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Development of an app for diagnosing autism

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Abstract

The early diagnosis of autism spectrum disorder (ASD) is crucial for timely intervention and improved developmental outcomes. Current diagnostic methods, however, often face challenges related to accessibility, cost, and time consumption. This concept note outlines the development of an innovative mobile application designed to assist in the diagnosis of autism. Leveraging advancements in artificial intelligence and machine learning, the app aims to provide an accessible, user-friendly, and cost-effective tool for parents, caregivers, and healthcare professionals. Key features include behavior tracking, developmental milestone assessments, and interactive questionnaires, all tailored to identify early signs of ASD. The app will utilize data analytics to offer preliminary risk assessments and facilitate connections with professional diagnostic services for further evaluation. Emphasis will be placed on creating a culturally sensitive and inclusive platform to ensure broad usability. This initiative holds the potential to revolutionize early autism diagnosis by integrating technology with clinical expertise, ultimately enhancing early intervention efforts and support systems.

Keywords: Autism diagnosis app; autism spectrum disorder (ASD); Early intervention; Artificial intelligence; Machine learning; Behavior tracking

1. Introduction

Early diagnosis of Autism Spectrum Disorder (ASD) is crucial for timely intervention and improved developmental outcomes. However, access to diagnostic services can be limited, especially in rural or under-resourced areas. Mobile technology offers a scalable solution to this problem. This project proposes the development of a mobile application designed to aid in the early diagnosis of autism by analyzing behavioral data using machine learning algorithms.

Autism Spectrum Disorder (ASD) is a developmental disorder characterized by difficulties with social interaction, communication, and repetitive behaviors. Early diagnosis and intervention are essential for improving outcomes for individuals with ASD. However, the current diagnostic process can be cumbersome and inaccessible to many, particularly in underserved areas.

The proposed mobile application aims to bridge this gap by providing an initial assessment tool that can identify potential signs of autism, thereby facilitating earlier professional evaluation and intervention. Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by a range of symptoms, skills, and levels of disability. These can include challenges with social skills, repetitive behaviors, speech, and nonverbal communication. Given the increasing prevalence of autism, which now affects approximately 1 in 54 children in the United States alone, early diagnosis and intervention have become paramount to improving long-term outcomes for those on the spectrum.

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The Autism Diagnostic Observation Schedule—Generic (ADOS-G) is a semi-structured, standardized tool used to assess social interaction, communication, play, and imaginative use of materials in individuals suspected of having autism spectrum disorders.

The assessment includes four 30-minute modules, each tailored to be administered based on the individual's level of expressive language. Psychometric data from a sample of 223 children and adults diagnosed with Autistic Disorder (autism), Pervasive Developmental Disorder Not Otherwise Specified (PDDNOS), or no spectrum diagnoses were analyzed. Participants in each module were matched by expressive language level.

The findings show significant interrater and test-retest reliability for individual items, high interrater reliability within domains, and strong internal consistency. Mean comparisons consistently distinguished individuals with autism and PDDNOS from those with non-spectrum diagnoses, though differentiation between autism and PDDNOS was less consistent.

Diagnostic algorithms were developed using predefined DSM-IV/ICD-10 criteria, factor analyses, and ROC curves, establishing thresholds for autism and broader autism spectrum/PDD. These algorithms demonstrated excellent sensitivity and specificity for distinguishing autism and PDDNOS from no spectrum disorders, with moderate effectiveness in differentiating between autism and PDDNOS. Lord, C., et al. (2000)

Autism Spectrum Conditions (ASC) can be accurately diagnosed by the age of 24 months. However, despite the recognized benefits of early intervention, there remains a gap between research and practice in the timely identification of ASC, especially in low-resource areas.

The Social Attention and Communication Surveillance (SACS) tool, which evaluates behavioral indicators of autism in children aged 12 to 24 months, has been used successfully in Maternal and Child Health (MCH) settings, demonstrating excellent psychometric properties. AS Detect is a free mobile application derived from the SACS, created to provide an effective, evidence-based resource for parents to understand early social-communication development in children and evaluate their child's 'likelihood' of having ASC. Bent, C. A., Dissanayake, C., & Barbaro, J. (2020).

However, traditional diagnostic methods can be time-consuming, expensive, and geographically inaccessible, particularly for individuals in underserved communities. In this context, the development of an innovative mobile application for diagnosing autism presents a transformative opportunity. Leveraging advances in technology, including artificial intelligence (AI), machine learning (ML), and mobile health (mHealth), this app aims to offer a scalable, user-friendly, and cost-effective solution for early autism detection. The app will not only assist parents and caregivers in identifying potential signs of autism but also support healthcare professionals in making more accurate and timely diagnoses.

2. Methodology

2.1. App Development

- User Interface (UI) Design: Develop an intuitive and user-friendly interface for easy navigation by parents and healthcare providers.
- Data Collection: Integrate methods for collecting data through video recordings, questionnaires, and interactive tasks.
- Machine Learning Algorithms: Employ machine learning techniques to analyse collected data for patterns indicative of ASD.

2.2. Features

- Video Analysis: Allow parents to upload videos of their child's behavior, which the app analyses for signs of ASD using computer vision and pattern recognition.
- Questionnaires: Include standardized questionnaires, such as the Modified Checklist for Autism in Toddlers (M-CHAT), to gather behavioral data.
- Interactive Assessments: Incorporate interactive games and tasks designed to observe and record responses to stimuli, which can be indicative of ASD.

2.3. Pilot Testing

- **Beta Testing:** Conduct beta testing with a diverse group of users to identify and fix any issues.
- **Clinical Validation:** Partner with healthcare institutions to validate the app's diagnostic accuracy through clinical trials.

2.3.1. Launch and Distribution

- **Distribution Strategy:** Release the app on major app stores (Google Play, Apple App Store) and promote through healthcare networks and pediatric practices.
- **Training and Support:** Provide training materials and customer support to ensure proper usage and address any user concerns.

Objectives

- **Develop a Diagnostic App:** Create a mobile application that uses advanced algorithms to analyse behavioral data and provide preliminary diagnostic insights for ASD.
- **Improve Accessibility:** Make diagnostic tools accessible to a broader audience, particularly in remote and under-resourced regions.
- **Facilitate Early Intervention:** Enable early detection of ASD to allow for timely and effective intervention strategies.
- **Support Research:** Collect anonymized data to support ongoing research in autism diagnosis and treatment.

2.3.2. Expected Outcomes

- **Early Detection:** Increased rates of early ASD diagnosis, leading to more timely and effective interventions.
- **Accessibility:** Broader access to diagnostic tools, especially in remote and under-resourced areas.
- **Improved Research:** Collection of valuable data to support further research in ASD diagnosis and treatment.
- **Parental Empowerment:** Empower parents with tools to understand and address their child's developmental needs early on.

3. Discussion and Recommendations

3.1. Data Privacy and Security

- **Challenge:** Ensuring the privacy and security of user data, particularly sensitive video and behavioral information.
- **Recommendation:** Implement robust encryption protocols and comply with relevant data protection regulations (e.g., GDPR, HIPAA)

3.2. Algorithm Bias

- **Challenge:** Ensuring that the machine learning algorithms are not biased and are effective across diverse populations.
- **Recommendation:** Train algorithms on diverse datasets and regularly review and update the models to maintain accuracy and fairness.

3.3. User Engagement

- **Challenge:** Ensuring high user engagement and accurate data collection through the app.
- **Recommendation:** Design engaging and easy-to-use interfaces and provide incentives for regular use, such as progress tracking and feedback.

3.4. Clinical Validation

- **Challenge:** Achieving clinical validation and acceptance within the medical community.
- **Recommendation:** Collaborate with healthcare providers and researchers to conduct rigorous validation studies and publish results in peer-reviewed journals.

3.5. Training for Mental Health Professionals

- Educational Modules: Develop modules on the use of the app for early ASD diagnosis, integrating them into medical and psychological training programs.
- Workshops and Seminars: Organize workshops and seminars to train healthcare providers on the app's features and its integration into clinical practice.
- Continuing Education: Offer continuing education credits for professionals who complete training on the app's usage and benefits.

3.6. Benefits for Parents

- Early Intervention: Provide parents with an accessible tool for early identification of ASD, enabling timely intervention strategies.
- Support and Resources: Offer resources and guidance within the app to help parents understand ASD and connect with support services.
- Monitoring Progress: Enable parents to track their child's developmental progress and the effectiveness of interventions over time.

4. Conclusion

The development of a mobile app for diagnosing autism represents a significant advancement in making early diagnostic tools accessible and effective. By leveraging machine learning and user-friendly interfaces, the app can facilitate early detection, leading to better outcomes for children with autism. The success of this project will depend on addressing challenges related to data privacy, algorithm bias, user engagement, and clinical validation. Through comprehensive training programs, mental health professionals can be equipped to utilize this technology effectively, ultimately benefiting children and their families. Future work will focus on clinical validation, user testing, and continuous improvement to ensure the app meets the needs of all stakeholders. The development of a mobile app for diagnosing autism represents a significant stride toward improving the early detection and intervention of this pervasive condition. By harnessing cutting-edge technology, this app aims to provide a practical, accessible, and reliable tool for parents, caregivers, and healthcare professionals. It stands to not only enhance the accuracy of autism diagnoses but also to alleviate the burdens associated with current diagnostic practices, ultimately contributing to better outcomes for individuals on the autism spectrum and their families.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

- [1] American Psychiatric Association. (2013). Diagnostic and Statistical Manual of Mental Disorders (5th ed.).
- [2] Lord, C., et al. (2000). The Autism Diagnostic Observation Schedule-Generic: A Standard Measure of Social and Communication Deficits Associated with the Spectrum of Autism. *Journal of Autism and Developmental Disorders*, 30(3), 205-223.
- [3] Robins, D. L., et al. (2001). The Modified Checklist for Autism in Toddlers: An Initial Study Investigating the Early Detection of Autism and Pervasive Developmental Disorders. *Journal of Autism and Developmental Disorders*, 31(2), 131-144.
- [4] Thatch, F. (2019). Machine Learning in Autism Spectrum Disorder Behavioral Research: A Review and Ways Forward. *Informatics*, 6(1), 8.
- [5] Lord, C., Rutter, M., Dillman, P. C., & Risi, S. (2003). Autism Diagnostic Observation Schedule. Western Psychological Services.
- [6] Robins, D. L., Fein, D., & Barton, M. L. (2009). Modified Checklist for Autism in Toddlers, Revised, with Follow-Up (M-CHAT-R/F). *Pediatrics*.
- [7] Bent, C. A., Dissanayake, C., & Barbaro, J. (2020). AS Detect: A Mobile App for the Early Detection of Autism Spectrum Conditions. *Journal of Autism and Developmental Disorders*.

- [8] Duda, M., Ma, R., Haber, N., & Wall, D. P. (2016). Use of Machine Learning for Behavioral Distinguishers of Autism in Young Children. *Pediatrics*.
- [9] Zhu, M., Zeng, N., & Wang, N. (2021). Autism & Beyond: A Mobile Health Platform for Early Screening of Autism. *Frontiers in Psychiatry*.
- [10] Bone, D., Bishop, S., & Black, M. P. (2016). Use of Machine Learning to Improve Autism Screening and Diagnostic Tools: *ACM Transactions on Accessible Computing*.
- [11] Egger, H. L., Dawson, G., & Hashemi, J. (2018). Automatic Emotion and Attention Analysis of Young Children at Home: A Research Kit App. *JAMA Pediatrics*.
- [12] Myers, S. M., & Johnson, C. P. (2007). Management of Children with Autism Spectrum Disorders. *Pediatrics*.
- [13] Smith, C. J., & Matson, J. L. (2010). Adapting Evidence-Based Interventions for Children with Autism: A Review of the Literature. *Journal of Child and Family Studies*.
- [14] Kuo, M. H., & Shen, N. (2017). Privacy and Security Considerations for Mobile Health Apps. *AMIA Annual Symposium Proceedings*.
- [15] Khowaja, K., Hazzan, A. A., & Jawed, A. S. (2021). The Integration of Digital Health into Pediatric Autism Care: Challenges and Opportunities. *JMIR Pediatrics and Parenting*.
- [16] Karthikeyan, B., Puri, A., Mathur, R., et al. (2016). Internet of Things (IOT) based attendance and intrusion detection system. *International Journal of Innovative Research in Computer and Communication Engineering*, 4(3).
- [17] Banerjee, P., Puri, A., Puri, A., et al. (2018). Challenges faced by non BPD spouse and family: a case study. *EC Psychology and Psychiatry*, 7(12).
- [18] Puri, A., Navya, N., & Shammi. (2019). Malaise of Domestic Violence: Scarring Children's Well Being. Vol. 7 No. 1 (2019): Volume 07, Issue 1, January-March, 2019. DOI: 10.25215/0701.067
- [19] Puri, A., Bamel, P., Sindhu, B., et al. (2023). Recent advances in psychotherapy in the Indian scenario - subconscious energy healing therapy: S.E.H.T for infertility counselling. *J Psychol Clin Psychiatry*, 14(6), 182–194. DOI: 10.15406/jpcpy.2023.14.00750
- [20] Puri, A., Sindhu, B. D., Puri, A., et al. (2023). Hypnotherapy as an intervention in infertility treatment. *Art Human Open Acc J*, 5(3), 214–218. DOI: 10.15406/ahoaj.2023.05.00211
- [21] Puri, A., Nayar, P., Bamel, P., Puri, A., & Kumar, A. (2024). Invisible Grief During A.R.T.. In Indian Fertility Society (Ed.), *Counseling in Assisted Reproduction Technology (A.R.T.)* (pp. 23).
- [22] Bamel, P., Puri, A., Nayar, K. D., Singh, T., & Jogy, S. (2024). Use of Interest-Based Technology for Patient Care. In Indian Fertility Society (Ed.), *Counseling in Assisted Reproduction Technology (A.R.T.)* (pp. 83).
- [23] Puri, A., Nayar, P., Bamel, P., Sindhu, B., & Puri, A. (2024). Implementing Distress Screening and Psychological Assessment at the A.R.T. Clinic. In Indian Fertility Society (Ed.), *Counseling in Assisted Reproduction Technology (A.R.T.)* (pp. 63).
- [24] Bamel, P., Sindhu, B., Sindhu, S., Puri, A., & Singh, T. (2024). Recent Eclectic Approach to Psychotherapeutic Interventions in the Indian Context - Subconscious Energy Healing Therapy (S.E.H.T). *International Journal of Creative Research Thoughts (IJCRT)*, 12(2), a434-a442. <http://www.ijcrt.org/papers/IJCRT2402052.pdf>
- [25] Puri, A., Mathur, R., & Sindhu, N. (2024). Harnessing the Power of AI in Healthcare: Benefits, Concerns, and Challenges for Medical Personnel Training. *Art Human Open Acc J*, 6(2), 90- 91.
- [26] Banerjee, P., Sindhu, B. D., Sindhu, S., et al. (2024). Exploring the intersections of AI (Artificial Intelligence) in psychology and astrology: a conceptual inquiry for human well- being. *J Psychol Clin Psychiatry*, 15(1), 75–77. DOI: 10.15406/jpcpy.2024.15.00761
- [27] Puri, A., Banerjee, P., Nayar, P., et al. (2024). Understanding the impact of environmental pollutants on infertility counselling: insights from the Indian scenario. *Art Human Open Acc J*, 6(1), 35–37. DOI: 10.15406/ahoaj.2024.06.00218
- [28] Puri, A., Mathur, R., & Sindhu, N. (2024). Enhancing assisted reproductive technology with AI: Addressing concerns and challenges. *International Journal of Science and Research Archive*, 12(01), 745-747. <https://doi.org/10.30574/ijsra.2024.12.1.0859>
- [29] Puri, A., Mathur, R., & Nayar, K. D. (2024). AI-powered fertility assessment tool. *International Journal of Science and Research Archive*, 12(1), 742-744. <https://doi.org/10.30574/ijsra.2024.12.1.0860>