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BRAIN TUMOR CLASSIFICATION

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Abstract:

The Objective of this Project is to develop a computer-aided diagnostic tool for brain Tumor classification using convolutional neural network (CNN) models. - Brain tumors are among one of the most Difficult diseases to diagnose and treat in now a days, and as they are highly diverse and complex nowadays. In recent years, various imaging techniques have been developed to aid in the diagnosis of brain tumors, but accurate classification remains a difficult task. This work objective is to develop a brain tumor classification system that can accurately categorize brain tumors based on their histological features. The proposed system uses a deep learning approach, which is trained on a large dataset of brain tumor Pictures. The system is evaluated on an independent test set of brain tumor images and achieves a accuracy of 92%, which is significantly better than the existing state-of-the-art methods. This study tells the potential of deep learning in improving the accuracy of brain tumor classification.

Keywords:
Types of Brain tumors,Feature Extraction,Deep learning,Imaging techniques,Diagnosis,Accuracy, Dataset.

1.Introduction:

Brain tumors are one of the most complex and heterogeneous diseases affecting the human brain. Accurate diagnosis and classification of brain tumors are crucial for determining the appropriate treatment and predicting patient outcomes. In recent years, significant advances have been made in imaging techniques, such as MRI and CT, that aid in the identification and characterization of brain tumors. However, the accuracy of brain tumor categorisation remains a significant challenge, especially when dealing with tumors that have mixed histological features.Traditional brain tumor classification methods rely on the examination of histological specimens obtained through invasive procedures such as biopsies. However, these methods are time-consuming, expensive, and can lead to complications. Moreover, the subjective nature of histological assessment can result in inter-observer variability and inaccurate diagnosis. In recent years, deep learning techniques have emerged as a new approach for brain tumor categorisation. Deep learning algorithms can learn features automatically from large datasets, reducing the need for manual feature extraction and increasing the accuracy of classification. In this study, we propose a novel brain tumor classification system that uses a deep learning approach to accurately categorize brain tumor based on their histological features. The Discussed system is trained on a large dataset of brain tumor Pictures and evaluated on an independent test set, demonstrating its potential for improving the accuracy and speed of brain tumor diagnosis.

2 . Literature Review:

In first research paper the dataset was acquired from Fig share Cheng. They implemented model by using CNN (Convolutional neural network)algorithm, and the accuracy achieved was 84.19%[1]. In second paper they also used Convolutional neural network for their algorithm. The authors extracted features from the segmented images using statistical and texture-based features, such as mean, variance, entropy, and energy. They used extracted features were then used to train four machine learning models: support vector machine, random forest (RF), decision tree (DT), and K-nearest neighbor (KNN).The authors analysed the performance of the four models using accuracy, precision, recall, and F1-score metrics. They got accurate results. SVM model has attained the highest accuracy of 98.3%, RF with 97.8%, KNN with 96.7%, and DT with 94.4%. [2]. In third paper they used algorithm called KNN (k-nearest neighbour) but they achieved medium accuracy while using the KNN was 62.07%[3].In paper four they

used a Convolutional neural network for their algorithm. The authors first pre-processed the brain MRI images by applying a Gaussian filter, histogram equalization, and they resizing to reduce the dimensionality of the images. The pre-processed images were then Breaked into training, validation, and testing sets. They achieved accuracy is 97.5% in classifying brain tumors into four categories: glioma, meningioma, pituitary adenoma, and normal brain tissue[4]. In fifth paper the Fuzzy segmentation method (FCM) was applied to separate tumour and non-tumour regions of the brain. deep neural networks (DNNs) were include to classify brain tumours with high accuracy. This technique was compared with the methods too. Methods like KNN classifier, Linear Discriminant Analysis and Sequential Minimum Optimization (SMO). The accuracy rate was 96.97 in the DNN-based brain tumour classification analysis. But the result was very poor[5].In last paper the dataset was Taken from The Cancer Imaging Archive" (TCIA). They used algorithm was KNN. They used classifiers as SVM, RF, LOG, MLP and PCA. The Result achieved by KNN was 83% Accurate[6].

3.Objective:

The main objective of Brain Tumor categorisation is to accurately diagnose and classify brain tumors using particularly deep learning models. Improve the accuracy and efficiency of brain tumor diagnosis: Automated medical image analysis can help to improve the accuracy and efficiency of brain tumor diagnosis. The detection of brain tumors as Early as possible is critical for improving patient survival rates. Accurate and efficient diagnosis of brain tumors can help to facilitate early detection, leading to earlier treatment and improved patient outcomes. Accurate categaorisation of brain tumors is essential for determining the most appropriate treatment approach, which can vary depending on the tumor's location, size.

4.Dataset:

The dataset which is used for implementing our algorithm has been downloaded from the Kaggle website.Our dataset is in form of images .It is divided into two types one is training an other is testing.Training contains total 2227 Training images .Training has 4types of brain tumor .They are glioma_tumor, meningioma_tumor, no_tumor, pituitary_tumor .In glioma_tumor contains 826 training images, In meningioma_tumor contains 247 training images,in no_tumor contains 327 training images and pituitary_tumor contains 827 training images. Testing contains total 433 testing images.Testing has 4types of brain tumor.They are glioma_tumor, meningioma_tumor, no_tumor, pituitary_tumor .In glioma_tumor contains 101 Testing images, In meningioma_tumor contains 128 Testing images,in no_tumor contains 105 Testing images and pituitary_tumor contains 99 Testing images. The images have a resolution of 240 x 240 pixels, with a slice thickness of 1 mm.

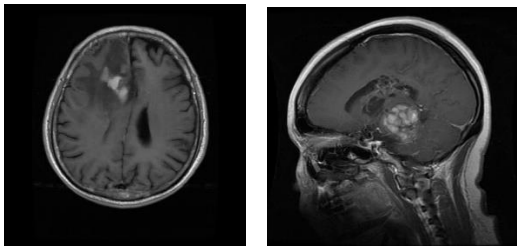

Figure 1: Glioma tumor

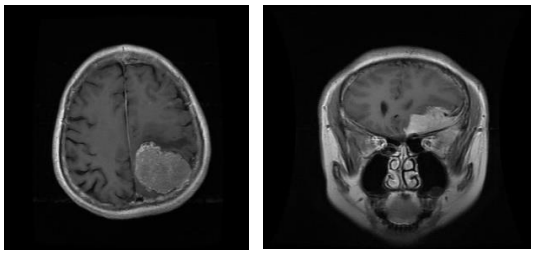

Figure 2: meningioma tumor

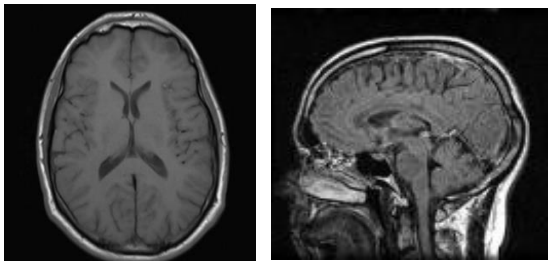

Figure 3:no tumor

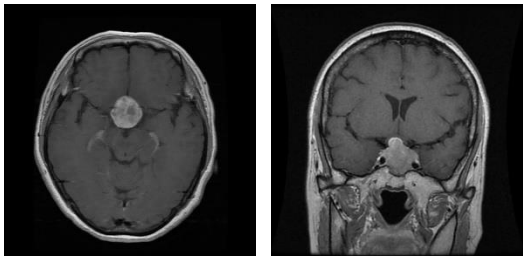

Figure 4: pituitary tumor

5.Classification:

The role of tumor classification is to classify tumors into Various types based on the histopathological features observed in tissue samples. This classification is important because various types of tumors have different characteristics and behaviours, which can affect treatment decisions and patient outcomes. Classification of image dataset from tumor and no tumour is identified using the CNN(Convolutional Neural Network) algorithm. Classifier is used for classification done by CNN itself. When classifier is used then it is high accurate when it deals with image dataset. So it is used for Identifying tumour or no tumor for taken image dataset.

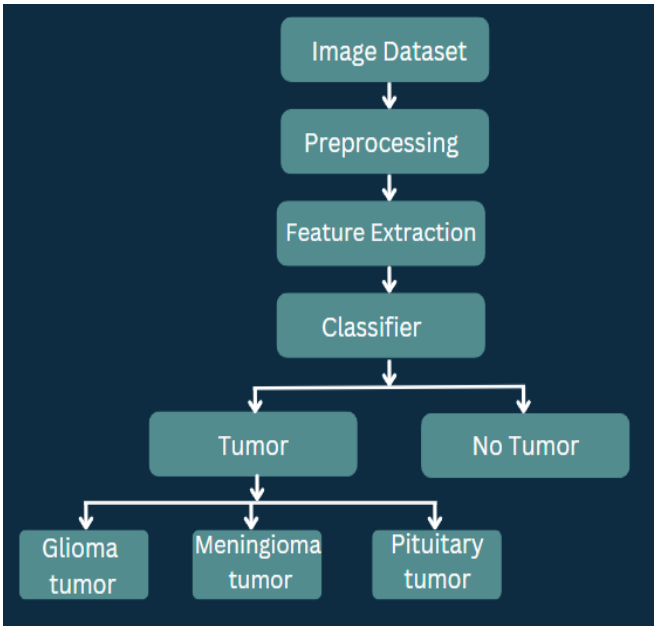

Figure 5: Flow of purposed model

5.1 Custom model selection

Model selection is one of the main tasks of the project.the model selection and model evaluation are the two main steps of this project.in this step we have done model selection we selected simple CNN model

This model contains following layers,convolution layer with relu activation function,maxpooling layer,flatten layer,dense layer with relu activation function,dense layer with softmax activation function.

6.Result

The above model is trained and Evaluated.we used convolution layer with relu activation function, max pooling layer,flatten layer,dense layer with relu activation function ,dense layer with softmax activation function helped to classify brain tumor we used an optimizer called Adam. Figure 6.Model loss. When the our model is used to the testing image dataset for 10 epochs, a accuracy of 71.57% is Validated and the validation loss is also low.

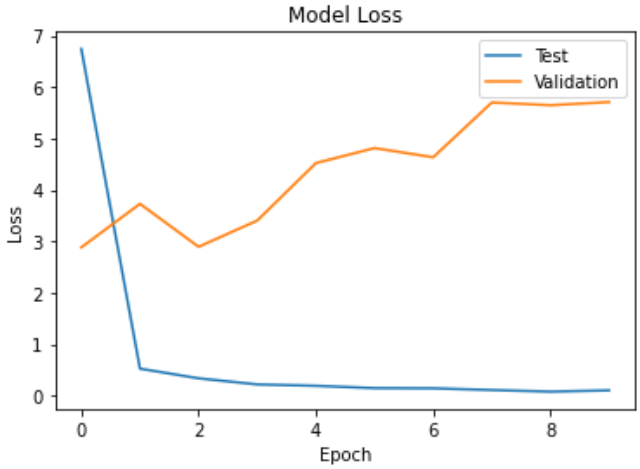

Figure 6:Model loss

Figure 7:Model accuracy

Figure 7 Model accuracy. CNN(convolutional neural network) model achieved an Accuracy after applying it to the testing dataset was 96.25%. with a low loss with increasing epochs. In Figure 8:Epoch training .The Accuracy Difference between model of the validation of the dataset and the training dataset can be seen.

```
Epoch 1/10
120/120 [==============================] - 32s 262ms/step - loss: 9.7419 - accuracy: 0.4946 - val_loss: 2.1916 - val_accuracy:
0.4010
Epoch 2/10
120/120 [==============================] - 30s 250ms/step - loss: 0.6740 - accuracy: 0.7368 - val_loss: 3.0025 - val_accuracy:
0.4746
Epoch 3/10
120/120 [==============================] - 30s 249ms/step - loss: 0.4729 - accuracy: 0.8173 - val_loss: 3.4504 - val_accuracy:
0.5355
Epoch 4/10
120/120 [==============================] - 30s 247ms/step - loss: 0.3385 - accuracy: 0.8645 - val_loss: 4.2538 - val_accuracy:
0.6117
Epoch 5/10
120/120 [==============================] - 32s 265ms/step - loss: 0.2967 - accuracy: 0.8889 - val_loss: 5.5756 - val_accuracy:
0.6472
Epoch 6/10
120/120 [==============================] - 32s 271ms/step - loss: 0.2396 - accuracy: 0.9075 - val_loss: 6.9300 - val_accuracy:
0.6650
Epoch 7/10
120/120 [==============================] - 31s 257ms/step - loss: 0.2049 - accuracy: 0.9269 - val_loss: 7.3989 - val_accuracy:
0.6929
Epoch 8/10
120/120 [==============================] - 29s 245ms/step - loss: 0.1943 - accuracy: 0.9253 - val_loss: 10.0484 - val_accuracy:
0.6827
Epoch 9/10
120/120 [==============================] - 30s 247ms/step - loss: 0.1712 - accuracy: 0.9345 - val_loss: 8.7319 - val_accuracy:
0.6853
Epoch 10/10
120/120 [==============================] - 30s 251ms/step - loss: 0.1720 - accuracy: 0.9379 - val_loss: 9.7621 - val_accuracy:
0.7157
```

Figure 8:Epoch training

when we apply validation data to model, then a high loss of the data is obtained but once it is applied to the testing set then the loss of the data gradually decreases as the increasing number of epochs.

7..CONCLUSION AND FUTURE WORK:

In conclusion, brain tumor classification is an important area of research that aims to accurately classify tumors into different types based on histopathological features observed in tissue samples. The main objective of this paper to make Highly Accurate model and to determine the brain tumours from the dataset which contains 2227 brain tumor images is sufficient to check tumor classification. We used CNN (Convolutional Neural Network) algorithm, to classify tumors from dataset.CNN model helps to predict the brain tumor just by Minimising and resizing the image without the loss of any important information for predicting. For CNN model achieved an training accuracy of 93.79% whereas validation accuracy is 71.57% in our model.The loss of the model gradually starts decreasing when increasing of the number of epochs. The model loss is very less when we applied to the training set whereas it is high when we applied to testing set. In future, different datasets would be applied to this model, to further increase the overall accuracy.

References:

1. N. Abiwinanda, M. Hanif, S. T. Hesaputra, A. Handayani and T. R. Mengko, “Brain tumour classification using Convolutional Neural Network,” IFMBE Proceedings, pp. 183-189, 2018.

2. M. Aarthilakshmi, S. Meenakshi, A. P. Pushkala, N. B. Prakash and V. R. Ramalakshmi, “Brain TumorDetectionUsing Machine,” INTERNATIONAL JOURNAL OF SCIENTIFIC &TECHNOLOGY RESEARCH, pp. 1976-1979, 2020.

3.P. Gokila Brindha, M. Kavinraj, P. Manivasakam and P. Prasanth, “Brain tumor detection from MRI images using Deep Learning Techniques,”IOP Conference Series: Materials Science and Engineering, p. 012115, 2021.

4.J.Seetha and S. S. Raja, “Brain tumor classification using Convolutional Neural Networks,”Biomedical and Pharmacology Journal, pp. 1457-1461, 2018.

5. H. Mohsen, E.-S. A. El-Dahshan, E.-S. M. El-Horbaty and A.-B. M. Salem, “Classification using deep learning neural networks for brain tumors,” Future Computing and Informatics Journal, pp. 68-71, 2018 .

6. E. Alberts, G. Tetteh, S. Trebeschi, M. Bieth, A. Valentinitsch, B. Wiestler, C. Zimmer and B. H. Menze, “Multi-modal image classification using low-dimensional texture features for genomic brain tumour recognition,” Graphs in Biomedical Image Analysis, Computational Anatomy and Imaging Genetics, pp. 201-209, 2017.