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DETECTION OF BRAIN TUMOR USING DATA SCIENCE: A SURVEY

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Abstract— **Detection of Brain Tumor is considered as one of the most complicated processes in medical science. As brain tumor may be in various shapes and size it is very difficult to analyze it and detect it. Brain tumors grow from various types of cells and these cells can help us to know about the classification of a tumor and severity of a tumor. It may lie in different position on the brain and those positions indicate which type of cell is causing it, which is helpful information for the diagnosis later on. So, this task of brain tumor detection is difficult with the existing techniques. By observing raw images, it is very difficult to find out if it is having a Tumor or not, so any model made to make a prediction may have some limitations.**

This article proposes a novel method to detect brain tumors from various MRI images by deep learning method. It explains preprocessing techniques which are finalized for training and testing and observing their impact on our MRI images dataset. A dataset having different tumor shapes, sizes, textures, and locations is used to carry out experimentations, so that the good prediction can be achieved.

Keywords— **MRI, Brain Tumor Detection, Data Science, Classification, Training, Testing.**

I. INTRODUCTION

With the development of new technologies and new programming languages a new revolution in deep learning and machine learning has started many new ways to make new inventions and various algorithm to solve complicated problems with ease by training with training data set. It has been observed that performance and use of deep learning has helped many areas like, health, education and IoT based application. Particularly in the field of Biomedical applications these learning techniques are recently catching more attention of the researchers [1].

One of the very deadliest diseases in the modern world is a cancer. As we know brain is the vital part of human body which control all parts of body's functionalities. Brain tumor is considered as most deadly type of cancer. Due to excessive use of technology like mobile devices, tablets, network devices now brain tumor is seen among the kids and youngsters too [2]. There are many tests which are used to identify the brain tumor by Doctor CT scan (Computed Tomography), PET scan (Positron Emission Tomography), and MRI (Magnetic Resonance Imaging). But MRI is considered as one of the popular and it is widely used by the doctors to detect the brain tumor it is very efficient technique because it clearly differentiates between the brain structure and tissue on the basis of contrast levels of the scan images. Right now, in most of the cases this tumor is detected by manually and it is very time consuming to detect and segment the tumor for treatment for the surgical purpose. So, in this study we are going to implement it using machine learning technique to solve by providing brain tumor positive MRI scan image and negative MRI scan image in the train class to train the system by machine learning so that high accuracy can be achieved [3].

One of the techniques in machine learning is Deep Learning which has been used most widely for the last many years to make process of detection of brain tumor with accuracy in less time [4]. One of the drawbacks of deep learning is that it requires large collection of data set to train the system. Accuracy of this technique is depended on how good your training dataset is.

II. LITERARTURE REVIEW

The work of done by Karnan used an image processing technique using clustering algorithms to identify the images of MRI scan into the group that has a positive brain tumor and make another images group which does not have brain tumor. More than 40 MRI images were present in the dataset which was used in this research work . Fuzzy C Means as an image clustering algorithm was used by them and m FCM achieved a classification accuracy of 74% approximately [5].

Research done by Othman and Ariffanan for brain tumor detection have used The Probabilistic Neural Network which uses pattern classification techniques to solve the detection problem [6]. They have used dataset from University Teknologi, Malaysia. In this technique, matrices are created by using MRI images with the help of MATLAB and then PNN algorithm is used to classify the MRI images for the positive or negative brain tumor detection [7]. This system was found to have an accuracy of approximately 73%.

Yakub Bhanothu, Anandhanarayanan Kamalakannan & Govindaraj Rajamanickam discussed automatic brain tumor detecting and classifying system through deep learning and

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even they tried dividing various types of tumors namely glioma, meningioma and pituitary tumor [8]. To make faster implementation of R-CNN algorithm they used deep convolutional network. A desired Map was achieved for detecting the tumor using test dataset. This system was found to be quite reliable in terms of accuracy [9].

Work done by Shanaka Ramesh Gunasekara, H. N. T. K. Kaldera, and Maheshi B. Dissanayake shows that they used CNN algorithm and Chan-Vese algorithm for identifying meningioma and glioma brain tumor [10]. The model was validated with figshare dataset. Also, they compared the difference between the segmentation method and typical gradient method. The model was used to aid the classification methods for detecting the brain tumor [11].

Research done by Muhmmad Irfan Sharif, Jian Ping Li, Muhammad Attique Khan, Muhammad Asim Saleem used two approaches novel brain tumor segmentation and multiple brain modalities [12]. Softmax classifier was used to validate optimal features. The saliency map was very clear which resulted into more accuracy. Also, the fusion of DRLBP and CNN features helps to enhance the overall accuracy [13].

Rajat Mehrotra, M.A. Ansari, Rajeev Agrawal, R.S. Anand used transfer learning approach to detect the tumor from the MRI images [14]. Deep learning associated with pre-trained convolutional network was also used to classify the images. They claimed that their system outperformed very well, and it was validated through AlexNet [15].

III. PROPOSED SYSTEM

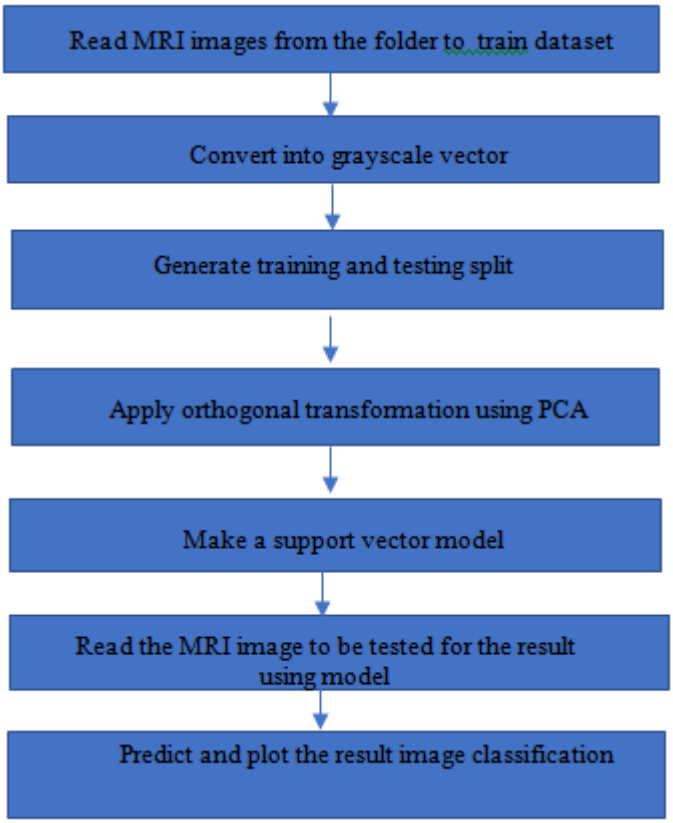

Fig. 1. Proposed System Flow

The proposed flow chart is as shown in figure 1. It shows the process of identification of tumor. At the Initial stage, the MRI images which is the defined data for the system is collected from the primary source and further the images are used for the training as training dataset. After, that the images are converted into grayscale vector through image processing technique. Then, training and testing dataset are bifurcated for further processing. Later, orthogonal transformation is applied using Principal Component Analysis. After that the support vector model is created which is used by the model to test the MRI input which is to be examined in order to identify the difference between infected brain and normal brain. In the last, the image is displayed along with the classification result in order to make the output more reliable and convenient.

IV. IMPLEMENTAION AND RESULT

We have used a method to segment MRI images of the brain to identify the brain tumor using machine learning and deep

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learning approach. This system trains the dataset of the MRI images which are having tumors and even do not have any tumor both. with possible maximum precision by using logistic regression and Support vector machine. We have tried to adopt a method which automated the procedure for diagnosing a brain tumor using machine learning. We can conclude from this research that yet no method including image processing, MLP are yet so perfect for the detection of the brain tumor automatically. Though we can achieve good result using machine learning if we have a proper labeled dataset. We can also conclude that our system may have accuracy in the range of 90% - 97%. However, we would also like to conclude that unwanted behavior of the dataset is not taken into consideration so MRI images dataset should be accurate to achieve accurate results for the brain tumor detection. Both the machine learning algorithms were quite efficient to detect the tumor part from the MRI images.

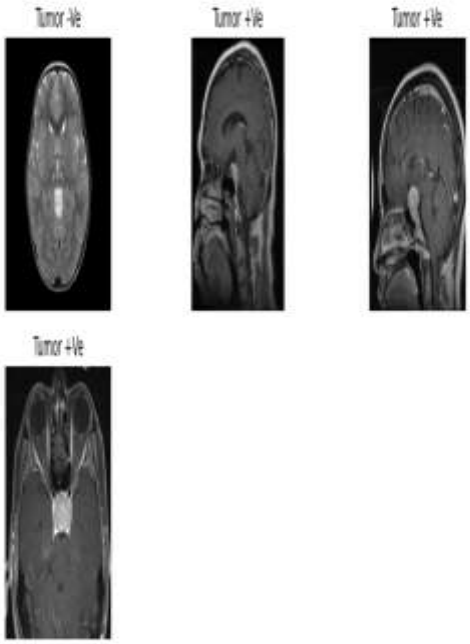

Fig. 2. MRI Images

The system delivers the standard output inform of the clear indication whether the MRI image has any symptoms of tumor or not, as shown in the figure 2, it says 'Tumor -ve' for normal MRI image and 'Tumor +ve' for infected brain. Also, it is possible that the Input i.e. the MRI images may be taken with different angles but it depends on the system and the model which has the ability to diagnose and bifurcate the image, which clearly depicts the robustness of machine learning model and its ability to work for each and every possible condition. The comparision graph is as shown in figure 3. It shows the comaprision between training accuracy versuse validation accuracy. The validation accuracy has values less than training accuracy on every stage.

Fig. 3. Training Accuracy Vs. Validation Accuracy

V. CONCLUSION

The survey of various brain detection system using data science and deep learning is done in this research article. The comparative analysis of training accuracy verses validation accuracy is done. The possibility of future research is also possible by selecting proper and more accurate dataset or modifying existing dataset by adding more images and train the system for modified dataset. Although the great advancement in the field of the brain tumor detection process using machine l earning and deep learning methods the robustness factor of this techniques are still a great hurdle for the expert performance of the system and accurate dataset and manual supervision is recommended for more accurate and précised system that will make the tedious process easy and more convenient for the health experts.

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