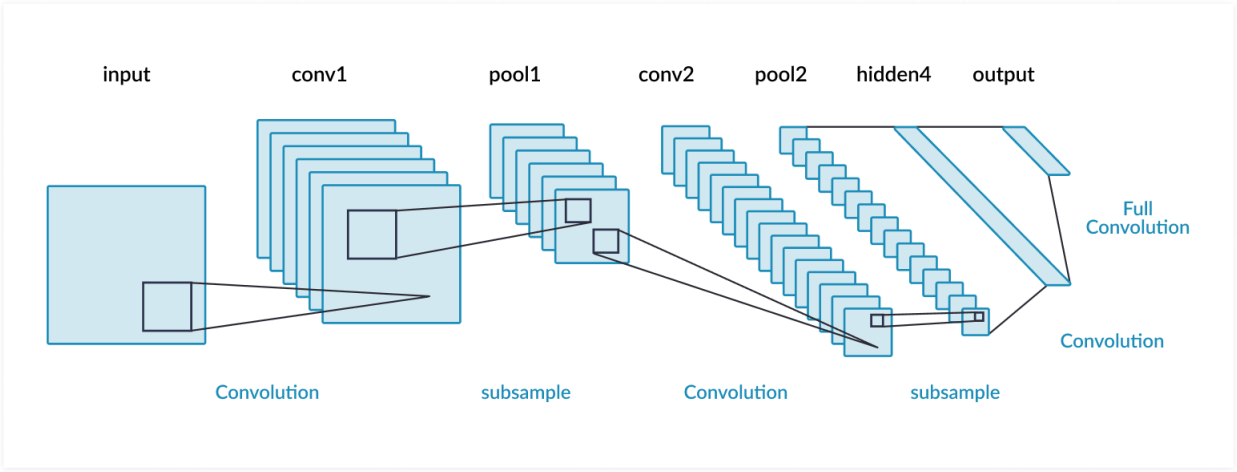

Fig 2: Convolutional Neural Network

III. RESULTS AND DISCUSSION

In this research, we have used two datasets, one was trained dataset collected from Web sites www. Kaggle.com and the other was test dataset. These datasets were built by experienced radiologists; this includes sample images of five patients with all modalities. The data were collected from digital imaging and communications in medicine dataset, and this project we are developing detection model using a Convolutional neural network in Tensorflow & Keras and used a brain MRI images data founded on Kaggle the dataset contains 2 folders: yes and no which contains 1500 Brain MRI Images The folder yes contains 850 Brain MRI Images that are lesions and the folder no contains 650 Brain MRI Images that are non- lesions.

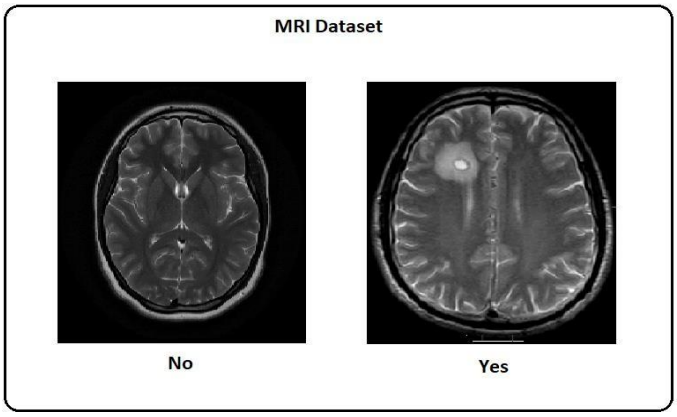

Fig 3: MRI Brain Dataset

Here in this paper, Dataset is MRI images of brain which are not Pre-processed. We can take any number of MRI images of brain lesions patients and can check whether lesions is identified or not and data set considered here is a set of brain images where they are divided into test and trained data sets. With the help of both trained and test data sets our selected algorithm Convolutional neural network in applied. The results are followed here:

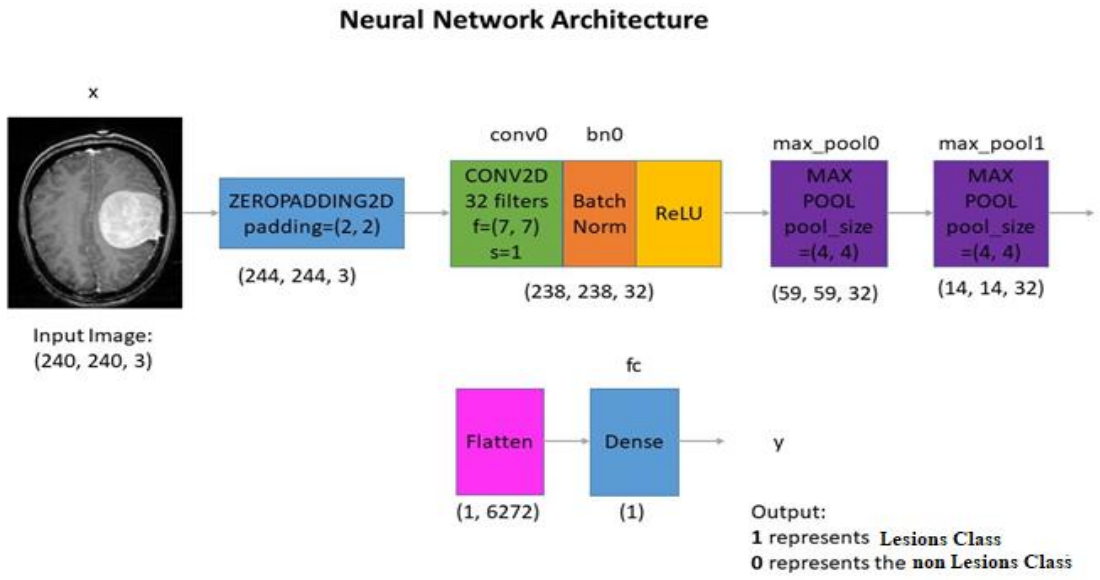

Fig 4: Convolutional Neural Network Architecture

IV. PERFORMANCE ANALYSIS

The trained dataset images for which the features extracted were trained using Convolutional neural network (CNN) classifier for the classification purpose, whereas the test dataset was not trained using CNN classifier, only the statistical and textural features were extracted. The accuracy of trained and tested image was compared based on the Classification of normal and abnormal lesions tissues. Figure 4 shows the accuracy results in classification of normal and abnormal lesions tissues. Accuracy or correct rate of classification is the efficiency of appropriate classification to the total number of classification tests.

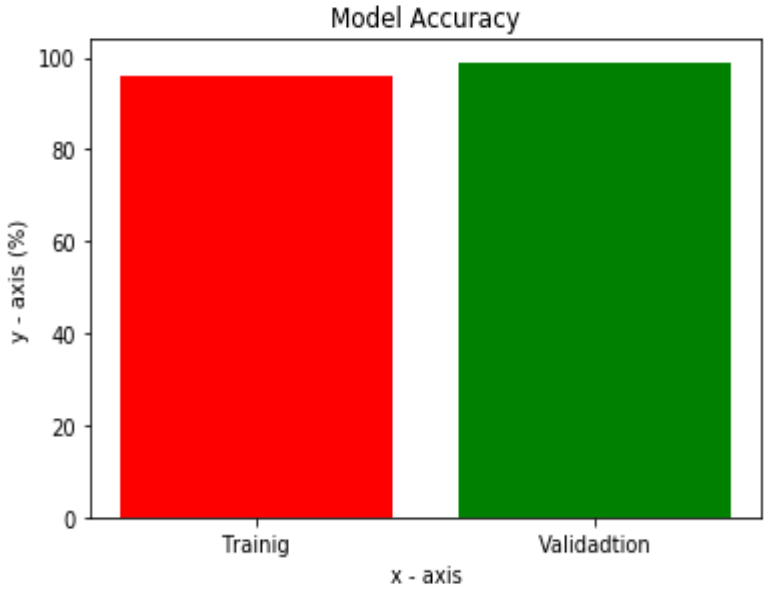

Fig 5: Model Accuracy

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V. CONCLUSION

This project consists of the details about the model which was used for the detection of brain lesion using the MRI images of the brain from the normal persons and the persons who had a brain lesion. From the resultant graphs, it is proven that the accuracy of the model has reached good level; if it is deployed in the real-time scenario then it will help many people in diagnosing the brain lesion without wasting the money on check-up. If the brain lesion is confirmed by the model, then the person can reach the nearest hospital to get the treatment. It can be the best way of practice for people to save money. As we know that the data plays a crucial role in every deep learning model, if the data is more specific and accurate about the symptoms of the brain lesion then that can help in reaching greater accuracy with better results in real-time applications.

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