Brain Tumors Detection Of Using MRI Images

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1.Abstract :

The detection of brain tumors from magnetic resonance imaging (MRI) images is a critical task in the field of medical diagnostics. Brain tumors can be life-threatening, and their early and accurate detection is essential for timely intervention and treatment planning. This abstract provides a brief overview of the approach and significance of utilizing computer vision and machine learning algorithms in the detection of brain tumors from MRI scans.
This research leverages computer vision techniques to preprocess MRI images, enhancing their quality and highlighting potential tumor regions. Subsequently, machine learning algorithms, such as convolutional neural networks (CNNs) and support vector machines (SVMs), are applied to classify these regions as either tumor or non-tumor, automating the detection process.

Key word: -Artifficial intelligence,proposed channel selection layer,partial correlation, deeo learning, faster R-CNN, brain tumor.

2.Introduction :

Tumour: The word “Tumour” is a synonym for the word “neoplasm” which is formed by an abnormal growth of cells. A tumour

is significantly different from cancer.Brain tumors are a significant health concern worldwide, with a profound impact on patients' lives and well-being. The early and accurate detection of brain tumors is paramount for timely intervention and treatment planning. Magnetic Resonance Imaging (MRI) has emerged as a powerful diagnostic tool in this context. It provides high-resolution, non-invasive images of the brain, enabling clinicians to visualize and analyze abnormalities in brain tissue. The application of computer vision and machine learning techniques to the analysis of MRI images has revolutionized the field of brain tumor detection. These technologies allow for the automated interpretation of MRI scans, facilitating the identification of potential tumor regions. Advanced algorithms can distinguish between healthy and abnormal brain tissue, streamlining the diagnostic process and reducing the reliance on manual interpretation by radiologists. Moreover, the integration of artificial intelligence in brain tumor detection holds the promise of improved accuracy, efficiency, and reproducibility in identifying and characterizing tumors. In this era of personalized medicine, these innovations have the potential to tailor treatments to individual patient needs, ultimately improving outcomes and quality of life. This introduction highlights the significance of brain tumor detection using MRI images and the transformative impact of technology in advancing the field. It underscores the critical role of automated analysis, paving the way for earlier diagnoses and more effective treatment strategies for patients with brain tumors. A series of physical and neurological examinations are performed to diagnose brain tumors. Diagnosis is made with MR (Magnetic Resonance) and CT (Computerized Tomography), and biopsy and pathological evaluation are performed to confirm the diagnosis. Among all these imaging modalities, MR is considered the most preferred because it is the only non-invasive and non-ionizing modality. Medical professionals can use a clinical decision support system to detect brain tumors, which has been developed over the model with increased accuracy.

• Data found on the Internet, previously labeled and made suitable for classification,

were used

3.Literature Survey :

Brain tumors can be located anywhere in the human brain and assume virtually any shape, size, or contrast (dissimilarity). It shows that ML-based solutions that can effectively and automatically classify and segment brain tumors are needed.Medical image segmentation is crucial for tumor analysis in MRI scans. Various techniques have been developed for tumor detection. Recent research findings are presented here, showcasing the use of Convolutional Neural Networks (ConvNets). Subhashis Banerjee's method involves layers like CONV2D, Pooling, and Fully-Connected to predict brain tumors. Sanjay Kumar employs Fully Convolutional Neural Networks (FCN) for precise segmentation and improved tumor characterization. Fatemeh Derikvand uses a mixture of Convolutional Neural Network architectures to leverage local and global brain tissue knowledge. G. Hemanth utilizes LinkNet, a light, deep network, for segmentation. These methods enhance tumor detection and description from MRI images.

Brain tumors exhibit diverse shapes, sizes, and contrasts, necessitating machine learning (ML) solutions for accurate classification and segmentation. This section explores ML-based, CNN-based, CapsNet-based, and ViT-based techniques. Classical ML algorithms such as SVMs, RFs, and k-NN are used either independently or in conjunction with other methods. Texture-based features, including GLCM, GLRLM, HOG, LBP, CDTM, and simplified texture spectrum features, have been employed to classify and segment brain tumors. Jena et al. proposed a two-stage approach, employing various ML algorithms for MRI image preprocessing, feature extraction, and classification. These techniques are anticipated to enhance the precision and consistency of medical diagnoses, holding promise for improved brain tumor detection and characterization.

- Data Set :

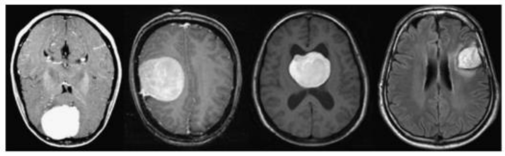


Fig. 5. Images with tumours.

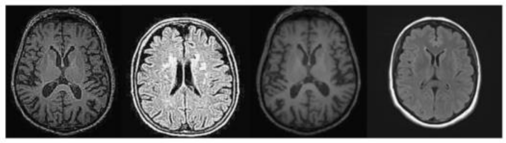


Fig. 6. Images with non-tumours.

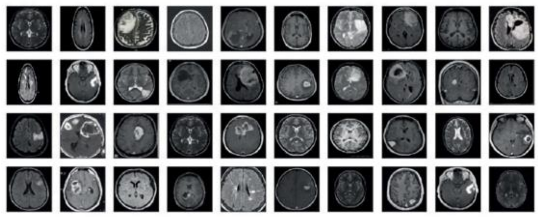


Figure 1. Sample MRI images.

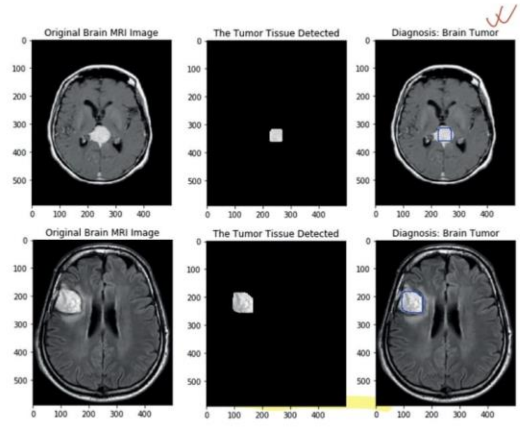


Figure 6. Detection of the 'Tumor' by the model.

In this research work , the Convolutional Neural Network (CNN) was implemented, which drives an overall accuracy of 91.3% and a recall of 88%, 81% and 99% in the detection of meningioma, glioma and pituitary tumor respectively. Deep learning architecture by leveraging 2D convolutional neural networks for the classification of the different types of brain tumor from MRI image slices. In this paper techniques like data acquisition, data preprocessing, pre –model, model optimization and hyper parameter tuning are applied. Moreover the 10-fold cross validation was performed on the complete dataset to check for the generalizability of the model. The method applied in this paper is based on Hough voting, a strategy that allows for fully automatic

localization and segmentation of the anatomies of interest . It also used learning techniques-based segmentation.
method which is robust, multi-region, flexible and can be easily adapted to different modalities. Different amount of training data and different data dimensionality (2D, 2.5D and 3D) are applied in predicting the final results.
Convolutional neural networks, Hough voting with CNN, Voxel-wise classification and Efficient patch-wise
evaluation through CNN are used in analyzing the image.

4.Motivation :

"Detecting brain tumors from MRI images saves lives. Early and accurate diagnosis empowers timely intervention, improving patient outcomes. Technology-driven approaches are enhancing diagnostic precision, offering hope for improved treatments and quality of life for those affected."

5. Objective:

The primary objective of this research is to develop and evaluate a robust and efficient system for brain tumor detection using MRI images. Specifically, our goals include:

1. Enhancing Early Detection: Develop methods to identify brain tumors at an early stage, facilitating prompt medical intervention and improving patient prognosis.

2. Leveraging Technology: Utilize computer vision, machine learning, and deep learning techniques to automate the detection process, reducing the reliance on manual interpretation.

3. Improving Accuracy: Achieve high accuracy in classifying brain tumor images, minimizing false positives and false negatives.

4. Streamlining Workflow: Create an efficient and user-friendly tool that can be integrated into clinical practice, optimizing the workflow of healthcare professionals.

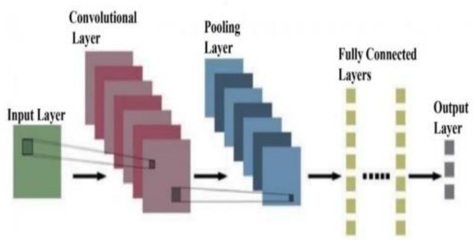
5. Enhancing Patient Care: Ultimately, contribute to improved patient care and outcomes by providing a reliable, non-invasive, and cost-effective method for brain tumor detection.

6.Methodology :

The two techniques ANN and CNN are applied on the brain tumor dataset and their performance on
classifying the image is analyzed. Steps followed in applying ANN on the brain tumor dataset are
1. Import the needed packages
2. Import the data folder
3. Read the images, provide the labels for the image (Set Image having Brain Tumor as 1 and image not
having brain tumor as 0) and store them in the Data Frame.
4. Change the size of images as 256x256 by reading the images one by one.
5. Normalize the image
6. Split the data set into train, validation and test sets
7. Create the model
8. Compile the model
9. Apply the model on the train set.
10. Evaluate the model by applying it on the test set.
The ANN model used here has seven layers. First layer is the flatten layer which converts the 256x256x3
images into single dimensional array. The next five layers are the dense layers having the activation function as relu
and number of neurons in each layers are 128,256,512,256 and 128 respectively. These five layers act as the hidden
layers and the last dense layer having the activation function is sigmoid is the output layer with 1 neuron
representing the two classes.
The model is compiled with the adam optimization technique and binary crossentropy loss function. The

model is generated and trained by providing the training images and the validation images. Once the model is trained, it is tested using the test image set. Next the same dataset is given to the CNN technique. Steps followed in applying CNN on the brain tumor dataset are :

11. Evaluate the model using the test images.
12. Plot the graph comparing the training and validation accuracy.
13. Draw the confusion matrix for actual output against the predicted output.



7.Result :

8.Conclusion :

A two-step approach for detecting brain tumor tissue was introduced in this process. The thresholding approach is combined with using a shape descriptor in this method. The thresholding algorithm groups picture pixels in the first phase, after which the image is binaries using a threshold value. Although tumor structures are formed in binary elements, they are frequently surrounded by healthy structures. The second step eliminates non-tumor tissues, only detecting those corresponding to the tumor. The CNN algorithm can be used to classify MRI images. It will improve the accuracy of brain tumor diagnosis.

CNN is considered as one of the best technique in analyzing the image dataset. The CNN makes the prediction by reducing the size the image without losing the information needed for making predictions. ANN model generated here produces 65.21% of testing accuracy and this can be increased by providing more image data. The same can be done by applying the image augmentation techniques and the analyzing the performance of the ANN and CNN can be done. The model developed here is generated based on the trail and error method. In future optimization techniques can be applied so as to decide the number of layers and filters that can used in a model. As of now for the given dataset the CNN proves to be the better technique in predicting the presence of brain tumor.

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