International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 08, 2020
ISSN: 1475-7192

Autism Spectrum Disorder Prediction

*[1] Shanthi S, [2]Nirmaladevi K, [3]Pyingkodi M, [4]Nithyaprakash S, [5]Tamilanban V

***ABSTRACT**--Autism Spectrum Disorder (ASD) is a syndrome that affects neurons and person's interaction, communication and learning skills. Detecting autism behavior through screening tests is very expensive and time consuming. Mostly ASD were seen from the children in age group of 2-14. This ASD has more chances to get cured but it will take more than 5 years of required treatment. The ASD will predict only by the doctors and they only give the required treatment for patient's earlier designation and correct medication at the first stage is extremely essential to manage ASD.ASD prediction framework is build to support interactive aspect based analysis model without any device. Machine learning techniques such as random forest, Artificial Neural Network have been utilized to improve the diagnosis accuracy. The ASD prediction process is focused on the childhood and adolescent's analysis model is utilized in the system.*

***Keywords**--Autism Spectrum Disorder, ASD, Mobile application*

I. INTRODUCTION

Autism spectrum disorder (ASD) is a developmental disability that can cause important social, communication and interactive challenges. People with ASD have: i) Intricacy with communication and interaction with other people, ii) Constrained interests and recurring behaviors iii) Symptoms that wound the person's ability to function appropriately in school, work, and other areas of life. There is often nothing about how the people are with ASD look that separates them apart from others, but people are with ASD may convey, perform and learn in the various ways that are different from the most other peoples . The learning, thinking and the problem-solving abilities of people with ASD can be range from severely challenged. Some people with ASD are need a lot of help in their daily lives. The ASD that includes several conditions that are used to be analyzed separately. These conditions are called autism spectrum disorder. It can be predicting by the using a technique of stick or by well trained doctors. Its takes time or several days to predict (Anibal S´olon Heinsfeld, 2017). Machine learning algorithms are used in different medical applications to predict the abnormalities (Shanthi & Murali Bhaskaran, 2013;2014;) To predict this syndrome lesser than 5-10 minutes by everyone with the help of this algorithm's. comparing Random Forest, and Artificial Neural Network (ANN) to find the accurate classifiation. Each algorithms follows its own nature and help to predict the accuracy level of the patient (Zhao et al., 2019).

[1] *Kongu Engineering College, shanthi.kongumca@gmail.com

[2] Kongu Engineering College, k_nirmal@kongu.ac.in,

[3] Kongu Engineering College, pyingkodi@kongu.ac.in

[4] Kongu Engineering College, nithyaprakashs.17mca@kongu.edu

[5] Kongu Engineering College, tamilanban1997@gmail.com

Received: 27 Feb 2019 | Revised: 20 Mar 2019 | Accepted: 30 Apr 2020

II. AUTISM SPECTRUM DISORDER

ASD is a syndrome that affects children's between 0 – 14. It's mostly affects the children with lacking of basic knowledge's, behaviours, verbal and nonverbal communications. Some the children's have been affected early by the age of 2 – 4 and it could be cured within 16 months (J. Baio et al.,2018). Our Research proves that our instructions are useful to cure in the early stage. This is can be caused by the environmental factors or genes or pre-mature birth of parents. More than over 25 million people and children's are affected till 2019. Questions are used to answered in the actual rates, result have the accuracy level of a syndrome. ASD-Test had been performed by the doctors with the help of CARS questionnaires tools. This tool had several Questions with different categories to find the child have affected by autism or not. It allows the all the type of users to find the Autistic behavior of their children's or patients. There are several methods that have been used in hospitals to find autism but this method helps the doctor or parents to find the autism have affected or not with the maximum accuracy level. In the beginning the test have started with the basic questions related to disorder find out the actual level of the student. Every questions are carried out with three options agree, slightly agree and none. Every score point had been stored in the excel for the data set and its used for the future purpose. Each question have neither 0 nor 1. Few questions are assigned to find out the accuracy level of the affected child (Thabtha, F, 2017).

III. LITERATURE REVIEW

Daniel Bone et al.,(2016) presented the machine learning techniques that will increase autism screening and diagnostic tools with multi-instrumental fusion.Machine learning (ML) that provides a novel actions for human behavior analysis and the clinical translation. The data consisted of Autism Diagnostic Interview-Revised (ADI-R) and Social Responsiveness Scale (SRS) scores for 1,264 peoples with the ASD and 462 peoples with non-ASD or psychiatric disorders. These algorithms are created from a robust Machine Learning classifier that supports a vector machine . Parameter settings were tuned in multiple levels of cross-validation.

Thabtah, F (2018) presented a machine learning model based on the instruction of some rules for autism detection. The Autism spectrum disorder is analyzed in a clinical environment that can be licensed by using procedures which can be lengthy and cost-ineffective. The Autism Spectrum Measure and Improved Checklist for Autism in Children are the initiated diagnosing autism and other pervasive developmental disorders. These accuracy and efficiency of the screening methods are commonly experienced and knowledge of the user. One favorable direction to improve the accuracy and efficiency of autism spectrum disorder that will build classification systems using intelligent technologies such as machine learning. Machine learning that offers a advanced systems to construct an automated classifiers, it can be exploited by users and clinical to essentially improve sensitivity, specificity, accuracy and the efficiency in analytical discovery. The Rules-Machine Learning method that not only detect in autistic characters and controls but also offers the users of knowledge bases. Rules-Machine Learning that offers an classifiers with higher predictive accuracy, sensitivity, harmonic mean and specificity than those of other machine learning approaches such as Boosting, Bagging, decision trees and rule induction.

Fadi Thabtah (2017) suggested the autism spectrum disorder screening mechanism with the help of machine learning variation and dsm-5 fulfillment. One of the most essential psychiatric disorders is the ASD. ASD

is a psychological issue that can use of verbal, communicative, intellectual skills as well as social skills and abilities. ASD has been analyzed from the interactive science that utilizing smart methods based on machine learning to speed up the screening time or to improve sensitivity, specificity or accuracy of the diagnosis process. The predictive models are worked with the historical cases and controls. Those models are plugged into a screening tool to achieve from one or more of the above-mentioned objectives. The consistency of ASD screening tools are analyzed using the DSM-IV instead of the DSM-5 manual. These screening tools are moved to reflect the executed criteria of ASD classification in the DSM-5 based on the diagnostic algorithms embedded within these methods.

Hanna Drimalla (2019) recommended the virtual social statement analysis method for detecting autism. Diagnosing autism spectrum conditions that take several hours by well-trained experts. Questionnaires as a diagnostic tool depend on self-response which is normally reduced in individuals with autism spectrum condition. The alternative screening mechanism is developed with the subjects takes part in a replicated social interaction.The subjects' voice, eye gaze and facial expression are followed by the simulated social during interaction analysis method. The random-forest classifier on the features can detect autism spectrum condition that accurately and function independently of diagnostic questionnaires. The regression model estimates the seriousness of condition that can more precisely than the reference screening method. Bram van den Bekerom (2017) constructs a machine learning technique for detection of autism spectrum disorder. Autism Spectrum Disorders are hardly to identify but it will requires physicians have proper training and experience. Early detection of Autism Spectrum Disorder improves the overall mental health of the child. The machine learning is applied to determine the set of conditions that prove to be predictive of Autism Spectrum Disorder. It is very useful for the physicians to identify Autism Spectrum Disorder at earlier stage. The child Autism Spectrum Disorder prediction is proved using developing interruption, learning disability and speech or other language problems as attributes. The physical action, early birth and birth weight are included to improve the accuracy. The Autism Spectrum Disorder serious level prediction is achieved. The 1-away method improved the accuracy level.

IV. METHODOLOGY

3.1 Dataset Description

The Autism spectrum disorder dataset had been collected from the UCI data repository (https://archive.ics.uci.edu/ml/datasets/Autism+Screening+Adult#, last access December 2019). The dataset has 704 objects with 21 attributes. Table 1 describes the attributes of the dataset. The data set has the missing values in the objects. In this research the object having missing attribute value has been ignored.

Table 1: Attributed of ASD Dataset

Sl. No.	Attributes	Description
1.	Age	Age in years
2.	Gender	Male or Female
3.	Ethnicity	List of fact and state of behaviors are formatted.
4.	Born with jaundice	Whether the case was born with jaundice

5.	Who is completing the test	Parent, self, caregiver, medical staff, clinician ,etc.
6.	Family_Autism	The score of the question based on the answer chosen.
7.	Country Residence	Case residencancy
8.	Score	The Final score is followed by the algorithm and the method used in it.
9.	Screening Method Type	The type of screening methods chosen based on age category (0=toddler, 1=child, 2= adolescent, 3= adult)
10.	Used the screening app before	Whether the user has used a screening app
11.	Q1	S/he often notices small sounds when others do not.
12.	Q2	S/he usually concentrates more on the whole picture, rather than the small details.
13.	Q3	S/he finds it easy to do more than one thing at once
14.	Q4	If there is an interruption, s/he can switch back to what s/he was doing very quickly.
15.	Q5	S/he finds it easy to ‘‘read between the lines’’ when someone is talking to her/him.
16.	Q6	S/he knows how to tell if someone listening to him/her is getting bored.
17.	Q7	When s/he is reading a story, s/he finds it difficult to work out the characters’ intentions.
18.	Q8	S/he likes to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.).
19.	Q9	S/he finds it easy to work out what someone is thinking or feeling just by looking at their face.
20.	Q10	S/he finds it difficult to work out people’s intentions..
21.	Screening Score	The final score obtained based on the scoring algorithm of the screening method used. This was computed in an automated manner

4.2 Autism Spectrum Disorder Prediction using Random Forest

Random forests or random decision forests are collective learning technique for classification, regression and different tasks that functions by constructing a gathering of decision trees at training time and outputting the class that is the method of the classification or mean prediction of the individual trees. Random forests correct for decision trees habit of over fitting to their training set.

The training algorithm for random forests applies the general technique of bootstrap aggregating, or bagging, to tree learners. Given a training set X = x1, …., and with responses Y = y1, …., in bagging, repeatedly selects a random sample with replacement o the training set and fits trees to these samples:

For b = 1, …., B:

1. Sample, with replacement, n training examples from X, Y, call these Xu, By.

2. Train a classification or regression tree fb on Xu, By.

After training, predictions for unseen samples x' can be made by averaging the predictions from all the individual regression trees on x':

f ^ = 1 B Σ b = 1 B f b (x ′) {\display style {\hat {f}}={\frac {1}{B}}\sum vote in the case of classification tree.

The machine learning algorithms are applied to perform the ASD prediction process. The Related Feature selection (CFS) based Random Forest algorithm is applied for the disease prediction process. The prediction scheme is compared with the Naïve Bayes and Support Vector Machine (SVM) based classifiers.

4.3 Autism Spectrum Disorder Prediction using ANN

Artificial Neural Network, a method followed by several algorithms that are followed by some mathematical model, actuated like a human brain. With the help of artificial neurons the networks are connected followed by weights. Human brain can acted adaptively to the behavior based on the sense and speech. But neural networks are behave like a human brains, they can be treated like to act as a normal brain with the help of the updating the parameters Θ in the network at the knowledge of D = {Z_1…..Z_N}, used to build the numerous models that are used to get the solution for all the type of psychological problems. Network parameters can change the output to make the modifications are aggressively match the attributes depends on the customer. The attribute J(Θ) are used to make the better mathematical calculations in it. J is used to get the output from the neural network. This method is followed by forward mode and the results are came with the unique. The lifespan of the model is depends on the agent knowledge from the environment from the dataset.

In this model the networks are connected with the method assigned depends on weights. Most of the algorithms are being started with random numbers that are in the weighted matrix. Finally, the validation of neural network have been resulted.

Each nodes are transmitted to other layers with the value of weights. Normally, weights are determined with the actual value of -0.5,0 or 0.5. Weights are calculated by

$Z=b+^{N}\sum_{i=1} (a_i w_i)$

In nature it has own weights of (-0.5, 0 or 0.5). and the resulted

$A_{out} = g(z)$

The machine learning algorithms are applied to perform the ASD prediction process. The Related Feature selection (CFS) based Random Forest algorithm is applied for the disease prediction process. The prediction scheme is compared with the Naïve Bayes and Support Vector Machine (SVM) based classifiers.

V. RESULTS AND DISCUSSIONS

The performance of the proposed model is evaluated with accuracy, sensitivity and specificity. Table 2 shows the performance of Random forest and ANN classifiers. Sensitivity refers the measures the proportion of actual positives that are correctly identified as positive. Specificity refers the measures the proportion of actual negatives that are correctly identified as negative. Accuracy refers the measures the proportion of actual positives and actual negatives that are correctly identified as positive and negative..

Table 2 Classification Performance

Received: 27 Feb 2019 | Revised: 20 Mar 2019 | Accepted: 30 Apr 2020

ClassificationAlgorithm/ Classification Measures	CFS-RF	ANN
Accuracy	93.54	94.15
Sensitivity	94.34	96.23
Specificity	90	85

The above table shows that the ANN gives better accuracy and sensitivity when compared to random forest and random forest gives higher specificity than the ANN.

VI. CONCLUSION

The Artificial Neural Network model proposed a result to show the accuracy of an autism. The input factors were obtained from an autism screening using CARS Questionarie's tools data set represents that users have been affected by an autism spectrum disorder. The product has been tested and the result comes with a maximum accuracy in all the algorithms. While comparing those algorithms Random forest and Artificial neural network have shown the accurate accuracy level. They have been clearly shown in comparison. In future, instead of removing the missing objects from the dataset, an appropriate missing value replacement algorithm could be employed.

REFERENCE

1. Anibal S´olon Heinsfeld, Alexandre Rosa Franco, Augusto Buchweitz and Felipe Meneguzzi, "Identification of Autism Spectrum Disorder using Deep Learning and the ABIDE Dataset", Neuroimage Clienical, 2017.
2. Shanthi, S., and V. Murali Bhaskaran. "A novel approach for detecting and classifying breast cancer in mammogram images." International Journal of Intelligent Information Technologies (IJIIT), 9(1), 2013, 21-39.
3. Shanthi, S., and V. Murali Bhaskaran. "A novel approach for classification of abnormalities in digitized mammograms." Sadhana ,39(5), 2014, 1141-1150.
4. Zhong Zhao, Xiaobin Zhang, Wenzhou Li, Xinyao Hu, Xingda Qu, Xiaolan Cao, Yanru Liu and Jianping Lu, "Applying Machine Learning to Identify Autism With Restricted Kinematic Features", IEEE Access, October2019.
5. J. Baio et al., "Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years - Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2014," MMWR. Surveillance Summaries, vol. 67, no. 6, pp. 1-23, Apr. 2018.
6. Thabtah, F. "Autism Spectrum Disorder Screening: Machine Learning Adaptation and DSM-5 Fulfillment", ACM, 2017.
7. 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.

Received: 27 Feb 2019 | Revised: 20 Mar 2019 | Accepted: 30 Apr 2020

8. Thabtah, F. Machine learning in autistic spectrum disorder behavioral research: A review and ways forward. Informatics for Health and Social Care, 1–20, 2018
9. Hanna Drimalla, "Detecting Autism by Analyzing a Simulated Social Interaction", 2019.
10. Bram van den Bekerom, "Using Machine Learning for Detection of Autism Spectrum Disorder", IEEE, 2017.
11. https://archive.ics.uci.edu/ml/datasets/Autism+Screening+Adult#, last access December 2019).

Received: 27 Feb 2019 | Revised: 20 Mar 2019 | Accepted: 30 Apr 2020