

## GUIDED E LEARNING SYSTEM AND DETECTION FOR EARLY LEARNERS WITH AUTISM SPECTRUM DISORDER(ASD)

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### ABSTRACT

**Autism spectrum disorder (ASD)** is a neurological and developmental disorder that start early in childhood and go on throughout a person's life. We need to provide education to young children those who have developed ASD in early childhood stages. These children do not respond naturally, they are always isolated so we need to make them utilize the E-Learning application and make them inclusive in the classroom, help them to develop interest and to interact with everyone in social. So, we are building an educational application incorporating intra and interpersonal development skills. Through this we can keep track on their ability and address their uneven progress in specific areas. The proposal of E- Learning application will be beneficial for the parents and teachers to understand the changes in the behaviour of an ASD child .Along with this we will be implementing Machine Learning algorithms(Classification) such as Random Forest- CART3 to make the E Learning application more simple and then we will be visualizing the data together on tableau and make analysis whether which child suffering from ASD has better grasping power and sustainability to think. It is also evolving such that the complexity will increase as the ASD learners understanding thought process progresses. This E- Learning application will play a drastic role in changing daily habitual life of an ASD child.

**KEYWORDS** - E- Learning application, Random Forest- CART3, ASD, Machine Learning algorithms.

### INTRODUCTION:

**AUTISM OR AUTISM SPECTRUM DISORDER(ASD)** is a complex neurobehavioral condition that refers to a broad range of constraints that people with all age groups face like repetitive behaviour, social skills, nonverbal communication and speech or it can be defined as the developmental disorder characterized by persistent problems in social communication and interaction, along with restricted and repetitive patterns of behaviour, interests or activities. ASD can be a minor problem or a full-time disability that needs to be taken special care. According to the survey by the disease control centre, Autism is affected to 1 in 59 children in the United States. These children having Autism may have unusual responses to people, attachment to objects, resistance to change in their routine environment and experience body movements such as hand flapping, pacing and rocking. At times, they may be aggressive or self-injurious. Sometimes they even feel pained by sounds, touches, smell or sight that may seem normal to other humans who are not suffering ASD.

The main symptoms of Autism are social communication challenges and that affects their life adversely are as follows:

- **Gestures**
- **Lack of Eye Contact**
- **Facial expressions**
- **Tone of Voice**
- **Not looking at or listening to other people**
- **Talking in a sing-song, flat, or robotic voice**
- **A narrow range of interests or intense interest in certain topics**

The children suffering from Autism Spectrum Disorder (ASD) do not respond and make eye contact while asking for something. They are self-involved and prefer to have solitary play time rather than interacting with other children who are not suffering ASD.

- **Asperger's syndrome.** These children don't have a problem with language; in fact, they tend to score in the average or above-average range on intelligence tests. But they have social problems and a narrow scope of interests.
- **Autistic disorder.** This is what most people think of when they hear the word "autism." It refers to problems with social interactions, communication, and play in children younger than 3 years.
- **Childhood disintegrative disorder.** These children have typical development for at least 2 years and then lose some or most of their communication and social skills.
- **Pervasive Developmental Disorder (PDD or atypical autism).** Your doctor might use this term if your child has some autistic behaviour, like delays in social and communications skills, but doesn't fit into another category.

#### **CAUSE AND DIAGNOSIS OF AUTISM:**

Researchers indicate that in majority of the cases, genetics could be a basic factor for the ASD. Children born to parents who are older have a higher risk of suffering from Autism. Parents who have a child with ASD have a 2 to 18 percent chance of a second child who is also affected. If a pregnant woman is exposed to certain drugs or chemicals, like alcohol or anti-seizure medications, her child is more likely to be autistic. Other risk factors include maternal metabolic conditions such as diabetes and obesity. Research has also linked autism to untreated phenylketonuria (also called PKU, a metabolic disorder caused by the absence of an enzyme) and rubella (German measles). There is no evidence that vaccinations cause autism. Diagnosing ASD can be difficult since there is no medical test to diagnose the doctors. So here comes an important role of machine learning, artificial intelligence and different algorithms to predict and detect the Autistic behaviour.

#### **Prevalence and Incidence Statistics about Autism:**

Prevalence of Autism: Between 1 in 500 (2/1,000) to 1 in 166 children (6/1,000) have an Autism Spectrum Disorder (Centre for Disease Control). Prevalence Rate: Approx. 1 in 500 or 0.20% or more than 2,160,000 people in India.

- In 2018, the disease control and prevention centre determined that approximately 1 in 37 boys and 1 in 151 girls were diagnosed with an Autism spectrum disorder. This fact denotes that boys are four times more likely to be diagnosed with autism than girls.
- Most children are still being diagnosed after 4 years of age, though autism can be reliably diagnosed by as early as age 2.

#### **RESEARCH METHODOLOGY:**

**A.DataCollection:** To develop an effective predictive model, AQ-10 dataset was used which consists of three different datasets based on AQ-10 screening tool questions. These three datasets contain data of age groups of 4-11 years (child), 12-16 years (adolescent) and lastly ages of 18 or more (adult). AQ-10 or Autism Spectrum Quotient tool is used to identify whether an individual should be referred for a comprehensive autism assessment.

**B. Data Synthesis** collected data were synthesized to remove irrelevant features. For example, the ID column was irrelevant to develop a prediction model, thus it was removed. To handle null values, listwise deletion technique was applied where a particular observation was deleted if it had one or more missing values. Then to extract unnecessary features from the dataset, decision tree algorithm was used. Results showed dropping 'relation', 'age description', 'used app before' and 'age' columns would result in more accurate classification and so those columns were dropped. Summary of the synthesized datasets.

**C. Developing the Prediction Model:** To generate prediction of autism traits, algorithms had been developed and their accuracy were 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. Further modifications were made to the algorithm to attain even better results.

**D. Evaluating the Prediction Model:** The proposed predictive model was tested with the AQ-10 dataset and data collected from real-world in terms of the accuracy, specificity, precision, sensitivity and false positive rate. For the AQ-10 dataset, leave-one-out technique was also applied to check the effectiveness of the proposed model. Again, to validate the proposed model almost 100 data of ASD cases were collected from an institute of special education for the people with special needs and 150 data of Non-ASD cases were collected through field visits to different schools and shopping malls, using both printed forms and online forms. In later cases, the online questionnaires were distributed through social media and email to different administrative and teaching communities.

**E. 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.

Methodology:

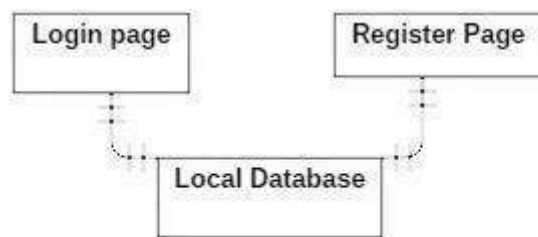
Data mining is a technique that uses data analysis methods and algorithms for extracting information from data. Classification is a data mining technique wherein the data is grouped/classified by different criteria and are used to build models which are used for prediction. The model is first trained using training data and then it is tested using unseen testing data [1].

Data collection is the elementary part of developing this application. Data was collected from parents, institutes and various other sources. The datasets contain data of children to adults. The data collected is then studied and cleaned so the application can be developed looking forward to the needs of autistic children.

This is an android application. The application aims at providing better understanding, learning and skills for autism spectrum disorder. This application will also include daily facts, knowledge and general FAQs.

In this application the autistic child or his caretaker will login/register on the portal and register themselves in the system's local database. The database used is Google Firebase.

Naive machine learning algorithms will be used to study the changes in the child's behaviour before and after using the application.



The key features provided by this application are:

1. Time Table: The child will be able to customize/schedule his daily activities as per his/her convenience using cartoonist figures. Here the child will create his daily schedule, and at the scheduled time the application will be used to ensure that the user completes the task using Facial recognition and button click count feature.
2. Gaming Centre: Play is the absence of stress. This app will act as a mode of gaming.

### Research Contributions:

This research provides a threefold outcome: firstly, a prediction model was developed to predict autism traits. Using the AQ-10 dataset, the proposed model can predict autism with 92.26%, 93.78%, and 97.10% accuracy in case of child, adolescent and adult persons, respectively. This result showed better performance compared to the other existing approach of screening autism. Moreover, the proposed model can predict autism traits for different age groups, while many other existing approaches missed this feature. The results showed marginal performance in terms of accuracy (77% to 85%) for real dataset. The main reason behind this marginal result was the insufficient number of real datasets. Secondly, this research provides a comparative view among different ML approaches in terms of their performance. The results showed that Random Forest-CART showed better performance than the Decision Tree-CART algorithm, while the proposed (merging Random Forest-CART and Random Forest-ID3) algorithm provide better performance comparing to both the Random Forest-CART and Decision Tree-CART algorithm. Finally, a user-friendly mobile application has been developed for end users based on the proposed prediction model so that any individual can use the application to predict the autism traits easily. This outcome indicated an extension of many other existing works, since most of the existing works mainly focus on developing and comparing the performance of prediction models or techniques and did not expand to develop any mobile application for end users. Since diagnosing the autism traits is quite a costly and lengthy process, it's often delayed because of the difficulty of detecting autism in children and adolescents

**Limitations and Future Work:** The primary limitation of the study is lack of sufficiently large data to train the prediction model. Another limitation is that the screening application is not designed for the age group below 3 years as open source data was not available for that age group. Our future work will focus to collect more data from various sources and to improve the proposed machine learning classifier to enhance its accuracy. A user study will also be conducted to evaluate the usability and user experience (UX) of the mobile application.

**CONCLUSION:** Till today, we have not yet met the proper requirements for inclusive classrooms and still lack behind in technology so by using this Intelligent guided E learning

system we can specifically address the needs of learner students with Autism Spectrum disorder (ASD) suffering at early stages. The system can be utilized by teachers, SEAs, interventionists, and parents as a guide for one-on-one activities or as a self-directed individual learning tool for the students. It will also provide reports on daily basis and day to day analysis of a particular student. The guide will be more useful in education exploration and will be a great invention to technology and will be meaningful to the E learning and life of the students. This will prove the model to become more robust and life-giving ways.

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