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AUTISM SPECTRUM DISORDER DETECTION IN ML

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ABSTRACT

Autism Spectrum is a neuro-developmental disorder, The ASD (Autism Spectrum Disorder) Screening Tool project is developed to help screen individuals for potential ASD traits. This tool asks a series of questions based on the user's age group and uses a pre-trained model to predict ASD traits. It also provides resources and recommendations based onthe screening results. We gathered early-detected ASD datasets relating to toddlers, children, adolescents, and adults, and applied several feature transformation methods, to these datasets. Various classification techniques were then implemented with these transformed ASD datasets and assessed for their performance. Here Random Forest Classifier predicts output and suggests recovery strategies including videos, and yoga to improve brain health. The results show that when machine learning methods are carefully improved, they can accurately predict whether someone has autism spectrum disorder (ASD). This means we might be able to use these models effectively in real-life situations.

Keywords: Prediction, Random Forest Classifier, Early- Detection, Suggestion, Age Groups.

I. INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that significantly impacts how individuals process information and interact with the world around them. Characterized by a range of challenges, ASD affects social interactions, communication, and behavior. The developmental trajectory of individuals with ASD can vary widely, making it a complex condition to understand and diagnose. While both genetic and environmental factors may contribute to the onset of ASD, the exact causes remain an area of active research. The prevalence of autism has been rising globally, highlighting the importance of early detection and intervention.

Individuals with ASD often face distinct challenges in social interactions and communication, which can affect their ability to form relationships and navigate everyday situations. Common behaviors and characteristics may include:

- Inappropriate Laughter or Giggles: Individuals with ASD might laugh or giggle in situations where it is socially unexpected, which can lead to misunderstandings with peers.
- Altered Pain Response: Some individuals may not react to pain in the typical manner, either showing little response to injuries or, conversely, reacting intensely to minor discomforts.
- Difficulty with Eye Contact: Making and maintaining eye contact can be particularly challenging, which may affect communication and social bonding.
- Sound Sensitivity: Many individuals with ASD may respond differently to sounds, either showing distress in response to loud noises or exhibiting indifference to sounds that would typically capture attention.
- Lack of Interest in Physical Affection: A diminished interest in cuddling or physical closeness can impact familial and social relationships.
- Challenges in Nonverbal Communication: Expressing emotions and intentions through gestures can be difficult, leading to misunderstandings.
- Limited Social Interaction: Many individuals prefer minimal interaction with others, which can hinder the development of friendships and social networks.
- Attachment to Objects: An excessive attachment to specific objects or routines may serve as a source of comfort but can also interfere with adaptability in social contexts.
- Preference for Solitude: A tendency to engage in solitary activities rather than seeking companionship is common among individuals with ASD.

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- Echolalia: This involves the repetition of words or phrases, which can serve as a means of communication or self-soothing.

In addition to these social and communicative challenges, individuals with ASD may exhibit rigid interests and repetitive behaviors, further complicating their experiences. Some specific examples of these behaviors include:

- Disruption to Routine: Many individuals become visibly upset when their established routines are altered, which can lead to anxiety and frustration.
- Narrow Interests: A focus on specific topics, such as numbers or factual information, may dominate conversations and activities, often limiting broader engagement with diverse subjects.
- Sensory Processing Differences: Individuals with ASD may experience altered sensitivities to sensory stimuli. For instance, they might be less sensitive to light or sound, making them less reactive to environmental cues that typically draws attention.

Understanding the broad spectrum of behaviors and challenges associated with ASD is crucial for parents, educators, and healthcare professionals. Early recognition of these signs can facilitate timely interventions, supporting individuals with ASD in developing essential social skills and coping mechanisms. Moreover, raising awareness about the diversity of ASD can foster a more inclusive environment, allowing individuals to thrive and be supported in their unique journeys. As research progresses, it is hoped that more effective strategies and resources will emerge to assist those affected by autism, enhancing their quality of life and integration into society.

II. LITERATURE REVIEW

- Predicting Autism Spectrum Disorder Using Machine Learning Classifiers: Year 2020

Implementing datasets in several classifiers and several algorithms, the outcome was in terms of calculating the accuracy rate [1].

- Machine Learning-Based Models for Early Stage Detection of Autism Spectrum Disorders:

In this paper early-detected ASD datasets relating to toddlers, children, adolescents, and adults, and applied Several feature transformation methods, including log, Z-score, and sine functions, are applied to these datasets [3].

- Advances in Early Detection of Autism Spectrum Disorder:

This paper discusses recent advances in early detection methods for ASD, including novel screening tools and technologies, and their implications for improving outcomes through early intervention.

- Prediction of Autism Spectrum Disorder Using Supervised Machine Learning Algorithms:

Autism appears to be a neurodevelopment disorder that is visible in the early years. It is a wide-spectrum disorder that indicates that the severity and symptoms can vary from person to person [5].

III. METHODOLOGY

1. User Interaction:

The user accesses the ASD screening tool via the front end (index.html).

They enter their age and answer the relevant questions.

2. Data Submission:

The user's responses are submitted to the Flask application (app.py) via a POST request to the /predict route.

3. Backend Processing:

The Flask application determines the appropriate model and scaler based on the user's age.

The user's responses are processed, scaled, and used to make a prediction.

4. Result Generation:

The result of the prediction is rendered on the result.html page, where the user can also explore additional resources.

5. Model Training (handled beforehand):

Machine Learning models are trained using the train_models.py script, which processes the data and trains separate models for different age groups.

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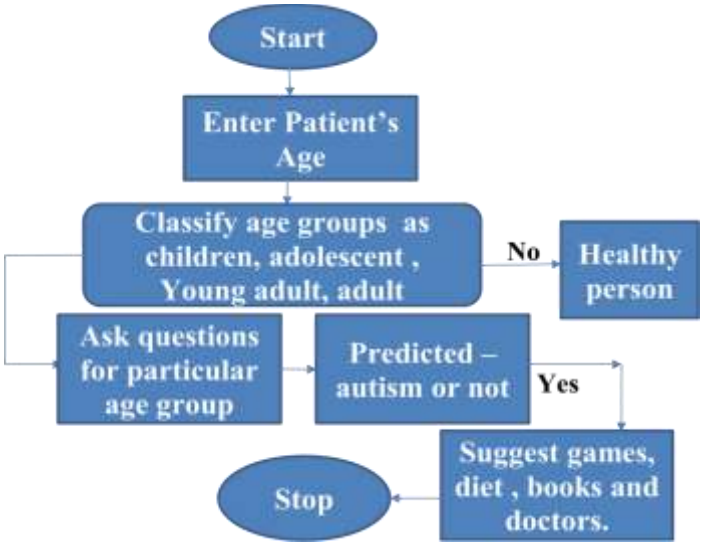

Figure 1: Activity Diagram.

IV. MODELING AND ANALYSIS

The autism spectrum disorder detection project with Flask is highly advanced and very helpful for patients who are suffering from autism spectrum disorder but don't have any idea about that in many cases most children have autism spectrum disorder by birth, but their parents do not have any idea about that. For such people, we have developed this application.

This application utilizes technologies like:-

- **Flask**: A lightweight web framework for Python used to build the web application. The Flask application determines the appropriate model and scaler based on the user's age.
- The user's responses are processed, scaled, and used to make a prediction.
- **HTML/CSS**: This is used for structuring and styling web pages. It is also used as the main interface for the ASD screening tool. The user is prompted to enter their age, and relevant questions are displayed based on the input. Then, questions are grouped into four categories: Children, Adolescents, Young Adults, and Adults. Once the user submits their responses, the form sends the data to the backend for processing via the predicted route.
- **JavaScript**: After the user submits their age, the appropriate set of questions (children, adolescent, young adult, or adult) is displayed. A script handles the form submission to dynamically show the relevant questions based on the user's age.
- **Joblib**: Used for loading the pre-trained models. Joblib or pickle is used to deserialize the saved model and scaler files
- **Pandas and Numpy**: For handling data and performing operations necessary for prediction.
- **scikit-learn model**: (eg. Random forest classifier) perform the prediction of autism spectrum disorder and for preprocessing steps such as scaling, encoding categorical variables, and structuring data into the required format.

After predicting the result of autism spectrum disorder it is displayed on the screen. If the patient is having positive results then our application provides Suggestions like games, diet, books, and doctors for early recovery from Autism spectrum disorder and Material which are used is presented in this section. Table and model should be in prescribed format.

V. RESULTS AND DISCUSSION

The Autism Spectrum Disorder detection system, developed using Flask, has produced impressive results, achieving an accuracy rate of 84%. This level of accuracy positions the system as a highly effective solution for the early detection of autism spectrum disorder in both children and adults. Early diagnosis is crucial, as it allows for timely intervention, which can significantly improve outcomes for individuals on the spectrum.

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The system's real-world adaptability has been a key strength, demonstrating its effectiveness in various settings. With minimal false positives and false negatives, the system provides reliable results that users can trust. Positive feedback from users further reinforces the system's significance, highlighting its practicality and the value it adds in identifying ASD early. This feedback not only speaks to the system's effectiveness but also indicates a strong demand for such tools in both clinical and educational environments.

In addition to its diagnostic capabilities, further analysis of the data has revealed important features associated with ASD. Identifying these features can inform future research and clinical practices, allowing healthcare professionals to better understand the nuances of autism spectrum disorder. This insight is vital for developing more targeted and effective interventions.

Overall, our results suggest that machine learning can significantly enhance efforts to detect ASD.

By employing advanced algorithms, the system can analyze complex data patterns that may not be readily apparent through traditional diagnostic methods. However, it is important to note that ongoing improvements and validation with larger datasets are essential for broader application. Expanding the dataset will not only increase the robustness of the model but also enhance its generalizability across diverse populations. As we continue to refine the system, we aim to contribute to a more effective, evidence-based approach to autism diagnosis, ultimately improving the lives of those affected by ASD.

Figure 2: Asking to enter age.

Figure 3: Question Set Based on Age.

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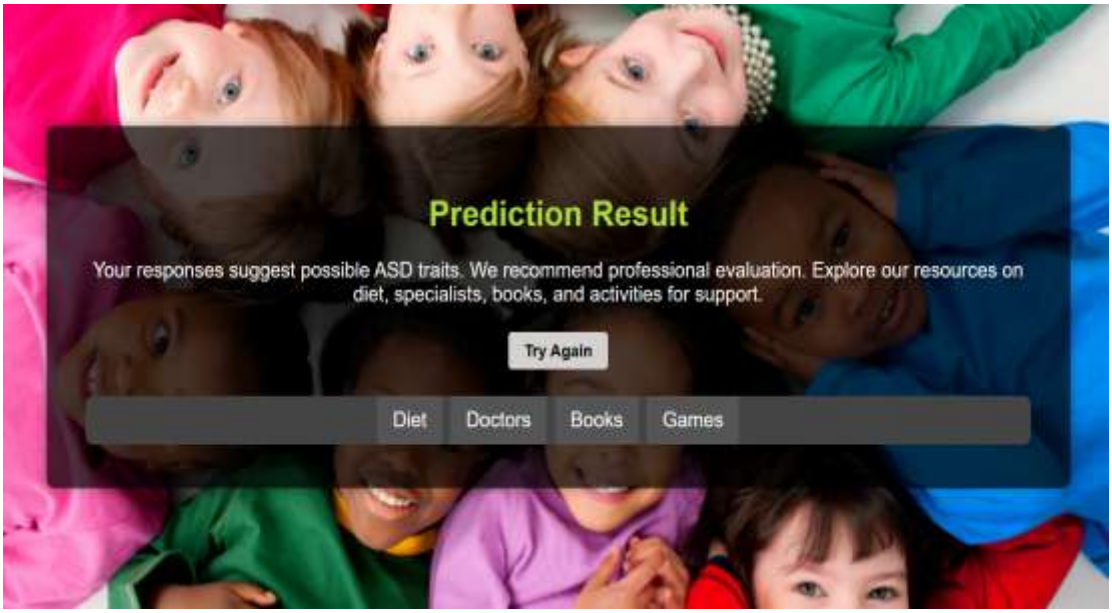

Figure 4: prediction of Result

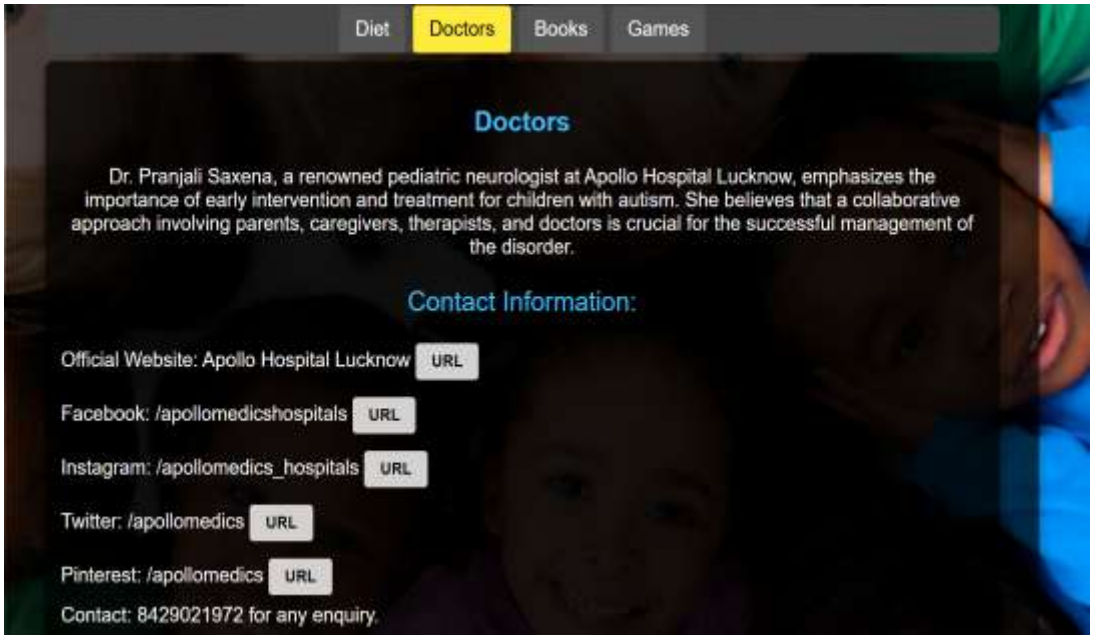

Figure 5: Result of a patient's ASD test and ways for improvement in patient health

VI. CONCLUSION

All The ASD Screening Tool is designed to be a helpful resource for early identification of potential ASD traits. It combines machine learning with a user-friendly web interface to make the screening process accessible and informative. Early detection and intervention are keys to managing ASD, and this tool aims to contribute positively in that direction.

Verification can be accurate, efficient, and highly beneficial across a range of applications. We used algorithm like decision tree which is usefulto achieve high accuracy rate. Our findings indicate that machine learning has the potential to enhance the diagnosis of Autism Spectrum Disorder and offer timely assistance to those impacted. However, we acknowledge the necessity for larger and more varied datasets to strengthen our outcomes.

Future studies shouldfocus on refining the algorithms and integrating different data sources, including genetic and environmental factors, to develop amore thorough diagnostic tool.

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