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A Machine Learning-Based Approach for Efficient Brain Tumour Classifications

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ABSTRACT

This journal paper deals with data-Mining striving as emerging technique which plays the vital role in digging out the significant appropriate information from the vast stream of data collection. The present research focusses on the diagnosis of the brain tumours and the predictions of disease distinguishing the healthy individuals and the patients. To accomplish this predictions, machine learning algorithm Multinomial-Naive-Bayes algorithm in the classification technique to prediction of the results in relevance with the brain tumors disease. The proposed research consists of Collection of dataset, pre-processing technique, Feature-selection method, and organisation of the data in the normalised form, classification implementation and in the generation of the predicted results. These depicted results were subjected to the comparative analysis of the existing previous predictive models with the present proposed work which is superior to them.

KEYWORDS

Correlation, Machine-Learning, Accuracy, Brain Tumours Classifications, Diagnosis, Data-set

INTRODUCTION

Medical research has focused on improving diagnosis through medical imaging in recent decades. Computer-assisted diagnosis (CAD) systems have been developed to help doctors identify suspicious areas of interest, particularly those with cancer-like characteristics (Guerroudji et al., 2023). CAD systems employ various algorithms and techniques to extract important numerical measurements from medical images that clinicians can use to evaluate patient conditions (Guerroudji et al., 2023).

The commonly known human identity management methods are premised on ownership (such as identity and smart cards) and acquaintance (such as personal identification number (PIN) and password). The ownership methods are prone to theft, counterfeiting, right violation forgetfulness, among others (Iwasokun et al., 2022).

The rapid advancement of technology has spurred a significant shift towards digitalisation, impacting various aspects of our daily routines (Albakjaji & Almarzouqi, 2024; Iyamu, 2020). Currently, there is a great focus on technology, which has generated many challenges (Ghazi & Alsamara, 2023; Khater, 2023). One of these challenges is AI, which is considered a new strategy of digital transformation (Azar et al., 2023).

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Indeed, handling an information stream is a basic report for a streaming application. There were numerous strategies which helped during big data streaming, however, it can't deal with the tremendous amount of information (Arunadevi & Thulasiraaman, 2022).

The vast development of health-relevant data has shown unprecedented options for enhancing patient's health. A brain-related disease is the primary reason for the rate of mortality in countries like India and the United Kingdom. The data mining medical approach would provide a user-oriented approach to the new patterns of data and invisible data patterns. Diagnosis in the medical field would be considered as complicated actions which need the efficient and powerful prediction of patient data. In accordance with the improvisation of the data mining techniques, various machine learning algorithms were employed in the prediction process. The machine learning process indulges the discovery of emerging trends in healthcare firms. With the aid of a machine learning process, research from different perspectives was conducted among healthy individuals and brain tumour disease individuals.

In other words, following the great success of convolutional neural networks (CNNs) in classification and image recognition, we used a deep learning method to study the problem of meteorological classification. In the literature, a CNN has been used to classify time into two classes, for example, 'cloudy' and 'sunny'. In addition, other work allows the prediction of the ambient temperature, the season, the month, the week and the day from a given image based on the VGG architecture. The data repository from where the data were retrieved was in the existing medical data sets. This machine learning technology has accelerated the exploration of knowledge (distinguished dimensions and the pattern evaluation of the data) in the detection of associations between the medically related factors interconnected to brain tumour disease complications. Hence, this approach makes the prediction to spare time and enhance the diagnosis of the disease in a precise manner and reduce brain tumour occurrences in humans. This would promote rectifying the hidden causes, thus involving the efficient diagnosis of the inaccuracies and uncertainties.

Therefore, in this study, one of the classification algorithms, the Multinomial-Naive-Bayes (MNB) algorithm, was employed as the predictive model in the diagnosis process. The overall results reveal the predictions of the healthy person's data and the disease-affected person's data classified as abnormal records. This study also emphasises the performance analysis of the proposed model in terms of accuracy factor, sensitivity factor, AUC factor, MCC factor and the specificity factor. These predictions were subjected to the performance metrics analysis of the existing predictive models, logistic regression model, k-Nearest Neighbour design model, support vector machine model, artificial neural networks system, Decision Tree model, Random Forest design model and Naive-Bayes predictive model with the currently proposed model.

The summative performance of the proposed work was found to be highly efficient in terms of all the above factors, highlighted in the accuracy level as well. Hence, the intention of the work relied on the growth of the healthcare system and providing the best healthcare benefits to the patients, reducing the cost and money in the diagnosis and treatment phases.

Arabasadi et al. (2017) proposed a high-level hybrid methodology in coronary-artery disease diagnosis. Further to the study, this proposed work is eligible to uplift the neural network performance to 10 percent by the implementation of generic algorithm (GA). Similarly, in Haq et al. (2019), another effective machine learning algorithm-based brain tumour disease prediction operational system was employed. In this methodology, the SBS sequential backward selection algorithm was presented to select the features to attain a better accuracy level of KNN.

Likewise, another system (Ali et al. 2019), referred to as the intelligent X^2-deep neural network (DNN) system, was developed to enhance the classification and prediction techniques in terms of accuracy in HDD-brain tumour disease diagnosis. It, again, demonstrates the influence of the neural network depth in the accuracy factor. As in the performance analysis of the various models, the study by Kannan & Vasanthi (2019) focuses on the evaluation and accuracy comparisons of four various machine learning approaches by the ROS receiver operating characteristic.