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LITERATURE REVIEW ON APPLYING MACHINE LEARNING TECHNIQUES TO DIAGNOSE AUTISM SPECTRUM DISORDER (ASD)

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ABSTRACT

Clinical decision support systems are computer based automated systems developed with the aid of AI and ML for supporting and improving the accuracy of clinical decision-making processes. These systems are used by clinicians in making diagnostic decisions and treatment plans. It is able to simulate expertise and express logical reasoning for making assertions. Many inexperienced clinicians are not well confident in certain autistic cases because their observed diagnosis and the calculated grade may not be always similar. Availability of diagnostic experts to provide clinical expertise is also a problem in the diagnosis of autism children. Hence, there is a need of a computer assist system comprised of experience and skill of a clinician, which can advance the power of existing diagnostic method. The computer-assisted system will help to confirm the assessment decisions of clinicians. Research works about the application of machine learning techniques for the development of autism assessment and grading in this area is very much required. This work proposes an approach which uses machine learning techniques for autism grading.

KEYWORDS: *Machine Learning, Autism Spectrum Disorder*

INTRODUCTION

Autism spectrum disorder (ASD) is a developmental disorder that affects communication and behavior. Although autism can be diagnosed at any age, it is said to be a 'developmental disorder" because symptoms generally appear in the first two years of life. People with ASD have Difficulty with communication and interaction with other people. Restricted interests and repetitive behaviors. Symptoms that hurt the person's ability to function properly in school, work, and other areas of life.

Autism is known as a "spectrum" disorder because there is wide variation in the type and severity of symptoms people experience. ASD occurs in all ethnic, racial and economic groups. The different factors that make a child more likely to have ASD include environmental and genetic factors. Most scientists agree that genes are one of the risk factors that can make a person more likely to develop ASD. Children who have a sibling with ASD are at a higher risk of also having ASD. ASD tends to occur more often in people who have certain genetic or chromosomal conditions, such as fragile X syndrome or tuberous sclerosis when taken during pregnancy, the prescription drugs valproic acid and thalidomide have been linked with a higher risk of ASD. There is some evidence that the critical period for developing ASD occurs before, during, and immediately after birth. Children born to older parents are at greater risk for having ASD.

LITERATURE REVIEW

In the paper, Prediction of the Autism Spectrum Disorder Diagnosis with Linear Discriminant Analysis Classifier and K-Nearest Neighbor in Children, published by the authors Osman Altay and Mustafa Ulas emphasizes on Autism Spectrum Disorder (ASD) which negatively affects the whole life of people. The main indications of ASD are seen as lack of social interaction and communication, repetitive patterns of behavior, fixed interests and activities. It is very important that ASD is diagnosed at an early age.

In this study, the classification method for ASD diagnosis was used in children aged 4-11 years. The Linear Discriminant Analysis (LDA) and The K Nearest Neighbor (KNN) algorithms are used for classification. To test the algorithms, 30 percent of the data set was selected as test data and 70 percent as training data.

As the result of the implementation, the LDA algorithm (accuracy: 90.8%) gave a better result than the KNN algorithm (accuracy: 88.5%) at the accuracy value. However, the KNN algorithm is more successful than LDA in the sensitivity value, which is a value indicating that children patients are ASD patients. The F-measure value is calculated as 0.9091 for the LDA algorithm and 0.8913 for the KNN algorithm. The LDA algorithm in the F-measure value provided a 1.95% better success rate than the KNN algorithm.

In the paper, Machine Learning Techniques to Predict Autism Spectrum Disorder, published by authors BhawanaTyagi, Rahul Mishra et al emphasizes on Autism Spectrum Disorder (ASD) which is a serious developmental abnormality that seriously affects the behavior and communication of an individual. It limits the use of communicative, social and cognitive skills as well as abilities of the affected personality whereas its symptoms may vary from person to person.

Artificial Intelligence's branch i.e Machine learning is applied to diagnose ASD problem as a classification task in which prediction models were built based on chronological dataset, and then used those patterns to predict that the person is suffering from ASD or not. So, it can be used for decision making under ambiguity. Naïve Bayes and LDA algorithms have been used in the classification. Here we convert the data of some attributes into the numerical values

As the result of the implementation, the Linear Discriminant Analysis algorithm showed the best result i.e 72.2024% and more accurate than Naïve Bayes (accuracy:70.7%).

In the paper, Grading Autism Children Using Machine Learning Techniques, published by authors Dr.C.S.Kanimozhiselvi, Mr.D.Jayaprakashet al emphasizes on Clinical decision support systems are computer based automated systems developed with the aid of AI for supporting and improving the accuracy of clinical decision-making processes. These systems are used by clinicians in making diagnostic decisions and treatment plans. It is able to simulate expertise and express logical reasoning for making assertions. Many inexperienced clinicians are not well confident in certain autistic cases because their observed diagnosis and the calculated grade may not be always similar. Availability of diagnostic experts to provide clinical expertise is also a problem in the diagnosis of autism children. Hence, there is a need of a computer assist system comprised of experience and skill of a clinician, which can advance the power of existing diagnostic method. The computer-assisted system will help to confirm the assessment decisions of clinicians.

Research works about the application of machine learning techniques for the development of autism assessment and grading in this area is very much required. This work proposes an approach, which uses machine-learning techniques for autism grading. Decision tree classifier algorithm has been used in the classification. As the result of the implementation, the Decision tree classifier algorithm gave a best result of accuracy 90%.

In the paper, A Machine Learning Approach to Predict Autism Spectrum Disorder, published by Kazi Shahrukh Omar, Prodipta Mondalet al emphasis on Autism Spectrum Disorder (ASD) that is gaining its momentum faster than ever. Detecting autism traits through screening tests is very expensive and time consuming. With the advancement of artificial intelligence and machine learning (ML), autism can be predicted at quite early stage. Though numbers of studies have been carried out using different techniques, these studies did not provide any definitive conclusion about predicting autism traits in terms of different age groups.

An effective prediction model based on ML technique and a mobile application for predicting ASD for people of any age. The proposed model was evaluated with AQ10 dataset and 250 real datasets collected from people with and without autistic traits. Support Vector Machine (SVM) algorithm has been used in the classification.

As the result of the implementation, the Support Vector Machine (SVM) algorithm gave a best result of accuracy 65%, 89.2% sensitivity and 59% specificity.

In the paper, Autism Spectrum Disorder Screening: Machine Learning Adaptation, published by Fadi Thabtah on one of the primary psychiatric disorders is Autistic Spectrum Disorder (ASD). ASD is a mental disorder that limits the use of linguistic, communicative, cognitive, skills as well as social skills and abilities. Recently, ASD has been studied in the behavioural sciences using intelligent methods based around machine learning to speed up the screening time or to improve sensitivity, specificity or accuracy of the diagnosis process. Machine learning considers the ASD diagnosis problem as a classification task in which predictive models are built based on historical cases and controls. These models are supposed to be plugged into a screening tool to accomplish one or more of the aforementioned goals.

Medical Diagnosis like Autism Diagnostic Observation Schedule Revised (ADOS-R), Autism Diagnostic Interview (ADI) along with Random Forrest Classifier (RFC).

As the result of the implementation, the Random Forrest Classifier (RFC) algorithm gave a best result of accuracy 63%, 80.2% sensitivity and 51.1% specificity

CONCLUSIONS

Autism is considered as one of the fastest growing developmental disorder in children, hence the study for its early diagnosis with the support of classification models will certainly contribute to a greater extent, in solving the problem of making a correct assessment. This work focused on the development of some classification models using machine learning algorithms such as Naive Bayes Algorithm, Decision Tree Algorithm, K Nearest Neighbors Algorithm, Support Vector Algorithm with real world clinical dataset and its application in grading childhood autism helps the clinical paediatrician to diagnose the grades of autism in the earlier stages. This could serve as an additional mechanism to detect autism and treat children by the paediatricians.

One of the major difficulties in this work is the unavailability of a standard data set for comparing the performance of models with the existing works. Hence, in the future work consideration will be given in collecting enough samples and standardizing the data set so that more machine learning models can be tested and compared easily.

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