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Optimization Accuracy of Brain Tumor Prediction using Machine Learning Technique

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ABSTRACT: - Brain is the regulatory unit in human body. It controls the functions such as memory, vision, hearing, knowledge, personality, problem solving, etc. The main reason for brain tumour is the abandoned progress of brain cells. Many health organizations have recognized brain tumour as the second foremost dispute that causes a large number of human deaths all around the world. Identification of brain tumour at a premature stage offers an opportunity of effective medical treatment. Use of Magnetic Resonance Imaging images have been recognized as more detailed and more consistent images when compared to Computed Tomography images. In this paper, brain tumor detection using K-nearest neighbor (K-NN), logistic regression (LR) and voting classifier (VC) machine learning (ML) technique are presented. The VC ML technique is providing good accuracy compared to other K-NN and LR technique..

KEYWORDS: - MRI Brain Image, Machine Learning, Accuracy

I. INTRODUCTION

A brain tumor occurs when abnormal cells form within the brain. Tumor has a tendency to repeat itself and spread over the region of the brain. Medical imaging technique, Magnetic resonance imaging (MRI) is one of the most commonly used techniques to identify and locate the tumor in the brain. Deep learning based approaches for analysis of brain MRI images for tumor detection is gaining interest due its self-learning ability. Deep learning is a robust and better approach in machine learning in many fields, such as medical image segmentation. It overcomes the inaccurate prediction of brain tumor done by humans. In this paper we have analyzed different deep learning techniques for brain tumor detection. In the model we used a Depth wise Separable convolution neural network algorithm which is better than a normal convolution neural network as it has more number of filters to detect the patterns in the magnetic resonance image, there is also less loss of data and it is based on streamlined architecture to build a lightweight deep neural network. It also has less computational time and has more accuracy than previously developed models.

The major challenge arises in detecting the brain tumor because of the tumor location, type, size, and shape variations [1]. The brain tumor diagnosis depends on the type and location of the tumor so that the doctors can predict the survival chances of the patients and make decisions for treatment that extent from surgery to radiotherapy and chemotherapy [2, 3]. Therefore, identifying and detecting the brain tumor at early stages helps plan the treatment and monitor the condition of patients. It plays a crucial part in enhancing the treatment and ensuring higher chances of survival. Different types of medical imaging and diagnostic techniques are used to obtain information related to tumors. Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) are methods for identifying normal and abnormal growing cells in the brain [4]. The Computed Tomography (CT) scan is used to diagnose the patient using an X-ray and the computer to create the brain images in the axial fragments [5, 6].

Magnetic resonance imaging creates 2D and 3D images of the body's internal organs without pain or needing surgery [7]. It is one of the most accurate methods for the early identification and diagnosis of cancer. However, determining the type of tumor with MRI is challenging, error-prone, and time-consuming, necessitating radiologists with extensive experience. Due to the variety of tumors, MRI images occasionally have no apparent features that would enable sound decision-making. Consequently the human cannot depend on manual diagnosis [8]. An accurate diagnosis helps the patient to receive adequate treatment and long-time survival. Furthermore, the brain tumor's under-diagnosis is risky because it lowers the effectiveness of treatment and chances of survival. Consequently, using artificial intelligence (AI) techniques has become necessary in the computer-aided diagnostic (CAD) system's ability to diagnose medical images like MRI scans. These techniques help doctors and radiologists make an accurate diagnosis while reducing burden [9].

II. MRI IMAGE

The sample MR images for the present experiment are drawn from BraTS 2018 dataset. They are used to train and test the proposed algorithm. There are two hundred thirty three patients with 6,128 brain MRI slices in the dataset. They contain three types of brain tumors: pituitary, glioma, and meningioma. These slices are acquired from the secondary sources. These slices were generated using a T1-weighted MRI sequence with 512×512 size pixels and are manually segmented by three expert radiologists to identify the tumor region. Each tumor has several slices, which are: 2026 slices for pituitary tumor, 1582 slices for meningioma, and 3020 slices for glioma.

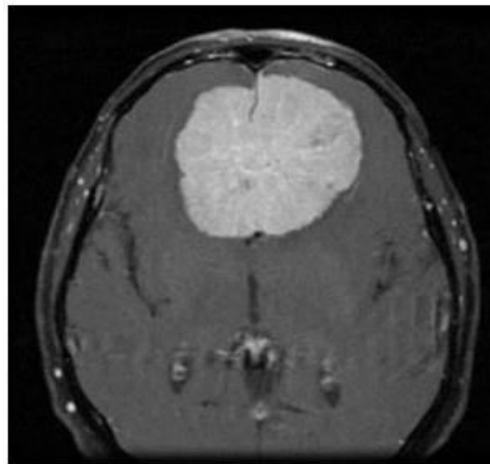


Fig. 1: A sample MR image with meningioma

The dataset is partitioned into two: the training set contains 6,128 slices, in which 1,860 are related to pituitary, 1,416 are related to meningioma, and 2,852 are related to glioma. The testing dataset contains 166 slices for pituitary, 166 slices for meningioma, and 168 slices for glioma tumors. The following are a few sample images drawn from the two datasets with the three types of tumors as mentioned above. Figure 1 is the first sample MR image with meningioma. It is known that meningiomas are the most common form of brain tumors. It is understood that about 80% of these cases are considered Grade 1, which can generally be cured by surgery.

Figure 2 is the second sample MR image with glioma. It is a common type of tumor originating in the brain. It is understood that about 33% of all brain tumors are gliomas. They originate in the glial cells that surround and support neurons in the brain.

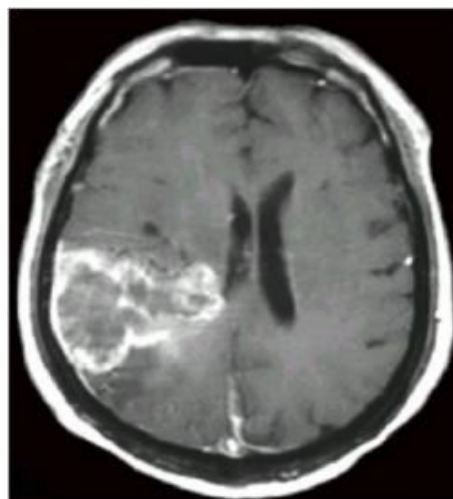


Fig. 2: A sample MR image with glioma

The pituitary is often called the ‘master gland’. It controls the secretion of most of the hormones in the body. A normal

pituitary gland weighs less than a gram. It is attached to the base of the brain and behind the nose. A large majority of pituitary tumors are benign. These tumors most commonly affect people in their 30s or 40s.

Figure 3 is the sample image with high-grade glioma. These are solid tumors and are highly malignant. They grow fast and frequently destroy healthy brain tissues. These high-grade gliomas in children and adolescents are rare. These have the potential of inducing the development of new tumors. The treatment is difficult due to their usually rapid and infiltrating growth.

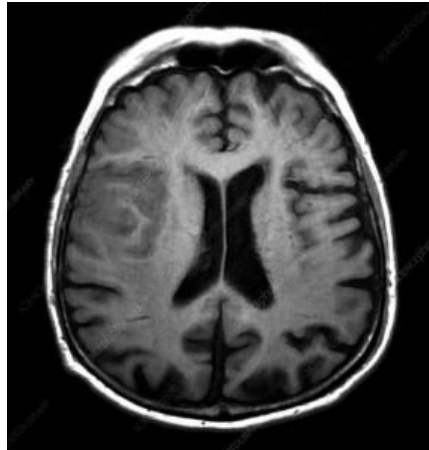


Fig. 3: A sample MR image with high-grade glioma

III. PROPOSED METHODOLOGY

The distribution in machine learning builds the module based on the training dataset with a classification algorithm. This learning can be categorized into all three possible classification algorithms. In a supervised learning class, labeled data is present at the beginning.

In semi-supervised learning, some of the class labels are known. Whereas in unsupervised learning no class label for the entire dataset.

Once the training phase is finished, features are extracted from the data based on term frequency, and then the classification technique is applied.

Step for Proposed Algorithm

- Step 1** Importing the libraries and packages
- Step 2** Initializing the parameters:
- Step 3** Reading the path of input files and initialize the output data
- Step 4** Pre-processing the heart disease data for giving them as the input to the model
- Step 5** Converting the heart and diabetic disease data to matrix form; flattening each heart disease data into an array vector
- Step 6** Assigning the labels to the heart and diabetic disease data classes
- Step 7** Rearranging the information to forestall overfitting and speculation of preparing
- Step 8** Isolating the train information and test information
- Step 9** Normalizing the heart and diabetic illness information
- Step 10** Characterizing a model and its individual layers
- Step 11** Ordering the model
- Step 12** Squeezing the information into the ordered model, i.e., preparing the model utilizing the at first characterized boundaries
- Step 13** Plotting the Accuracy bends of the preparation interaction
- Step 14** Print the Classification Report and Confusion Matrix of the preparation interaction

IV. SIMULATION RESULTS

Data collection

Collect data from fig share website containing four classes like no tumor, pituitary_tumor, meningioma_tumor, glioma_tumor, 2870 images with 512*512 height and width.

	File	DiseaseID	Disease Type
0	pituitary_tumor/p (27).jpg	0	pituitary_tumor
1	pituitary_tumor/p (175).jpg	0	pituitary_tumor
2	pituitary_tumor/p (260).jpg	0	pituitary_tumor
3	pituitary_tumor/p (125).jpg	0	pituitary_tumor
4	pituitary_tumor/p (384).jpg	0	pituitary_tumor

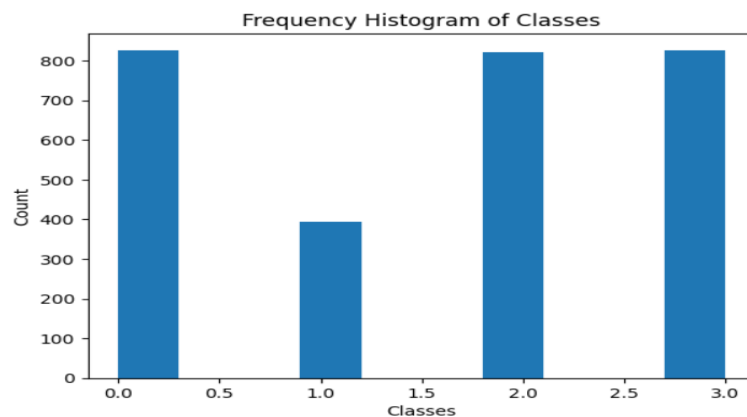


Fig. 4: Expleatory Data Analysis

Preprocessing

Resize and rescale images into 200*200 and convert into a numpy array

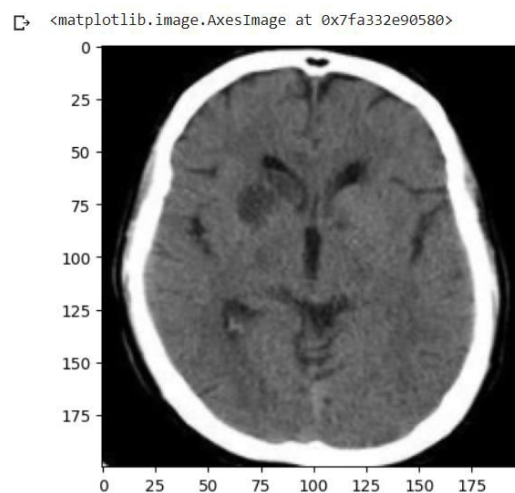


Fig. 5: Final processed image

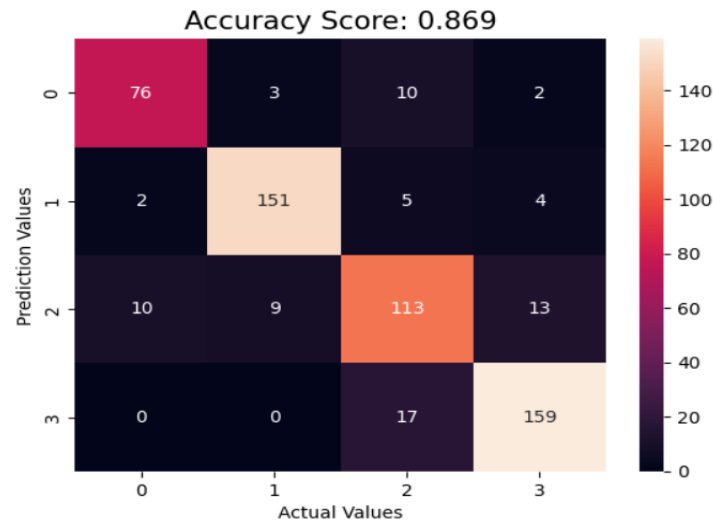


Fig. 6: Accuracy of Voting Classifier

V. CONCLUSION

Medical image processing gains popularity due to various types of disease detection, prediction and classification. The processing and evaluation of normal as well as abnormal images is the major objective of medical image processing which helps in diagnosing the tumor affected regions from brain image dataset. It enables the automated processing to challenging scenarios without human intervention. But how accurately and effectively it is diagnosing the tumor images, it depends on the techniques we are using in various phases of cancer recognition. The accurate brain tumor detection is still very demanding because of tumor appearance, variable size, shape, and structure. Although tumor segmentation methods have shown high potential in analyzing and detecting the tumor in MR images, still many improvements are required to accurately segment and classify the tumor region. Existing work has limitations and challenges for identifying substructures of tumor region and classification of healthy and unhealthy images.

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