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ijirset@gmail.com



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# Brain Tumour Detection using CNN

Prof. Ajit N. Gedam<sup>1</sup>, Atharva M. Daphal<sup>2</sup>, Atharv S. Jori<sup>3</sup>, Mahesh S. Kadam<sup>4</sup>, Sahil M. Kadolkar<sup>5</sup>

Dept. of Computer Engineering, AISSMS Polytechnic, Pune, India

**ABSTRACT:** Nowadays brain tumor is a serious threat to the society because it can be fatal if not treated on time so it becomes very necessary to detect brain tumor in the initial stages which minimizes the risk of one's health. It can damage the brain as the mass of irregular cells inside the brain results in brain tumor which can be life-threatening. Brain tumor can be denoted as an abnormally formed mass of tissue where the cells multiply abruptly and continuously, that the growth of cells can't be controlled. The process of Image segmentation is adopted for extracting abnormal tumor region within the brain. In the MRI (magnetic resonance image), segmentation of brain tissue holds very significant in order to identify the presence of outlines concerning the brain tumor. There is abundance of hidden information in stored in the health care sector. With appropriate use of accurate data mining classification techniques, early prediction of any disease can be effectively performed. This paper presents a brief summary on brain tumor detection using CNN convolutional neural network machine learning algorithm used to increase efficiency and effectiveness of predicting brain tumor. The correct diagnosis and accurate classification of brain tumor detection is the main objective of this paper.

**KEYWORDS:** Brain Tumor, CNN, MRI.

## I. INTRODUCTION

A brain tumour is an abnormal growth of tissue in the brain or central spine that can disrupt proper brain function and creates an increasing pressure in the brain. This paper is intended to present a comprehensive review of the methods of brain tumour detection through Magnetic Resonance Imaging (MRI) technique used in different stages of Computer Aided Detection System (CAD). It also provides a brief background on brain tumour in general and non-invasive imaging of brain tumour in order to give a comprehensive insight into the field. Lastly, the paper concludes with a concise discussion and provides a direction toward the upcoming trend of more advanced research studies on brain image segmentation and tumour detection. For successful treatment of the disease, accurate and early detection of brain tumours are essential. Early detection not only helps to come up with better medications, it can also save a life in due time. Machine learning algorithms are recently have been put to use for processing medical imagery and information in contrast to manual diagnosis of a tumour, which is a tiresome task and involves human error. Computer-aided mechanisms are applied to obtain better results as compared with manual traditional diagnosis practices. This is generally done by extracting features through a convolutional neural network (CNN) and then classifying using a fully connected network.

## II. PROBLEM STATEMENT

Brain tumor is the disease which increase the brain tissue, tumor cells spread across the brain making it very dangerous and causes death. The main reason for brain tumour is the abandoned progress of brain cells. Use of Magnetic Resonance Imaging images have been recognized as more detailed and more consistent images when compared to Computed Tomography images. There are various techniques to detect brain tumour or neoplasms. Machine learning algorithms will help with this analysis of the datasets. These techniques will be used to predict the outcome. So, to overcome this problem we have used CNN algorithm.

## III. MOTIVATION

For successful treatment of the disease, accurate and early detection of brain tumours is essential. Early detection not only helps to come up with better medications, it can also save a life in due time. Neuro-oncologists are benefiting in many ways by the advent of Computer-Aided Diagnosis and biomedical informatics. Machine learning algorithms are recently have been put to use for processing medical imagery and information in contrast to manual diagnosis of a tumour, which is a tiresome task and involves human error. Computer-aided mechanisms are applied to obtain better

results as compared with manual traditional diagnosis practices. This is generally done by extracting features through a convolutional neural network (CNN) and then classifying using a fully connected network. The proposed work involves the approach of deep neural network and incorporates a CNN based model to classify the MRI as “TUMOUR DETECTED” or “TUMOUR NOT DETECTED”.

#### IV. METHODOLOGY

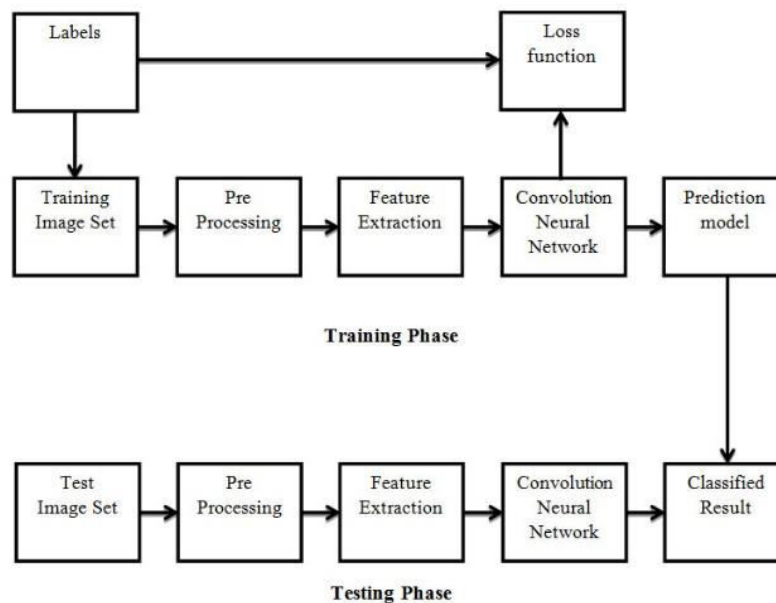


Fig 1: Architecture of the system

The Convolution Neural Network (CNN) consists of input layer, convolution layer, Rectified Linear Unit (ReLU) layer, pooling layer and fully connected layer. In the convolution layer, the given input image is separated into various small regions. Element wise activation function is carried out in ReLU layer. Pooling layer is optional. We can use or skip. However, the pooling layer is mainly used for down sampling. In the final layer (i.e) fully connected layer is used to generate the class score or label score value based on the probability in-between 0 to 1.

The block diagram of brain tumour classification based on convolution neural network is shown in fig.1.

1. The CNN based brain tumour classification is divided into two phases such as training and testing phases. The number of images is divided into different category by using labels name such as tumour and non-tumour brain image...etc.
2. In the training phase, pre-processing, feature exaction and classification with Loss function is performed to make a prediction model. Initially, label the training image set. In the pre-processing image resizing is applied to change size of the image.
3. Finally, the convolution neural network is used for automatic brain tumour classification. The brain image dataset is taken from image net. Image net is a one of the pre-trained models.
4. If you want to train from the starting layer, we have to train the entire layer i.e., up to ending layer. So, time consumption is very high. It will affect the performance. To avoid this kind of problem, pre-trained model-based brain dataset is used for classification steps.
5. In the proposed CNN, we will train only last layer in python implementation. We don't want to train all the layers. So, computation time is low meanwhile the performance is high in the proposed automatic brain tumour classification scheme.
6. The loss function is calculated by using gradient descent algorithm.
7. The raw image pixel is mapping with class scores by using a score function. The quality of particular set of parameters is measured by loss function. It is based on how well the induced scores approved with the ground

truth labels in the training data. The loss function calculation is very important to improve the accuracy. If the loss function is high, when the accuracy is low.

8. Similarly, the accuracy is high, when the loss function is low. The gradient value is calculated for loss function to compute gradient descent algorithm. Repletely evaluate the gradient value to compute the gradient of loss function.

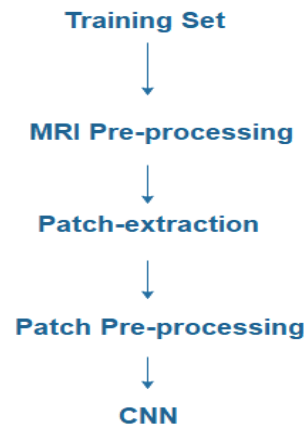


Fig2. Flowchart

In this figure in the initial stage, data sets of MRI images will be pre-processed then the pre-processed images will move towards the patch extraction phase in which the mean of each patch is removed from each pixel's value. Patches are sorted based on their energy, those with a high level of energy are kept by thresholding. After that the next step is patch pre-processing in which the patch will be Pre-processed and the steps will be taken to format patches before they are used by model training and inference. After patch pre-processing Convolutional Neural Network is a Machine Learning algorithm will be used, which can take in an input image, assign importance (learnable weights and biases) to various aspects in the image and be able to differentiate one from the other.

## V. RESULT

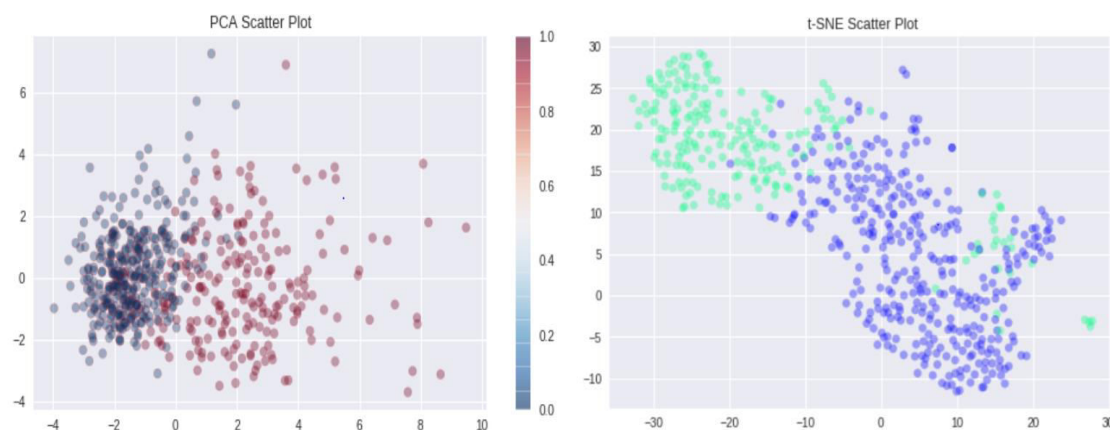


Fig 3.Principal component analysis and its Scatter Plot



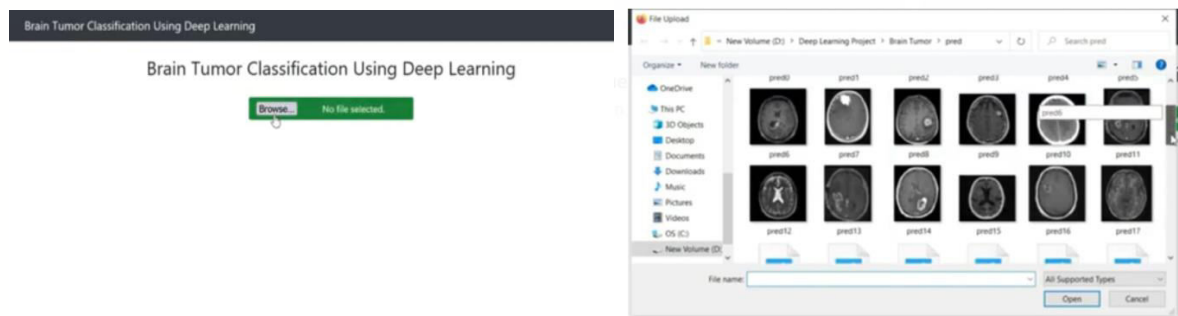


Fig4. Browse images for detecting brain tumor

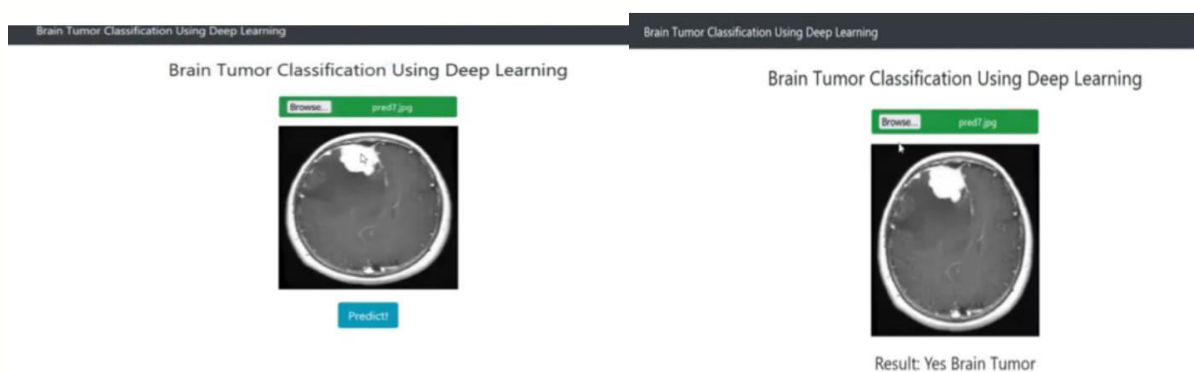


Fig 5.MRI Images used for detecting brain tumor

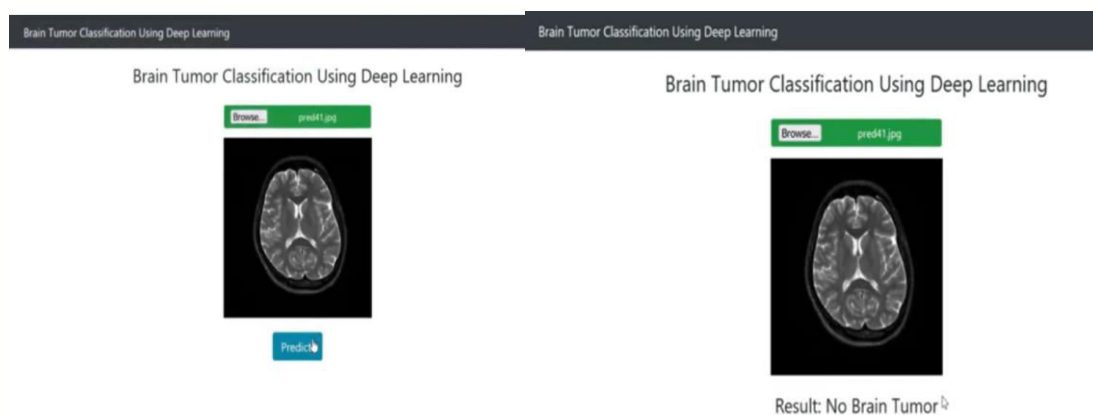


Fig 5.MRI Images used for detecting brain tumor

## V. LIBRARIES

### 1. Scikit-learn in Python:

Scikit-learn (formerly scikits-learn and also known as sklearn) is a free software machine learning library for the Python programming language. It features various classification, regression and clustering algorithms including support-vector machines, random

forests, gradient boosting, *k*-means and DBSCAN, and is designed to interoperate with the Python numerical and scientific libraries NumPy and SciPy. Scikit-learn is a NumFOCUS fiscally sponsored project.

## 2. NumPy:

NumPy is an abbreviation of **Numerical Python**. It is one of the most fundamental and powerful python libraries to create and manipulate numerical objects. The basic purpose of designing the NumPy library was to support large multi-dimensional matrices. It helps to perform high-level mathematical functions and complex computations using single and multi-dimensional arrays. NumPy provides innumerable features that reduce the complicated tasks of data analytics, data scientists, researchers, etc.

## 3. OpenCV in Python:

OpenCV is the huge open-source library for the computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today's systems. By using it, one can process images and videos to identify objects, faces, or even handwriting of a human. When it integrated with various libraries, such as NumPy, python is capable of processing the OpenCV array structure for analysis. To Identify image pattern and its various features we use vector space and perform mathematical operations on these features.

## 4. TensorFlow in Python:

TensorFlow is a free and open-source software library for machine learning and artificial intelligence. TensorFlow is an end-to-end open-source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries and community resources that lets researchers push the state-of-the-art in ML and developers easily build and deploy ML powered applications. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks.

## 5. Keras:

**Keras** is a powerful and easy-to-use free open-source Python library for developing and evaluating deep learning **models**. Keras is a deep learning API written in Python, running on top of the machine learning platform TensorFlow. It wraps the efficient numerical computation libraries Theano and TensorFlow and allows you to define and train neural network models in just a few lines of code.

## VII. FUTURE SCOPE

The analysis of the results signifies that the integration of multidimensional data along with different classification, feature selection and dimensionality reduction techniques can provide auspicious tools for inference in this domain. This topic will play an important role in the research and the medical advancement that is happening out there in the world; The analysis of the results signifies that the integration of multidimensional data along with different classification, feature selection and dimensionality reduction techniques can provide auspicious tools for inference in this domain. Further research in this field should be carried out for the better performance of the classification techniques so that it can predict on more variables. We are intending how to parameterize our classification techniques hence to achieve high accuracy. We are looking into many datasets and how further Machine Learning algorithms can be used to characterize Brain Tumour.

## VIII. CONCLUSION

The Brain tumour detection decision support system assists and helps doctors in making the best, most accurate, and quickest decisions possible while also reducing total treatment costs. By predicting strokes at an early stage, the suggested technique lowers treatment costs and improves quality of life. We were able to attain a stunning 97 percent accuracy on a specific dataset by using Artificial Neural Networks, which is a tremendous outcome in terms of science and creativity and will help you have fewer people die from malignancies and offer required aid at an early stage.

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