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EARLY DETECTION & ANALYSIS OF AUTISM SPECTRUM DISORDER USING MACHINE LEARNING

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Abstract - Autism Spectrum Disorder (ASD) is a neuro-disorder in which a person has a lifelong effect on interaction and communication with others. Autism can be diagnosed at any stage in once life and is said to be a "behavioral disease" because in the first two years of life symptoms usually appear. According to the ASD problem starts with childhood and continues to keep going on into adolescence and adulthood. Propelled with the rise in use of machine learning techniques in the research dimensions of medical diagnosis, in this there is an attempt to explore the possibility to use Naïve Bayes, Support Vector Machine, Logistic Regression, KNN, Neural Network and Convolutional Neural Network for predicting and analysis of ASD problems in a child, adolescents, and adults. The proposed techniques are evaluated on publicly available three different non-clinically ASD datasets. First dataset related to ASD screening in children has 292 instances and 21 attributes. Second dataset related to ASD screening Adult subjects contains a total of 704 instances and 21 attributes. Third dataset related to ASD screening in Adolescent subjects comprises of 104 instances and 21 attributes. After applying various machine learning techniques and handling missing values, results strongly suggest that CNN based prediction models work better on all these datasets with higher accuracy of 99.53%, 98.30%, 96.88% for Autistic Spectrum Disorder Screening in Data for Adult, Children, and Adolescents respectively.

- The problem of autism spectrum disorder (ASD) have been mounting swiftly nowadays among all ages of the human population. Early detection of this neurological disease can greatly assist in the maintenance of the subject's mental and physical health. With the rise of application of machine learning-based models in the predictions of various human diseases, their early detection based on various health and physiological parameter now seems possible. This factor motivated us to increase interest in the detection and analysis of ASD diseases to improve better treatment methodology. Detection of ASD becomes a challenge as there are several other mental disorders whose few symptoms are very similar to those with ASD symptoms, thereby makes this task a difficult one. Autism Spectrum disorder is a problem that is related to human brain development. A person who has suffered from the Autism Spectrum Disorder is generally not able to do social interaction and communication with other persons. In this, a person's life is usually affected for his or her entire lifetime. It is interesting to know that both environmental and genetic factors may turn out to be the causing factors for this disease. The symptoms of this problem may be started at the age of three years and may continue for the lifetime. It is not possible to complete treat the patient suffering from this disease, however its effects can be reduced for some time if the symptoms are early detected. By assuming that human genes are responsible for it, the exact causes of ASD have not been recognized by the scientist yet. The human genes affect the development by influencing the environment. There is some risk factor which influences ASD like as low birth weight, a sibling with ASD and having old parents, etc. Instead of this, there are some social interaction and communication problems like as:
    - Not able to make eye contact properly
    - No proper response to sound
    - May not have a wish for cuddling
    - Not able to express their gestures
    - No interaction with others
    - Inappropriate objects attachment
    - Want to live alone
    - Using echo words etc.

Early detection and treatment are most important steps to be taken to decrease the symptoms of autism spectrum disorder problem and to improve the quality of life of ASD suffering people. However, there is no procedure of medical test for detection of autism. ASD Symptoms usually recognized by observation. In Older and adolescents who go to school, ASD symptoms are usually identified by their parents and teachers. After that ASD symptoms are evaluated by a special education team of the school. These school team suggested these children visit their health care doctor for required testing. In adults identifying ASD symptoms is very difficult than older children and adolescents because some symptoms of ASD may be overlap with other mental health disorders. It is easy to identify the behavioral changes in a child easily by observation because

it can be seen early in the 6 months of age than Autism specific brain imaging because brain imaging can be identifying after 2 years of age.

2. LITERATURE SURVEY

Sasikala R et al. [1] proposed a method to identify autism with an optimal set of behaviors. In this work, his ASD diagnostic dataset of 21 features from the UCI machine learning repository was experimented with a swarm intelligence-based binary firefly function selection wrapper. The alternative hypothesis of experiment claims that the machine learning model can achieve better classification accuracy with a minimal subset of his features. Using a swarm intelligence-based single-objective binary firefly feature selection wrapper, we found that 10 features out of 21 features in the ASD dataset were sufficient to distinguish between ASD and non-ASD patients. The results obtained with this approach yield average accuracies ranging from 92.12% to 97.95% using the best subset of features, which is approximately equal to the average accuracy obtained from all ASD diagnostic data records generated.

M. S. Mythili, A. R. Mohamed Shanavas et al. [2] conducted a study on ASD using classification techniques. The main purpose of this paper was to identify autism problems and levels of autism. In this neural network, SVM and fuzzy techniques were used along with his WEKA tool to improve student behavior and social Analyze human interactions.

FadiThabtah et al. [3] proposes his ASD screening model using machine learning adaptation and DSM-5. The screening tool was used to meet his goal(s) of ASD screening. In this paper, researcher described his ASD machine learning classification and its strengths and weaknesses. Using the DSM-IV instead of the DSM-5 manual, the researcher sought to highlight his issues related to existing his ASD screening tools and the consistency of such tools.

Li B, Sharma A, Meng J, Purushwalkam S, Gowen E (2017) et al. [4] We used a machine learning classifier to imitatively recognize autistic adults. The purpose of this study was to investigate fundamental issues related to the test conditions and identified motor parameters. The dataset contains 16 ASC participants with a series of hand gestures. It extracted 40 kinematic constraints from 08 mimic conditions using machine learning techniques. This study demonstrates that for small samples, machine learning techniques can be applied to analyze high-dimensional data and diagnostic classification of autism.

Me. Kosmicki1, V. Sochat, M. Duda and D.P. Wallet Al. [5] employed a search method for a minimal set of features to detect autism. The authors recorded a clinical score for ASD using a machine learning approach. ADOS was performed on a behavioral subset of children based on the autism spectrum. Eight different machine learning algorithms were used in this work. This includes identification of his back reference features step by step on 4540 scoresheets. Using 9 of the 28 behaviors in module 2 and 12 of the 28 behaviors in module 3, where it identifies ASD risk with an overall accuracy of 98.27% and 97.66%, respectively.

3. PROBLEM STATEMENT

Autism Spectrum Disorder (ASD) could focus on the late and inaccurate diagnosis due to a lack of effective early detection methods and the insufficient support for transitioning individuals into adulthood. Key issues include persistent difficulties in social communication, the need for better diagnostic tools beyond self-report questionnaires, and the significant gap in age-appropriate resources for young adults, who may lose support services after turning 18.

4. EXISTING SYSTEM

The most crucial actions to be taken to lessen the symptoms of autism spectrum disorder and to enhance the quality of life for ASD sufferers are early detection and treatment. There is, however, no method or medical test for autism detection. Observation is usually how ASD symptoms are identified. ASD symptoms are typically recognized in older children and adolescents who attend school by their parents and instructors. A school's special education team then assesses any signs of ASD. The school staff advised the youngsters to visit their doctor for the necessary testing. Because certain ASD symptoms may overlap with those of other mental health conditions, adults have a much harder time diagnosing ASD symptoms than older children and adolescents do.

5. PROPOSED SYSTEM

In order to anticipate and analyze ASD issues in children, adolescents, and adults, this makes the potential usage of Nave Bayes, Support Vector Machine, Logistic Regression, KNN, Neural Network, and Convolutional Neural Network. On three separate publicly accessible, non-clinically relevant ASD datasets, the suggested approaches are assessed. Results obtained after utilizing a variety of machine learning algorithms and handling missing values strongly indicate that prediction models based on CNN perform better and more accurately when screening for autistic spectrum disorders in data for adults, children, and adolescents, respectively.

6. OBJECTIVES

- The major Objective of this application is to analyze the presence of AUTISM SPECTRUM DISORDER in the groups of Toddlers, Teenagers and the Adults.
- To Predict the presence of the disease which cannot be easily identified normally.
- To increase awareness and understanding of ASD symptoms through educational resources in the system

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7. METHODOLOGY

1. Data Collection

- Gather a comprehensive dataset: This involves collecting data from sources that contain indicators of ASD. Examples include:
  Brain imaging data (MRI, EEG)
  Genetic information
  Behavioral data (e.g., eye-tracking, gait patterns)
  Clinical and demographic data.

2. Data Preprocessing

- Clean and organize the data: Remove noise and inconsistencies, handle missing values, and ensure data is in a usable format.
- Balance the dataset: Address class imbalance, where the number of samples for ASD positive and negative cases might be unequal, to prevent bias in the model.
- Feature selection: Use techniques like Principal Component Analysis (PCA) or Pearson Correlation Coefficient (PCC) to reduce the number of features, which can improve accuracy and reduce training time.

3. Model Training

- Select and implement algorithms: Choose appropriate machine learning algorithms, such as Support Vector Machines (SVM), Naive Bayes (NB), Random Forest (RF), or Logistic Regression.
- Train the model: Feed the preprocessed data into the chosen algorithms. The algorithm learns patterns that map input data attributes to the correct outcome (ASD or no ASD).

4. Model Evaluation

- Test the model's accuracy: Evaluate the model's performance on a separate, unseen set of data to ensure it generalizes well.
- Use appropriate metrics: Measure the model's performance using metrics like accuracy, precision, recall, and sensitivity to understand its effectiveness.
- Verify the model's reliability: Use methods like Bayesian probability to check the confidence and reliability of the predictions. Autism Spectrum.

REFERENCES:

[1] Thabtah, F. An accessible and efficient autism screening method for behavioral data and predictive analyses. Health Informatics Journal 2019.

[2] Vaishali, R., and R. Sasikala. "A machine learning based approach to classify Autism with optimum behavior sets. (2018) " International Journal of Engineering & Technology.

[3] M. S. Mythili, and AR Mohamed Shanavas. (2014) “A study on autism spectrum disorders using classification techniques.” International Journal of Soft Computing and Engineering (IJSCE),

[4] Fadi Thabtah. (2017). “Autism spectrum disorder screening: machine learning adaptation and DSM-5 fulfillment.” In Proceedings of the 1st International Conference on Medical and Health Informatics.

[5] Baihua Li, Arjun Sharma, James Meng, Senthil Purushwalkam, and Emma Gowen. (2017) “Applying machine learning to identify autistic adults using imitation: An exploratory study.”

[6] J. A. Kosmicki, V. Sochat, M. Duda, and D. P. Wall. (2015) “Searching for a minimal set of behaviors for autism detection through feature selection-based machine learning.”

[7] Keerthi, S. Sathiya, Shirish Krishnaj Shevade, Chiranjib Bhattacharyya, and Karuturi Radha Krishna Murthy. (2001) “Improvements to Platt's SMO algorithm for SVM classifier design.

[8] Li, B., Sharma, A., Meng, J., Purushwalkam, S., & Gowen, E. (2017). Applying machine learning to identify autistic adults using imitation

[9] Crippa, A., Del Zotto, M., & Marconi, V. (2020). Machine learning approaches for autism spectrum disorder diagnosis