# Brain Tumor Detection

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*Abstract:* A brain tumour is a misshapen cell growth that can be malignant or non-cancerous in nature. The most deadly condition is a brain tumour, which can be detected with automated procedures on MRI images and identified quickly and accurately. Several methods of diagnosis and segmentation of brain tumors have been suggested by many researchers for effective tumor detection. Because of the high diversity in tumor tissue of different patients, automating this process could be a challenging risk. Medical resonance imaging is a challenging and innovative field in the medical science field. In the medical field, the techniques of ML( Machine learning ) and Deep learning holds a significant stand. Brain tumor detection using MRI images have many applications. Brain tumor detection from MRI images is one in all the emerging fields in medical science. There are different brain tumor detection methods. Detection and segmentation methods are used to detect the brain tumor from the MRI images. Here a brief review of the different brain tumor detection methods has been discussed. The different methods include Convolution Neural Network, Artificial Neural Network, Resnet - 50 and CNN with Transfer Learning.

*Index Terms* - **Brain Tumor, MRI images, Convolution Neural Network, Artificial Neural Network, Resnet - 50, CNN with Transfer Learning**

## I.INTRODUCTION

The brain is one of the most complicated organs inside the human body that works with a large number of cells. Brain tumors increase when there's an unregulated division of cells that forms an irregular. The group of a cell affects the normal functionality of brain activity and damages the healthy cell. [1]. Brain tumor detection is one of the most difficult tasks in the analysis of medical images. A person is affected by a brain tumor when there is an abnormal or unusual growth of the cells in his/her brain. Nowadays brain tumors had become a big reason for the human death. By using image processing we can early detect the tumors[2].

MRI scan is a technique that depends on the magnetic fields and radiofrequency pulses in the water molecules present in the human body. MRI scan is more efficient than CT scan because CT scan doesn't make use of radiofrequency. The latest traditional diagnostic method relies on the experience of humans within the perception of a choice in MRI scan and arise the chance of false diagnosis and tumour recognition in addition. Digital image processing allows the identification of the tumor easily and reliably. Radiologists use CT scan and MRI techniques to examine the patient visually. They analyze the brain structures, tumor size, and tumor location which was illustrated by MRI Images.

Diagnosis of brain tumors from MR images can result in a waste of your time and misinterpretations for physicians. Recently, computer-aided automatic detection and diagnosis systems supported deep learning and image processing algorithms are wont to minimize both the time of interpretation of MR images and therefore the margin of error within the interpretation. it's a synthetic intelligence method that uses multilayered neural networks within the fields of deep learning, visual perception and image classification and is one amongst the forms of machine learning. Deep learning can learn automatically from icons of images, video, audio and text data rather than learning with coded rules, which is different from the classical machine learning methods.

## II. TECHNIQUES AND METHODS

*A. Convolution Neural Network*

A convolutional neural network, or CNN, is one of the deep learning neural networks designed for processing structured arrays. Convolutional neural networks are widely employed in computer vision and are the state of the art for many visual applications such as image classification, and have also found success in natural language processing(NLP) for text classification.

The architecture of a convolutional neural network is a multi-layered feed-forward neural network, made by stacking many hidden layers on top of every other in sequence. It is this sequential design that permits convolutional neural networks to learn hierarchical features. The hidden layers are typically convolutional layers followed by activation layers and some of them are followed by pooling layers.

*B. Artificial Neural Network*

Artificial neural networks (ANNs), usually simply called neural networks (NNs),biological neural networks of human beings work in a similar way.

An ANN is a collection of connected units called artificial neurons, which resemble the neurons in the biological brain of human beings. Each node, like the synapses in the brain, which can transmit a signal to other neurons. Similarly an artificial neuron receives a signal then processes it and sends signal to neurons connected to it. The "signal" is a real number, and the output of each neuron is computed based on some non-linear function of its inputs. These connections are called edges. Neurons and edges have respective weight that adjusts the learning proceeds.Increasing or decreasing the weights leads to change in the strength of the signal at a connection. Neurons may have a threshold value such that a signal is sent only if the aggregate signal crosses that threshold value. Generally, neurons are aggregated into the layers. Each layer may perform different functions on their inputs. Signals move from the input layer, to the output layer, possibly after traversing through the layers multiple of times.

Steps involved in the code are:

i. Importing the required libraries.

ii. Converting the CSV files of the dataset into a dataframe to perform specific operations on it.

iii. Analyze the pixel values of the mask image.

*C.* Resnet 50

Transfer Learning is a technique to use the pre-trained models in your training. You can build your model using this pre-trained model. This process helps you decrease the development time and increase performance.

ResNet, is an acronym for Residual Networks is a set of classic neural networks used as a backbone for many computer vision applications. This model was the winner of the ImageNet challenge in the year 2015. The ResNet allowed us to train extremely deep neural networks with 150+ layers successfully. Prior to ResNet training, very deep neural networks were difficult due to the problem of vanishing of the gradients.

ResNet (Residual Network) is an ANN trained on the ImageNet dataset that is used to train the model on the top of it. ResNet50 is the variant of the ResNet model which has 48 Convolution layers along with one MaxPool and one Average Pool layer.

Here, we are using the ResNet50 Model which is Transfer Learning Model. Using this, we will further add many more layers to build our model.

*D.* CNN with Transfer learning.

Transfer learning is an optimization which will yield rapid progress or improved performance when modeling the second task.Libraries are imported which are utilized in further code like Pandas, Numpy, os, Matplotlib, FilterWarnings from Warnings, Keras, Tensor flow, cv2 and etc.Dataset is imported using dropbox and dataset are analyzed like number of images, Creating a function that help generate the folders for train, val and testA convolution multiplies a matrix of pixels with a filter matrix or 'kernel' and sums up the multiplication values.Till all the image pixels are covered then convolution slides over to the following pixel and repeats the identical process.Data Prepared using Data Generator and Augmentation. a controversy with training neural networks is within the choice of the quantity of coaching epoch to use.And so many epochs can ends up in overfitting of the training dataset, whereas too few may ends up in an underfit model. Early stopping could be a method which allows you to specify an arbitrary sizable amount of coaching epochs and stop training once the model performance stops improving on a hold out validation dataset.

Training a model means determining good values for all the weights and therefore the bias from labeled examples. In supervised learning, a machine learning algorithm yields a model by examining many examples and attempting to search out a model that minimizes loss and this process is thought as empirical risk minimization.

Loss is that the penalty for a foul prediction. So loss may be a number indicates how bad the model's prediction was on one iteration. If the model's prediction is ideal then the loss is zero otherwise, the loss is bigger. The goal of the training a model is to seek out the set of weights and their biases that have low losses, on average, across all the train data.The answer on the evaluation of dataset (held out data) is predicted so predicted target is compared to the particular answer(ground truth). to live the predictive accuracy of a model, number of metrics are employed in ML

## III. COMPARATIVE STUDY

Table 1 Performance comparison table

| No | Method | Remarks | Accuracy |
|----|--------|---------|----------|
| 1 | Convolution Neural Network | Low accuracy | 70-80% |
| 2 | Artificial Neural Network | Not appreciable for image detection tasks | 80-85% |
| 3 | Resnet - 50 | Requires high GPU | 80-90% |
| 4 | CNN with Transfer Learning | High accuracy | 95-99% |

## IV. DISCUSSION AND CONCLUSION

The various brain tumor detection techniques are discussed and analyzed in this paper. From the comparative study we can conclude CCN with transfer learning method is an efficient method for brain tumor detection using image processing. Overall, when used appropriately, transfer learning gave us trifecta of benefits: a higher starting accuracy, faster convergence and higher asymptotic accuracy (the accuracy level to which the training converges).

REFERENCES

[1] Brain Tumor Detection Analysis Using CNN: A Review

[2] Brain Tumor Detection Model from MR Images using Convolutional Neural Network.

[3] S. S. Hunnur, A. Raut and S. Kulkarni, "Implementation of image processing for detection of brain tumors," 2017 International Conference on Computing Methodologies and Communication (ICCMC), 2017, pp. 717-722, doi: 10.1109/ICCMC.2017.8282559.

[4] S. Kumar, R. Dhir and N. Chaurasia, "Brain Tumor Detection Analysis Using CNN: A Review," 2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS), 2021, pp. 1061-1067, doi: 10.1109/ICAIS50930.2021.9395920.

[5] H. Ucuzal, Ş. YAŞAR and C. Çolak, "Classification of brain tumor types by deep learning with convolutional neural network on magnetic resonance images using a developed web-based interface," 2019 3rd International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT), 2019, pp. 1-5, doi: 10.1109/ISMSIT.2019.8932761.

[6] Ranjbarzadeh, R., Bagherian Kasgari, A., Jafarzadeh Ghoushchi, S. *et al.* Brain tumor segmentation based on deep learning and an attention mechanism using MRI multi-modalities brain images. *Sci Rep* 11, 10930 (2021).

[7] A. E. Babu, A. Subhash, D. Rajan, F. Jacob and P. A. Kumar, "A Survey on Methods for Brain Tumor Detection," 2018 Conference on Emerging Devices and Smart Systems (ICEDSS), 2018, pp. 213-216, doi: 10.1109/ICEDSS.2018.8544353.

[8] T. M. Shahriar Sazzad, K. M. Tanzibul Ahmmed, M. U. Hoque and M. Rahman, "Development of Automated Brain Tumor Identification Using MRI Images," 2019 International Conference on Electrical, Computer and Communication Engineering (ECCE), 2019, pp. 1-4, doi: 10.1109/ECACE.2019.8679240.