A Study on Autism Spectrum Disorders using Classification Techniques

M. S. Mythili, A. R. Mohamed Shanavas

Abstract-In recent years, the academic establishments has undertaken variety of initiatives to support school boards, college authorities, special schools and colleges in teaching students with Autism Spectrum disorders(ASD). Autism Spectrum Disorders (ASD) are complex neurological disorders that have a lifelong effect on the event of assorted talents and skills. The foremost vital goal of the paper is to review the autism problem, to detect the levels of autism with the help of data mining classification algorithms. The data mining has been typically accepted as a decision making process to facilitate higher resource utilization in terms of autism students' performance.

Index Terms- Autism Spectrum Disorders, data mining

I. INTRODUCTION

Data Mining could be a promising and flourishing frontier in analysis of knowledge and in addition the results of analysis have several applications. Data Mining can even be referred as Knowledge Discovery from Data (KDD).This system functions as the machine-driven or convenient extraction of patterns representing knowledge implicitly keep or captured in immense databases, data warehouses, the Web, data repositories, and information streams. Data Mining can be a multidisciplinary field, has the areas like information technology, machine learning, statistics, pattern recognition, information retrieval, artificial neural networks, and knowledge based systems, artificial intelligence and data visualization. The application of data mining is widely prevalent in education system. An Autism-spectrum disorder is a complex developmental disability that basically affects The knowledge that emerges can be used to better understand autism students' health, autism students' learning skills, autism students' communication rate and the autism students' success rate. The data mining system is pivotal and crucial to measure the autism students' performance improvement. The classification algorithms are accustomed to classify and analyze the students' data set in correct and accurate manner. The main objective of the paper is to use data mining methodologies to study the autism students' performance. Data mining provides several tasks that could be used to study the autism students' performance. In this paper, the classification task is used and employed to gauge autism students' level by the various classification data mining algorithms.

A. Types of Autism Spectrum Disorders

The autism spectrum disorders belong to an "umbrella" class category of five childhood-onset Conditions called pervasive developmental disorders (PDD).

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They are concerning the three most common PDDs

1. Autism
2. Asperger's Syndrome
3. Pervasive Developmental Disorder - Not Otherwise Specified (PDD-NOS) Childhood disintegrative disorder and Rett Syndrome are the other pervasive developmental disorders. As results of each are extremely rare genetic diseases, they are sometimes thought of to be separate medical conditions that do not really belong on the autism spectrum.

B. Signs and Symptoms of Autism Spectrum Disorders

In every children and adults, the signs and symptoms of the autism spectrum disorders embrace issues with social interaction skills, speech and communication. The autism spectrum disorders are measured based on the presence of multiple symptoms that disrupt the child's ability to talk, make the relationships, explore, play, and to study. the method an individual communicates and relates to people. Educational data mining is an emerging field which can be effectively applied with in the field of education. The educational data mining uses many ideas and concepts like Association rule algorithm, classification algorithm and clustering algorithm. The symptoms of autism spectrum disorders: Social skills. Basic social interaction may be troublesome for children with autism spectrum disorders. Symptoms might include

1. Unusual or inappropriate visual communication, gestures, and facial expressions (e.g. avoiding eye contact or facial expressions that don't match what he or she is saying).
2. Lack of interest in people or in sharing interests or achievements (e.g. showing you a drawing, pointing to a bird).
3. Unlikely to approach others or to pursue social interaction; comes across as aloof and reserved; prefers to be alone.
4. Problem and difficulty in understanding individual person's feelings, reactions, and nonverbal cues.
5. Resistance to being touched.
6. Difficulty or failure to create friends with children the same age.

C. The Symptoms of Autism Spectrum Disorders: Speech and Language

Problems with speech and language comprehension are a telltale sign of the autism spectrum disorders. Symptoms might include

1. Delay in learning the way to speak (after the age of or doesn't talk in the least.
2. Speaking in abnormal tone of voice, or with an odd rhythm or in high pitch.
3. Repeating words or phrases over and over.

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4. Trouble beginning a spoken language or keeping it going.
5. Difficulty communicating needs or desires.
6. Doesn't perceive straightforward statements or queries.
7. Taking what's same too virtually, missing humor, irony, and satire.

D. The Symptoms of Autism Spectrum Disorders: Restricted Behavior and Play

Children with autism spectrum disorders are typically restricted, rigid, and even psychoneurotic in their behaviors, activities, and interests. Symptoms could include

1. Repetitive body movements (hand undulation, rocking, spinning); moving perpetually.
2. Obsessive attachment to uncommon objects.
3. Preoccupation with a particular topic of interest, typically involving numbers or symbols (maps, license plates, sports statistics).
4. A strong would like for sameness, order, and routines. Gets upset by modification in their routine or surroundings.
5. Clumsiness, abnormal posture, or odd ways that of moving.
6. Fascinated by spinning objects, moving items, or elements of toys (e.g. spinning the wheels on a motor car, rather than fidgeting with the whole car).

E. Related Signs and Symptoms of Autism Spectrum Disorders

1. Sensory issues
2. Emotional difficulties
3. Uneven psychological feature talents

II. HELPING CHILDREN WITH AUTISM

Autism may be a lifelong disorder and there is presently no notable cure for autism. Besides several children with autism will develop considerably with early, well-planned and on individual basis tailored academic efforts in specially adapted settings. The main objectives are to assist the child purposeful communication. The educational approaches should specialize information concerning the distinctive ways in which children with autism learn. Several (Applied behavior analysis) ABA methods as well as the structured teaching method within the (Treatment and Education of Autistic and related Communication Handicapped Children) TEACCH-model are samples of such specially-tailored academic strategies for persons with autism. The first are early identification, diagnosis and assessment and next step is to give correct knowledge for parents. Specially adapted nursery school and subsequent schooling are vital demand for the child; moreover an adapted home atmosphere and also the daily actions are equally vital for the adults. Adults and adolescents might have continuing access to academic measures to more develop skills that aim to extend independence and Participation.

III. RELATED WORK

Rahman, 2010 urged that Increasing Intelligibility within the Speech of the Autistic Children by an Interactive Computer Game. There is no definite treatment for autism. Serving to autistic children by providing games and teaching facilities to improve their skills. In the year 2013 Santos examines the first detection of Autism means that taking the symptoms of patient during childhood supported by preverbal vocalization by using the classification technique supervised learning SVM (support vector machine). Chaminade, 2012 started a shot to use MRI study of young adults with autism interacting with a humanoid robot. Prud'hommeaux et al. [15] examines the difficulties for classification of non standardized text of machine learning techniques. Kathleen T Quach [16] suggested that problem through the classification problem is that ASD may be a terribly heterogeneous disorder which will have subgroups with totally different genetic expression signatures. To boost classification, it should be helpful to stratify the ASD class into subgroups and enrich the input set with clinical measures. Alexander Genkin et al. [17] have given a easy Bayesian logistic regression approach that uses a Laplace prior to avoid over fitting and produces sparse predictive models for text data. They applied this approach to a spread of document classification issues and show that it produces compact predictive models a minimum of as effective as those created by support vector machine classifiers or ridge logistic regression combined with feature selection.

IV. CLASSIFICATION

This process is employed to classify data into predefined categorical class labels. Classification can be a two step process consisting of training data and testing data. In the first step, a model is constructed by examining and analyzing the data tuples from training data having a collection of attributes. For every tuple in the training data, the need of class label attribute is understood. Classification rule techniques are applied on training data to form the model. In the second step of classification, the test data is employed and used to examine the accuracy of the model. If the accuracy of the model is appropriate then the model can be used to classify the unknown data tuples.

A. Neural Network

Neural network are generally organized in layers. Layers are created by Variety of Interconnected 'nodes' that contain an 'activation function'. Patterns are given to the network via the 'input layer' that communicates to one or more 'hidden layers. The hidden layers then link to an 'output layer'. Most ANNs contain some type of 'Learning rule' that modifies the weights of the connections in step with the input Patterns.

B. Support Vector Machine

In classification support vector machine are supervised learning models with associated learning algorithms that analyze data and acknowledge the patterns, used mainly for classification and regression analysis. A SVM training algorithm builds the model that assigns new examples into one class or the other, creating it a non-probabilistic binary linear classifier. An SVM model could be a representation of the examples as points in space, and it is mapped so that the examples of the separate categories are divided by a transparent gap that is as wide as possible.

C. Fuzzy Logic

The term "fuzzy logic" was introduced with the 1965 proposal of fuzzy set theory by Lotfi A. Zadeh. Fuzzy logic has been applied to several fields, from control

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theory to artificial intelligence. Fuzzy logic could be a type of many-valued logic; it deals with reasoning that s approximate instead of fixed and exact. Fuzzy logic variables could have a truth value that ranges in degree between the binary values 0 and 1. Fuzzy logic is extended to handle the conception of partial truth, where the truth value may lie in the range between completely true and completely false. Once linguistic variables are used, these degrees are also managed by specific functions.

IV. DATA PREPROCESSING

Datasets utilized within the classification algorithm ought to be clear and can be preprocessed for handling missing or redundant attributes. The data are to be handled with efficiency to induce the best outcome from the Data Mining process.

A. Attribute Identification

Dataset collected from autism student database consists of

Attributes	Description	Possible values
Language	Communication skills	Mild,Moderate,Severe
social	Social skills	Mild,Moderate,Severe
Behavior	behavioral	Mild,Moderate,Severe
Levels of autism	levels	High, Medium, Low

V. IMPLEMENTATION OF MODEL CONSTRUCTION

Weka is open source software system that implements a large collection of machine learning algorithms and is widely utilized in data mining applications. From the above data, autt.arff file was created. This file was loaded into a Weka explorer. The autism students' prediction is influenced by various factors like language, social, behavior and the levels of autism is predicted.100 samples were taken for the implementation. The classify panel permits the user to use classification algorithms to the dataset and it is used to estimate the accuracy of the resulting autism students' predictive model, and to visualize the model.

The Neural Network, Support Vector Machine and Fuzzy logic were enforced in Weka. Under the "Test options", the 10 fold cross validation is chosen.

VI. RESULTS AND DISCUSSION

The analysis and interpretation of classification is time consuming process that needs a deep understanding of statistics. The models need a large amount of time to finish and expert analysis to look at the classification and relationships within the data.

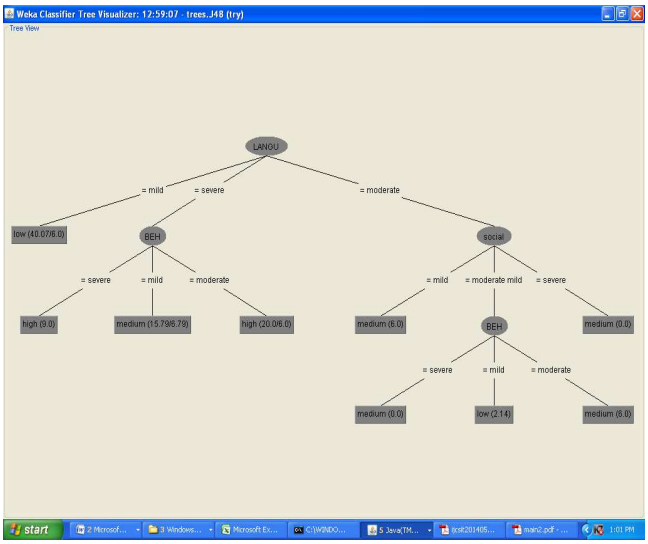

Fig. 1. Visual Image of Generated Decision Trees

The Language of the autism students' is taken as root node from that social and Behavior factors. The knowledge represented by decision tree can be extracted within the Form of IF-THEN rules.

1. IF language="mild" THEN autism ="low"
2. IF language="severe" AND beh="severe" THEN autism="high"
3. IF language="severe" AND beh="mild" THEN autism="medium"
4. IF language="severe" AND beh="moderate" THEN autism="high"
5. IF language="moderate" AND social="mild" THEN autism="medium"
6. IF language="moderate" AND beh="severe" THEN autism="medium"
7. IF language="moderate" AND social=mild AND beh="mild" THEN autism="low"
8. IF language="moderate" AND social=mild AND beh="severe" THEN autism="medium"
9. IF language="moderate" AND social=mild AND beh="mild" THEN autism="low"
10. IF language="moderate" AND social=mild AND beh="moderate" THEN autism="mild"

From the above set of rules an inescapable conclusion emerges the language, social, behavior is considerably related with autism student prediction. From the rule set it was found that autism students' prediction of data whether the students' have mild, moderate and severe autism.

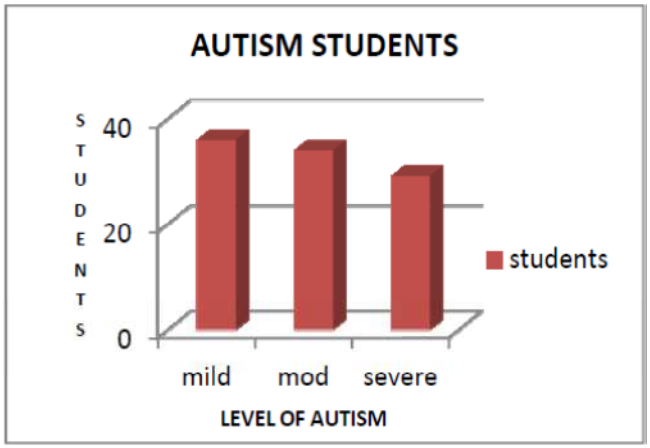

Fig. 2. Level of Autism

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VI. CONCLUSION

Autism spectrum disorders (ASDs) are measured by impairments in social functioning and language, and by the presence of restricted interests and repetitive behaviors. To be diagnosed with autism, the behavioral symptoms altogether of the above-mentioned areas should be present by age 3. Even if the parents typically notice that something is wrong throughout infancy, it is terribly tough to diagnose autism before the age of eighteen months. The bulk of children with autism even have a learning disability (mental retardation), though many have brain disorder and visual and hearing impairment are over-represented in this group. Persons with Asperger's syndrome resembling autism, have average or higher than average intelligence. This paper mentioned concerning the matter of autism and the various kinds of disorder autism and compares the effectiveness of popular machine learning methods with Artificial Neural Network (perceptron), Support Vector Machine, and with the fuzzy logic. The algorithms are very useful to handle the autism students'prediction level. In future, new technique is proposed for Autism Disorder classification by using fuzzy cognitive map and by bee hive swarm optimization.

REFERENCES

[1] "Guidelines for Educating Students with Autism Spectrum Disorders", October 2010 Virginia Department of Education, Office of Special Education and Student Services.

[2] "Guidelines for Identification and Education of Children and Youth with Autism ", July 2005, CONNECTICUT STATE DEPARTMENT OF EDUCATION Division of Teaching and Learning Programs and Services Bureau of Special Education

[3] Felix D. C. C. Beacher et al., "Sex Differences and Autism: Brain Function during Verbal Fluency and Mental Rotation", June 2012 | Volume 7 | Issue 6 | e38355

[4] Volkmar FR, Klin A (2000) Pervasive Developmental Disorders. In: Kaplan and Sadock's Comprehensive Textbook of Psychiatry CDROM 7th edition. Publisher: Lippincott Williams and Wilkins, Philadelphia, PA.

[5] "Autism Spectrum Disorders" Centre for Developmental Disability Health Victoria Building 1, 270 Ferntree Gully Road, NOTTING HILL, VIC 3168 Telephone: (03) 9902 4467 Facsimile: (03) 8575 2270 E-mail: cddh@monash.edu.

[6] "Autism Spectrum Disorders: Information Pack" Autism Victoria Inc. ABN 15 600 724 949 A14601C 24 Drummond St, Carlton, 3053, Postal Address: P.O. Box 374, Carlton South, 3053 E: info@autismvictoria.org.au T: 03 9657 1600 W: www.amaze.org.au.

[7] "A Parent's Guide to Evidence-Based Practice Autism", Copyright © 2011 National Autism Center. [8] Cosgrove KP, Mazure CM, Staley JK (2007) Evolving knowledge of sex differences in brain structure, function, and chemistry. Biological psychiatry. Oct 15;62(8): 847–55.

[9] Baron-Cohen S (2009) Autism: the empathizing-systemizing (E-S) theory. Annals of the New York Academy of Sciences. Mar;1156: 68–80.

[10] Eric Zander et al., "An introduction to autism", AUTISMFORUM Handikapp & Habilitering, Box 17519, 118 91 Stockholm 08-690 60 52, www.autismforum.se, autismforum@sll.se Zander, E. An introduction to autism ¼ 1/9 2004.

[11] Kathleen T Quach et al., "Application of neural networks in classification of autism diagnosis based on gene expression signatures"

[12] Demuth et al. "Neural network toolbox for use with MATLAB.",1993. Rachna Ahuja et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (2), 2014, 2166-2170 www.ijcsit.com 2169

[13] Nagesh Adluru et al., "Characterizing brain connectivity using - radial nodes: application to autism classification". [14] Hagmann, P., Kurant, M., Gigandet, X., et. al.: Mapping human whole-brain structural networks with Diffusion MRI. PLoS one 2(7) (2007).

[15] Prud'hommeaux et al., "Classification of atypical language in autism", in Proceedings of the 2nd Workshop on Cognitive Modeling and Computational Linguistics, pp: 88-96, 2011.

[16] Kathleen T Quach et al., "Application of Artificial Neural Networks in Classification of Autism Diagnosis Based on Gene Expression Signatures".

[17] Alexander Genkin et al., "Large-scale Bayesian logistic regression for text categorization", Technometrics, pp: 291-304, 2007. Rachna Ahuja et al, / (IJCSIT) International Journal of Computer Science and Information Technologies

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