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Intervention of Autism Spectrum Disorder by ISAA Tool using Machine Learning

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Abstract: Autism spectrum disorder (ASD) is a brain and neural developmental disorder which cause difficulties with various communication, social and behavioral disorder. It is also psychological disorder characterized by restricted, repetitive behaviors and social interaction. They also have problems with learning. ASD screening is normally conducted by a medical practitioner. Diagnosing the ASD will have various assessment tools is also known as screening tool which have wide range of intelligence quotient. The intelligence quotients consist of questionnaire used for specific age groups which aims to investigate whether child, adolescent and adult have symptoms of ASD. ASD screening involves gathering a large number of responses of the child or adult behavior either given by the parents or a caregiver. The diagnosis is done by observation. The children with ASD is diagnosis by screening method. The screening method consist of various questions with is answered by parents how the child react and interact with others. And also the doctors keep the children in the observation. By observing the children the answer for the question is answered. Therefore the answer is converted into digitally and helps the doctor to predict the autism spectrum disorder using machine learning by applying various the classification methods.

Keywords: ASD- Autism spectrum disorder

I. INTRODUCTION

Autism spectrum disorder (ASD) is a brain and neural developmental disorder which cause difficulties with various communication, social and behavioral disorder. It is also psychological disorder characterized by restricted, repetitive behaviors and social interaction.

They also have problems with learning. ASD screening is normally conducted by a medical practitioner. Diagnosing the ASD will have various assessment tools is also known as screening tool which have wide range of intelligence quotient. The intelligence quotients consist of questionnaire used for specific age groups which aims to investigate whether child, adolescent and adult have symptoms of ASD. ASD screening involves gathering a large number of responses of the child or adult behavior either given by the parents or a caregiver.

The diagnosis is done by observation. The children with ASD is diagnosis by screening method. The screening method consist of various questions with is answered by parents how the child react and interact with others. And also the doctors keep the children in the observation.

By observing the children the answer for the question is answered. Therefore the answer is converted into digitally and helps the doctor to predict the autism spectrum disorder using machine learning by applying various the classification methods. In 2012, a study shows that the prevalence of autism spectrum disorders estimates globally and found 61 cases per 9999 people. Autism and Developmental Disabilities Monitoring (ADDM) describes in 2014 that approximately 1 in 59 children in the United States has been identified with autism spectrum disorder (ASD).

Since there is no studies of autism found in India, and no other part of the world gives the exact prevalence and incidence. Numerous adults with the autism spectrum disorder in India continue to be unfairly considered to have personality disorders. The major part of the people with autism in India are unlike diagnosed and they did not receive the assistance they need. But in India, due to insufficient of awareness, the professionals misdiagnose or under-diagnose condition. The diagnostic tools most often used at worldwide is Diagnostic and Statistical Manual, Fifth Edition (DSM V).

II. DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS

The Diagnostic and Statistical Manual of Mental Disorders (DSM) is accepted by psychiatrists and clinicians to diagnose the mental illnesses and behavior of the child. The DSM is used for psychiatric diagnosis which cover all categories of mental health disorders for both adults and child.

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III.AUTISM ASSESSMENT TOOLS

There are various number screening and assessment tools that are used throughout the assessment process to determine the diagnosis of autism spectrum disorder according to DSM-5 or ICD-10 criteria.

A. The M-CHAT contains 20 yes/no questions asked regarding the child's behavior and the final result helps the parents whether future assess is needed or not.
B. The M-CHAT is commonly used in United States of America by American Psychological Association (APA).VBut in India, NIMH-National Institute for Mentally Handicapped developed the ISAA-Indian Scale for Assessment of Autism for diagnosing and estimate autism spectrum disorder.
C. ISAA assessment tool is divided into Sensory Aspects, Social Relationship and Reciprocity, Cognitive Component, Speech - Language and Communication, Emotional Responsiveness Behavior Patterns.

Therefore, there is a huge difference between M-CHAT and ISAA and also there is a difference between child growth and environment compared to United States of America and India.

IV. LITERATURE REVIEW

In this section, we do discuss about the literature that are in close relation to our proposed work. These paper that are to be discussed will help to identify screening process and how supervised machine learning algorithms are used to detect autism spectrum disorder.

A. Thabtah et al. (2019) have suggested a new Machine Learning method called RML- Rules-Machine learning that not just boosts the predictive accuracy, sensitivity, specificity of the ASD screening process.
B. Thabtah et al. (2017) have proposed that a detectable problem with contemporary ASD screening tools, the accuracy of these tools using the DSM-IV rather than the DSM-5 manual. This paper mainly provide an in-depth discussion about 2 familiar clinical diagnostic methods along with research studies that review the need for updating screening methods to fulfil DSM-5.
C. Kosmicki et al. (2015) talk about that he used machine learning to assess one of the best and utmost commonly used instruments for clinical assessment of ASD, the Autism Diagnostic Observation Schedule (ADOS) which contains four modules, with module 2 reserved for individuals with some vocabulary and module 3 for higher levels of cognitive functioning. They have found that 9 of the 28 behaviour captured by items from module 2, and 12 of the 28 behaviors captured by module 3 are sufficient to detect ASD risk with 98.27% and 97.66% accuracy.
D. Al-Diabat et al. (2018) have discussed that Fuzzy rules is extracted automatically from the past controls and cases to form the screening classification system. FURIA builds screening models in an automated way from historical controls and cases and then utilizes the models to detect the possibility of autistic traits in new individuals.
E. Duda et al.(2016) have discussed that that the 65 behaviors measures by this screening tool which is sufficient under the curve = 0.965. SVC, LDA, Categorical Lasso and Logistic Regression performed with accuracy 0.962–0.965.
F. Thabtah et al. (2018) have proposed a computational method called variable analysis Va is verified using two machine learning algorithms by deriving automated classification systems with respect to specificity, sensitivity, negative predictive values (NPVs), positive predictive values (PPVs), and predictive accuracy.
G. Omar et al. (2019) have proposed an effective prediction model based on ML technique and to develop a mobile application for predicting ASD for people of any age. They also state that their research provides a comparative view among different ML approach 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 when compared to both Random Forest and Decision Tree-CART algorithm.
H. G. Kent et al. (2013) have discussed that using Sample 1 and 2 showed that the Initial Algorithm had the highest level of sensitivity but lowest specificity, while the Youden J Algorithm had the highest level of specificity but lowest sensitivity.
I. Hyde, K.K.et al (2019) have discussed a total of 45 articles that used supervised machine learning algorithms were naïve Bayes, SVM, and Random Forest. This Paper is used knowing supervised machine learning trends in ASD.

V. EXISTING SYSTEM

In existing system the question from M CHAT and ISAA is varied from each other. ISAA seems to have more questions and translated to get more accurate classification. This ISAA have taken very long time to diagnose. Furthermore this study aims to get accurate result to help the professionals.

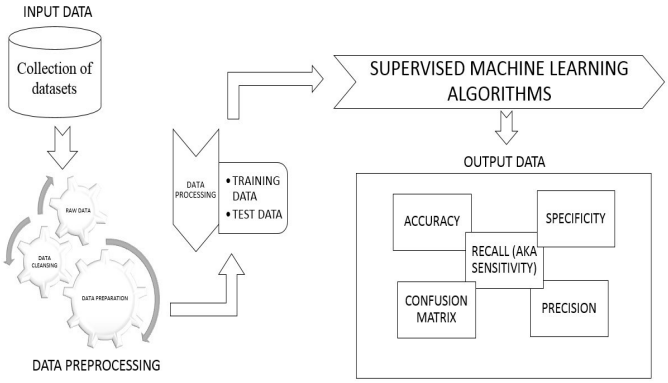
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VI. PROPOSED SYSTEM

In the proposed system, by implementing supervised machine learning algorithms for the screening process and identification of autism spectrum disorder. Therefore Machine learning is used to automate the screening process to help the professionals effectively.

Data are collected by using the ASD screening methods by M -chat. The source data is collected, it is then pre-processing i.e., raw data is cleansed and ready for data preparation. The missing values and values are digitization of certain continuous attributes such as age, answers of quotients of individuals. Furthermore, a method is given to take out features, which came to be redundant. Once the source data are collected and pre-processed, then a supervised learning algorithm is applied to differentiate the correlations between the variables in the training dataset and the individuals with class variables ASD or No ASD.

Then the model is assess to remove useless and redundant rules, storing only variables that have classified training instances.



A. Data Collection.

Data are collected by the m-chat questionnaire. The screening questionnaires contains questions according to the DSM-5 standards. The collected source data is stored in a excel file format, used for future data .But here we have collected the dataset from UCI machine learning repository. In that repository we have 1800 number of instances with 21 attributes which also have missing values and null values.

B. Data pre-processing.

A numerous amount of pre-processing operations were appealed on the collected source data. Missing values replaced and digitization for continuous attributes such as the age, classes ASD/NO-ASD of the individuals. Data processing phase, rejected a various number of variables from the datasets that are either redundant or non-redundant.

C. Data Processing.

A data processing remove attribute that were redundant and possibly created the possible results. Source data are pre-processed and then machine learning algorithm is applied.The beginning model is then assess to remove useless and storing only redundant rules that have been used for classified training instances.

D. Train and Test Data.

To assess the model on the same data to train it, then the model could be very fit or over fit. A model should be concealed on its ability to predict new and unseen data. Hence separate the training and test the subsets of the dataset into 80:20. 80 is for training the sets and 20 is for test the sets. Training sets are used to fit and tune the models. Test sets are put aside as "unseen" data to assess the models.

VII. FUTUER ENHANCEMENT

One of the future work is getting the data from ISAA questions and reviewing the data by supervised machine learning to obtain the accuracy, specificity, sensitivity and precision for ISAA model.

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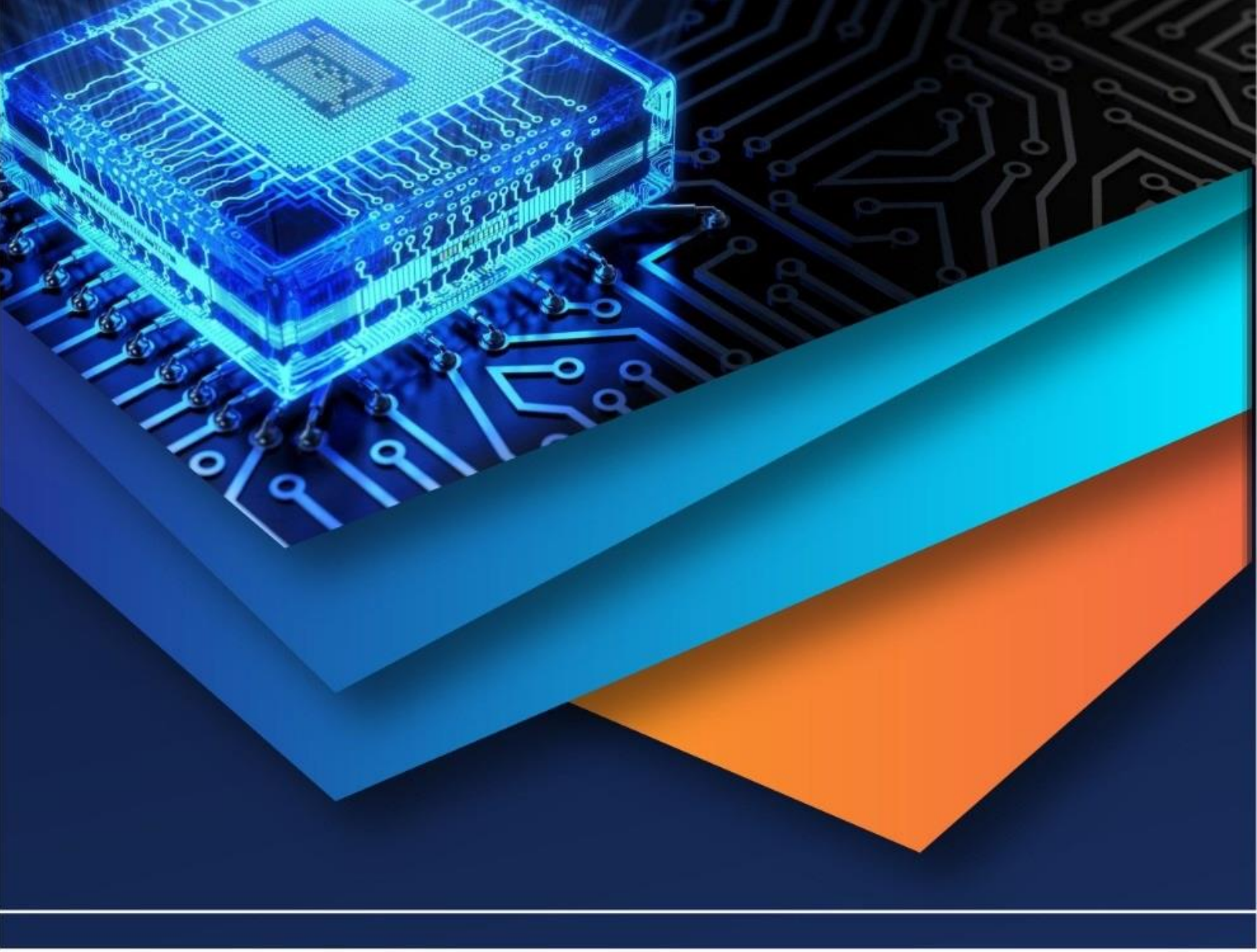
VIII. CONCLUSION

ASD is a psychological disorder characterized by restricted, repetitive behaviors or behavioral disorder. Autism spectrum disorder (ASD) is a developmental disorder that cause difficulties with communication, social and behavioral challenges. The efficiency and accuracy of ASD screening methods depend primarily on the knowledge and experience of the user and also the items designed in the screening method. By using ML techniques the accuracy, precision, recall, specificity and confusion matrix were computed for the dataset acquired from the UCI repository. In the future, a computer assisted system is developed for children's who have autism spectrum disorder.

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