BRAIN TUMOR DETECTION USING MACHINE LEARNING

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Abstract: With the requirement for automated, reliable, rapid, and efficient diagnostics that can deliver superior picture understanding than human eyes, medical imaging is growing. Brain tumours are the second highest cause of cancer mortality in males aged 20–39 and the first in women. Brain tumors hurt and may lead to many disorders if untreated. Tumor diagnosis is crucial to therapy. Identification helps diagnose benign and malignant cancers. Ignorance about early tumor therapy is a major cause of cancer's global growth. This research proposes a machine learning technique that uses brain MRI to write tumor information to the user. Image noise reduction, sharpening, basic morphological operations, erosion, and dilation create the backdrop. Age is derived by subtracting background and negative from distinct photos. Plotting the tumor's shape and c-label and boundaries may help us see and diagnose cases. This helps determine tumor size, shape, and location. It helps doctors and patients comprehend the tumor's severity using color-coding for elevation levels. A GUI for the tumor's outline and boundaries may educate medical professionals via user choice buttons.

Keywords: classification, convolutional neural network, feature extraction, machine learning, magnetic resonance imaging, segmentation, texture features.

I. INTRODUCTION

The many types of cells that make up the physical body. Every cell has a distinct purpose. The body's cells divide and expand in a predictable way to produce new cells. The human body depends on these new cells to be healthy and function correctly. Certain cells proliferate in an unorganized manner when they are unable to control their proliferation. The excess cells combine to produce a mass of tissue known as a tumor. The tumors may be cancerous or benign. Benign tumors are not cancerous, while malignant tumors cause cancer. The medical image data from various biomedical equipment that employ diverse imaging methods, such as x-ray, CT scan, and MRI, is an essential consideration in the diagnosis. The measurement of magnetic flux vectors, which are produced after the proper excitation of high magnetic fields and radiofrequency pulses in the nuclei of hydrogen atoms present in the water molecules of a patient's body, may be the basis for magnetic resonance imaging (MRI). Since the MRI scan doesn't include radiation, it is much more effective for diagnosis than the CT scan. With MRI, radiologists may assess the brain. Tumors inside the brain might be detected using the MRI method. Additionally, operator interference has resulted in noise in the MRI, which might lead to incorrect categorization. Because automated methods are less costly, they are necessary due to the vast amount of MRI data that has to be analyzed. Tumor diagnosis in MR imaging that is automated is crucial since managing human life demands a high degree of precision. Classifying a brain MR picture as normal or abnormal may be done using supervised and unsupervised machine learning algorithms. In this research, machine learning methods are used to present an effective automated brain MRI categorization method. The brain MR picture is classified using the supervised machine learning technique.

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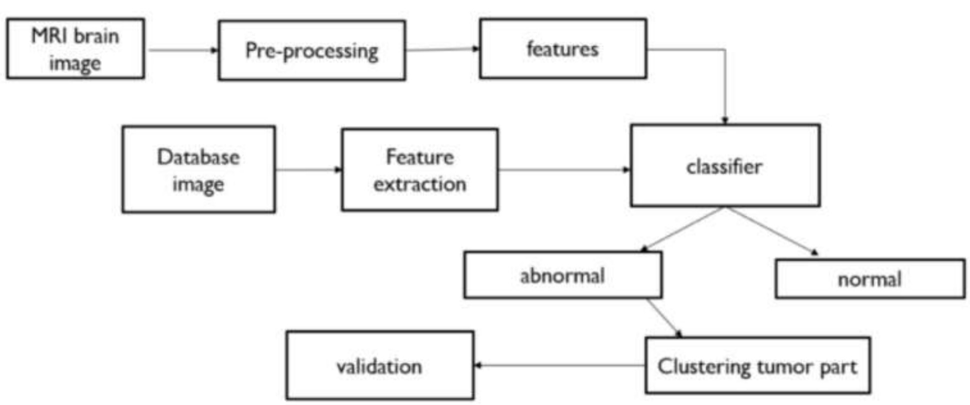
II. RELATED WORK

Joshi suggested techniques for detecting and classifying brain tumors in magnetic resonance imaging (MR) pictures by first removing the tumor's section from the image, then utilizing a gray level co-occurrence matrix (GLCM) to extract the tumor's textural properties, and then classifying the tumor using a neuro-fuzzy classifier. A modified fuzzy c-means (FCM) method was presented by Shasidhar for the identification of MRI brain tumors. After extracting the texture characteristics from the brain MR image, a modified FCM algorithm is used to identify brain tumors. The updated FCM algorithm yields average speed-ups of up to 80 times compared to the standard FCM method. An expedient substitute for the conventional FCM method is the modified FCM algorithm.

Rough set theory and a feed-forward neural network classifier were the methods Rajesh and Malar suggested for classifying brain MR images. Rough set theory is used to extract characteristics from magnetic resonance pictures. A feed forward neural network classifier that distinguishes between the normal and disordered brain uses the chosen characteristics as input, yielding an accuracy of about 90%. Based on image attributes and automated abnormality identification, Ramteke and Monali presented automatic brain MR image categorization into two classes: normal and abnormal. After obtaining the statistical texture feature set from both normal and pathological pictures, an image is classified using the KNN classifier. The KNN achieves a classification rate of 80%. Othman presented a probabilistic neural network method for classifying brain tumors. First, principal component analysis (PCA) is used to extract the features, and then probabilistic neural networks (PNNs) are used to conduct the classification. Jafari and Shafaghi presented a hybrid method based on support vector machines (SVM) for the identification of brain tumors in magnetic resonance imaging. The elements of texture and intensity are applied. More robust accuracy of around 83.22% is attained. Thus, based on a thorough review of the literature, we discovered that texture, symmetry, and intensity are characteristics used by the majority of the brain tumor detection systems in use today. Texture aspects are significant brain properties because the human visual system relies heavily on texture perception for detection and interpretation. In addition, we suggest using the ml method to get around the problems with conventional classifiers. In this paper, we examine the performance of a machine learning algorithm, namely CNN. Because they can learn intricate input-to-output mappings, neural networks are helpful. They can do much more difficult categorization jobs.

III. PROPOSED WORK

The literature review revealed that brain tumor detection automation is critical since human life is at stake and high accuracy is required. Feature extraction and categorization using a machine learning algorithm are required for the automated identification of malignancies in magnetic resonance imaging. This work proposes an automated tumor detection technique for magnetic resonance imaging, as seen in the picture.



Block Diagram

Image Acquisition

Brain MRI pictures were utilized as the image data for this challenge in order to identify brain tumors. It comprises of two classes' worth of mri scans:

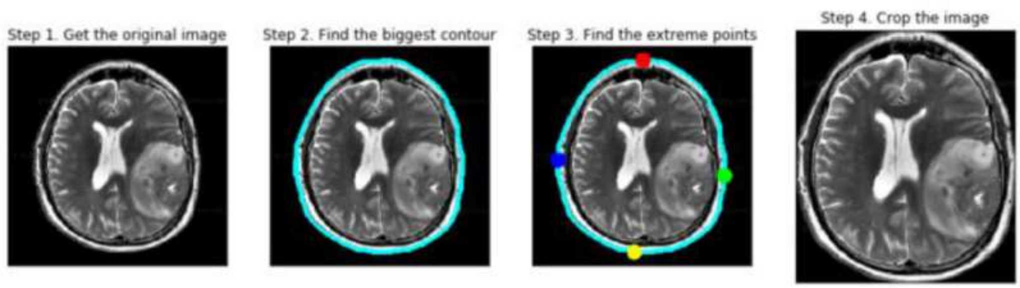
• Yes - tumor encoded as 1; • No - no tumor, encoded as 0

Every picture is housed in a single folder with both yes and no subfolders. The data will be divided into train, val, and test folders to facilitate working with photos of the same size.

The validation set is the set that the hyperparameters are adjusted on during model training.

• The test set is a tiny set that is completely untouchable throughout the training procedure. These are a few example pictures of both classes that were utilized for the final model performance assessment.

The pictures varied in terms of height, breadth, and "black corner" sizes. The vgg-16 input layer's picture size is (224,224), therefore scaling certain broad photos can make them seem strange. Removing the brain from the pictures would be the first step toward "normalization".



Normalised images

Pre-processing

Pre-processing is necessary since it improves the picture data and highlights many elements that are crucial for further processing.

The MR image is subjected to the following pre-processing steps: To remove noise from brain MR pictures, the RGB MR image is transformed to a grayscale image and the median filter is used. Since great precision is required for future processing, the noise must be eliminated. Then, as shown, edges are identified from a filtered picture by use of clever edge detection. The segmentation of the picture requires the edge-detected image. The goal of segmentation is to transform an image's representation into one that is simpler to examine.

Segmentation

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Feature Extraction

(a) picture-based features: these include characteristics such as texture, intensity, form, and histogram-based features that are extracted from the picture data;

(b) Coordinate-based features: these comprise coordinate features, spatial prior probabilities for structures or tissue types in the coordinate system, and local measures of anatomic variability within the coordinate system, extracted based on registration to a standard coordinate system; (c) Registration-based features: these are features extracted from one or more aligned templates based on known properties of the templates; these features may include image-based features at corresponding locations in the template, features based on labeled regions in the template, features derived from the warping field, and features derived from using the known line of symmetry in the template.

Classification

MR brain pictures are classified as normal or abnormal using machine learning methods. ML algorithms' primary goal is to automatically learn and make wise judgments. The following characteristics are used for classification:

(A) Feature processing: The extracted feature set may be improved to achieve higher classification accuracies prior to classification.

(b) classifier training: using the extracted features and pixels labeled as normal and abnormal, a model of classification is automatically learned to predict labels based on the features;

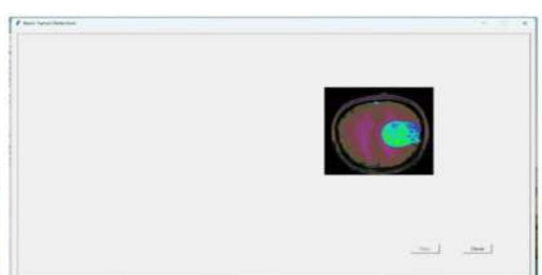
(c) Pixel classification: using the characteristics that were retrieved, the learnt classification model could then be used to predict the labels for pixels that had no assigned labels;

(d) relaxation: In order to improve the classification predictions and produce a final segmentation, the classification results may be relaxed by taking into consideration dependencies in the labels (i.e., Classification) of nearby pixels. This is because the learnt classification model may be noisy.

Just a little quantity of training data is needed for this CNN technique to predict the parameters required for classification. Less time is needed for categorization and training. By feeding data by levels, this may extract valuable properties from training weights and adjust CNN for the given job.

IV. EXPERIMENTAL RESULTS

As a statistic to support the model's performance, accuracy is defined by its sensitivity, specificity, and accuracy (ACC, SE, and SP). The working model's outcomes are shown below.



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V. CONCLUSION

Various medical photos, such as MRI brain cancer images, are acquired in this suggested effort in order to identify tumors. The multi-layer perceptron neural network is categorized by the suggested method for brain tumor detection, which supports convolution neural networks. The suggested method makes use of a combination of neural network techniques and includes pre-processing, training the system, implementing the tensor flow, and classifying data. We'll use a larger database in the future and investigate to provide higher accuracy that can be used to any kind of MRI brain tumor.

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