ScienceDirect

Advances in Engineering Software

Volume 173, November 2022, 103221

Research paper

Performance analysis of machine learning algorithm of detection and classification of brain tumor using computer vision

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https://doi.org/10.1016/j.advengsoft.2022.103221

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Abstract

Brain tumor is one of the undesirables, uncontrolled growth of cells in all age groups. Classification of tumors depends no its origin and degree of its aggressiveness, it also helps the physician for proper diagnosis and treatment plan. This research demonstrates the analysis of various state-of-art techniques in Machine Learning such as Logistic, Multilayer Perceptron, Decision Tree, Naive Bayes classifier and Support Vector Machine for classification of tumors as Benign and Malignant and the Discreet wavelet transform for feature extraction on the synthetic data that is available data on the internet source OASIS and ADNI. The research also reveals that the Logistic Regression and the Multilayer Perceptron gives the highest accuracy of 90%. It mimics the human reasoning that learns, memorizes and is capable of reasoning and performing parallel computations. In future many more AI techniques can be trained to classify the multimodal MRI Brain scan to more than two classes of tumors.

Introduction

Computer Aided Diagnosis (CAD) is one of the major contributions of technology implemented in the field of medical science for better precision and high accuracy. It is considered as a high throughput for the expediency to investigate the outgrowth expanse. The implementation of technology, diagnosis and treatment planning becomes easy and gives the physician a second taught of his predictions. The most dominant tool for imaging the brain is the Magnetic Resonance Imaging (MRI) which are multimodal, where in these modalities can reveal different parts in the tumor, and provides information concomitant to anatomical assemblies as well as potential anomalous tissues essential for diagnosis and treatment planning

[1,2]. The different sequences like the T1 weighted, T2 weighted, Fluid Attenuation Inversion Recovery (FLAIR) and Diffusion Weighted Imaging (DWI) show the different intensity variations that help in identifying the region of interest. Extracting reckonable data from MRI helps to capture the functions of different consequence crevices in case of different types of tumors. The possibility of survival of a patent is increased if the tumor is perceived at an early stage. However precise segmentation and categorization of abnormalities are not forthright. There exist a number of semiautomatic and fully automatic methods for the classification of tumors but clinical acceptance depends on simplicity and less human intervention. Classification of tumors in the human brain is possible by implementing the Supervised Machine Learning techniques, in this research we work upon the Naïve Bayes, The Logistic, Multilayer Perceptron (MLP), The Support Vector Machine (SVM) and the Decision Tree (DT) for classification and the results are compared on the basis of classification accuracy for the data used. Classification is performed with more discriminative features initially on the OASIS and ADNI [3,4] database

Yet there are some challenges to be addressed for classification of abnormalities in medical imagining like selection of appropriate model, describing the given data, finding the errors in the data, the adequacy of data used and confidence about the results. Therefore, there is no universal recognized method for medical image classification. So, it remains a challenging problem in computer vision and Machine learning. Fully automatic systems determine the tumor part without human intervention these systems generally include human intelligence and prior knowledge about the throughput. These algorithms which are mostly developed by using soft computing and model-based techniques prove to produce accurate results. The study of automatic brain tumor classification represents interesting research in Machine Learning and Artificial intelligence (AI)

The organization of this paper is as follows. In Section II, the existing scientific research in medical image classification is reviewed, along with the motivation for this research. Section III presents the materials and methods used in this work it describes the dataset implemented, it also shows the proposed work. Section IV, represents the experimental results obtained and finally the section V, elaborates the outcomes and conclusion.

Section snippets

Literature survey

The literature survey elaborates the details of research work studied in the domain to diagnose this life-threatening disease; it deals with the previous work carried out in the field of Tumor recognition and classification implementing computer vision and Machine learning. The initial papers describe the review of some of the best segmentation techniques using image processing followed by research based on automatic segmentation and classification techniques by building neural network and…

Pre-processing

In image analysis Pre-processing plays an important role it enhances the image to identifying the region of interest. Prior to the processing of the image for the desired task, preprocessing is an important phase where the undesired data is suppressed and the image is made ready for further analysis. The MR images

are degraded by distortion during the image digitization and transmission process. The bias field distortion alters the image which causes variations in intensity when captured at…

Result of Naïve Bayes classifier

The results of Naïve Bayes classifier with respect to 10-fold cross validation on a set of 100 MRI scans is given in Table2 and the same is plotted in Fig.1. The mean absolute error and the root mean square error are tabulated in Table3 and plotted in Fig.2. The details of accuracy rate are tabulated in Table4 and plotted in Fig.3 these indicates the true positive rate, false positive, precision and recall, Table5 gives the classification instances and the same are illustrates in Fig.4, …

Conclusion of the research

This research shows the state-of-art methods for classification of the tumor as cancerous and non-cancerous (Benign and Malignant). The advantage here is that it does not need any prior information about the probability distribution of different classes. Logistic and MLP are the branches of Machine learning that learns, and performing parallel computations. The most advantageous part in applying ML model is that the result of the system does not depends on the dataset and the structure of the…

Declaration of Competing Interest

The authors declare that we have no conflict of interest.…

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