IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⫶ Peer-reviewed & Refereed journal ⫶ Vol. 13, Issue 3, March 2024

DOI: 10.17148/IJARCCE.2024.13350

BRAIN STROKE PREDICTION USING ENSEMBLE LEARNING

Nandu Krishna G[1], Neha Mashoora[2], Nisar Ahamed P[3], Dr.Amirthavalli. M[4]

Student, Dept. of Artificial Intelligence and Machine learning, Mangalore Institute of Technology & Engineering, Moodbidri, Karnataka, India[1,2,3]

Professor, Dept. of Artificial Intelligence and Machine learning, Mangalore Institute of Technology & Engineering, Moodbidri, Karnataka, India[4]

Abstract: Brain stroke prediction is a critical task in healthcare, as early detection can significantly improve patient outcomes. In this study, we propose an ensemble learning framework for brain stroke prediction using convolutional neural networks (CNNs) and pretrained deep learning models, specifically ResNet50 and DenseNet121. The ensemble model combines the strengths of these architectures to enhance predictive performance. Firstly, the CNN extracts relevant features from brain imaging data. Then, ResNet50 and DenseNet121, renowned for their efficacy in image classification tasks, further refine these features through deep learning-based feature extraction. The ensemble model integrates the predictions from these individual models to make a final prediction.

Keywords: Ensemble learning, Classification, CNN, Resnet50, DenseNet121

I. INTRODUCTION

Brain stroke, also known as cerebrovascular accident (CVA), is a leading cause of mortality and morbidity worldwide, accounting for a significant burden on healthcare systems and societal well-being. Prompt detection and intervention are crucial to mitigate the devastating consequences of stroke, which can include permanent disability or even death. However, accurately predicting the onset of a stroke remains a challenging task due to its multifactorial nature and complex interplay of risk factors.

The major challenges in the face recognition and detection includes;

(i)Complex Interplay of Risk Factors: Brain stroke can be influenced by a multitude of risk factors, including hypertension, diabetes, obesity, smoking, and genetics, among others.

(ii) Heterogeneity of Stroke Subtypes: Stroke can manifest in different subtypes, including ischemic stroke, hemorrhagic stroke transient ischemic attack

(iii) Temporal Dynamics and Progression: Stroke risk may vary over time, with certain risk factors evolving or becoming more pronounced as individuals age or experience changes in health status.

(iv) Dimensionality and Feature Selection: Stroke prediction models often rely on a wide array of features, including demographic, clinical, genetic, and imaging data. However, selecting the most informative features while avoiding overfitting and dimensionality issues remains a non-trivial task.

II. LITERATURE SURVEY

In[1] **A Brain Stroke Detection Model using soft voting based ensemble machine learning classifier(A.Srinivas,Joseph Prakash,2023)**

In their study titled "A Brain Stroke Detection Model using Soft Voting-Based Ensemble Machine Learning Classifier" (A. Srinivas, Joseph Prakash, 2023), the authors propose an approach to improve brain stroke detection accuracy. Their method employs a soft voting-based ensemble machine learning BRAIN STROKE PREDICTION Dept.of AI&MLMITE,Moodabidri. Page 6 classifier, combining predictions from multiple models for enhanced performance. While showing promise, the study identifies areas for improvement. These may include refining ensemble techniques, optimizing feature selection, exploring advanced deep learning architectures, and suggesting avenues for future research, such as improving clinical relevance and real-time implementation

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In[2] **Performance Analysis of Machine Learning Approaches in Stroke Prediction(Minhaz Uddin Emon, Maria Sultana Keya, Tamara Islam Meghla,2020) [2] :**

In their 2020 paper titled "Performance Analysis of Machine Learning Approaches in Stroke Prediction," Minhaz Uddin Emon, Maria Sultana Keya, and Tamara Islam Meghla proposed a methodology to assess various machine learning methods for stroke prediction. They likely selected relevant datasets, extracted pertinent features, and trained predictive models using a range of algorithms. Through rigorous evaluation, they identified the strengths and weaknesses of each approach. While their study likely indicated potential areas for improvement, such as exploring novel feature engineering techniques or optimizing model hyperparameters, further validation on larger datasets and exploration of ensemble methods could enhance the robustness of their findings.

In[3] **Stroke Risk Prediction with Machine Learning Techniques.(Elias Dritsas and and Maria Trigka,2022) [3]**
"Stroke Risk Prediction with Machine Learning Techniques," Elias Dritsas and Maria Trigka propose a methodology for predicting stroke risk using machine learning. Their approach likely involves leveraging diverse datasets and employing various algorithms like logistic regression or decision trees for model construction. To improve this methodology, the authors could refine feature selection, explore advanced algorithm

In[4] **Early Stroke Prediction Methods for Prevention of Strokes.(Mandeep Kaur, Sachin R. Sakhare, Kirti Wanjale and Farzana Akter,2022)[4]**
In the paper "Early Stroke Prediction Methods for Prevention of Strokes" by Mandeep Kaur, Sachin R. Sakhare, Kirti Wanjale, and Farzana Akter (2022), the authors propose methodologies aimed at developing early stroke prediction methods for preventive interventions. The approach likely involves leveraging various risk factors and clinical markers to build predictive models, potentially employing machine learning algorithms. However, scope for improvement likely exists, including enhancing predictive accuracy by incorporating additional features or exploring advanced BRAIN STROKE PREDICTION Dept.of AI&MLMITE,Moodabidri. Page 7 techniques, as well as streamlining data collection processes and improving model interpretability.

In[5] **Stroke Disease Detection and Prediction Using Robust Learning Approaches.(Tahia Tazin, Md Nur Alam, Nahian Nakiba Dola, Mohammad Sajibul Bari, 2021)[5]**
In their paper titled "Stroke Disease Detection and Prediction Using Robust Learning Approaches," authored by Tahia Tazin, Md Nur Alam, Nahian Nakiba Dola, and Mohammad Sajibul Bari in 2021, the proposed methodology employs robust learning approaches for stroke detection and prediction. Likely involving machine learning and possibly deep learning techniques, the methodology encompasses data preprocessing, feature extraction, model training, and evaluation. Identified areas for improvement may include data augmentation, feature engineering, model interpretability, optimization, and clinical validation. Addressing these areas could enhance the methodology's effectiveness in improving stroke prediction accuracy and aiding clinical decision-making.

III. SCOPE AND METHODOLOGY

Aim of the project
The aim of a major project on brain stroke prediction is to develop accurate and reliable machine learning models capable of detecting the likelihood of an individual experiencing a stroke. These models aim to facilitate early detection and diagnosis of strokes, enabling timely medical interventions and improving patient outcomes.

Existing system
The existing system for brain stroke prediction typically relies on traditional risk assessment methods and clinical evaluation, which may not fully capture subtle indicators of stroke risk.Proposed system As a result, there is a growing need for more accurate and efficient predictive models leveraging advanced machine learning techniques to enhance stroke risk assessment and improve patient outcomes.

Proposed System
The proposed system for the brain stroke DL project aims to revolutionize early detection and intervention for stroke patients. Utilizing advanced deep learning algorithms, the system will analyze medical data including brain scans, patient history, and vital signs to identify subtle indicators of stroke risk. Through continuous monitoring, the system will provide real-time alerts to healthcare providers, enabling prompt intervention and potentially life-saving treatment. Additionally, the system will employ predictive analytics to forecast stroke probabilities for individual patients, allowing for personalized preventative measures. Seamless integration with existing healthcare infrastructure will ensure widespread adoption and accessibility of the system, maximizing its impact on stroke prevention and management. Overall, the proposed system holds the potential to significantly improve patient outcomes and reduce the burden of stroke-related disabilities.

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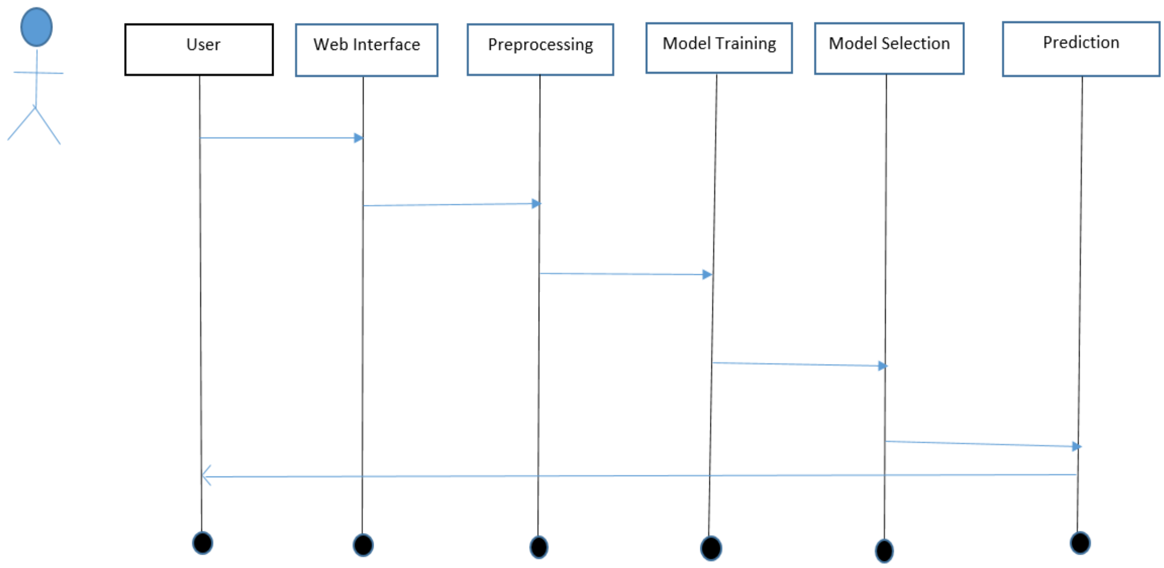
IV. DESIGN AND IMPLEMENTATION

In the design phase of a brain stroke prediction ML project, the first step involves defining the project's objectives and scope, such as whether it aims to predict strokes in a general population or specific demographics. Next, data collection strategies must be devised, considering factors like the types of data needed (e.g., medical records, imaging scans), data sources, and potential biases Model selection involves choosing appropriate algorithms for prediction tasks, considering factors like interpretability, scalability, and performance metrics. Lastly, the project design should include plans for model evaluation, validation techniques, and deployment strategies to ensure the model's effectiveness and ethical considerations.Speech Recognition System Architecture

A sequence diagram is a graphical representation of an interaction between objects in a software system. It is used to describe the flow of messages that occur between objects during a particular interaction. These diagrams are part of the Unified Modeling Language (UML) and are commonly used in software design and development.

In a sequence diagram, objects are represented by vertical lines called lifelines. These lifelines represent the lifespan of an object and are arranged from top to bottom focused on the time of their creation. The messages between objects are shown as horizontal arrows between the lifelines.



The sequence diagram for a brain stroke prediction ML project illustrates the sequential flow of activities involved in the prediction process. It begins with the data collection phase, where medical records and imaging scans are gathered from various sources. Once collected, the data undergoes preprocessing steps such as cleaning and feature extraction to prepare it for model training.

The preprocessed data is then used to train the machine learning model, during which patterns and relationships between input features and stroke occurrences are learned. Following model training, the model's performance is evaluated using a separate set of labeled data to assess its accuracy. Once validated, the trained model can be deployed for making predictions on new, unseen data, effectively assessing the risk of stroke based on input features. Optionally, a feedback loop may be incorporated to refine the model further based on prediction results.

V. CONCLUSION

Our machine learning model demonstrates promising accuracy in predicting the likelihood of brain strokes, offering valuable insights for early intervention and prevention strategies. By leveraging advanced computational techniques, we aim to significantly reduce the burden of stroke-related morbidity and mortality, ushering in a new era of proactive healthcare management.

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