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Detection and Analysis of Autism Spectrum Disorder using Machine Learning

Kavyashree E D, Sathwik K, Syed Tayeeb, Syeda Afra, Tejas B V

Department of Computer Science and Engineering, ATME College of Engineering, Mysuru, India

ABSTRACT: Autism Spectrum Disorder (ASD) is a neurodevelopmental condition associated with brain development that starts early stage of life, impacting a person's social relationships and interaction issues. Autism Spectrum Disorder (ASD) profoundly impacts individual's daily lives, and while complete eradication remains challenging, early interventions can mitigate its severity. This study introduces a robust framework evaluating Machine Learning (ML) techniques for early ASD detection. The framework identifies optimal classification methods by employing four Feature Scaling (FS) strategies and eight ML algorithms on diverse age-specific datasets. The proposed work incorporates Machine Learning algorithms like Random Forest (RF), Decision Tree (DT), K-Nearest Neighbors (KNN), and Support Vector Machine (SVM). Then using the SVM Model a web-based application has been developed and implemented.

KEYWORDS: Autism, Neurodevelopmental Disorder, SVM, Feature Selection.

I. INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition associated with brain development that starts early stage of life, impacting a person's social relationships and interaction issues. ASD has restricted and repeated behavioral patterns, and the word spectrum encompasses a wide range of symptoms and intensity. Even though there is no sustainable solution for ASD, simply early intervention and proper medical care will make a significant difference in a kid's development to focus on improving a child's behaviors and skills in communication. Even so, the identification and diagnosis of ASD are really difficult and sophisticated, using traditional behavioral science. Usually, Autism is most commonly diagnosed at about two years of age and can also be diagnosed later, based on its severity. A variety of treatment strategies are available to detect ASD as quickly as possible. These diagnostic procedures aren't always widely used in practice until a severe chance of developing ASD.

Diagnosing autism spectrum disorder (ASD) can be difficult because there is no medical test, like a blood test, to diagnose the disorder. Doctors look at the child's developmental history and behavior to make a diagnosis. ASD can sometimes be detected at 18 months of age or younger. By age 2, a diagnosis by an experienced professional can be considered reliable. However, many children do not receive a final diagnosis until much older. Some people are not diagnosed until they are adolescents or adults. This delay means that people with ASD might not get the early help they need. Diagnosing children with ASD as early as possible is important to make sure children receive the services and support they need to reach their full potential. There are several steps in this process.

II. PROBLEM DESCRIPTION

A. PROBLEM STATEMENT: The problem addressed in this study revolves around Autism Spectrum Disorder (ASD), a neurodevelopmental condition significantly impacting individuals' daily lives. Despite the challenges associated with completely eradicating ASD, there is a recognized need for effective early interventions to mitigate its severity. The specific problem under consideration is the development of a robust framework for evaluating various Machine Learning (ML) techniques to enable the early detection of ASD. The goal is to assess the performance of different ML algorithms and Feature Scaling (FS) strategies on diverse datasets representing different age groups (Toddlers, Adolescents, Children, and Adults). The study aims to identify the most effective ML algorithms and FS techniques for accurate ASD classification, considering various statistical evaluation metrics. Additionally, the research explores the importance of specific attributes in predicting ASD risk through detailed Feature Selection Techniques (FSTs). Ultimately, the objective is to contribute insights that guide healthcare practitioners in decision-making during ASD screening and offer a promising alternative to existing approaches for early detection.

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B. OBJECTIVES:

The main objectives is:

- To create a robust and versatile framework that integrates various Machine Learning (ML) techniques for the early detection of Autism Spectrum Disorder in children.
- To assess the performance of ML algorithms Random Forest, Decision Tree, K-Nearest Neighbors, and Support Vector Machine on ASD datasets.

III. LITERATURE SURVEY

YEAR	AUTHORS	SURVEY PAPER
2020	Dr. Poonam Tanwar, Anshu Sharma	Deep Analysis of Autism Spectrum Disorder Detection Techniques
2022	S.M. Mahedy Hasan, MD Palash Uddin, MD Al Mamun, Muhammad Imran Sharif, Anwar UlHaq, and Govind KrishnaMoorthy	A Machine Learning Framework for Early-Stage Detection of Autism Disorders
2020	Eni, Ilan Dinstein, Michal ilan, Idan Menashe, Gal Meiri, and Yaniv Zigel	Estimating Autism Severity in Young Children From Speech Signals Using a Deep Neural Network
2017	Elizabeth Stevens, Abigail Atchison, Laura Stevens, Esther Hong, Doreen Granpeesheh, Dennis Dixon, Erik Linstead	A Cluster Analysis of Challenging Behaviors in Autism Spectrum Disorder
2023	Pradeep Raj Krishnappa Babu, J.Matias Di Martino, Zhuoqing Chang, Sam Perochon, Kimberly L. H. Carpenter, Scott Compton, Steven Espinosa, Geraldine Dawson, and Guillermo Sapiro	Exploring Complexity of Facial Dynamics in Autism Spectrum Disorder

IV. METHODOLOGY

A. PROPOSED SYSTEM:

1. **Data Collection:** Gather data from various sources such as medical records, behavioral assessments, and possibly genetic information. Include demographic information (age, gender, etc.) and relevant features associated with autism spectrum disorder (ASD) such as social interaction patterns, communication skills, repetitive behaviors, and sensory sensitivities.

2. **Preprocessing:** Clean the collected data, handling missing values, outliers, and inconsistencies. Normalize or scale features to ensure they're on similar scales for better model performance. Encode categorical variables if necessary.

3. **Feature Selection/Extraction:** Identify relevant features that may contribute to autism classification. Use domain knowledge and statistical methods to select the most informative features. Optionally, perform feature extraction techniques to reduce dimensionality and improve model efficiency.

4. **Model Development:** Choose appropriate machine learning algorithms for classification tasks. Options may include Support Vector Machines (SVM), Decision Trees, and Random Forests. Split the dataset into training, validation, and test sets. Train the selected model on the training data and tune hyperparameters using the validation set to optimize performance.

5. **Model Evaluation:** Evaluate the trained model's performance using appropriate metrics such as accuracy, precision, recall, F1-score, and area under the ROC curve (AUC). Use cross-validation techniques to ensure robustness and generalization of the model. Compare the performance of different models to select the best-performing one.

6. **Deployment:** Integrate the trained model into a user-friendly application or system. Design a user interface for inputting data and obtaining classification results. Ensure the system is scalable, efficient, and complies with relevant

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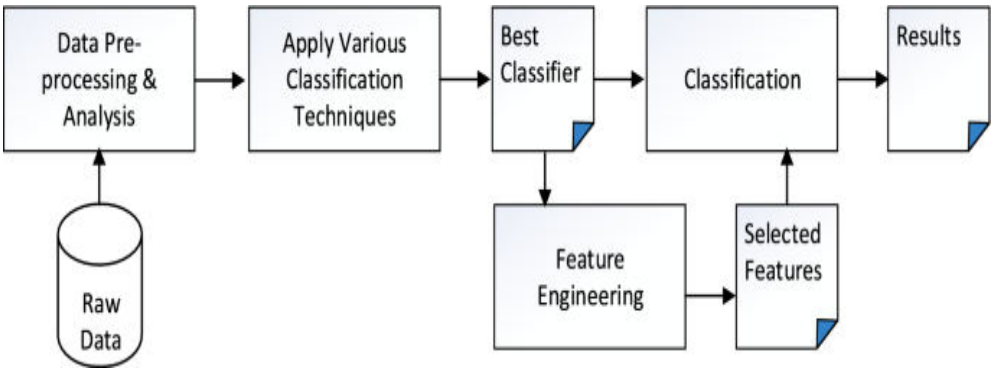
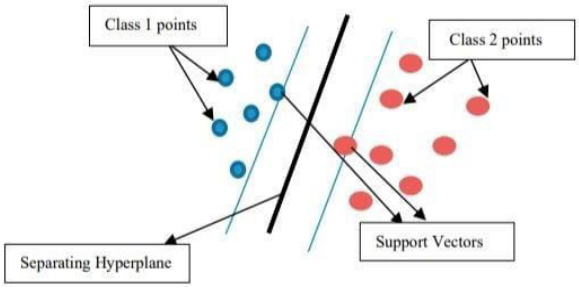
regulations regarding data privacy and security. Document the system's design, implementation, and evaluation process. Prepare reports or publications detailing the system's methodology, findings, and implications for future research or clinical practice.

B. ARCHITECTURE / BLOCK DIAGRAM:



C. SVMMODEL:

- A support vector machine (SVM) is a type of supervised learning algorithm used in machine learning to solve classification and regression tasks.
- The key idea behind SVMs is to transform the input data into a higher-dimensional feature space. This transformation makes it easier to find a linear separation or to more effectively classify the data set.



- Python and Support Vector Machine, which is a Machine learning model is used in the Detection and Analysis of ASD. The modules used in Python are tensor-flow, Scikit-learn, pandas, num- py.

V. RESULTS

The data sets used in this study, and the experimental evaluations that show the value of proposed model are presented in this part.

A. DATASET DETAILS

The dataset used in this study was obtained from Kaggle. The aim of this study was to identify the presence of autism is there or not in a child including A1-A10, age, gender, ethnicity, jaundice etc. The dataset included data of 800 hundred patients of different age groups and nationality.

B. RESULTS

In this 800 attributes total 161 people were having autism. Using this dataset we trained and tested the dataset and built a application to predict the whether autism is there or not. Among this 352 people were having A1 attibute which is one of the symptom of autism.

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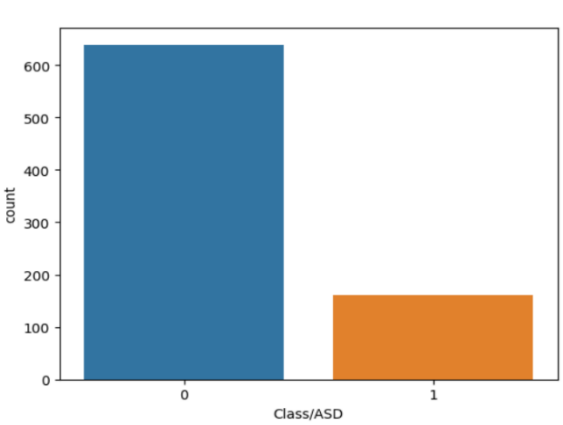
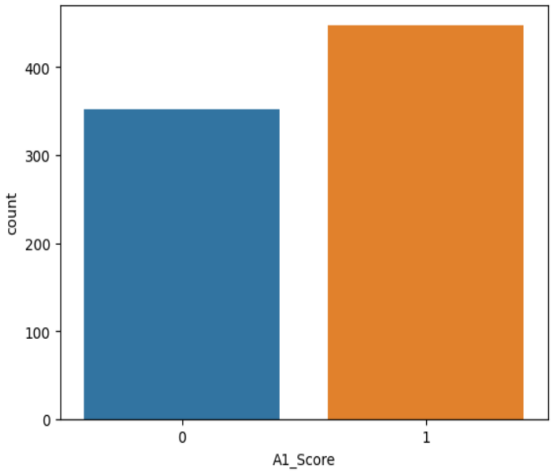
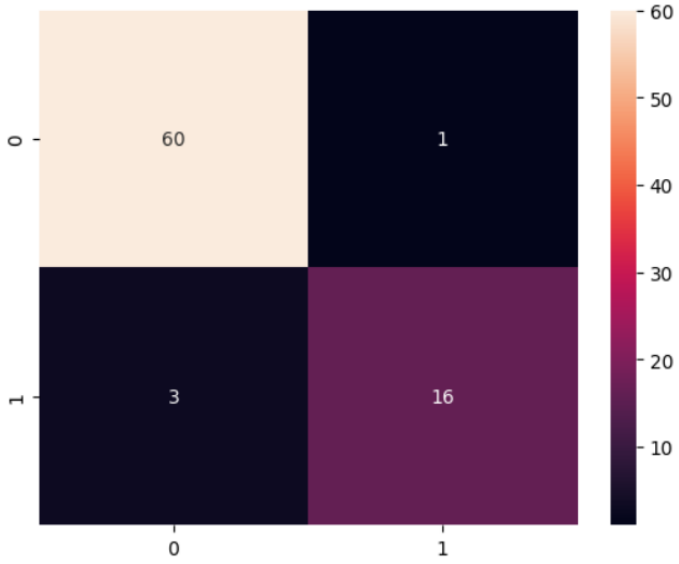




5.1 Graph for autism presence

Support Vector Machine, which is a Machine learning model is used in the Detection and Analysis of ASD. The result of SVM Model applied for the taken dataset is below :



SVM Confusion Matrix

VI. CONCLUSION

To sum up, the initiative that focuses on the early diagnosis and analysis of autism spectrum disorder (ASD) is a major development in the support services and healthcare industries. For physicians, educators, families, and caregivers alike, the research has produced a useful tool in the form of a web application designed specifically for screening signs of ASD. Early detection is made possible by the application, which makes it easier to provide timely support and intervention—both of which are essential for enhancing the quality of life and outcomes for people with ASD. The effectiveness and accessibility of ASD identification and support services could be further improved with further research and development in this field, which would ultimately help create a society that is more accepting and helpful to people with ASD and their families.

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REFERENCES

[1] . A Sharma and Dr. Poonam Tanwar, "Deep Analysis of Autism Spectrum Disorder Detection Techniques" Published in 2020 International Conference on Intelligent Engineering and Management (ICIEM).

[2]. S.M.Mahedy Hasan, MD Palash Uddin, Md Al Mamun, Muhammad Imran Sharif, Anwaar Ulhaq and Govind Krishnamoorthy, "A Machine Learning Framework for Early-Stage Detection of Autism Spectrum Disorders."

[3]. Marina Eni, Ilan Dinstein, Michal Ilan, Idan Menashe, Gal Meiri and Yaniv Zigel, "Estimation Autism Severity in Young Children From Speech Signals Using a Deep Neural Network."

[4]. Elizabeth Stevens, Abigail Atchison, Laura Stevens, Esther Hong, Doreen Granpeesheh, Dennis Dixon, Erik Linstead, "A Cluster Analysis of Challenging Behaviors in Autism Spectrum Disorder.", 16th IEEE International Conference on Machine Learning and Applications-2017.

[5]. Dr. Archana Nayar, "http://www.csrmandate.org/autism-centre-forexcellence-unlockingunlimited-potentials-for-autistichildren", 2017.

[6]. Paul Fergus, Basma Abdulaimma, Chris Carter, Sheena Round, "Interactive Mobile Technology for Children with Autism Spectrum Condition (ASC)", " IEEE 11th Consumer Communications and Networking Conference (CCNC)",10.1109/CCNC.2014.7111685, 2014.

[7]. Wenbo Liu, Ming Li, and Li Yi, " Identifying Children with Autism Spectrum Disorder Based on Their Processing Abnormality: A Machine Learning Framework", International Society for Autism Research, Wiley Periodicals,2016

[8]. Kayleigh K. Hyde, Marlena N. Novack, Nicholas LaHaye, Chelsea Parlett-Pelleriti, Raymond Anden, Dennis R. Dixon. Erik Linstead. "Applications of Supervised Machine Learning in Autism Spectrum Disorder Research: a Review", "Review Journal of Autism and Developmental Disorders",2019.,https://doi.org/10.1007/s40489-019- 00158-x

[9]. Daniel Bone, Somer Bishop, Matthew P. Black, Matthew S. Goodwin, Catherine Lord, and Shrikanth S. Narayanan, "Use of machine learning to improve autism screening and diagnostic instruments: effectiveness, efficiency, and multi-instrument fusion", "Journal of Child Psychology and Psychiatry", 2016, doi:10.1111/jcpp.12559

[10]. Fadi Thabtah, "Machine learning in autistic spectrum disorder behavioral research: A review and ways forward", "informatics for Health and Social Care",2018, https://doi.org/10.1080/17538157.2017.1399132

[11]. Kazi Shahrukh Omar, Prodipta Mondal, Nabila Shahnaz Khan, Md. Rezaul Karim Rizvi, Md Nazrul Islam, "A Machine Learning Approach to Predict Autism Spectrum Disorder", "International Conference on Electrical, Computer and Communication Engineering (ECCE)", 2019

[12]. Md. Shahriare Satu , Farha Farida Sathi, Md. Sadrul Arifen, Md. Hanif Ali and Mohammad Ali Moni, "Early Detection of Autism by Extracting Features: A Case Study in Bangladesh", "International Conference on Robotics, Electrical and Signal Processing Techniques", 2019

[13]. Osman Altay and Mustafa Ulas, "Prediction of the Autism Spectrum disorder diagnosis with Linear Discriminant Analysis Classifier and K-Nearest Neighbor in Children", "Institute of Electrical and Electronics Engineers", 2018, 10.1109/ISDFS.2018.8355354

[14]. JA Kosmicki, V Sochat, M Duda and DP Wall, "Searching for a minimal set of behaviors for autism detection through feature selection-based machine learning", www.nature.com/tp, vol 5, 2014, doi:10.1038/tp.2015.7

[15]. V. Y Tittagalla, R. R. P Wickramarachchi, G. W. C. N. Chandrarathne, N. M. D. M. B. Nanayakkara, P. Samarasinghe, P. Rathnayake and M.G.N.M. Pemadasa, "Use of machine learning to improve autism screeningand diagnostic instruments: effectiveness, efficiency,and multi-instrument fusion", "Institute of Electrical and Electronics Engineers", 2018

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