A Review On: Autism Spectrum Disorder Detection by Machine Learning Using Small Video

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***Abstract*— Autism spectrum disorder (ASD) is a mental ailment that can be diagnosed by the study of social media data and biopsy. Those with autism spectrum disorder (ASD), a neurodevelopment condition, may experience permanent changes to their facial appearance over time. The faces of children with ASD are easily identifiable from those of normally developing (TD) children. After the toddler years, specialists will typically look at a child's behaviour patterns to make a diagnosis of autism spectrum disorders (ASD). Quicker intervention and better long-term outcomes are possible after an early diagnosis of autism spectrum disorder. Machine learning uses data science to facilitate early autism diagnoses. This literature review aims to bridge a gap in understanding by bringing together the results of recent studies and technologies that use machine learning based approaches for ASD screening in infants and children younger than 18 months. Individuals on the autism spectrum have restricted interests and behaviors and struggle to communicate and interact socially with others. The prevalence of ASD has increased in recent years. The potential for innovative methods like machine learning to be integrated into established therapeutic practices is quite encouraging. How computers can be taught to recognize patterns in data is the focus of machine learning research. Artificially intelligent technologies can identify signs and symptoms, organize data, make diagnoses, and forecast outcomes. Machine learning is an area of artificial intelligence that focuses on teaching computers new behaviors by observing how they interact with the world. These days, there are a wide variety of machine learning methods available. In this piece, we look at the existing literature on the frequency of ASD in the general community. The main interest of this paper is the academic literature were sought by searching numerous databases.**

Keywords*— *ASD, Machine Leaning for ASD, Deep Learning For ASD, Autism spectrum disorder.

I. INTRODUCTION

Autism spectrum disorders (ASD), which include a number of illnesses such as autism, childhood disintegrative disorders, and Asperser's syndrome, are characterized by a wide range of symptoms and severity levels, as the term "spectrum" suggests. According to current diagnostic standards, these illnesses fall within the International Statistical Classification of Diseases and Related Health Problems' Pervasive Developmental Disorders subgroup of the Mental and Behavioral Disorders branch. Lack of eye contact, apathy to carers, and an inability to respond to name calling are all early indicators of autism spectrum disorder (ASD), which can show up as early as the first year of life. Some otherwise typically developing infants and toddlers start displaying autistic symptoms between the ages of 18 and 24 months, linguistic challenges, constrained interests and activities, and restricted and repetitive patterns of behavior. In the first five years of life, children with these problems may abruptly become reclusive or violent because of the influence on perception and socialization. Autism spectrum disorder (ASD) symptoms can manifest in early childhood and continue to plague a person well into adulthood. Numerous studies using various diagnostic methods, Key signs of autism have been identified by techniques like feature extraction, eye tracking, facial recognition, medical picture analysis, and speech recognition. However, recognizing a face is more important than reading someone's mood when it comes to making a diagnosis of autism. One prominent method of determining whether or not someone is typical or odd is by facial recognition.

In this article, we look at how recent studies have used machine learning to analyze observational behavioral indicators for ASD diagnosis. Consequently, a thorough literature search was done on the use of machine learning models for the quick and accurate diagnosis of ASD. By conducting a literature review, we hope to determine whether and how recent discoveries may be accurately applied to the creation and dissemination of ML-based ASD screening and diagnostic models. However, prior research has assessed the efficacy of ML models in ASD detection and diagnosis using accepted evaluation standards including specificity, sensitivity and accuracy. There is a lack of information on whether or not the models are ready and sufficient for actual deployment of the ML-based systems, and no previous literature reviews have provided a full analysis of the topic.

A complicated neurodevelopment illness, autism spectrum disorder (ASD) affects around 1% of the population and presents considerable difficulties for all parties involved. Since the causes of ASD are unknown, a diagnosis is made by looking for symptoms. Brains of autistic people have been demonstrated by sMRI studies to have a number of volumetric and geometric irregularities. However, due to contradictory findings, many advances never made it into clinical practice. The development of trustworthy biomarkers based on sMRI is vital for the accurate diagnosis and treatment of persons with ASD. Recent years have seen exponential growth in ML and DL, with the technologies infiltrating nearly every sector and showing particular promise in the field of illness diagnosis. As a result, there has been development and adaptation of ASD diagnostic strategies to meet the needs of the majority of clinical settings. Unfortunately, ASD diagnosis is still challenging. In this post, we discuss the research done thus far on using ML in ASD diagnosis.

II. LITERATURE REVIEW

Mohammad Wedyan et. All (2020) Early diagnosis and intervention can increase the success of treatment for autism. Whether or not these kids' motions start in the brachium and expand to the rest of their body is crucial for making a diagnosis of autism spectrum condition. Research done as late as the 2000s examined the diagnostic utility of upper-limb tremors in preschoolers (ages 2–4) with ASD. To better understand the differences between the ASD and the TG, LDA is used to extract features from the compiled sub-motions. Kinematic data plays an important role in detecting statistically significant differences between groups. In this research, we used LDA techniques to generate features and reduce their dimensionality; LDA has several applications, including but not limited to information classification and data reduction, which we also explored. [1]

Amirreza Rouhi et. All (2020) People with autism spectrum disorder (ASD) struggle greatly in all areas of communication and social interaction, but particularly in the areas of understanding and expressing emotions. The purpose of the game Emotify is to help children with ASD learn to recognise facial expressions and convey their emotions through words. Emotify analyses the child's reaction using machine learning algorithms and methods, then makes recommendations to help the child learn to recognise and process emotions. In our research, we found that the developed automatic emotion recognition system achieved a satisfactory 72% accuracy. Experiments in the field are the next natural step after this research to provide conclusive answers about the therapeutic potential of Emotify. Extending the game to make use of this capabilities and cross-validating audio data with human facial emotions are also on the docket for the future. [2]

Mirac Baris Usta et. All (2018) The researchers wanted to see how different demographic and clinical variables affected the development of autism spectrum disease. We analysed the characteristics that predicted a "better result" among 433 patients during the 36-month follow-up period. The symptoms improved by 39% after 12 months, 60% after 24 months, and 77.8% after 36 months. Future outcomes were affected by using DSM-IV-TR diagnostic categories. Parents' age and the severity of autism are the two most critical determinants of a child's development and future success. Taking into account MR comorbidity, birth weight, and age after diagnosis, the PDD-NOS group has been demonstrated to have a better prognosis. People with Asperger's who are older when they are diagnosed, older when they get their initial evaluation, and older when they meet the developmental milestone of speaking two words have a better prognosis. [3]

Fadi Thabtah et. All (2019) In a clinical setting, screening for autism is a crucial first step in acquiring insight into autistic traits and permitting rapid referrals for further assessment. However, current screening methods like AQ, Q-CHAT, and many more use scoring mechanisms that rely on simple arithmetic, such as adding up people's scores. These screening score systems have been created using subjective criteria, which leaves them vulnerable to criticism. Screening for autism spectrum disorder (ASD) has emerged as a key area of study as a means to better serve both individuals and their families. In order to accomplish this, automated ML-based methods that build trustworthy categorization systems using pre-existing cases and controls are a practical option. This paper proposes a novel machine learning (ML) approach called RML to enhance ASD screening by delivering automatic classification in addition to rich rule sets for use by clinicians, carers, patients and their families, and educators. [4]

Paul T Shattuck et. All (2012) There is insufficient data on services for adults with ASD to utilise it as a foundation for choices on policies and programmes. Though they recognise the urgency of the situation, advocates, service providers, and lawmakers are moving forward with plans to produce and distribute much-needed assistance. As a result, there is an opportunity to collaborate with innovative service providers to develop tried-and-true methods. In order to generate more relevant research goals and minimise the time it takes to transform those goals into action, a recent US study proposed that academics cooperate with programme innovators to adopt community-based participatory research approaches. There were a lot of similarities across the various conceptual frameworks. People have been urged to place more importance on their own sense of autonomy, satisfaction, and decision-making. In order to produce long-lasting advantages at the population level, it is crucial to intervene and measure at the organizational, community, and societal levels as impairment is thought to be the result of the interaction between a person's talents and the surrounding social context. [5]

Uğur Erkan et. All (2019) The potential of the machine learning techniques vizkNN, SVM, and RF for diagnosing ASD was covered in the essay. The AQ-10-Adult, AQ-10-Adolescent, and AQ-10-Child datasets in the UCI database contained both adults and children as participants. In terms of accuracy, sensitivity, F-measure, and area under the ROC curve, the RF and SVM approaches both perform admirably. According to our research, the RF method is better than SVM and kNN for classifying ASD data. In addition, authors learned that ASD can be diagnosed in toddlers. Machine learning methods can make an accurate diagnosis of autism spectrum disorder if adequate data is available. The dependability is also impacted by the completeness of the obtained data. If all necessary characteristics are included in the ASD dataset, early diagnosis of ASD will be quite precise. [6]

Mostafa1 et. All (2019) In this paper, the authors provide a unique feature set for use in Sakib diagnosis of ASD from rs-fMRI data. We built 264 regions of interest (ROIs) from rs-fMRI data into brain networks, with the pairwise correlation coefficients (PCCs) of their time-series signals serving as edge weights. The connectivity matrix is used to define attributes in the next stage. The eigenvalues of the Laplacian matrix of brain networks are proposed as distinctive traits, in contrast to more conventional network-based qualities like topological centralities, which are already well-established. By combining all these features, we increased the effectiveness of machine learning algorithms and attained higher accuracy than with earlier techniques. [7]

Tania Akter et. All (2019) Despite the fact that many researchers have conducted studies using ASD datasets, there is always room for improvement in ASD prediction. Authors research involved collecting and analysing early detection ASD datasets covering four developmental ages (infant, child, adolescent, and adult) and using a variety of classifiers to delve into the key characteristics of ASD. For all accuracy criteria, we found findings of 100%, the best prediction imaginable, in the distribution of random experimental outcomes; nonetheless, we analysed averaged results to compare with earlier studies. We examined ASD screening data using a range of FT techniques and added classifiers to these datasets in R, including Adaboost, FDA, C5.0, Glmboost, LDA, MDA, PDA, SVM, and CART. [8]

Wenbo Liu et. All (2015) In this paper, the authors put forth a machine learning framework for identifying those with autism spectrum disorders by tracking their eye movements while looking at scanned images of their faces. In addition, authors offered a whole suite of efficient strategies for feature extraction, as well as a prediction and scoring framework. Authors have achieved encouraging results on two ASD datasets, especially on the child set, despite the enormous difficulty of this task. The practicality and future promise of the proposed methodologies are supported by experimental findings. [9]

Md. Mokhlesur Rahman et. All (2020) Improving diagnostic performance is a key area of research in the field of autism spectrum disorders because it allows for more precise and economical categorization of the many forms of the disorder. A few examples of how this can be done include through improved prediction accuracy, sustained sensitivity, specificity, and validity, and shorter diagnostic times. Still, categorization efficiency has been subpar. Therefore, more study is needed to develop a reliable system for categorising ASD. In this line of study, machine learning algorithms are used as a smart, hands-off approach. The use of machine learning algorithms for the diagnosis of ASD has shown promising results. Effective feature selection prior to adopting categorization is, nevertheless, a crucial challenge in ASD diagnosis. Successful classification can be aided by careful feature selection. Using machine learning algorithms, we present and explore important concerns related to autism in this research. [10]

Maitha Rashid Alteneiji et. All (2020) The major goal of this research was to present the most effective machine-learning model for identifying persons with Autistic Spectrum Disorder based on their symptom profiles. The best machine-learning model was chosen through a series of procedures. We were able to choose the optimal ASD questionnaire diagnostic approach and create a high-quality database for each age group with the help of previous research studies and surveys of medical specialists. Using the available datasets and the pertinent data mining technologies, the most accurate model was selected as the best machine-learning model for diagnosing ASD symptoms. Part one covered how to use machine learning to predict if a person has certain traits of Autistic Spectrum Disorder based on data from their knowledge discovery in databases. [11]

Shirajul Islam et. All (2021) the authors proposed methodology improves the reliability of early autism diagnosis. Parents are asked confidential questions in order to determine whether or not their children are in danger. Our proposed model uses the dataset from Q-CHAT and AQ tools to provide predictions with an accuracy of 83% via SVM, 93% via Random Forest, 89% via Naive Bayes, and 98% via KNN for toddlers. After cleaning and preparing our data, we run supervised algorithms on it. With the help of SVM, Random Forest, Naive Bayes, and KNN, authors were able to improve the precision of our results. This result was more successful than the others. With a 93% and 98% degree of accuracy, our results were just average. The insufficiency of big data for model training is our sole real drawback. A lack of data is the most likely cause of problems with our thesis research because of restrictions on the design or approach. [12]

Anshu Sharma et. All (2020) Having a child with autism presents a significant challenge for any family because it is one of the most important problems that cannot be prevented but can be managed. As a result, getting an early diagnosis is crucial. Developing better diagnostic instruments that can produce reliable results quickly is a pressing concern in modern science. The results of applying machine learning techniques have been encouraging. It is possible to diagnose autism spectrum disorder using machine learning's leveraging methods. Robust algorithms are created using machine learning, and accompanying infrastructure is made to order. Researchers were able to construct a model with higher levels of accuracy and precision by making use of a variety of ML methods. [13]

Dadang Eman et. All (2019) This study surveyed the literature on autistic spectrum disorder with machine learning, specifically supervised learning. After a careful screening process, we found that 16 research publications from internet databases fit the criteria for this investigation. The study found that 68.75% of the time, support vector machines were utilised; 31.25% of the time, random forests were used; and 31.25% of the time, decision trees were employed (decision tree). Despite its limitations, With machine learning applied to ASDs that are anticipated to identify early in expediting the process of developing and enhancing diagnostic accuracy compared to those remaining manual, this study illustrates the promise of machine learning in the field of autism spectrum disorders (ASD). [14]

Pramit Mazumdar et. All (2021) In this paper authors discuss the challenge of detecting ASD in its earliest stages. Authors use a different approach by analysing how children's eyes move when they look about in unfamiliar images. Image content, fixations, and centre bias were used to derive features from the scanpaths that are sensitive to anomalous viewing behaviour. That data was fed into a classifier that proved highly effective at spotting autism spectrum disorders. However, there is still potential for improvement when compared to alternative algorithms. An in-depth investigation into the topics of fixation that autistic people fail to cover could be a focus of future research. This examination has the potential to reveal which topics are not interesting to someone with ASD. [15]

Suman Raj et. All (2020) In this study, a number of machine learning and deep learning techniques were evaluated for their capacity to identify Autism Spectrum Disorder. On a non-clinical dataset from three age groups, the models used for ASD detection were assessed using a variety of performance evaluation markers. All age groups are covered, including children, teens, and adults. Compared to another recent investigation [3] into the same issue, the CNN classifier performed better after managing missing values in its features and attributes. After missing value is handled, the prediction accuracy of the SVM and CNN based models for the ASD Child dataset is nearly identical, at around 98.30%. On the other hand, the CNN-based model outperformed all other model-building methods on the other two datasets, clearly indicating that it can be used to detect ASD instead of the more traditional machine-learning classifier that had been proposed in previous studies. [16]

Bhawana Tyagi et. All (2020) Many people's lives can be prevented from being destroyed by ASD if the disorder is diagnosed early. Here, we use data mining techniques to a dataset consisting of adults aged 17–60 in an effort to diagnose ASD. Our research dataset contains a wide variety of questions. The classification process has made use of the KNN, LR, SVM, Naive Bayes, CART and LDA algorithms. In this case, we quantify the information about certain traits. Our implementation showed that Linear Discriminant Analysis approach yields best results, with a percentage of 72.2024% accuracy. [17]

Koushik Chowdhury et. All (2020) In this research, we examine how various machine learning classifiers fare on a sample of the full dataset and draw comparisons between them. Predictions are made about the autism spectrum using data from medical records. Authors mapped the features and constructed a dataset with no blanks so that the work could be done efficiently. Through testing, authors discovered that the Support Vector Machine (SVM) performs admirably on this particular data set. In light of this, authors decided to employ support vector machines to conduct a more thorough investigation of the dataset. We implemented the most common SVM kernels for a more stable result. In comparison to other algorithms and classifiers, the SVM Gaussian Radial Basis kernel performed the best. It was not simple to manage this sort of medical dataset and find the optimal classifier that yields a reliable result. [18]

Catherine Lord et. All (2018) Today, many ASD sufferers have higher quality of life than they did fifty years ago. More persons with ASD are able to vocally speak, read, write, drive, finish school, and operate independently in the community, even when accounting for changes in diagnostic criteria over time and disparities in intelligence. The fact that things have changed for the better and will keep changing gives those who provide care for people with ASD hope. In order to help more people overcome these barriers and enable them to live more freely and fully engage in society, this study aims to identify those individuals who are still dealing with substantial hurdles. Government leaders and the scientific community both have a chance to influence these changes. Working with families, schools, and other community organisations, clinicians can improve the lives of children and adults by offering accurate and realistic information, support, and hope. [19]

Kate Nation et. All (2006) From this study, several conclusions about the reading abilities of autistic children can be made. As determined by their capacity to read aloud single words presented in isolation, 78% of the children whose families consented to participate in our study could be considered to possess reading abilities. On a test of reading accuracy, the group as a whole did about average, but they struggled more on a test of reading comprehension. On all of the reading exams, there was a wide range of performance, from very near the bottom to the top of the group. Therefore, group means are largely unhelpful for analysing component reading abilities in this group of young people. The majority of the children in the sample, 65%, had reading comprehension scores that were at least one standard deviation below community norms, and around one-third of them had very significant reading comprehension deficits, as was to be predicted. Some of these children may struggle to comprehend what they read because they are unable to read it properly. It seems sense that they won't be able to understand what it says if they can't recognise or decode the words. [20]

Kristine D. Cantin-Garside et. All (2020) These results are the first indication that wearable sensors can be used to accurately and specifically identify a wide range of SIBs (accelerometers). As high as 99.1% accuracy (the average accuracy across all people was 93%) was achieved when using classification models based on kNN and SVM to diagnose SIB at the individual level. Similar classifiers achieved up to 97% average accuracy on a massive scale, across multiple behavioural traits. The results of this study provide support for the hypothesis that the development of extreme irritable behaviours, one of the leading sources of worry in ASD, may be effectively managed. [21]

Kayleigh K. Hyde et. All (2019) The purpose of this work was to provide an overview of works that looked at ASD using supervised machine learning techniques. We compiled and analyzed 45 articles that applied supervised machine learning techniques to text mining and ASD research projects. In the 35 ASD research that were analyzed, SVM and ADtree were the two supervised machine learning methods that were most frequently utilized. These studies used supervised machine learning algorithms to make binary predictions (usually based on diagnoses) in order to enhance ASD diagnosis and screening, discover new ASD biomarkers, and learn more about the genetic basis of ASD (e.g., using neuroimaging). The three text mining methods that were most frequently utilized in the literature we looked at were naive Bayes, support vector machines, and random forests. The examined text mining studies looked into contentious issues in online ASD support groups, discovered possible ASD genes, and discovered previously unrecognized links between ASD and other fields. [22]

Kaushik Vakadkar et. All (2021) Overlapping symptomatology makes the already time-consuming procedure of assessing ASD behavioral features even more challenging. There is not yet a reliable diagnostic test for ASD, nor is there a screening method that is both comprehensive and optimised for detecting ASD in its early stages. Automated ASD prediction models were developed, with minimal behaviour sets taken from each dataset used for diagnosis. Authors tested five different models on our data, and Logistic Regression yielded the best results. The biggest problem with this study is the lack of accessible large ASD datasets. It takes a huge dataset to produce a reliable model. The number of instances in the dataset we utilised was insufficient. Authors findings, however, have helped guide the creation of an automated model that can aid doctors in the early diagnosis of autism in youngsters. [23]

TABLE I. FINDING OF OUR REVIEW

S. No.	Author	Description	Key finding
1.	Santos et al. (2013) [24]	Acoustic prosodic features data type used	"Accuracy (%): 79.1-97.7, AUC (%): 66-97, Sensitivity (%): 69.6-95.6, Specificity

			(%): 50-100”
2.	Bussu et al. (2018) [25]	VABS, AOSI data type used	“Accuracy (%): 66.4 (8 m), 64.4 (14 m), Sensitivity (%): 68.8 (8m), 67.5 (14m), Specificity (%) 64.4 (8m) 67.5 (14m), AUC (%) 69.2 (8m), 70.8 (14m)”
3.	Emerson et al (2017) [26]	“Data type used FcMRI: Functional brain connections”	“PPV (%): 100, NPV (%): 96, Sensitivity (%): 81.8”
4.	Goel et al. [27]	“Proposed Optimization Algorithm for improved performance over common ML”	“The proposed MGOA (GOA with Random Forest classifier) predicted ASD cases with approximate accuracy, specificity, and sensitivity of 100%.”
5.	Thabtah and Peebles [28]	“Demonstrate the superiority of Rules-based ML over other models”	“Empirically evaluated rule induction, Bagging, Boosting, and decision trees algorithms on different ASD datasets. The the superiority of the RML model was reported in not only classifying ASD but also offer rules that can be utilized in understanding the reasons behind the classification”.
6.	Abdolzadegan D et. All [29]	“SVM, KNN algorithm used and EEG data from 34 children 3-12 years old with ASD and 11 control children in the same age range”	“Children above 5 were used to train the models, and they tested children below 5 to support diagnosis ASD SVM: 90.57% KNN: 72.77%”
7.	Bahado-Singh RO et. all [30],	“DL, ML (5 different algorithms)”	“DL : AUC 0.958–1.00 for detection of ASD ML : 4 out of 5 algorithms had an AUC of≧0.95”
8.	Bajestani GS et. all [31]	“Data set: EEG data from 60 children ranging in ages 6-8, 30 normal cases and 30 ASD cases”	“EEG signals of the brain’s C3 and C4 channels and the topological features of its network used to distinguish ASD from normal cases at an early age. Accuracy is: 81.67%”
9.	Geetha Ramaniand & Sivaselvi [32]	“Data set collected from UCLA’s Centre for Autism Research and Treatment”	“Fisher, Runs, Relief- (Feature selection), New centrality measure, Neuroimaging techniques, RS-FMRI”
10.	Demirhan [33]	“ASD adolescent scan data from UCI Machine Learning Repository is used -2017”	“Sigmoid, polynomial, radial basis function (RBF)kernel function,10fold CV”

III. Deep Learning

Deep learning is a type of machine learning that uses numerous layers of data processing and big datasets to automate feature extraction and pattern detection. Simply defined, deep learning uses a concept hierarchy that is created by piling more challenging concepts on top of the simpler ones that define it as it gathers knowledge through experiences, enabling a computer to build complex concepts out of simpler ones. The idea that a focus on learning from past experiences results in a diminished necessity for human operators to officially describe parameters to the computer is also developed. Machines trained using deep learning approaches employ hierarchical structures to find underlying themes and patterns in datasets. NLP, ISR, and many other disciplines of artificial intelligence can benefit from the study of machine learning, which focuses on how to learn from data. The authors aimed to better understand the function of epigenetic in the development of ASD by concentrating on cytosine ('CpG' or cg') loci (and related genes) that were epigenetically changed. 4 By examining the DNA methylation status of newborn leukocyte DNA, deep learning prediction algorithms have already been applied to the diagnosis of ASD.

IV. Structural MRI and Features Extraction

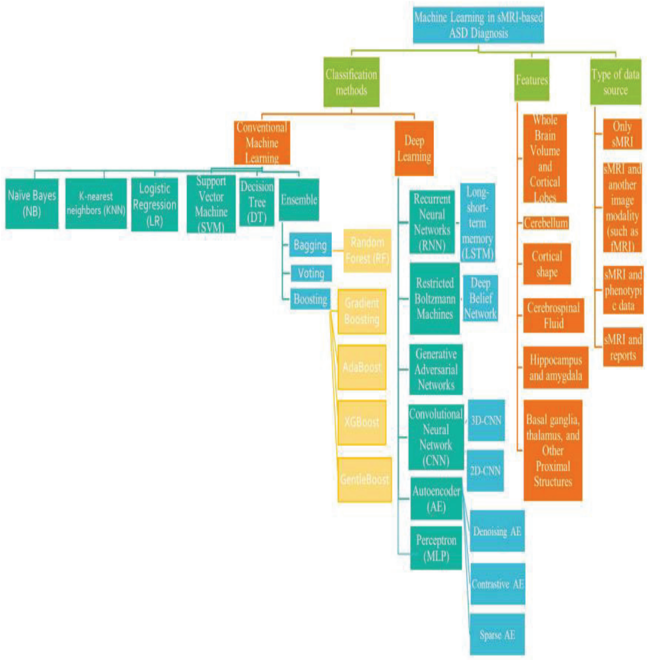

Fig. 1. A literature-based Structure for ML-based ASD classification

MRI, along with other modalities of medical imaging, can provide reliable diagnosis. It generates images of the internal body without harming the patient, images that can be utilised for clinical evaluations and to characterise disease processes. In order to study the effects of autism spectrum disorder (ASD) on the brain from various angles, researchers have turned to magnetic resonance imaging (MRI) techniques. It is very crucial to study the brain morphology of children and adolescents using sMRI due to its high contrast sensitivity, spatial resolution, and absence of exposure to ionising radiation. Different regions of the brain can be studied using sMRI because of the flexibility of the stimulation and repetition times (e.g., T1, T2, and FLAIR). The increase of data in medical imaging of all kinds has made analysing medical images and extracting therapeutically useful information a severe problem. The analytical prowess of artificial intelligence technology is crucial to enhancing health care results. Research into computer-aided diagnostic (CAD) imaging is expanding rapidly. To be effective in medical pattern identification, "learning from cases" is crucial given that complex structures like organs may resist mathematical simplicity. To gain a deeper understanding of an object, ML is typically employed to categorise input features into one of several predetermined categories, such as "healthy" or "autistic" (e.g., GM volume). There are many steps involved in acquiring, improving, extracting, identifying, and analysing the region of interest (ROI) of a sMRI image, and CAD systems handle all of them automatically. Feature extraction applies scientific, mathematical, and statistical procedures or algorithms to identify measurable features/biomarkers in a sMRI image that can be used as inputs to ML models for detecting brain disorders.

V. A MACHINE LEARNING BASED FRAMEWORK FOR CLASSIFICATION OF ASD

Fig. 2. Steps of typical Deep Learning based methods for diagnosing ASD

Figure 2 illustrates generic steps for establishing an Machine learning based ASD diagnosis. ASD classification may be divided into four components:

(a) Data acquisition and preprocessing;

(b) Feature extraction and selection;

(c) Training the model; and

(d) Testing the model and performance evaluation.

Using the available video dataset for ASD diagnosis prediction is difficult. First, there is a severe lack of video instances, particularly for ASD participants, which makes it difficult to train deep neural networks and frequently leads to overfitting. Second, although we have a small sample size of videos, each of those videos is annotated with a large number of fine-grained manual behaviour annotations that have been demonstrated to be helpful in differentiating ASD from TD. Therefore, making use of semi-supervised data may facilitate network learning. The first step involves obtaining accurate predictions of various activities in each video clip; they will be used to deduce the ultimate diagnosis based on the aforementioned two factors.

VI. BEHAVIOR DETECTION BASED ON IMAGE-BASED DEEP LEARNING

Fig. 3. Examples of four behaviors of interest

VII. BASIC ALGORITHM FOR AUTISM DISORDER DETECTION

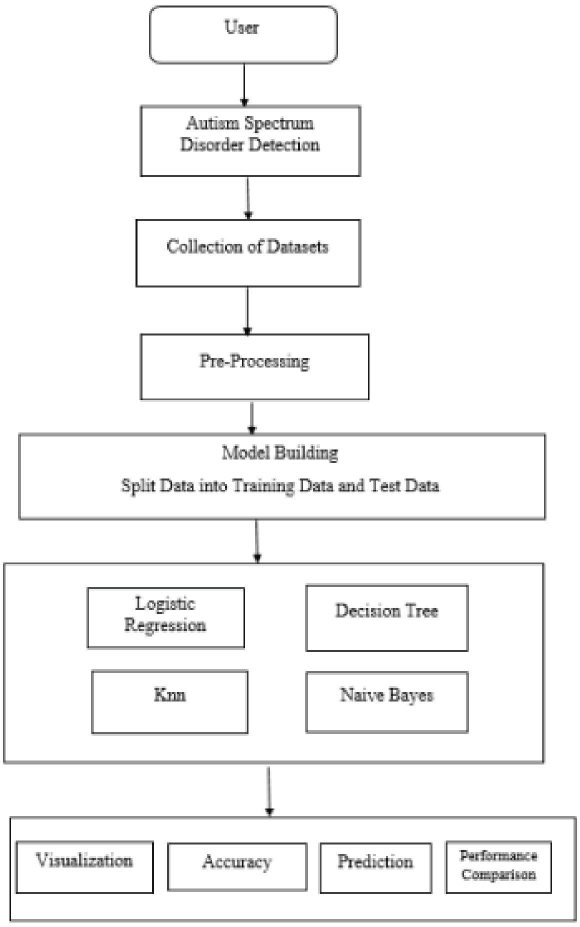

Fig. 4. Basic Algorithm for Autism Disorder Detection

Pre-processing techniques are first applied to the dataset. Determine the overall data's mean, median, and mode, and then verify that the dataset is free of null values, missing data, and irrelevant information. First, the pre-processing method is applied, and then the dataset is saved in.csv format. In this work, machine learning techniques are used to predict autism spectrum disorder. An individual's prediction of where they fall on the autism spectrum can then be seen in real time, thanks to the algorithm's implementation in a web browser.

VIII. CONCLUSION

Machine learning algorithms allow computers to analyze data patterns, learn from experience, and adjust to new information. Machine learning in the form of deep learning uses many layers of processing data in order to automatically extract features and recognise patterns. In a nutshell, deep learning stacks increasingly challenging concepts on top of the simpler ones that define it as it accumulates information from experiences to assist a computer create complex concepts out of simpler ones. Another concept is the reduction of the need for human operators to explicitly specify parameters to the computer by stressing learning from prior experiences. Machines trained with deep learning methods use hierarchical structures to search for commonalities and patterns in datasets. Many subfields of AI, such as natural language processing (NLP), information retrieval (ISR), and others, benefit from the study of machine learning, which focuses on learning from data. The researchers investigated the probable epigenetic aetiology of autism spectrum disease by focusing on cytosine ('CpG' or cg') loci (and related genes) that were epigenetically modified. Autism has been diagnosed using deep learning in prediction algorithms trained on the DNA methylation state of newborn leukocyte DNA. Some of the most pervasive symptoms of autism, such as difficulty with social interaction, behavioral patterns, cognitive difficulties, and sensory impairments, may be alleviated with the use of Machine Learning algorithms into the research of autism, as suggested by the results of this study. Early identification of autism spectrum disorder (ASD) is challenging since so many issues emerge for parents, caregivers, medical experts, therapists, etc. before the disease's distinguishing symptoms become visible, in this paper we review many research paper and also mention findings of the our review.

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