

# Expending Deep Learning in Generic Model to Analyze and Predict Brain Tumor from MRI and CT Images

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## Abstract

In this survey paper we have concentrate on deep learning through brain tumor detection using normal brain image or abnormal by using deep learning. The brain is largest and most complex organ in human body that works with billions of cells. There are three types of tumors as benign, premalignant and malignant. The convolutional neural network algorithm is used to detecting the brain tumor. There are many existing techniques are available for brain tumor segmentation and classification to detect the brain tumor. There are many techniques available presents a study of existing techniques for brain tumor detection and their advantages and limitations. To overcome these limitations, we used Convolution Neural Network (CNN) based classifier. CNN based classifier is used to compare the trained data and test data, from this data get the best result.

## Keywords

BrainTumor, CNN, Deep Learning, MRI, Classification.

## I. Introduction

### A. Brain

The brain is largest and most complex organ in human body that serves as the center of the nervoessystem[1]. It is located in the head usually it is close to the sensory organ for sences such as vision.

### B. Tumor

A tumor is tissue that is growing where it should not be. Another name of tumor is neoplasm[1]. A tumor is usually form as lump or mass. Tumors are either malignant(harmful) or benign(safe) tumors. Cancer for examples is malignant and sometime spreads to other places on body. Tumor can occur in many different parts of the brain, and it may be classified as primary tumor or secondary tumor.



Fig. 1: Tumor [1]

### C. Brain Tumor

A brain tumor occurs when abnormal cells from within the body. There are main two types of tumors malignant (cancerous) and benign(non cancerous) [1]. The Cancerous or malignant tumors are divided into primary tumors, which starts within the brain, and the secondary tumors, which have spread from elsewhere, known as brain metastasis tumors. All types of brain tumors may produce more than one symptoms that vary depending on the part of brain involved. These symptoms may include headaches, seizures, problems with vision, vomiting and mental changes.

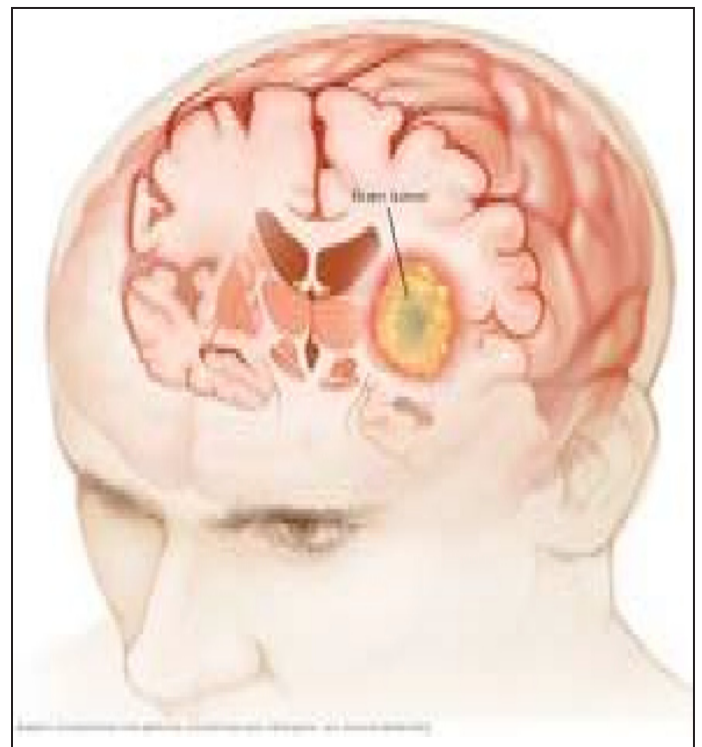


Fig. 2: Brain Tumor [1]

### C. Machine Learning

Machine Learning (ML) is a field of Artificial Intelligence, which educates computers on how to perform complex task. With machine learning software applications can learn to increase their accuracy of expected outputs. Machine Learning is a algorithms and models that performs a specific tasks. The main goal of machine learning algorithm is to study, engineer and improve or builds a mathematical model based on sample data, known as "training data". Machine Learning applications in everyday life are Amazon recommendation system , Self- driving car, Web Search, Computer Vision, Drug Design. Types of machine learning algorithms are supervised learning, unsupervised learning, semi supervised learning and reinforcement learning algorithms [2].

### D. Deep Learning

Deep Learning is specialized form of machine learning. Deep learning is an Artificial Intelligence function. In deep learning, classification can be performed directly from a dataset of images,

sound or text. It can achieve excellent accuracy as compared to human performance. Deep learning model needs large amount of labelled data and many layered neural network architecture. Deep learning uses many neural network layers for advanced feature recognition and prediction. So it is also called as deep neural learning or deep neural network. The deep neural network (DNN) is an artificial neural network (ANN) with multiple layers between the input and output layers each mathematical manipulation as such is considered a layer, and complex DNN structure have many layers, hence the name “deep” networks. DNN can model complex non-linear relationships. The applications of deep learning are cancer detection and speech translation.

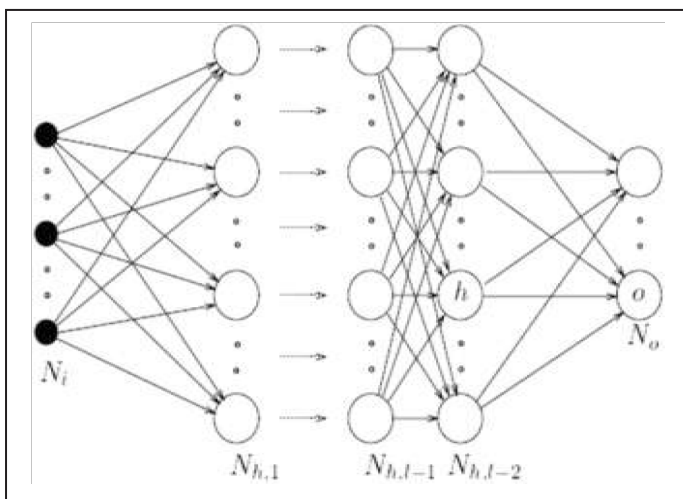


Fig. 3: DNNs Architecture [3]

In above Figure 3 DNN Architecture the  $N_i$  represent the input layers for contain neurons the input features, the  $N_o$  represent output layers for contain neurons output classes, and the  $N_{h,1}$  represent the hidden layers [3].

## II. Related Work

Gao et al. [4] studies for the Alzheimer’s disease early detection, this disease destroy the mental function of the brain. They have used two CNN models, 2D and 3D, and these models were trained by using the 2D and 3D Computerized Tomography images and the result is declared by combining the output of these two models.

Pereira et al. [5] have used magnetic resonance images to train the CNN model, in the proposed algorithm, for the segmentation of the brain tumor, they have investigated intensity normalization and augmentation.

Devkotea B et.al. [6] proposes the CAD approach which helps to detecting the brain tumors. Authors have used Mathematical morphological Reconstruction in their study.

They have studied various number of brain images, which are preprocessed to find the regions of the brain tumor. Once the preprocessing is completed then segregated images are classified to find the type of the tumor, benign or malignant. UmitIhan&AhmetIhan “Brain tumor segmentation based on a new threshold approach” [7].

### Median filter.

- Threshold based segmentation.
- Tumor detection with limited number of parameters.

BhavanaGhotekar& K. J. Mahajan “Brain Tumor Detection and

Classification using SVM”[8].

- Masking is not properly done used for threshold.
- Support vector machine is used for classification.
- Less accuracy was achieved about 86%.

Heba Mohsen et al “Classification using deep learning neural networks for brain tumors”2017[9]

### Deep learning used.

- Discrete wavelet transform is used with the high accuracy was achieved.

## III. Methodology

There are four methodologies Namely they are Preprocessing, Segmentation, Feature Extraction, Classification. Data Preprocessing Pre-processing is required as it improves the image data which enhances some of the image features that are important for the further processing. The RGB MRI image is converted to grey scale image and the median filter is applied to brain MR images for noise removal. The noise has to be removed for further processing as high accuracy is required. The edges are detected from filtered image using canny edge detection. The detected image of the edges is required for segmentation of the image. Segmentation Segmentation is the process of dividing an image into multiple segments. The aim of segmentation is to change the representation of an image into something which is easier to analyze. Segmentation is the process of separating the tumor from normal brain tissues. Watershed segmentation is performed for finding the location of the tumor in the MRI images. The result of watershed segmentation is label image. In label image, the different objects that are identified will have different pixel values When an input to an algorithm is very large and redundant to be processed, it is transformed into reduced representative set of features called feature vector. Transformation of this input data into a set of features is called feature extraction. In this step, the important features required for image classification are extracted. The segmented brain MRI image is used and texture features are extracted from the segmented image which shows the texture property of the image. When a input to an algorithm is very large and redundant to be processed, it is transformed into reduced representative set of features called feature vector. Transformation of this input data into a set of features is called feature extraction. In this step, the important features required for image classification are extracted. The segmented brain MRI image is used and texture features are extracted from the segmented image which shows the texture property of the image. These features are extracted using Grey Level Co-occurrence Matrix (GLCM) as it is robust method with high performance. This texture feature extraction method is very competitive as using smaller number of grey levels shrinks the size of GLCM which reduces the computational cost of the algorithm and also maintains the high classification rates. These features are used to differentiate between normal and abnormal brain.

## IV. Proposed Methodology

### A. Image Acquisition

The brain tumor MRIs dataset acquisition has been used to implement the proposed methods[10]. This method is used to designed for extraction of tumors with accuracy and composed number of stages are including image capturing, edge detection, and classification of tumor.

## B. Image Pre-Processing

In this module, we are performing some basic operation on image to get proper image for processing. In this module, we are perform certain operation like gray-scale conversion, filtering, sharpening, smoothing, edging, and image segmentation to get proper and clean image. Preprocessing step enhances the quality of the images by eliminating noise. The Gray scale images, a kind of black-and-white or gray monochrome images, are composed exclusively of shades of gray. Gray scale images can be measuring the intensity of light at each pixel. The Filtering operation is performed on the image to increase the smoothness, sharpness as well as edge enhancement. In sharpening filter is used to enhancement the images insharpening and toenhance detail that has been blurred[10]. Smoothing filter is used to reduce the noise. It has used many different algorithms[10].Edging is a technique of finding and identifying sharpness presented in an image.

## C. Image Segmentation

Image Segmentation ia an important step in domain of computer vision based on emerging applications including medical imaging, video surveillance and many more. The image segmentation is a step of processing which is used threshold method to segment the MRI(Magnetic Resonance Images) image gray level to binary image [11]. Segmentation means partitioning the digital images into multiple parts of segments or objects. Segmentation is a process of grouping the pixels that have similar attributes. Is is used to locate the objects and boundaries in images. Basically, the segmentation process performed to extract important features from the image for further analysis.

## D. Feature Extraction

In this module, we are performing some more operation on segmented image. In this module we will perform feature extraction operation to get all detailed information about brain image. Feature Extraction and reduction has been playing a vital role for tumor region into their relevant categories in the field of computer vision and machine learning[12]. The major issue behind feature extraction is to compute the most active or robust features for classification, which produced an efficient performance. The Feature extraction is used related to dimensionality reduction.

## E. Classification

In this module, we are performing classification techniques with help of deep learning algorithm to determine brain condition. The Brain tumor classification is the final step of the proposed approach, that is used to identify the type of braintumor normal or abnormal[13]. After features are extracted and selected the classification step using CNN is performed on the resulted feature vector. Classification is performed by using training phase and testing phase of CNN structure.

## F. Convolutional Neural Network

The name of “Convolutional Neural Network” performs the mathematical operation called convolution. Convolution is a specialized kind of linear operation. In deep learning, a convolutional neural network (CNN, or ConvNet) is a class of deep neural networks, Convolutional networks are simply neural networks that use convolution in matrix multiplication in at least one of their layers. ConvNets have been successful in Identifying faces, objects ,diseases detection. A convolutional neural network consists of an input layer, output layer, as well as multiple hidden layers [14]. CNN which is feedforward

neural network and is widely used for image recognition and classification. The Convolutional neural layers convolve the input and pass its result output to the next layer. CNNs are regularized versions of multilayer perceptrons. The Multilayer perceptrons are the fully connected networks each one neuron is connected to all other neurons in next layer. The “fully-connected” network means overfitting data.

## IV. Conclusion

In this papers, We have studied various types of tumors. In summary we proposed a CNN based method for segmentation of brain tumors in MRI images. There are number of technique are available for brain tumor segmentation and classification to detect the brain tumor. To overcome these limitations, propose Convolution Neural Network (CNN) based classifier. The CNN based classifier are used to compare the trained data and test data, from this data we get the best result. In future we have finding the tumor type and other brain related disease.

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