© UNIVERSAL RESEARCH REPORTS | REFEREED | PEER REVIEWED
ISSN : 2348 - 5612 | Volume : 10 , Issue : 04 | October - December 2023

Impact of Artificial Intelligence on Training of Autistic Children

Mandeep
Research Scholar, Department of Education
Baba Mastnath University, Rohtak

Dr. Renu Kansal
Department of Education
Baba Mastnath University, Rohtak

Abstract

Smart monitoring and supported living systems for cognitive health assessment are crucial to health assessment. Autistic children struggle with social skills, repetitive habits, vocal and nonverbal communication, and environment adaptation. Due to their emotional cognitive deficit, autistic children are difficult to understand, making them a public health issue. Most social assistive research on autism spectrum disorder (ASD) has not suggested a treatment for autistic youngsters. This research focuses on enhancing cognitive ability and daily life skills to help autistic children function and participate in the community. We help autistic youngsters adapt to their environment by using AI and IoT technology. The AI-enabled IoT solution we propose uses a sensor to measure the child's heart rate to anticipate their state and sends the state to the guardian via a mobile app with their feelings and expected conduct. Additionally, the device can give a new virtual environment to help the child improve eye contact. Imagery of these people in 3D models breaks this child's fear barrier. The system emphasises social communication skill development, especially in young children, to encourage interaction.

Key words: Artificial, Intelligence, Training, Autistic, Children, etc.

Introduction

ASD is a neurological disorder that affects speech, socialisation, and repetitive habits. Autistic children need particular care and interventions to learn and thrive. Traditional educational methods may not meet autistic students' various demands, requiring novel strategies and technologies. Recently, artificial intelligence (AI) has become a strong technology that could alter education, especially autistic child teaching. AI includes machine learning, natural language processing, virtual reality, and social robotics, which may be customised for each student. AI in autism intervention programmes can improve learning and quality of life for autistic youngsters. AI may tailor learning, adjust materials to the child's talents and interests, and provide real-time feedback and support. AI-powered communication tools and assistive technologies can also help autistic people improve their communication and social skills.

Review of literature

Jamal et al Autism was tested using functional brain connectivity from children's electro-encephalograms (EEGs). Autism and 128-channel EEG readings helped them classify the two groups of children. Complex network parameters yielded 94.7 percent accuracy. Scheming and equating support vector family and discriminant analysis employed these parameters. The maximum happening synchro-state uses the best distinguishing processed data, according to this study. Modularity index is an autism biomarker.

Chanel et al created a data-driven ASD matter and control classification approach without prior processing. This is done by combining BOLD processes from two heterogeneous studies. This novel strategy relies on feature selection. Only feature rank determines statistics estimation. This method can combine disparate data and allow brain imaging. Brain pictures must be co-registered and have identical spatial results. Choosing discriminant subsets of voxels reduces dimensionality, according to the

research. This was done via SVMRFE feature selection. Every task could be modelled using the combination approach. This solved the nonidentically distributed sample problem.
Anibal et al Deep learning algorithms using massive brain imaging dataset found autism spectrum disorder individuals. One in 68 Americans have ASD, according to a poll. They aimed to unveil classification-derived neural models. These results changed ASD identification accuracy. Patterns from the classification showed an anti-correlation in brain function between anterior and posterior areas. Deep learning models identified the brain regions most involved in ASD differentiation. ASD had positive values and controls negative ones.
Eslami et al A single layer preceptron (SLP) and auto-encoder learning approach improved extracted feature quality. Data augmentation was used to create synthetic datasets for machine learning model training. Community datasets from Autism Brain Imaging Data Exchange were used to evaluate the proposed approach. Algorithm execution time has been reduced. Testing used only 27 CMU samples.
Usta et al created a two-step data preprocessing technique. Data was cleaned for missing values using denial. If more than 30% of data was missing, column-wise omission was used, and k-nearest neighbourhood for other missing values. Dimension reduction followed principal component analysis. A discrete classification challenge was created from CGI points. Success and error rates were calculated from replication means. The data set included 433 ASD youngsters.
Thabtah & Peebles built a rule-based architecture for observing ASD (RML) that uses searching for rule discovery. It reduces redundant data. Even the evaluation step lowers data set search space. They removed redundant features using feature selection. The rule sets were discovered using a learning technique after pre-processing the raw data. Rule estimation produces a classification algorithm that can be used to estimate class values for unknown cases. RML-derived classifiers have useful rules for discovering ASD classification grounds, as shown in this article.
Lee et al compared random forest to many baseline classifiers. Unsupervised Latent Dirichlet allocation (LDA) is used for topic modelling, not document categorization. Latent semantic analysis reduces evaluation dimensions by computing dense representations. Multinomial The supervised learning algorithm Naive Bayes uses Bayes' rule to calculate a document's class probability based on its words. A rudimentary fastText model uses neural networks. The complete dataset was randomly divided into training and validation sets (57 percent training, 13% validation, and 30% test).

Impact of AI on Training of Autistic Children:

AI's impact on autistic children's training is complicated yet promising for boosting their learning and growth. Here are some ways AI has improved autistic children's training:

- **Personalized Learning:** AI can customise instructional materials for autistic children's needs, preferences, and talents. AI systems can analyse kid learning habits and adapt educational content and pacing using machine learning algorithms. This tailored approach improves learning and engagement.
- **Enhanced Communication Skills:** Speech delays, linguistic difficulties, and social communication deficiencies are common in autistic children. Speech recognition and natural language processing algorithms can assist children improve their communication skills with real-time feedback and support. These technologies aid speech treatment, language understanding, and socialisation.
- **Social Skills Development:** Virtual reality environments and social robots allow autistic youngsters to practise and enhance their social abilities in a supervised environment. Virtual reality simulations let kids practise social skills in a safe environment. AI-powered social robots can interact with kids and provide them feedback on their social skills, building confidence and competence.

- **Assistive Technologies:** AI-powered assistive devices can help autistic children with daily tasks. These technologies include apps and devices for organising, time management, sensory modulation, and assistance communication. AI-powered assistive technology help autistic youngsters participate more in school and society by providing individualised support and adjustments.
- **Early Intervention and Diagnosis:** AI systems may help detect autism spectrum disease early (ASD). AI systems can detect early autism in young children by studying behavioural data, speech patterns, and other data. Autistic children benefit from early diagnosis and intervention to maximise educational and therapeutic treatments and improve long-term outcomes.
- **Data-driven Insights:** AI can detect patterns, trends, and individual learning trajectories in autistic children by analysing vast educational and behavioural datasets. Using data-driven insights, educators and therapists may customise interventions for each child, track progress, and make educated decisions about educational programming and support services.

AI transforms autistic child training, providing creative solutions to their various requirements and obstacles. AI can help educators, therapists, and caregivers help autistic children learn and develop by providing more effective and individualised support.

Software Implementation

Now, we describe software implementation parts including android, computer graphics, and 3D modelling. Android, an open-source mobile operating system, is built for touchscreen smartphones and tablets. Computer graphics are visual images or designs presented on computer monitors, canvas, walls, and signs for enjoyment and information. 3D modelling involves representing any object or surface in simulated 3D space using polygons, edges, and vertices.

Child heart rate is read and converted by the heartbeat sensor. This state is transformed to emotion utilising a mobile programme, as shown in Figure, to help us understand the autistic child's state. After that, the graphical design helps this child adapt to non-contact people. This software also has scheduling chores to assist parents recall child activities. Web services allow flexible data management and storage. This software can be explained using these steps:

(1) Classify numeric values using Python by using a web service with the SVM algorithm.
(2) Develop a smartphone app using Android Studio.
(3) Integrate this app with Firebase web service via the internet.
(4) Create a 3D graphic model with IBM Watson Assistant.
(5) Creating a 3D model for communication with the guardian.

Experimental Results and Discussion

In this section, we empirically analyse the proposed autism care system using data from the centre of autistic children aged 4–12. These findings relies on children's homocysteine-based heart rates. All experiments are conducted on a Core I7 Windows10 system with 16GB memory, using Python and IBM Watson Assistant for Unity to create 3D graphics.

Preprocessing Steps

To optimise system software performance, preprocessing steps were examined before testing. To choose the most relevant features, filter-based feature selection methods first assess the correlation between input variables using statistical measures. Figure shows that heart rate measurement before and after filter selection has varied properties. Thus, this will improve model prediction and heart rate measurement while minimising characteristics.

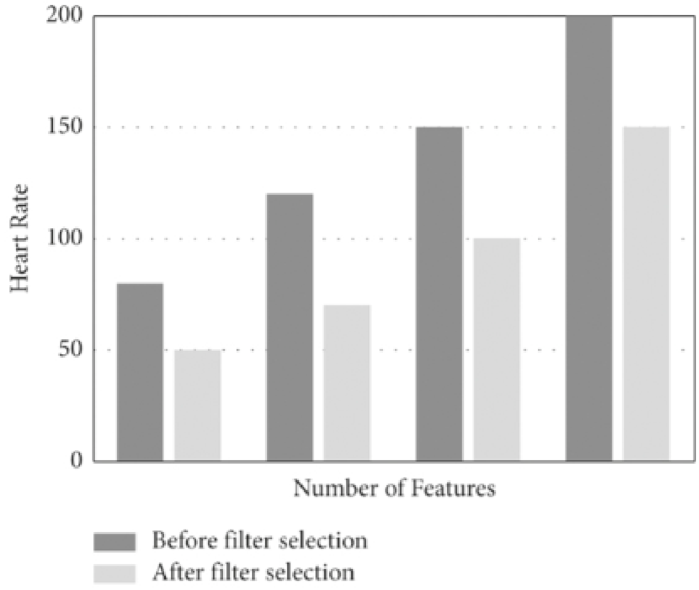

Fig: Heart rate before and after filter selection based on number of features.
Source : https://www.hindawi.com/cin/2022/2247675/
Classification strategy gives help vector machine machine learning in step two. The accuracy matrix from SVM can be used to measure heart rate. Figure shows the SVM link between heart rate and classification accuracy. In the 70-100 bpm heart rate range, accuracy percentages range from 98 to roughly. Thus, more features can lower classification accuracy and vice versa.

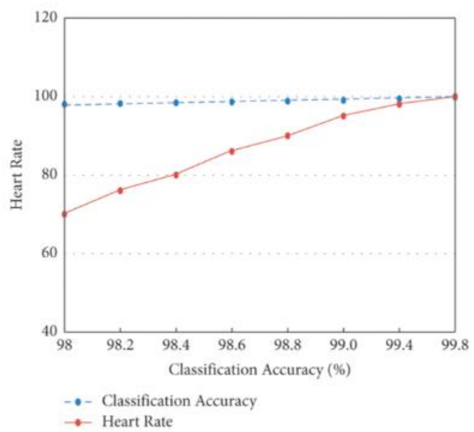

Fig: Relationship between heart rate and classification accuracy achieved by SVM technique.
Source: https://www.hindawi.com/cin/2022/2247675/

Emotion Analysis

Figure shows that the suggested system changes 30 autistic children's emotions (angry, happy, thrilled, and sad) based on their heart rate. The unique heart rate patterns were linked to problematic behaviours in ASD youngsters. We also found abnormal heart rate responses to stimuli and compared homocysteine and other biomarkers in autistic children to age-matched healthy children. A child's heart rate can indicate anger when it's between 80-180 bpm, whereas happiness is between 60-100 bpm. When the heart rate is between 110 and 140 beats per minute, the child is stimulated. Finally, a child's heart rate between 160 and 185 indicates sadness. For autistic youngsters, the pulse can be a strong predictor of emotions. Our technology helps parents engage with autistic children effortlessly.

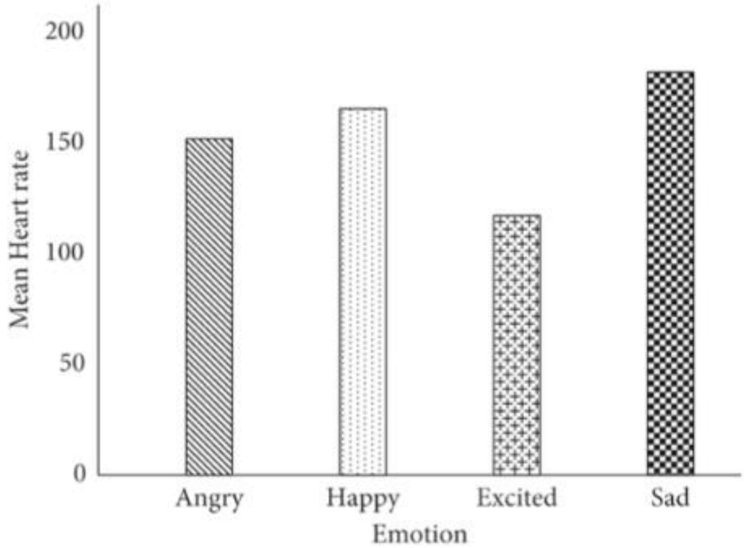

Fig: Relationship between emotions and mean heart rate among 30 autistic children.
Source: https://www.hindawi.com/cin/2022/2247675/

Performance of Classification

Based on extracted dataset features, classification models should be tested using a variety of machine learning methods including Random Forest (RF), KNN, and SVM to select the best one. Table shows that RF and KNN have 95 and 97 accuracy, respectively. Ensemble approaches with SVM improve accuracy to 99.8. Thus, the SVM is the ideal algorithm for classifying data to accurately and effectively analyse ASD children's emotions using heart rate.

Comparison between four machine learning classifiers.

Algorithm	KNN	RF	SVM
Accuracy %	95	97	**99.8**
Precision %	81	83	**88**
Best	95	97	**99.8**
Worst	90	93	**95.8**

Source: https://www.hindawi.com/cin/2022/2247675/

Conclusions

This study proposes an intelligent system with AI-enabled Internet of Things to help autistic children adapt to their environment by detecting their emotional state using a sensor that reads their heartbeat and classifies it using machine learning models. Four classification models are examined, and SVM and RF perform best. The guardian receives a notification with the child's state and emotional recommendations. Further, the suggested system's application interface lets guardians recall a child's activities. This programme helps autistic youngsters improve eye contact by engaging with a 3D graphical representation. The suggested system analyses heart rate before, during, and after demanding behaviours in autistic children to determine emotional feelings. Cloud computing services can increase accuracy and data security. With this technology, optimization algorithms can assist parents improve their autistic children's conduct easily.

References

1. Wasifa Jamal, Saptarshi Das, Ioana-Anastasia Oprescu, Koushik Maharatna, Fabio Apicella, Federico Sicca, "Classification of Autism Spectrum Disorder Using Supervised Learning of Brain Connectivity Measures Extracted from Synchrostates", Journal of Neural Engineering, Vol. 11, No. 4, 2004.
2. Guillaume Chanel, Swann Pichon, Laurence Conty, Sylvie Berthoz, Coralie Chevallier, Julie Grèzes, "Classification of autistic individuals and controls using cross-task characterization of fMRI activity", Elsevier, 2016.
3. Daniel Bone, Matthew S. Goodwin, Matthew P. Black, Chi-Chun Lee, Kartik Audhkhasi, Shrikanth Narayanan, "Applying Machine Learning to Facilitate Autism Diagnostics: Pitfalls and promises", Journal of Autism and Developmental Disorders, J Vol. 45, No. 5, pp. 1121– 1136, 2016.
4. Chintan Amrit, Tim Paauwy, Robin Alyz, MihaLavric, "Using text mining and machine learning for detection of child abuse", Expert Systems with Applications: An International Journal, Vol. 2, 2017.
5. Anibal SólonHeinsfeld, Alexandre Rosa Franco, R. Cameron Craddock, Augusto Buchweitz, Felipe Meneguzzi, "Identification of autism spectrum disorder using deep learning and the ABIDE dataset", Neuro Image: Clinical, Vol. 17, pp. 16-23, 2018.
6. TabanEslami, Vahid Mirjalili, Alvis Fong, Angela R. Laird, Fahad Saeed, "ASD-DiagNet: A Hybrid Learning Approach for Detection of Autism Spectrum Disorder Using fMRI Data", frontiers in Neuro-informatics, Vol. 13, No. 70, pp. 1-14, 2019.
7. MiracBarisUsta, KorayKarabekiroglu, BerkanSahin, Muazzez Aydin, Abdullah Bozkurt, TolgaKaraosman, Armagan Aral, CansuCobanoglu, AysegülDuman Kurt, NerimanKesim, İremSahin& Emre Ürer, "Use of machine learning methods in prediction of short-term outcome in autism spectrum disorders", Psychiatry and Clinical Psychopharmacology, Journal of Psychiatry and Clinical Psychopharmacology, 2018.
8. FadiThabtah, David Peebles, "A new machine learning model based on induction of rules for autism detection", Health Informatics Journal, pp. 1-21, 2019.
9. Scott H. Lee, Matthew J. Maenner, Charles M. Heilig, "A comparison of machine learning algorithms for the surveillance of autism spectrum disorder", PLOS ONE, Vol. 14, No. 9, pp. 1-11, 2019.
10. Yukari Takarae, John Sweeney, "Neural Hyper-excitability in Autism Spectrum Disorders", Brain Sci, Vol. 13, No. 7, pii. E129, 2017.