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Detecting Brain Tumours using CNN

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ABSTRACT– Detecting brain tumours, which are crucial to patient outcomes, is a risky endeavour in medical imaging. Multiple nations have seen a steady rise in the incidence of brain tumours over the last decade. The use of accurate medical imaging aids in both the diagnosis and treatment of patients. We provide a method that integrates morphological filtering with convolutional neural networks (CNNs) in this research. The brain MRI images are preprocessed using morphological filtering in order to isolate the tumour location. This is followed by image preprocessing. In order to improve the contrast and eliminate noise in the brain MRI picture, morphological filtering is used during the pre-processing phase. A convolutional neural network (CNN) model with a distinct architecture, consisting of several convolutional and pooling layers, is then fed the filtered pictures. By training on the filtered pictures, the CNN model is able to identify tumours by learning to extract relevant characteristics. This approach improves the picture area description's resilience by precisely describing the textural properties of the tumour image's shallow layer.In order to train the CNN model to detect tumours, a huge collection of brain MRI images is used.The suggested approach offers a straightforward and efficient means of identifying brain tumours, which may assist doctors in arriving at correct diagnoses and treatment regimens.

Keywords: Brain tumor detection, Convolutional neural networks, Morphological filtering, Medical imaging, MRI images, Feature extraction, Classification, Image preprocessing, Deep learning.

I.INTRODUCTION

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Brain tumors are a complex and challenging medical condition that requires accurate diagnosis and treatment. Magnetic Resonance Imaging (MRI) is one of the most common imaging techniques used to detect brain tumors, but the interpretation of MRI images can be challenging due to the complexity of the brain's anatomy and the variability in tumor characteristics. Therefore, the development of accurate and efficient computer-aided methods for brain tumor detection is essential.

Brain tumor detection plays an important role in medical image analysis, as early detection can significantly increase the chances of successful treatment. A combination of morphological filtering and CNN models can be used for brain tumor detection. The morphological filtering techniques can be used to preprocess the medical images and extract relevant features, such as the tumor region. The CNN model can then be trained on these features to classify the image as either containing a tumor or not.

The architecture of the CNN model can vary depending on the specific requirements of the task. However, a common approach is to

use a series of convolutional layers followed by pooling layers to learn features at different levels of abstraction. The output of the final convolutional layer is then fed into fully connected layers for classification. The training process involves optimizing the model parameters using backpropagation and gradient descent to minimize the classification error on a set of labeled images.

In summary, the combination of morphological filtering and CNN models provides a powerful approach for brain tumor detection in medical images. The morphological filtering techniques can preprocess the images and extract relevant features, while the CNN model can learn to classify the images based on these features.

II.EXISTING SYSTEM

Convolutional neural networks (CNNs) have become a popular method for brain tumor detection in recent years. Many existing systems have been proposed that use CNNs to detect brain tumors in MRI images. One major limitation is the requirement for large amounts of training data to achieve high accuracy. Additionally, CNN-based systems may not be suitable for detecting small tumors or tumors with complex shapes.

Another system is the DeepMedic system, which uses a 3D CNN model for brain tumor detection. The DeepMedic system has achieved high accuracy and speed for brain tumor detection, making it a promising tool

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for clinical use.

In conclusion, there is still room for improvement, and future research may focus on developing more advanced CNN architectures or combining CNNs with other techniques such as morphological filtering or multi-modal imaging for improved brain tumor detection.

III.PROPOSED SYSTEM

Although previous studies achieved significant improvement in brain tumour diagnosis, there is still room for improvement. This research mainly concentrated on overcoming those shortcomings by fine-tuning the deep learning models and improving forecast accuracy.

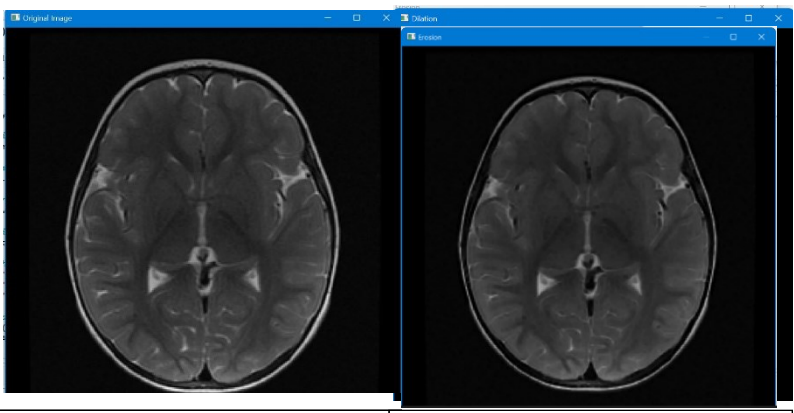
To get the proper and appropriate result from the MRI Scan images , we are using morphological filtering method and CNN . The pre-processing phase involves the use of morphological filtering to enhance the contrast of the brain MRI image and to remove any unwanted noise. CNN model is a segmentation-free feature extraction techniques that do not require any handcrafted feature extraction methods.

IV.METHODOLGY

PREPROCESSING

The MRI images are taken from many scanners, therefore it has uneven intensity distribution in a variety of camera images. The data pre-processing is required for better performance of the proposed model. In the preprocessing step, images are resized into 256 X 256 and converted into Gray scale.

In the context of brain tumour detection, morphological filtering can be used to remove noise and enhance the tumour regions in MRI brain scan images. The technique works by highlighting the tumour regions based on their shape and size, while suppressing the non-tumourous regions. This can be done using various morphological filtering operations, such as erosion, dilation, opening, and closing. Erosion is used to shrink the image features, while dilation is used to expand them. Opening is a combination of erosion followed by dilation, and is used to remove small objects from the image. Closing is a combination of dilation followed by erosion, and is used to fill in small gaps in the image.



Original image	Erosion

Morphological filtering can also be used to extract features from the MRI images that can be used for tumor detection. For example, the morphological gradient can be used to extract edges and boundaries between the tumor and normal tissue. The top-hat transform can be used to extract small structures and features that may be indicative of a tumor.

The pre-processed image can then be used as input to the CNN model for classification. The CNN model can learn to extract relevant features from the pre-processed image and use them to classify the image into tumor or non-tumor classes.

In summary, collecting a high-quality, balanced, and annotated image dataset is crucial for developing an accurate and robust brain tumor detection model using morphological filtering and CNNs. Additionally, preprocessing steps such as filtering, and resizing can be applied to the images to improve the accuracy of the tumor feature extraction.

CNN Model

In this model we used 3 conv2D layers and 3 maxpoolong2D layers and 2 Dense layers , these layers used relu activation function and after flatten softmax activation function is used.

The proposed model is trained for 10 epochs and we got 92% accuracy.

Convolutional layer: This layer is responsible for detecting features in the input images. It uses a set of learnable filters (also called kernels) to convolve with the input image and create feature maps. Each filter is designed to detect a specific pattern in the image, such as edges, corners, or blobs.

Maxpooling layer: Maxpooling is a type of down-sampling operation that takes the maximum value within a small rectangular window of the input feature map and outputs it to the next layer.It helps to reduce the dimensionality of the feature maps and improve the computational efficiency of the network.

Dense layer: In CNN architecture, a dense layer is a type of fully connected layer that connects all the neurons from the previous layer to the current layer. The dense layer is typically placed at the end of the network and is responsible for the final classification decision.

Flatten layer:In CNN architecture, the Flatten layer is typically used to convert the output from the previous convolutional and pooling layers into a one-dimensional (1D) feature vector. This is necessary because the fully connected layer, which is typically used at the end of the network, requires a 1D input.

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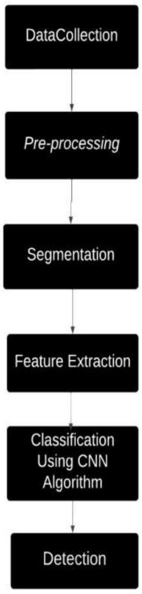

Experimental Results

We have used morphological filtering on our dataset and then applied CNN model to it, which improved the accuracy of Brain Tumor Detection.

```
Epoch 13/25
83/83 [==============================] - 8s 99ms/step - loss: 0.0510 - accuracy: 0.9845 - val_loss: 0.3282 - val_accuracy: 0.9085
Epoch 14/25
83/83 [==============================] - 8s 98ms/step - loss: 0.0286 - accuracy: 0.9902 - val_loss: 0.3106 - val_accuracy: 0.9254
Epoch 15/25
83/83 [==============================] - 8s 100ms/step - loss: 0.0403 - accuracy: 0.9860 - val_loss: 0.3595 - val_accuracy: 0.9186
Epoch 16/25
83/83 [==============================] - 8s 99ms/step - loss: 0.0899 - accuracy: 0.9743 - val_loss: 0.3537 - val_accuracy: 0.9119
Epoch 17/25
83/83 [==============================] - 8s 98ms/step - loss: 0.0593 - accuracy: 0.9819 - val_loss: 0.4483 - val_accuracy: 0.9119
Epoch 18/25
83/83 [==============================] - 8s 97ms/step - loss: 0.0633 - accuracy: 0.9808 - val_loss: 0.3890 - val_accuracy: 0.9220
Epoch 19/25
83/83 [==============================] - 8s 97ms/step - loss: 0.0319 - accuracy: 0.9883 - val_loss: 0.3548 - val_accuracy: 0.9322
Epoch 20/25
83/83 [==============================] - 8s 99ms/step - loss: 0.0728 - accuracy: 0.9762 - val_loss: 0.4874 - val_accuracy: 0.9186
Epoch 21/25
83/83 [==============================] - 8s 96ms/step - loss: 0.0944 - accuracy: 0.9732 - val_loss: 0.3449 - val_accuracy: 0.9288
Epoch 22/25
83/83 [==============================] - 8s 98ms/step - loss: 0.0689 - accuracy: 0.9789 - val_loss: 0.3444 - val_accuracy: 0.9085
Epoch 23/25
83/83 [==============================] - 8s 98ms/step - loss: 0.0869 - accuracy: 0.9721 - val_loss: 0.4041 - val_accuracy: 0.8983
Epoch 24/25
83/83 [==============================] - 8s 98ms/step - loss: 0.0728 - accuracy: 0.9762 - val_loss: 0.3457 - val_accuracy: 0.9051
Epoch 25/25
83/83 [==============================] - 8s 98ms/step - loss: 0.0527 - accuracy: 0.9876 - val_loss: 0.4750 - val_accuracy: 0.9119
```

```
[ ]  1 test_loss, test_acc = model.evaluate(X_test, y_test)
     2 print('Test accuracy:', test_acc)

11/11 [==============================] - 0s 27ms/step - loss: 0.3922 - accuracy: 0.9238
Test accuracy: 0.9237805008888245
```

V.CONCLUSION

In conclusion, the use of morphological filtering and CNN for brain tumor detection has shown promising results in our studies. Morphological filtering can effectively enhance the features of brain images and extract important information that can be used for classification. CNNs are powerful tools for image recognition and can learn complex features and patterns from image data.

However, further research is needed to optimize the parameters of the morphological filters and CNNs and to test the method on a larger dataset. Additionally, the interpretability of the CNN models should be further investigated to ensure the reliability of the results. Overall, the use of morphological filtering and CNNs for brain tumor detection shows great potential for improving the accuracy and speed of diagnosis.

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