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A Review Paper on Brain Tumor Detection and Classification

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Abstract— nowadays, there is a great rise in disease called brain tumor. Now with such an enormous growth in it has become very important to make use of computer to make use of computer-based detection software to detect brain tumor and its types efficiently in less time. Nowadays magnetic resonance imaging (MRI) images. Is playing a very important role for detecting the types of tumors. From previous analysis it is being observed that Convolutional Neural Network (CNN) is been designed for the overall accuracy purpose with 97.5% accuracy. Likewise, accuracy is high and validation loss is very low [1]. The following contains five sections: introduction, methodology, literature review, and conclusion. In the study, we have discussed numerous sorts of approaches for identifying brain tumors.

Keywords- (Neural Networks, Magnetic resonance imaging, Data Wavelet Transforms)

1. INTRODUCTION

It is proof that if the tumor is accurately identified at an early stage, the chances of survival can be improved. When a tumor is surrounded by dense brain tissue, it is very challenging to detect these tumors in the brain. Due to human mistakes brought on by visual tiredness, visual recognition of these aberrant tissues may lead to incorrect volume and location diagnoses. In many diagnostic and therapeutic applications today, the automatic detection of brain tumors in MRI images is crucial. Early medical tumor identification research employed algorithms that directly applied established image processing techniques (such as region growth and edge recognition based on picture grey intensities) [6].The Brain is a Complex Organ of Body That Controls Thought, Memory, Emotion, Vision and Every Function Related to Human Body. Brain tumor is an uncontrolled division of cells which is being formed from abnormal group of cells. Further The Tumor is classified in two groups' Low grade and High grade. Low grade tumor consists of grade 1 and grade 2 which is also called as benign tumor, it stays in the primary location without affecting another part of the body. Benign tumor is non-cancerous Tumor. Other is malignant tumor which is high grade tumor having grade 3 and grade 4 tumor although malignant tumor is a dangerous tumor it is cancerous tumor it spread quickly in another region of the body [1] [2]. So now how to detect this ailment. However, this can be easily detected by photographing the brain. The imaging can be done with distinct Techniques Such as MRI magnetic resonance imaging, CT computer tomography. But as compared to another techniques MRI is more efficient as it provides more detailed information of the medical image and

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information about brain Structure [1]. Although Support vector machine (SVM) and Neural Networks are also used for better results Such as K-Nearest Neighbor (KNN) [1] [2].

2. METHODOLGY

The Basic Methodology for Brain tumor Detection through Images is Image Acquisition, Pre-processing, segmentation, Feature extraction, training, classification.

2.1 Image Acquisition

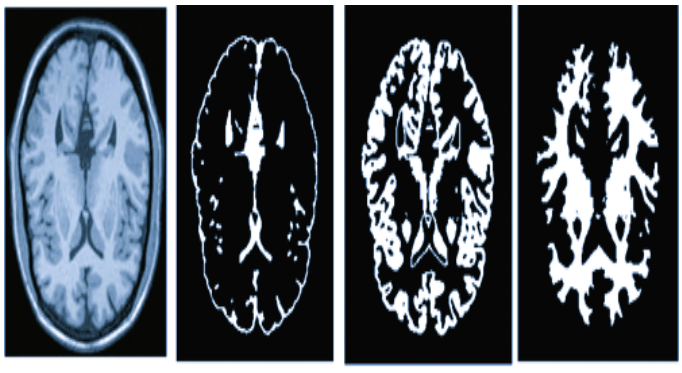
It is a process of collecting MRI Images of a patient (Datasets) from Any Online Platform. And can be separated into two categories and converted into the same dimension. If it is a grayscale image it will be displayed in default size if it is a color image then the image is defined in a large matrix.

2.2 Pre-processing

The elimination of noise and artifacts is essential in medical imaging because of its diagnostic and therapeutic uses. Particularly in MRI, patient motion during imaging and external noise are known sources of artifacts and other undesirable consequences. In automatic image analysis and brain tumor diagnosis, these represent the primary sources of computational errors. To undertake any picture analyses, it is therefore required to eliminate them during the preprocessing phase. The preprocessing stage in this work consists of image enhancement and image restoration [6].

2.3 Segmentation

The task of separating the grey matter, white matter, cerebrospinal fluid, and skull of normal brain tissue from tumor tissue in images is known as image segmentation. Fuzzy C-means, a method, is used to carry out this operation. The process requires dissecting an image into its individual pixels, which are subsequently displayed as a mask or tagged image [2] [5].



Input MRI CSF GM WM

Fig 1. Segmentation of Brain MRI [8]

2.4 Feature extraction

Extraction is a process of transforming the raw data into numerical features that can be processed while preserving the information in the real data set. [1] The segmented tumor is extracted using discrete wavelet transform (DWT). As it is having the advantage of extracting more relevant features.

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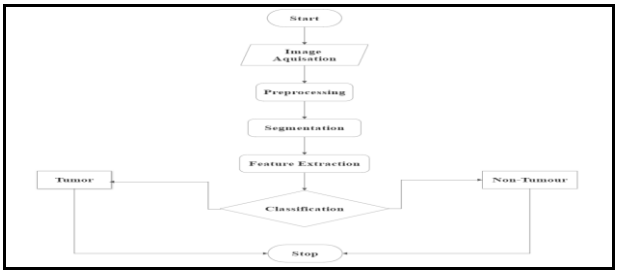
2.5 Classification

After All the Process Are Completed then image classification classifies from MRI Images. With the help of an Algorithm that is applied to the model. And detects whether the image consists tumor or not.



3.LITERATURE REVIEW

In [1] Brain Tumor Classification Using Convolutional Neural Networks from the Biomedical and Pharmacology Journal. To determine how effective the suggested model is, the training and validation accuracy and validation loss are determined. The authors experimented with it using the model-based classification method that is currently in use, support vector machine (SVM). It requires feature extraction output, on which the classification is made and accuracy is calculated. SVM-based tumor and non-tumor detection has a long computation time and poor accuracy. Further to increase accuracy in less time. They proposed the Convolutional Neural Network (CNN) as a deep learning model for categorization. The training accuracy for convolutional neural networks is 97.5%. Additionally, validation accuracy is excellent and validation loss is minimal.

In [2] Deep learning neural networks for brain tumor classification. The proposed methodology is based on a deep neural network (DNN), which has several layers between its input and output levels. Another DL architecture that is frequently used for regression or classification is DNN. The DNN process consists of the following steps: data collection, picture segmentation, feature extraction, and classification. This approach combines the discrete wavelet transform (DWT) with deep neural networks to classify brain MRI data into various malignant tumor kinds. This technique is distinguished using methods from the KNN Classifier, Linear Discriminant Analysis (LDA), and Sequential Minimal Optimization (SMO). 96.97% of the calculations were accurate. However, there was a huge disparity between the performance and complexity.

In [3] Brain Tumor detection using a machine learning model. The following methodologies are being followed Data Acquisition, Pre-processing, Image Smoothening, Feature Extraction, and finally Classification. Converting the images of different proportions into one proportion 224*224.The proposed technique was CNN. The machine learning-based CNN Model attain and accuracy of 97.79% after applying it to the training set. Attain accuracy of 82.86% after applying to validation set and the Data set consists of 253 Brain Images.

In [4] Hybrid Deep Learning Models for Multiple Tumor Classification from MRI of the Brain. Convolutional neural networks (CNN) and machine learning classifiers are used to classify brain tumors in a hybrid deep learning approach. A pre-trained InceptionV3 model using a transfer learning strategy is used to extract deep characteristics from brain pictures using two different types of CNN. Two deep CNN and two machine learning techniques (RF, SVM) are employed for the categorization of brain MRI data. For real-time performance, the InceptionV3 model requires specialized hardware. The CNN-RF model performs the best, providing 96.52% accuracy on the 3C data set. On a sizable Kaggle 4c data set, the CNN SVM Model provides accuracy of 95.41%.

In [5] the authors of this article presented a four-model CAD system based on the SMO classifier. The picture segmentation stage, the feature extraction and reduction stage, and the classification stage made up the four

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models' three primary steps. FCM and K-means are two of the approaches used in the image segmentation stage. GLCM and DWT are two of the techniques used in the feature extraction and selection stage, which is followed by PCA. The FCM+DWT+PCA+SMO model outperformed other models in the experiments for testing and evaluating the performance of the four models in terms of classification rate over the three performance tests: the entire training set test, the 85% percentage split, and K-fold Cross-Validation. Additionally, this model's average AUC of ROC in these performance tests was greater than 0.963, making it.

In [6] to discriminate between normal and pathological (benign or malignant) brain MRIs, the authors of this research created a unique neural network-based classifier. Preprocessing, Automatic seeded region developing segmentation, Connected Component Labelling, Feature Extraction, Feature Dimension Reduction, and Classification are the six stages of the suggested technique. For a better image for upcoming automated analysis, pretreatment approaches like enhancement and restoration are applied (An image is divided into useful parts during the segmentation stage using the automatic seeded region growth technique. The final step involves labelling each pixel with its associated component after all groups have been established. In the fourth stage, they used the discrete wavelet transform to retrieve the MRI image characteristics. The principal component analysis is used in the fifth stage to minimize the amount of MRI features. To categories subjects as normal or abnormal (benign or malignant), a supervised feed-forward back-propagation neural network approach is used. On 600 photos, of which 50 were normal, 250 were benign, and 300 were cancerous, they used this methodology. 100% sensitivity and 96% specificity were achieved in the categorization. Experimental findings show that the suggested strategy effectively divides human brains into normal and abnormal classes.

In [7] The authors of this research offer a novel approach for classifying magnetic resonance (MR) pictures of the human brain that uses wavelets as input to neural network self-organizing maps and support vector machines. The suggested technique labels MR brain pictures as normal or abnormal. Using a dataset of 52 MR brain imaging scans, we evaluated the suggested methodology. The neural network self-organizing maps (SOM) and support vector machine both produced good classification percentages of over 94% and 98%, respectively. They discovered that a support vector machine classifier had a higher classification rate than a self-organizing map-based method.

4. Conclusion

In the above given paper, we have proposed various techniques to detect brain tumor and its types. From the above discussion and analysis, we concluded that the CNN model of deep learning is more feasible and provide or generate more accurate result. Thus, the development of such a system plays a huge role as such systems are very much required for the accurate and efficient diagnosis of such diseases and health problems which are life threatening in nature. And also, in future work different methods can achieve more accuracy and efficiency.

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