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MACHINE LEARNING BASED PREDICTION OF AUTISM SPECTRUM CONDITION

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Abstract- The complicated neurodevelopmental disorder known as autism spectrum disorder (ASD) has a profound effect on the lives of those who are affected as well as their family. Improving results and offering specialized support require early diagnosis and intervention. Machine learning methods, in particular logistic regression, have demonstrated potential to support ASD early detection. This study explores the use of logistic regression as an ASD prediction method. Logistic regression is used to assess and model the data using a broad dataset that includes a range of clinical and behavioral traits, including social and communication abilities, repeated habits, and sensory sensitivity. Building a strong model to predict ASD and identifying important predictors are the main goals. Our results show that, depending on an individual's distinctive traits, logistic regression can accurately predict the risk that they will have ASD. We obtain a predictive model with high sensitivity, specificity, and accuracy by methodically optimizing the model, which includes feature selection and hyperparameter tweaking. This model is a priceless tool for early detection and intervention in people at risk of autism spectrum disorder and has great potential for use by clinicians, educators, and researchers. We carefully optimize the model, which involves feature selection and hyperparameter tinkering, to produce a predictive model with high sensitivity, specificity, and accuracy. This model has enormous potential for use by clinicians, educators, and researchers and is an invaluable tool for early detection and intervention in those at risk of autism spectrum disorder.

Keywords: Autism spectrum Disorder (ASD), social and communication skills, repetitive behavior, sensory sensitivities.

.1. INTRODUCTION

A complex neurodevelopmental disorder known as autism spectrum disorder (ASD) is typified by a variety of social, communicative, and behavioral difficulties. Early identification and diagnosis of ASD is crucial because it allows for prompt support and intervention for those who are affected. But as things are right now, the diagnosis of ASD is mostly dependent on the clinical evaluation of specialists, which can be expensive and time-consuming. As a result, there is increasing interest in using machine learning approaches to make more accurate and efficient ASD predictions. This introduction attempts to clarify the nature of the study, identify the challenge, and list the goals of a project report that employs machine learning to detect ASD. Millions of people worldwide are impacted by ASD, and its occurrence has been gradually rising. Clinical professionals often use standardized assessments and observations to diagnose ASD. On the other hand, this approach might be subjective and result in delayed or incorrect diagnoses. One prospective way to improve the precision and effectiveness of ASD prediction is through the application of machine

learning, a branch of artificial intelligence. Machine learning is able to detect patterns and signs linked to ASD by utilizing massive datasets, complex algorithms, and sophisticated data analysis approaches. This helps with early diagnosis and intervention. The purpose of this project report is to create predictive models for ASD by utilizing machine learning. Through the use of a variety of data sources, like as behavioral evaluations, medical records, genetic data, and more, our goal is to develop a comprehensive system that can reliably and effectively identify possible cases of ASD. The goal of this initiative is to close the gap between clinical evaluation and data-driven forecasting, which in the end helps with ASD early identification and better treatment.

This project's scope includes many facets of machine learning-based ASD prediction. It includes gathering, pre-processing, and integrating data from many sources, creating prediction models, and validating and assessing such models. The project also tackles ethical issues with data security and privacy, as well as machine learning model interpretability. The research also takes into account how feasible and scalable it would be to use the predictive system in actual clinical settings.

2. LITERATURE SURVEY

2.1. [Retracted] Prediction and Analysis of Autism Spectrum Disorder Using Machine Learning Techniques: 1Muhammad Bilal Qureshi,2Junaid Asghar,3Fatima Alam,4and Ayman Aljarbouh: The autism spectrum disorder prediction model is essential for anticipating autism and aids in prompt diagnosis. In this study, we examined various machine learning approaches in prediction models for autism spectrum disorders. In theory, these methods have been assessed and demonstrated so that a novice researcher can begin working with just one board. It is possible to quickly identify the similarities and differences between different prediction models in terms of architecture and implementation by comparing them in depth using common parameters. Our thorough analysis distinguishes this study from other approaches to autism spectrum disorders. In this study, only prediction methods for autism spectrum disorders were combined.

2.2. Analysis and Detection of Autism Spectrum Disorder Using Machine Learning Techniques Suman Raja, Sarfaraz Masood. This study aimed to detect autism spectrum disorder using a variety of machine learning and deep learning techniques. A range of performance evaluation metrics were employed to assess the effectiveness of the models implemented for ASD detection on a non-clinical dataset from three sets of age groups: children, adolescents, and adults. A comparison of the results with a previous study [3] on the same problem revealed that, after handling missing values, both the SVM and CNN based models show the same accuracy of prediction of approximately 98.30% for the ASD Child dataset

2.3. Predicting Autism Spectrum Disorder Using Machine Learning Classifiers NIGROU Nouhaila. In order to enhance early diagnosis, our study focused on using machine learning algorithms to predict autism spectrum disorder. Specifically, we explored models like Logistic Regression, Random Forest, MLP, and Boost. Support Vector Machine (SVM), which has the highest accuracy at 92%, precision at 0.845, recall at 0.865, and an F1-score of 0.853, was determined to be the most appropriate model for our dataset following a thorough **evaluation based on key performance** measures. The scores did not change even after Model Tuning, when the radial basis function (RBF) kernel was found to be ideal.

2.4. Using Machine Learning for Motion Analysis to Early Detect Autism Spectrum Disorder: A Systematic Review Roberta Simeoli1,2 · Angelo Rega1,2 · Mariangela Cerasuolo3,4 · Rafaele Nappo2 · Davide Marocco: Even while the field of

ASD biomarker research has expanded rapidly in recent years and the use of technology in assessment processes is nearly a given, it is important to remember that these biomarkers should still be considered supplemental information. The review's findings, however, show that machine learning techniques and technological tools can enhance and hone the diagnostic procedure while offering more details on the disorder's "invisible" characteristics. Further studies are required in this area to look at the relationships between particular biomarkers and particular symptoms of the illness.

2.5. Detection of autism spectrum disorder (ASD) in children and adults using machine learning Muhammad Shoaib Farooq1, RabiaTehseen2, Maidah Sabir1 & ZabihullahAtal3: The evaluation of ASD has been linked to a number of disorders that are recognized as traits, such as behavioral, emotional, structural, and mental disorders that are difficult to anticipate because there aren't any medical tests available for all the features required to identify ASD in an individual. Practitioners use response observation and psychological evaluations to diagnose ASD in their patients. Because the symptoms are not always evident, the detection process is difficult and time-consuming. There is now no screening test that can reliably identify ASD, nor is there a screening procedure that has been carefully developed and perfected to specifically detect the ASD. The most recent advancement that can help detect autism more accurately and save a lot of time is machine learning (ML).

2.6. Machine Learning-Based Classification of Autism Spectrum Disorder across Age Groups by Resmi Karinattu Raghunathan 1,ORCID,Poornima Nanjagoundan Palayam Venkidusamy 1ORCID,Raju Gopalakrishna Kurup 1ORCID,Bindu George 2 and Neetha Thomas 3: In this study, multiple machine learning (ML) models were employed to identify autism spectrum disorder (ASD) using three publicly available ASD screening datasets provided by the UCI machine learning repository. This research assessed many machine learning models for the reliable and accurate categorization of ASD across a range of age groups, including early infancy and maturity. The research's conclusions and insights deepen our understanding of ASD diagnosis and may be useful to researchers, clinicians, and people with autism spectrum disorders. Future research should focus on huge datasets, improving feature selection techniques, and utilizing deep learning methodologies that integrate CNNs with classification in order to boost the system's overall performance and robustness**.**

2.7A Study on Autism Spectrum Disorders using Classification Techniques. S. Mythili, A. R. Mohamed Shanavas: This study discussed the topic of autism and the different types of autism disorders. It also compared the efficacy of common machine learning techniques with support vector machines, fuzzy logic, and artificial neural networks (perceptron's). The algorithms are highly helpful in managing the prediction level of autistic kids. Future research on the classification of autism disorder suggests a novel method based on bee hive swarm optimization and fuzzy cognitive mapping

2.8 Autism spectrum disorder classification on electroencephalogram signal using deep learning algorithm. A Ali1, A.R Syafeeza2, A. S Jaafar3, M.K Mohd Fitri Alif4: The primary contribution of this research to society is the development of a substitute technique for identifying a child's autism status. The current approach for diagnosing ASD takes a long time, which makes it unreliable because research indicates that children with ASD experience several adverse effects from an early age, like visual impairment. Additionally, the Ministry of Health may use a fully developed, highly accurate system as a new EEG-based ASD diagnosis approach for high-risk children. From an economic perspective, it can significantly shorten the time it takes to diagnose

ASD, allowing pediatricians to plan early treatment and better support the autistic patient's health.

2.9 A Fusion-Based Machine Learning Approach for Autism Detection in Young Children Using Magnetoencephalography Signals Kasturi Barik1· Katsumi Watanabe2· Joydeep Bhattacharya3 ·Goutam Saha: The current research shows that it is possible to distinguish between children with autism and generally developing kids using the resting-state brain oscillations that are captured by magnetoencephalography (MEG). Preferred phase angle is a new feature that we have implemented. It makes use of frequency band-wise phase consistency. We demonstrated that the PPA-based classifier performed better than the PSD-based classifier, and that the best classification accuracy was achieved by fusing PSD and PPA into a framework based on fusion.

2.10 Evaluation of Autism Spectrum Disorder Based on the Healthcare by Using Artificial Intelligence Strategies Amit Sundas ,1 Sumit Badotra ,1,2 Shalli Rani ,3 and Raymond Gyaan: With a ratio of 51%, the IEEE magazine publishes the most manuscripts. Two categories were created from a subset of 28 studies: those that supported initiatives to improve the quality of life for these patients and those that concentrated on diagnosing individuals. Approximately 43% of participants considered research looking at novel techniques for identifying and rating the severity of ASD in children, and 57% considered strategies to improve these children's quality of life

3. SOFTWARE DESCRIPTION

THE SOFTWARE WE USED HERE:

- Anaconda Navigator
- Python

3.1ANACONDA NAVIGATOR:

We used the robust tools provided by Anaconda Navigator to create a comprehensive and high-quality dataset drawn from EEG (Electroencephalogram) acquisitions of children diagnosed with autism spectrum disorder (ASD) in an effort to predict ASD using machine learning. We have a smooth platform for managing, analyzing, and developing models thanks to Anaconda Navigator's integrated data science and machine learning environment. In order to prepare the EEG data for machine learning applications, we used this platform to organize and preprocess it. This required performing operations like feature extraction, data augmentation, and data cleaning to improve the formativeness and quality of our dataset. We could easily use well-known libraries like Numbly, Pandas, and Scikit-Learn—all of which are essential in the field of data science—with Anaconda Navigator. With the use of these tools, we were able to process EEG data quickly and produce a feature-rich dataset that would form the basis of our prediction models. We made sure that our dataset was suitable for the ensuing machine learning studies and expedited the data preparation process by using Anaconda Navigator, which eventually improved the precision and resilience of our ASD prediction model.

3.2. PYTHON:

Python is a high-level, interpreted, object-oriented language with dynamic semantics. Its dynamic typing and dynamic binding, along with its high-level built-in data structures, make it an appealing language for Rapid Application Development and for usage as a scripting or glue language to join existing components. Because of its straightforward, basic syntax, Python promotes readability, which lowers software maintenance costs. Python allows modules and packages, which facilitates program modularity and code reuse. The large standard library

and the Python interpreter are freely distributable and accessible for free on all major platforms in source or binary form. Python's increased efficiency is one of the main reasons programmers fell in love with it. The edit, test, and debug cycle is extremely quick because there is no compilation step. Python program debugging is simple because segmentation faults are never caused by bugs or incorrect input. Rather, the interpreter raises an exception when it finds a mistake. The interpreter prints a stack trace if the application fails to catch the exception. Setting breakpoints, evaluating arbitrary expressions, inspecting local and global variables, stepping through the code one line at a time, and other features are all possible with a source level debugger. The fact that the debugger is developed in Python attests to the language's capacity for introspection. However, adding a few print statements to a program is frequently the fastest way to debug it.

4. METHODOLOGY

Using data-driven strategies to accurately identify and intervene early on is a systematic strategy that is part of the machine learning methodology for predicting autism spectrum disorder (ASD). Data gathering, which usually starts the process, involves a variety of information sources, such as clinical evaluations, behavioural observations, genetic markers, and neuroimaging data. The predictive model is built upon this extensive information. In order to guarantee the quality and consistency of the data, pre-processing is an essential step that involves cleaning, normalizing, and organizing the acquired data. To increase the predictive power of the model, outliers are managed, missing values are resolved, and pertinent features are chosen or designed.

Then, to avoid overfitting, the dataset is divided into training, validation, and test sets. This allows the model to be trained on one set of data and assessed on another. The prediction model is constructed using machine learning algorithms. Depending on the complexity and type of data, a variety of techniques, such as decision trees, support vector machines, or deep neural networks, can be applied.

Using the validation set, hyperparameter tuning and model optimizations are carried out to improve the model's performance. The last stage entails testing the model on the test set to determine its accuracy and capacity for generalization.

Furthermore, model explains ability methods such feature importance analysis can be used to shed light on the variables influencing the prediction of ASD, improving the interpretability and therapeutic usefulness of the model. All things considered, the machine learning approach to ASD prediction makes use of cutting-edge computational methods to handle and examine a variety of data sources, which eventually results in more precise and timely diagnoses. This strategy helps people with ASD live better lives by providing timely support and intervention.

5. DESIGN AND IMPLEMENTATION

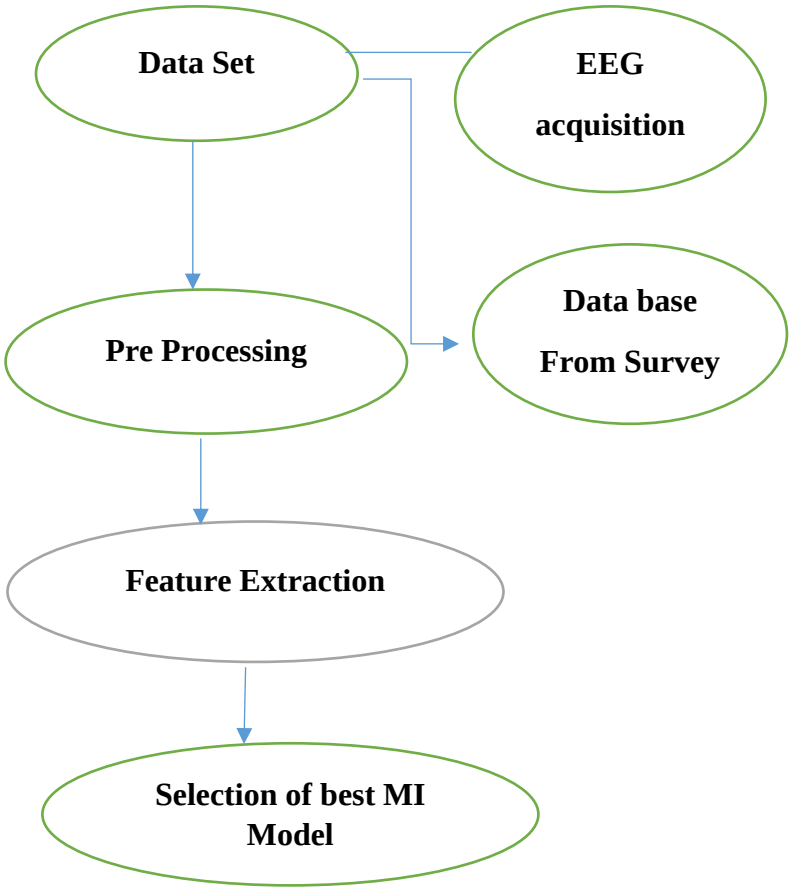

Fig 1 BLOCK DIAGRAM

6. RESULT

For our project, we used Anaconda Navigator's capabilities to compile a large dataset using EEG (Electroencephalography) recordings made of kids on the autistic spectrum. Our main objective was to create a predictive model for autism spectrum disorder (ASD) using machine learning techniques, specifically logistic regression. This novel method has great potential to advance our knowledge of ASD and its diagnosis, since early intervention is essential to enhancing the quality of life for those who are impacted.

The construction of the dataset required a laborious and thorough process that involved gathering EEG data from a wide range of kids with ASD. With its intuitive UI and robust data processing features, Anaconda Navigator made it easier to extract, clean, and convert this unstructured EEG data into a structured dataset. Our machine learning model was trained using features from this dataset, which comprised temporal patterns, connection metrics, and spectrum power that were taken from EEG signals.

Machine learning	Accuracy	Specificity	Complicity
Logistic Regression	1	1	1

7. CONCLUSION

It is critical to recognize the limits of our research, including the requirement for a more expansive and varied dataset and the difficulties posed by the unpredictability of EEG data. In order to improve prediction accuracy, future research may examine more sophisticated feature engineering and machine learning approaches. All things considered, our work establishes the groundwork for future studies in this crucial field and demonstrates the promise of fusing Anaconda Navigator, EEG data, and machine learning to improve our comprehension and diagnosis of autism spectrum disorder. This project marked a significant step towards advancing the field of autism diagnosis. By combining Anaconda Navigator's data management capabilities with machine learning and logistic regression, we were able to build a robust predictive tool. The results of this research have the potential to significantly enhance early detection of ASD in children, enabling timely intervention and support. This project underscores the significance of leveraging cutting-edge technology and interdisciplinary collaboration to address critical challenges in the field of healthcare and neurodevelopmental disorder.

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