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Brain Tumor Classification Using Machine Learning Mixed Approaches

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Abstract: In this paper, we propose an effective method using Machine learning for the classification of brain tumor tissues. For successful treatment correct and early detection of brain tumors is essential. Here proposed system is using Convolutional Neural Network for feature extraction and classification. In feature extraction, we reduce the number of features in the dataset by creating new features from the existing ones. Here we recognize the types of tissues using CNN. The pooling layer is used to reduce the spatial resolution of the feature maps. This layer brings down the number of parameters needed for image processing. This paper is focused on helping the radiologist and physician to have a second opinion on the diagnosis. These systems help specialists to perform tumor detection very easily. This study aims to diagnose brain tumors using MRI images.
Keywords: Convolutional Neural Network, Machine Learning, MRI, Brain tumor.

I. INTRODUCTION

The Brain is the most important organ in humans.

There are many diseases but brain tumor is the most dangerous disease which is seen in adults as well as children. Brain tumor means uncontrolled or abnormal growth of tissues or cells in the part of the brain. A Brain tumor can be cancerous (malignant) or some can be noncancerous (benign). Brain tumors are classified as primary or secondary. Many primary brain tumors are benign. In adults, the most common types of brain tumors are gliomas and meningiomas. Gliomas are tumors in glial cells that are developed in part of the brain. Tumors like astrocytic tumors, oligodendroglial tumors, and glioblastoma are benign in which glial cells are developed. Meningioma tumors originated in the meanings, and are diagnosed more often in women than men. According to a study that grouped participants into men and women. Most pituitary tumors are primary tumors in which cells are grown abnormally in the pituitary gland. A secondary brain tumor occurs when cancerous cells or tissues spread to the brain from another organ like the lung, kidney, or breast. Secondary brain tumors are always malignant.

Diagnosis of a brain tumor begins with a physical exam and a look at your medical history. After that physical exam doctor does more tests like CT scan, MRI, Angiography, Skull X-rays, Biopsy, etc. In MRI a special dye can be used to detect tumors. An MRI is different from a CT scan because it does not use radiation, and it generously provides much more detailed pictures of the structures of the brain itself. To help the Medical Imaging field for effective diagnosis of the patient many techniques have been reported for the classification of brain tissues in MR images. Current methods have low accuracy [11].

Machine learning is considered a subset of artificial intelligence. Machine learning is a technology in which computers learn automatically from past data.

Machine learning uses various algorithms for building mathematical models, Classification, and making predictions using past data or information. There are two types of classification. The first type is supervised learning such as SVM, K-NN, and ANN which are used for classification purposes. The second type is unsupervised learning for data clustering such as K-means clustering. In this paper, CNN is used for the classification of brain MR images as it gives improved accuracy and better performance than other classifiers. The classification rate is higher for CNN than for other algorithms.

II. EXISTING SYSTEM

Many systems have been developed to detect brain tumors from images. The existing system performs brain tumor detection to identify the category from provided data by using algorithms like naïve Bayes classifier, support vector machine, convolution neural network, genetic algorithm, and many more. It classifies the provided data with respect to brain tumor types. Every system gives different results like accuracy, precision, and recall values.

The recent research uses feature extraction and classification process for classification of brain tumor tissues using some algorithms like Convolutional Neural Network, Support Vector Machine (SVM), Artificial Neural Network, Genetic Algorithms, and classifiers.

In 2013, Author Shweta Jain used Classification of Brain Cancer Using Feature Extraction in Artificial Neural Network (ANN). Firstly, an MRI database is introduced; including Astrocytoma type of brain cancer classified into four tumor types namely pilocytic (grade1), low grade (grade2), anaplastic (grade3), and glioblastoma multiforme (grade4).

Then the feature extractions are being discussed.

Finally, the architecture of an artificial neural network is developed for the classification of brain cancer. The scope of this work is to improve the ANNs architecture with an improvement of feature functions to achieve well-separated data [1].

In 2013, Authors Narkhede Sachin G, and Prof. Vaishali Khairnar, addresses some of the challenging issues on brain magnetic resonance (MR) image tumor segmentation caused by the weak correlation between magnetic resonance imaging (MRI) intensity and anatomical meaning.

This paper first checks whether the image can be divided into symmetric axis or not. If it is divided into Symmetric parts then no tumor in the brain and if it can be divided in a curve shape then chance of a tumor in the human brain However, if there is a macroscopic tumor, the symmetry characteristic will be weakened.

According to the influence on the symmetry of the tumor, develop a segmenting algorithm to detect the tumor region automatically [5].

In 2017, Authors Ravikumar Gurusamy and Dr. Vijayan Subramaniam reprocessed and extracted the features of the MRI images. Both real-time images and simulated images are used in this project which is an added advantage. Secondly, an extensive pre-processing technique is employed to remove the unwanted noises.

A new method for denoising, extraction, and tumor detection on MRI images is presented in this paper. The success rate of this step is high which has guaranteed the overall accuracy of the system [10].

In 2014, Author Subhashis Banerjee Investigated Deep Convolutional Neural Networks (ConvNets) for the classification of brain tumors using multisequence MR images And proposed three ConvNets, which are trained from scratch, on MRI patches, slices, and multi-planar volumetric slices

The author has presented three novel ConvNet architectures for grading brain tumors non-invasively, into HGG and LGG, from the MR images of tumors and explored transfer learning for the same task, by fine-tuning two existing ConvNet models. An improvement of about 12% in terms of classification accuracy on the test dataset was observed from deep ConvNets compared to shallow learning models [9].

In 2021, Authors B Kokila1, M S Devadharshini1, A Anitha1, and S Abisheak Sankar used the Convolutional Neural Network. The Convolutional Neural Network (CNN) based multi-task classification is equipped for the classification and detection of tumors. This Brain tumor classification model uses a multi-task classifier rather than using a different model for each classification. This method will be suitable even for classifying rare tumor types as the diagnosis can be done with other results obtained [8].

In 2017 Authors, Sunil L. Bangare, G. Pradeepini, and Shrishailappa T. Patil proposed an effective mixed-method approach for the classification of brain tumor tissues.

Here proposed system will be using a Genetic Algorithm for Feature Extraction and a Support Vector Machine for classification. This mixed-method approach shows the possibility of better brain tumor classification [3].

In 2017, Authors Saumya Chauhan, Aayushi More, Ritumbhra Uikey, Pooja Malviya, and Asmita Moghe proposed work MRI brain images are pre-processed by median filtering. To segregate the lesion from the image, color-based segmentation and edge detection are performed.

Multiple feature extraction schemes, namely histogram of oriented gradients and gray level co-occurrence matrix are used to represent the images.

In this work, an automated method has been developed for the classification of normal, benign, and malignant tumors in brain MRI images using the IBkLG classifier [7].

In 2020, Authors Chirodip Lodh Choudhury, Chandrakanta Mahanty, and Raghvendra Kumar proposed work that involves the approach of a deep neural network and incorporates a CNN-based model to classify the MRI as “TUMOUR DETECTED” or “TUMOUR NOT DETECTED”.

The author proposed a new system based on CNN, which discriminates between the Brain MRI images to mark them as tumorous or not. The model is having CNN with 3 layers and requires very few steps of pre-processing to produce the results in 35 epochs [8].

III. PROPOSED SYSTEM

In proposed method we are doing Classification of brain tumor tissues using machine learning techniques. Here we are using CNN algorithm for feature selection and then classify the image into normal and abnormal brain.

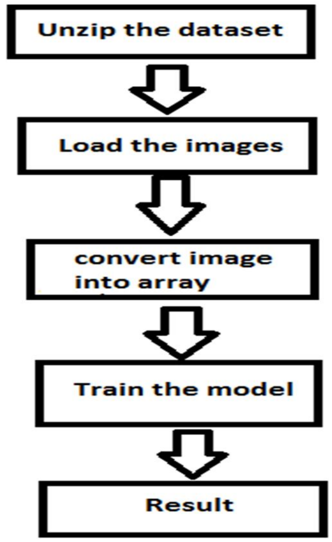

Fig 1 Proposed System

A. Convolutional Neural Network (CNN)

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics.

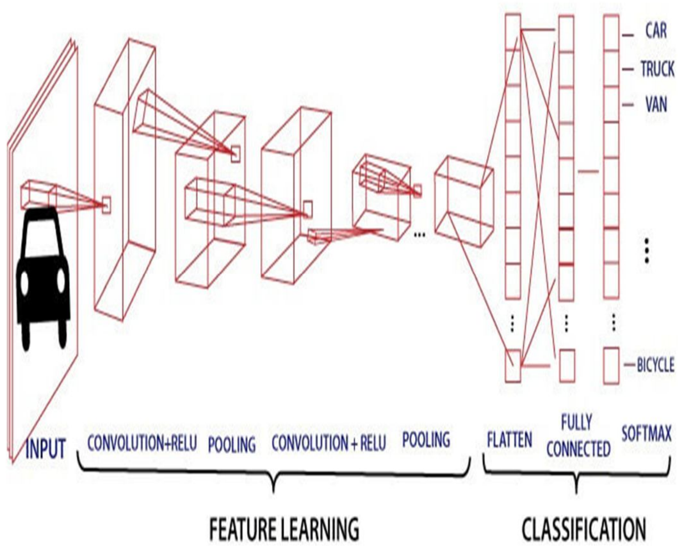

Fig 2 Layers of CNN

B. Model Description

The Sequential model consists of three convolution blocks (tf.keras.layers.conv2D) with a max pooling layer (tf.keras.layers.MaxPooling2D) in each of them. There's a fully-connected layer (tf.keras.layers.Dense) with 128 units on top of it that is activated by a ReLU activation function ('relu').

Here we chose the tf.keras.optimizers.Adam optimizer and tf.keras.losses.SparseCategoricalCrossentropy loss function. To view training and validation accuracy for each training epoch, pass the metrics argument to Model.compile.

The overall summary can be stated as:

TABLE1.Model: "sequential"

Layer (type)	Output Shape	Param #
rescaling_1 (Rescalin g)	(None, 512, 512, 3)	0
conv2d (Conv2D)	(None, 512, 512, 3)	448
max_pooling2d (Max Pooling2D)	(None, 256, 256, 16)	0
conv2d_1 (Conv2D)	(None, 256, 256, 32)	4640
max_pooling2d_1 (M axPooling2)	(None, 128, 128, 32)	0
conv2d_2 (Conv2D)	(None, 128, 128, 64)	0
max_pooling2d_2 (M axPooling2	(None, 64, 64, 64)	0
flatten (Flatten)	(None, 262144)	0
dense (Dense)	(None, 128)	33554560
dense_1 (Dense)	(None, 4)	516

Total params: 33,578,660
Trainable params: 33,578,660
Non-trainable params: 0

C. Over fitting

In the plots, the training accuracy is increasing linearly over time, whereas validation accuracy stalls at around 60% in the training process. Also, the difference in accuracy between training and validation accuracy is noticeable - a sign of overfitting.

When there are a small number of training examples, the model sometimes learns from noises or unwanted details from training examples—to an extent that it negatively impacts the performance of the model on new examples. This phenomenon is known as overfitting. It means that the model will have a difficult time generalizing on a new dataset.

There are multiple ways to fight overfitting in the training process. Here we used, data augmentation and add Dropout in the model.

D. Data Augmentation

Overfitting generally occurs when there are a small number of training examples. Data augmentation takes the approach of generating additional training data from your existing examples by augmenting those using random transformations that yield believable-looking images. This helps expose the model to more aspects of the data and generalize better.

We implement data augmentation using the following Keras preprocessing layers: tf.keras.layers.RandomFlip, tf.keras layers RandomRotation and tf.keras.layers.RandomZoom. These can be included inside your model like other layers, and run on the GPU.

E. Dropout

Another technique to reduce overfitting is to introduce dropout regularization to the network.

When we apply dropout to a layer, it randomly drops out (by setting the activation to zero) a number of output units from the layer during the training process. Dropout takes a fractional number as its input value, in forms such as 0.1, 0.2, 0.4, etc. This means dropping out 10%, 20%, or 40% of the output units randomly from the applied layer.

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IV. EXPERIMENTAL RESULT

In this paper Classification of brain tumors using CNN is proposed. The proposed technique was implemented on a human MRI dataset. The algorithm described in this paper is successfully implemented.

Plots of loss and accuracy on the training and validation sets:

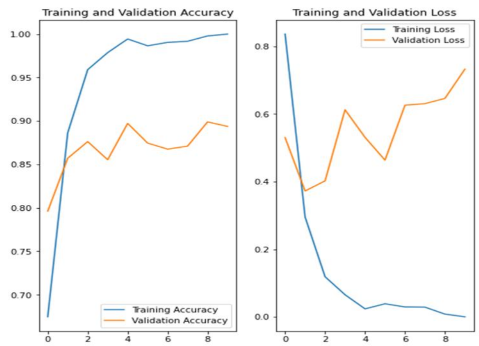

Fig 3 Training and Validation Accuracy And Loss

TABLE 2.Model: "sequential_2"

Layer (type)	Output Shape	Param #
sequential_1 (Sequential)	(None, 512, 512, 3)	0
rescaling_2 (Rescaling)	(None, 512, 512, 3)	0
conv2d_3 (Conv2D)	(None, 512, 512, 16)	448
max_pooling2d_3 (MaxPooling2)	(None, 256, 256, 16)	0
conv2d_4 (Conv2D)	(None, 256, 256, 32)	4640
max_pooling2d_4 (MaxPooling2)	(None, 128, 128, 32)	0
conv2d_5 (Conv2D)	(None, 128, 128, 64)	18496
max_pooling2d_5 (MaxPooling2)	(None, 64, 64, 64)	0
dropout (Dropout)	(None, 64, 64, 64)	0
flatten_1 (Flatten)	(None, 262144)	0
dense_2 (Dense) (None, 128) 33554560	(None, 128)	33554560
dense_3 (Dense)	(None, 4)	516

Total params: 33,578,660
Trainable params: 33,578,660
Non-trainable params: 0

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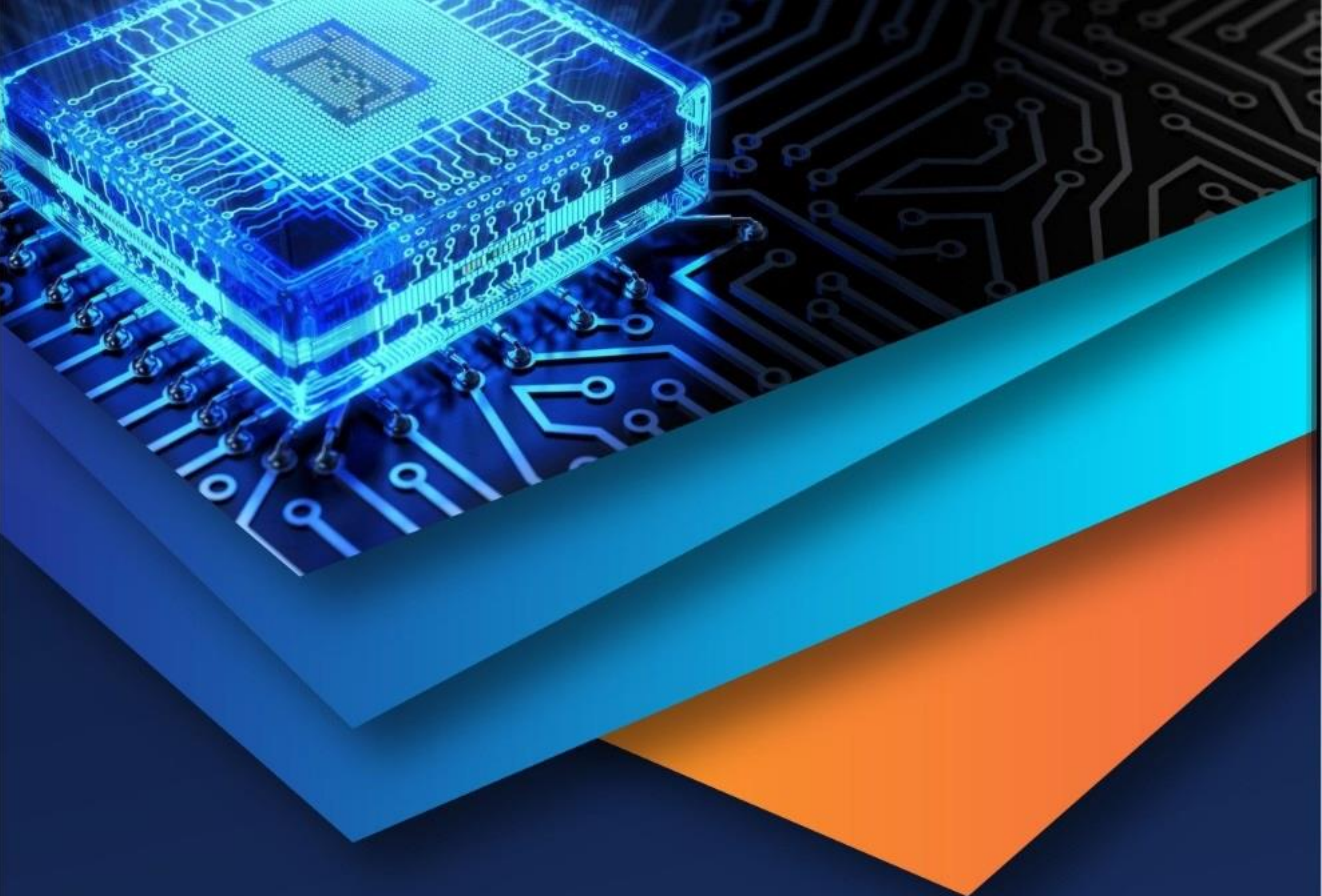
VI. CONCLUSION

In this research paper, we proposed a system that classifies the brain tumor using CNN, which differentiates between the Brain MRI images to mark them as tumorous or not. Firstly, datasets are introduced; including primary brain tumors classified into four classes namely gliomas tumor, meningiomas tumor, pituitary tumor, and no tumor. Then feature extraction is discussed. Finally, the architecture of CNN is developed for the classification of brain tumors.
The proposed system will be definitely useful for the precise diagnosis of tumors and tissues in the medical field.

The scope of this work is to improve the accuracy of the model with the improvement of feature functions to achieve well separate data. In the future, we will take an outsized database and check out to offer more accuracy which can work on any sort of MRI brain tumor. Here we use a Convolutional Neural Network which shows the possibility of better brain tumor classification.

REFERENCES

[1] Shweta Jain, “Brain Cancer Classification Using GLCM Based Feature Extraction in Artificial Neural Network”, International Journal of Computer Science & Engineering Technology (IJCSET), ISSN: 2229-3345, Vol. 4 No. 07 Jul 2013.
[2] Ahlam F.Mahmood et al, “Automatic Brain MRI Slices Classification Using Mixed method Technique”, Al-Rafidain Engineering Vol.22 No. 3 April 2014, pp.198-222.
[3] Sunil L. Bangare, G. Pradeepini and Shrishailappa T. Patil,” Brain Tumor Classification Using Mixed Method Approach”, International Conference on Information, Communication & Embedded Systems (Icices 2017).
[4] Chirodip Lodh Choudhury, Chandrakanta Mahanty and Raghvendra Kumar, Brain Tumor Detection and Classification Using Convolutional Neural Network and Deep Neural Network, July 04,2020.
[5] Narkhede Sachin G, Prof. Vaishali Khairnar,” Brain Tumor Detection Based On Symmetry Information”, et al Int. Journal of Engineering Research and Application ISSN: 2248-9622, Vol. 3, Issue 6, Nov-Dec 2013, pp.430-432.
[6] M. Aarthilakshmi, S. Meenakshi, A. Poorna Pushkala, V. Rama@Ramalakshmi and N.B. Prakash,” Brain Tumor Detection Using Machine Learning,” INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 9, ISSUE 04, APRIL 2020.
[7] Saumya Chauhan, Aayushi More, Ritumbhra Uikey, Pooja Malviya, and Asmita Moghe,” Brain Tumor Detection and Classification in MRI Images using Image and Data Mining”, Proceeding International conference on Recent Innovations is Signal Processing and Embedded Systems (RISE-2017) 27-29 October,2017.
[8] B Kokila1, M S Devadharshini1, A Anitha1 and S Abisheak Sankar,” Brain Tumor Detection and Classification Using Deep Learning Techniques based on MRI Images”, Journal of Physics: Conference Series, ICCCEBS 2021.
[9] Subhashis Banerjee,” Brain Tumor Detection and Classification from Multi-Channel MRIs using Deep Learning and Transfer Learning”.
[10] Ravikumar Gurusamy and Dr Vijayan Subramaniam,” A Machine Learning Approach for MRI Brain Tumor Classification”, CMC, vol.53, no.2, pp.91-108, 2017.
[11] S. L. Bangare, S. T. Patil et al., “Implementing Tumor Detection and Area Calculation in MRI Image of Human Brain Using Image Processing Techniques”, Int. Journal of Engineering Research and Applications www.ijera.com ISSN: 2248-9622, Vol. 5, Issue 4, (Part-6) April 2015, pp.60-65.
[12] https://brain-surgery.com
[13] http://www.drtimothysteel.com.au/brain-tumors/



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