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(REVIEW ARTICLE)

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A review on predictive model for Autisim spectrum disorder

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Abstract

In present day Autism Spectrum Disorder (ASD) is becoming more often, but testing for it is expensive and slow. However, with the help of machine learning (ML) algorithms, we can predict autism in the early stages. So far different Machine Learning algorithms are used to predict Autism in early stages but those are not for both adults and children. So, there is a new prediction model using machine learning by creating a mobile app for predicting autism in people of any age. This model combines two algorithms, Random Forest-CART and Random Forest-ID3, to improve accuracy.

Keywords: ASD; ML; Random Forest-CART; ID3

1. Introduction

Children with autism behave in a way that prevents them from making eye contact with others; they live in their own world. Youngsters exhibiting autism behavior are nonverbal. However, with the rapid advancement of technology, parents have increasingly turned to the internet to seek information when their children do not exhibit age-appropriate developmental milestones. This trend is particularly evident when parents suspect that their child might be autistic based on observed behavior's. Many obstacles must be overcome by people with autism spectrum disorder (ASD), including learning deficits, attention problems, and mental health conditions including sadness and anxiety. They could also struggle with associated concerns including motor skills and sensory disorders.As a result; many parents are seeking medical evaluations and interventions to address potential autism spectrum disorders (ASD) early on. So, we need a predictive model which detects autism at an early stage.

Autism spectrum disorder (ASD) is a neurodevelopmental condition impacting interaction, communication, and learning skills. While ASD can be diagnosed at any age, its symptoms typically manifest within the first two years of life and evolve over time. [1].

Individuals with autism spectrum disorder (ASD) face a variety of challenges, including difficulties with concentration, learning disabilities, and mental health issues such as anxiety and depression. They may also experience motor difficulties, sensory problems, and other related issues.

According to the WHO [2], autism spectrum disorders (ASD) encompass a variety of conditions characterized by challenges with social interaction and communication. Individuals with ASD often exhibit specific patterns of behavior and activities, such as difficulty transitioning between activities, an intense focus on details, and unusual sensory reactions.

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The abilities and needs of people with ASD can vary greatly and change over time. Some individuals with autism are capable of living independently, while others have severe disabilities and require lifelong care and support. Autism significantly impacts educational and employment opportunities, and the demands on families providing care can be substantial. The quality of life for individuals with autism is heavily influenced by societal attitudes and the level of support from local and national authorities.

Although characteristics of autism can be detected in early childhood, diagnosis is frequently delayed until much later. People with autism often have co-occurring conditions like epilepsy, depression, anxiety, and attention deficit hyperactivity disorder (ADHD), as well as challenging behaviors such as sleep difficulties and self-injury. Intellectual functioning in individuals with autism varies widely, ranging from profound impairment to superior abilities.

[3] The article “Toward Brief ‘Red Flags’ for Autism Screening” highlights the need for frontline health professionals to have a "red flag" tool. This tool would assist them in deciding whether to refer children and adults for a comprehensive diagnostic assessment for autism spectrum conditions (ASC).

[4]The article “Autistic Spectrum Disorder Screening Data for Adults” emphasizes the importance of a time-efficient and accessible ASD screening tool. Such a tool would help health professionals and individuals determine whether a formal clinical diagnosis should be pursued.

[5] Autism spectrum disorder (ASD) is primarily influenced by genetic and environmental factors. Early detection and treatment can significantly improve outcomes. Currently, ASD diagnosis relies on clinical standardized tests, which are time-consuming and increasingly costly [5].

The article "Detection of Autism Spectrum Disorder in Children Using Machine Learning Techniques" aims to enhance the accuracy and efficiency of diagnosis by employing machine learning methods alongside traditional approaches. The study applies models like Support Vector Machines, Random Forest Classifier, Naïve Bayes, Logistic Regression, and K-Nearest Neighbours to a dataset, constructing predictive models based on the results. The primary goal is to identify susceptibility to ASD in early childhood, facilitating a more streamlined diagnostic process.

[6] The study titled "Identifying Children with Autism Spectrum Disorder Based on Their Face Processing Abnormality: A Machine Learning Framework" introduces a novel approach using machine learning algorithms for face recognition to detect autism in children.

[7] The article "Applying Machine Learning to Facilitate Autism Diagnostics: Pitfalls and Promises" explores the significant potential of machine learning in improving diagnostic and intervention research within the behavioral sciences, particularly in addressing the complex and diverse nature of autism spectrum disorder (ASD).

2. Methodology

The research was carried out in five phases: Data collection, Data synthesization, developing the prediction model, evaluating the prediction model and developing a mobile application. The phases are briefly discussed in the following sub-sections.

2.1. Data Collection

To develop an effective predictive model, AQ-10 dataset was used which consists of three different age groups of 4-11 years (child), 12-16 years (adolescent) and lastly ages of 18 or more (adult).

2.2. Data Synthesization

The collected data to be synthesized to remove irrelevant features.

2.3. Developing the Prediction Model

To generate prediction of autism traits, algorithms had been developed and their accuracy was tested. After attaining results from various types of supervised learning like Linear Regression, SVM, Naive Bayes; Random Forest was found to be highly feasible with higher accuracy than the other algorithms. So, Random Forest (CART) was proposed for implementing the ASD predictive system.

2.4. Evaluating the Prediction Model

The proposed predictive model has to be tested with the AQ10 dataset and data collected from real-world in terms of the accuracy, specificity, precision, sensitivity and false positive rate.

3. Developing a Mobile Application

Finally, a mobile application was developed for the use of general mass. By answering a set of closed ended questions, user will get a result of having or not having autism traits.

3.1. System Architecture

The architecture of the proposed system is shown in Figure 1.

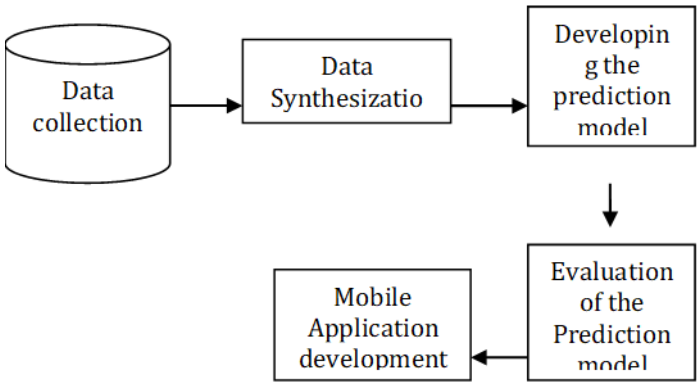

Figure 1 System Architecture

4. Workflow

The work flow of the system indicates step by step process of implemented work.

- Step1: Initially the dataset has to be loaded.
- Step2: Then, preprocess the dataset by removing the Null values/missing values/unwanted columns.
- Step3: Develop a Prediction model for the synthesized data.
- Step4: Now Evaluate Prediction Model by applying some Algorithms.
- Step5: Develop the mobile application using *Random Forest-CART, ID3.*

5. Future work

The main limitations of the study are the insufficient data for training the prediction model and the exclusion of children under 3 years old due to a lack of open-source data. Future efforts will aim to collect more diverse data, improve the machine learning classifier's accuracy, and conduct a user study to evaluate the app's usability and user experience (UX).

6. Conclusion

The outcome of this review offers a promising approach to efficiently and effectively detect autism traits across different age groups. Diagnosing autism is often a costly and time-consuming process, and early detection is frequently delayed due to the challenges in identifying autism in children and adolescents. The use of an autism screening application can

guide individuals at an early stage, preventing the situation from worsening and reducing the costs associated with delayed diagnosis.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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