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The integration of Artificial Intelligence for Autism Spectrum Disorder: A Mini Review

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Abstract: Artificial Intelligence (AI) presents transformative possibilities for Autism Spectrum Disorder (ASD) diagnosis and intervention. This mini review synthesizes findings from a scoping review of 55 studies (2020–2024), exploring AI's role in early detection, multimodal interventions, and personalized care. While Convolutional Neural Networks (CNNs), ResNet 18, and hybrid models such as GoogleNet SVM show high accuracy in diagnosing ASD, novel approaches integrating visual, audio, and textual data enhance contextual understanding. AI tools also support intervention through virtual reality, telehealth, and IoT based monitoring. Nevertheless, challenges such as access inequities, ethical concerns, and research gaps on adult ASD populations persist. This review highlights the importance of inclusive, ethical innovation in AI powered ASD care.

Keyword: Autism Spectrum Disorder, Artificial Intelligence, Diagnosis, Interventions

INTRODUCTION

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by persistent deficits in communication, social interaction, and the presence of repetitive behaviors and restricted interests. The manifestation of symptoms and associated cognitive abilities varies significantly across individuals and is frequently accompanied by comorbidities such as attention deficit hyperactivity disorder (ADHD), anxiety, depression, and epilepsy (American Psychiatric Association, 2013; Khoirunnisa et al., 2024). Initially categorized under pervasive developmental disorders in the DSM III, ASD was redefined in the DSM 5 and ICD 11 with refined diagnostic criteria and clinical specifiers to improve clarity and consistency (Lord et al., 2020).

Despite increasing global prevalence estimated at approximately 1 in 100 children annually diagnosis often occurs between the ages of four and five, delaying access to early intervention services (Wankhede et al., 2024; Manohar et al., 2019). Early identification, particularly before 36 months of age, is crucial given the heightened neuroplasticity in early childhood, which is associated with significantly improved developmental outcomes (Grzadzinski et al., 2021; Klintwall & Eikeseth, 2014). Conventional diagnostic instruments, such as the Autism Diagnostic Observation Schedule (ADOS 2) and the Autism Diagnostic Interview Revised (ADI R), have played a critical role in assessment. However, recent advancements in artificial intelligence (AI) have introduced new possibilities for enhancing diagnostic precision. AI technologies facilitate the rapid and accurate processing of behavioral, neuroimaging, and genetic data, thereby supporting clinical decision making and enabling more individualized approaches to care (Pandya et al., 2024; Joudar et al., 2023; Langer & Landers, 2021; Zhang & Lu, 2021).

Although scholarly interest in Autism Spectrum Disorder (ASD) has increased in recent years, significant research gaps remain. Many diagnostic procedures are hampered by methodological limitations and an overreliance on subjective judgment, resulting in inconsistencies that complicate the creation of standardized intervention frameworks (Okoye, 2023; Pardeshi, 2024). Despite broad agreement on the importance of early intervention, there is a lack of longitudinal research evaluating the long-term effectiveness and sustainability of various treatment approaches (Pizur Barnekow et al., 2020).

Moreover, the application of artificial intelligence (AI) in ASD research remains at a nascent stage, particularly in clinical contexts that are under resourced or lack the technological infrastructure required for implementation (Bhatt, 2024; Sassu & Volkmar, 2022). This disparity is especially evident in regions with restricted access to specialized care, highlighting the urgent need for inclusive and innovative AI driven solutions to enhance both diagnostic accuracy and intervention efficacy (Wieckowski et al., 2022; Sumiła, 2022).

This mini review aims to explore and synthesize recent developments in the application of artificial intelligence (AI) for individuals with Autism Spectrum Disorder (ASD), with a specific focus on its roles in diagnosis and intervention within the field of computer science. By mapping key concepts, technologies, and empirical findings from recent literature, this review seeks to identify emerging patterns, evaluate the potential benefits of AI based solutions, and highlight gaps that warrant further investigation. The objective is to provide a comprehensive yet focused overview that can inform future research and technological advancements in AI assisted ASD care.

METHOD

This mini review employed a scoping review methodology guided by the framework proposed by Hilary Arksey and Lisa O'Malley (2005) to systematically identify, map, and synthesize the existing body of literature concerning the application of Artificial Intelligence (AI) in Autism Spectrum Disorder (ASD). The scoping review approach was selected due to its suitability for examining emerging, interdisciplinary, and rapidly evolving research domains, particularly those characterized by diverse methodological approaches and continuous technological innovation. Within the context of AI and ASD, where studies span areas such as computer science, healthcare, education, psychology, and assistive technology, the scoping review method provides a comprehensive strategy for exploring the breadth and complexity of the available evidence.

By adopting this framework, the review aimed not only to summarize current findings but also to develop a broader conceptual understanding of how AI technologies have been integrated into ASD-related diagnostic, therapeutic, and educational interventions across recent studies. Furthermore, the approach enabled the identification of dominant research trends, methodological patterns, technological advancements, and existing knowledge gaps

within the literature. This broader mapping process is particularly important in AI-related ASD research because technological developments often progress more rapidly than the consolidation of empirical evidence and theoretical frameworks.

The review process followed several structured stages, including the identification of research questions, systematic literature searching, study screening and selection, data charting, and synthesis of findings. To strengthen the rigor and transparency of the search strategy, the Population Concept Context (PCC) framework was employed. Within this framework, the population referred to individuals with ASD across various age groups and functional profiles; the concept focused on the implementation of AI-based technologies and computational approaches; and the context encompassed diagnostic, therapeutic, educational, and intervention-related applications associated with ASD. The adoption of the PCC strategy enabled the review to maintain conceptual clarity while ensuring comprehensive coverage of relevant studies within the interdisciplinary intersection of healthcare, computer science, and educational technology.

Literature was retrieved from major electronic databases Scopus, PubMed, and IEEE using the search terms: “Artificial Intelligence” OR “AI” AND “Autism Spectrum Disorder” OR “ASD” OR “Autism,” restricted to peer reviewed, open access articles published in English between 2020 and 2024. This time restriction was applied to capture contemporary developments in AI technologies, particularly those associated with machine learning, deep learning, intelligent systems, and automated diagnostic tools that have experienced substantial advancement in recent years.

The inclusion criteria focused on empirical studies investigating the practical application of AI in ASD, especially research situated within the domains of computer science, intelligent systems, and technology assisted interventions. Studies were considered eligible when they examined AI-driven diagnostic models, behavioral prediction systems, assistive technologies, or intervention platforms specifically designed for individuals with ASD. Conversely, review articles, conference proceedings, editorial papers, and studies unrelated to AI-based diagnostics or interventions were excluded to maintain methodological consistency and empirical relevance. The emphasis on empirical research enabled the review to capture measurable outcomes, technological effectiveness, and implementation trends across different AI applications.

Following the selection process, the included studies were systematically charted to extract and organize key information, including research objectives, targeted ASD-related conditions or behaviors, AI methods and algorithms employed, datasets or intervention settings, and the primary findings reported by each study. This structured charting process facilitated the identification of dominant research trends, methodological patterns, technological innovations, and existing research gaps within the field. Furthermore, the synthesis enabled a clearer understanding of the growing role of AI in supporting ASD diagnosis, personalized intervention, behavioral monitoring, and adaptive learning systems, while also highlighting challenges related to ethics, interpretability, accessibility, and long-term implementation (Baoum et al., 2022; Whiteley et al., 2021).

RESULTS AND DISCUSSION

Findings

Recent studies have demonstrated the transformative potential of artificial intelligence (AI) in supporting both diagnostic and intervention strategies for individuals with Autism Spectrum Disorder (ASD). In the diagnostic domain, AI techniques such as Convolutional Neural Networks (CNNs), Support Vector Machines (SVMs), and hybrid architectures have achieved high levels of precision, with some models reporting accuracy rates approaching 99% for early ASD detection. These methods have proven effective in identifying subtle

patterns in behavioral data and neuroimaging outputs that often elude traditional clinical observation.

Furthermore, multimodal approaches incorporating visual, auditory, and textual inputs have shown promise in enhancing the depth and accuracy of ASD understanding. In addition to diagnostic applications, AI has also enabled the development of innovative intervention tools tailored to the diverse needs of individuals with ASD. Technologies such as social robots, mobile health (mHealth) applications, and Internet of Things (IoT) based monitoring systems have been employed to enhance social communication, emotional recognition, and behavioral management. These tools facilitate personalized and adaptive therapeutic experiences, expanding the reach of services through remote platforms and real time feedback mechanisms.

To better understand the current landscape, the reviewed literature was categorized into five primary domains based on focus and application:

Diagnosis (27.27%)

Research efforts in the field of Artificial Intelligence (AI) and Autism Spectrum Disorder (ASD) remain predominantly concentrated on diagnostic applications, reflecting the increasing global demand for more accurate, objective, and early identification of ASD. Early diagnosis plays a critical role in improving developmental outcomes, intervention effectiveness, and long-term quality of life for individuals with ASD. However, traditional diagnostic approaches frequently depend on behavioral observation, clinician interpretation, and standardized assessment instruments, which may introduce subjectivity, inconsistency, and delays in clinical decision-making. In response to these limitations, AI-driven diagnostic systems have emerged as promising alternatives capable of supporting faster, data-driven, and more reliable assessment processes.

Recent advances in machine learning and deep learning have significantly expanded the potential of AI-assisted ASD diagnostics. Deep learning architectures such as Convolutional Neural Networks (CNNs), 3D-CNNs, ResNet-based models, and multimodal neural frameworks are increasingly utilized to identify neurological and behavioral markers associated with ASD. Ahmed et al. (2022), for instance, demonstrated that eye-tracking data analyzed through machine learning and deep learning techniques can effectively support early ASD detection by identifying atypical gaze behavior patterns. Similarly, Wang et al. (2023) developed a multi-view CNN model integrated with an attention mechanism capable of improving ASD classification performance through enhanced feature extraction and pattern recognition.

The literature also highlights the growing integration of neuroimaging analysis into AI-based diagnostic systems. Studies by Alharthi and Alzahrani (2023) employed 3D-CNN and vision transformer architectures to analyze structural MRI (sMRI) and functional MRI (fMRI) data for ASD diagnosis, demonstrating high predictive accuracy in identifying neurodevelopmental abnormalities. Likewise, Nogay and Adeli (2024) emphasized the effectiveness of deep learning techniques in classifying ASD-related brain MRI patterns across age and gender categories, suggesting that AI can support more personalized and demographically sensitive diagnostic approaches. Beyond neuroimaging, researchers increasingly incorporate computer vision, facial analysis, speech processing, and electroencephalography (EEG) signals to improve diagnostic precision and reduce variability across clinical evaluations. Omar (2024), for example, utilized multi-dimensional CNN models to analyze EEG signals for ASD detection, revealing that neurophysiological data can provide reliable biomarkers for automated screening systems.

The growing implementation of Explainable Artificial Intelligence (XAI) also reflects increasing awareness regarding transparency and accountability in AI-assisted healthcare systems. As discussed by Krupa-Kotara (2023), explainable models help clinicians

understand how diagnostic predictions are generated, thereby improving trust, interpretability, and the practical integration of AI into clinical workflows. This development is especially important considering the heterogeneity of ASD symptoms and developmental trajectories, which require nuanced and context-sensitive interpretation.

Intervention (23.64%)

Intervention focused studies increasingly explore how Artificial Intelligence (AI) can be utilized to enhance therapeutic processes and support skill development among children with Autism Spectrum Disorder (ASD). Unlike conventional intervention approaches that often rely heavily on repetitive human-led instruction, AI-based systems offer adaptive, interactive, and personalized learning experiences that can be adjusted according to the behavioral and developmental characteristics of each child. This flexibility has positioned AI as a promising tool for addressing the diverse cognitive, communicative, and socio-emotional needs commonly associated with ASD. (Wieckowski et al., 2022)

A growing body of research highlights the integration of AI with emerging technologies such as social robots, intelligent tutoring systems, and interactive learning platforms. Social robots, including humanoid robots such as NAO, are widely employed because of their ability to deliver predictable, structured, and non-threatening social interactions that are often more comfortable for children with ASD than conventional face-to-face communication. These robotic systems are commonly integrated with AI algorithms capable of analyzing user responses, adapting interaction patterns, and providing real-time feedback to support the development of communication abilities, emotional understanding, and social engagement (Mutawa et al., 2023).

AI-supported interventions enable continuous monitoring and personalization of therapy progress. Through data-driven analysis, AI systems can identify behavioral patterns, learning preferences, and response tendencies, allowing interventions to be adjusted dynamically according to individual performance and developmental needs. This personalized capability contributes not only to improved learning outcomes but also to greater autonomy and confidence among children participating in therapeutic activities. (Ahmed et al.,2022).

Despite these promising advancements, challenges remain regarding accessibility, affordability, ethical considerations, and long-term effectiveness. Most existing intervention studies are still conducted in controlled or experimental settings, with limited evidence regarding their scalability and sustainability in broader educational and clinical contexts. Consequently, future research should emphasize longitudinal evaluations, interdisciplinary collaboration, and inclusive implementation strategies to ensure that AI-based interventions can be applied effectively, ethically, and equitably across diverse ASD populations.

IoT & Sensors (18.18%)

Internet of Things (IoT) and sensor-based technologies are increasingly gaining prominence in the field of Autism Spectrum Disorder (ASD), particularly for real-time monitoring, behavioral assessment, and adaptive intervention. The integration of AI-driven wearable systems enables continuous collection and analysis of physiological and behavioral data, allowing researchers and clinicians to better understand the complex and dynamic characteristics of individuals with ASD. For example, wearable devices embedded with artificial intelligence algorithms can analyze physiological indicators such as heart rate variability, skin conductance, and movement patterns to detect emotional states, stress responses, and behavioral tendencies in individuals with ASD (Abdel Hameed et al., 2022). Despite their promising contributions, the implementation of IoT and AI-based monitoring systems also raises important ethical and practical considerations, particularly regarding data privacy, security, informed consent, and long-term accessibility. Accordingly, future research

should focus not only on improving technological accuracy and interoperability but also on establishing ethical frameworks and user-centered designs that ensure the responsible and sustainable integration of these technologies into ASD care and education.

Emotional & Social (21.82%)

Research within this category highlights the growing contribution of Artificial Intelligence (AI) to the development of emotional recognition and social communication skills among individuals with Autism Spectrum Disorder (ASD). A substantial number of studies focus on the use of Explainable Artificial Intelligence (XAI) and emotion recognition systems to analyze and interpret social cues, including facial expressions, vocal intonation, gestures, and body language. These technologies enable the creation of more adaptive and personalized interventions aimed at improving socio-emotional understanding and interpersonal interaction.

The integration of XAI is particularly important in ASD-related applications because it enhances the transparency and interpretability of AI-generated outputs. By explaining how emotional classifications or behavioral predictions are derived, these systems support clinicians, educators, and caregivers in making more informed intervention decisions while increasing trust in AI-assisted therapeutic processes. Such capabilities are especially relevant given the heterogeneity of emotional and social functioning among individuals with ASD. Recent studies further reinforce this trend by demonstrating how deep learning and multimodal sensing technologies can improve the detection and interpretation of emotional responses among children with ASD. For example, Talaat (2023) developed a real-time facial emotion recognition framework based on deep learning and IoT integration, demonstrating the potential of AI systems to support continuous emotional assessment in naturalistic settings. Similarly, Banos et al. (2024) emphasized the growing use of sensing technologies and machine learning methods for emotion recognition in autism, highlighting the increasing shift toward multimodal and data-driven socio-emotional analysis.

For example, the *Emo-Mirror* system developed by Wali et al. (2023) employs AI-based emotion recognition to help children identify, interpret, and appropriately respond to emotional expressions. Through interactive visual feedback and guided learning activities, the system encourages children to associate facial cues with corresponding emotional states in a more engaging and accessible manner. This approach demonstrates how AI can function not merely as an assistive technology, but also as an interactive socio-emotional learning tool capable of fostering empathy, communication, and adaptive social behavior. Additional evidence is provided by recent AI frameworks integrating facial expression analysis, speech features, and explainable learning models to support emotional awareness and social-emotional skill enhancement among children with ASD.

Studies in this category indicate that AI-driven emotional and social interventions hold significant potential for improving the quality of social interaction and emotional understanding among individuals with ASD. Nevertheless, further research remains necessary to evaluate the long-term effectiveness, cultural adaptability, and ethical implications of implementing such systems across diverse educational and clinical settings. Recent scholarship also highlights the importance of ecological validity and real-world implementation, particularly through privacy-preserving and explainable AI systems capable of operating within classroom and therapeutic environments (Levy et al., 2024).

Multimodal (9.09%)

Multimodal studies integrate diverse data types, such as visual, auditory, and textual inputs, to provide a holistic understanding of ASD characteristics. Although this category accounts for the smallest proportion of research, its potential is substantial. Integrated models like CNN-LSTM and decision support frameworks have demonstrated significant

improvements in diagnostic accuracy by combining data from multiple modalities (Jung et al., 2024).

Diagnostic applications continue to dominate, reflecting the persistent need for early and accurate identification. Advanced models such as ResNet 18 and CNNs are widely used to detect neurological markers and behavioral indicators, outperforming conventional observational tools in both speed and precision (Ahmed et al., 2022; Krupa Kotara, 2023). Complementary to this, 5intervention focused research has explored the integration of AI in therapeutic tools like the NAO social robot and interactive platforms, which enhance user engagement and improve communicative and emotional skills (Mutawa et al., 2023).

IoT and sensor-based innovations are gaining prominence for their role in continuous, non- intrusive monitoring. AI powered wearable technologies, for instance, track physiological parameters such as heart rate and movement patterns to assess stress levels or predict behavioral outbursts, thereby supporting caregivers with actionable insights (Abdel Hameed et al., 2022). Similarly, studies in the emotional and social support category emphasize the importance of AI in interpreting facial expressions, tone of voice, and body language through emotion recognition systems and Explainable AI (XAI), such as the Emo Mirror project (Wali et al., 2023). Although multimodal research represents the smallest share, it holds substantial potential due to its integrative nature. Combining various data sources using models like CNN LSTM has led to more robust diagnostic frameworks and improved clinical decision-making processes (Jung et al.,2024).

This integrated approach aligns with a growing recognition that ASD is multifactorial and cannot be fully understood through a single data modality. Despite these promising developments, several limitations persist. Many AI tools remain insufficiently validated in real world clinical settings, raising concerns about their generalizability. Moreover, the overrepresentation of pediatric populations limits the applicability of findings to adolescents and adults with ASD. The unequal distribution of research, concentrated in high income countries, also highlights disparities in accessibility and implementation of AI solutions in low resource environments. Furthermore, the ethical implications surrounding data privacy, algorithmic bias, and informed consent are still underexplored in much of the existing literature.

Overall, while AI offers a multifaceted and promising avenue for enhancing ASD related services, future research should prioritize longitudinal validation, the inclusion of diverse populations, and the development of inclusive, ethically grounded frameworks. Particular 6attention should be directed toward expanding multimodal applications and ensuring the scalability of AI tools across varied real-world contexts.

DISCUSSION

The integration of Artificial Intelligence (AI) into the field of Autism Spectrum Disorder (ASD) represents a significant paradigm shift in both diagnostic and intervention practices. Conventional diagnostic approaches, although foundational in clinical assessment, are often constrained by subjectivity, variability in expert interpretation, and lengthy evaluation procedures, which may delay early identification and reduce the effectiveness of individualized interventions. In response to these limitations, AI-driven technologies have emerged as promising alternatives capable of improving diagnostic precision, efficiency, and scalability through large-scale data processing and advanced pattern recognition techniques. Recent developments in AI have enabled the identification of subtle behavioral, neurological, and communicative indicators associated with ASD that may not be easily detected through traditional assessment methods. Techniques such as computer vision, machine learning, deep learning, and Integrated Decision Support Systems (IDSS) have demonstrated considerable potential in enhancing diagnostic reliability and supporting early screening processes (Krupa Kotara, 2023). By analyzing facial expressions, eye-tracking patterns, speech characteristics,

motor behavior, and neurophysiological signals, AI systems can generate more objective and data-driven assessments, thereby assisting clinicians in making more accurate and timely diagnostic decisions.

Beyond diagnostics, AI has revolutionized therapeutic interventions by enabling highly personalized, adaptive, and engaging experiences for individuals with ASD. One notable application is the use of Virtual Reality (VR), which allows users to practice social communication and behavioral responses in immersive, controlled environments. These simulated scenarios minimize sensory overload while promoting skill acquisition in areas such as eye contact, conversational turn taking, and emotional regulation (Malihi et al., 2020). AI driven VR systems can dynamically adjust the complexity of tasks based on user performance, ensuring continuous engagement and relevance across a wide range of abilities. This level of adaptability is essential for addressing the heterogeneity that characterizes the ASD population, as it supports individualized learning trajectories.

In addition, AI based tools provide real time feedback and longitudinal data, which can inform therapists and caregivers in refining intervention strategies. These tools not only improve therapeutic outcomes but also enable more efficient monitoring and decision making (Abdel Hameed et al., 2022). The benefits of AI extend beyond VR, with educational robots and gamified learning platforms increasingly utilized to foster social interaction, motivation, and behavioral consistency. These platforms often integrate real time analytics and interactive 7 interfaces, promoting sustained engagement while tailoring content to the user's progress (Mutawa et al., 2023).

The educational implications of AI are equally significant. AI powered learning aids such as visual activity schedules and adaptive instructional technologies support students with ASD in developing independence, maintaining attention, and navigating daily routines (Tosun et al., 2023). These tools can also assist educators in identifying individualized learning needs and optimizing pedagogical approaches. Moreover, AI enabled systems can simulate complex social environments, helping learners practice communication skills in a structured and safe manner (Hoogdalem et al., 2021).

Equity and accessibility are other domains where AI has demonstrated critical potential. Telehealth platforms supported by AI are emerging as scalable alternatives to traditional in person services, particularly in underserved and remote areas. These platforms reduce geographical and social economic barriers, democratizing access to qualified ASD professionals and timely interventions (Drahota et al., 2020). Such digital innovations are vital for extending the reach of ASD care and ensuring that technological advancements translate into broader public health benefits.

Nevertheless, despite these considerable benefits, ethical considerations must remain central to the deployment of AI in ASD contexts. Issues such as data privacy, algorithmic transparency, and informed consent require robust frameworks to safeguard user rights and dignity. The potential for algorithmic bias, particularly in systems trained on non-representative datasets, also calls for vigilance in design and implementation. Future research must therefore prioritize the development of inclusive, fair, and accountable AI systems that align with the diverse needs of the ASD community and uphold ethical standards in both clinical and educational settings.

CONCLUSION

This mini review examined the evolving role of Artificial Intelligence (AI) in the diagnosis and intervention of Autism Spectrum Disorder (ASD). The findings indicate that AI-driven techniques, particularly deep learning models such as Convolutional Neural Networks (CNNs) and hybrid architectures including GoogleNet-SVM frameworks, have substantially improved the accuracy, efficiency, and scalability of early ASD detection. These technologies enable the identification of subtle behavioral, neurological, and communicative

indicators that are often difficult to capture through conventional assessment approaches. In parallel, AI-supported personalized interventions including virtual reality-based therapies, intelligent tutoring systems, social robotics, and telehealth platforms demonstrate considerable potential in enhancing individual learning experiences, behavioral adaptation, emotional regulation, and therapeutic outcomes among individuals with ASD.

The review further highlights the growing importance of multimodal AI approaches that integrate visual, auditory, and textual data to provide a more comprehensive and context-sensitive understanding of ASD characteristics. Such approaches enable more adaptive and individualized support systems, reflecting the increasing shift toward precision-oriented interventions in ASD care. Nevertheless, several critical challenges remain. Limited technological accessibility in underserved and low-resource regions continues to restrict the broader implementation of AI-based solutions. In addition, ethical concerns related to data privacy, algorithmic transparency, and the interpretability of AI decision-making processes remain insufficiently addressed within current research. The review also reveals that most existing studies predominantly focus on children with ASD, while research involving adolescents, adults, and long-term intervention outcomes remains comparatively limited.

Overall, this review emphasizes the necessity of developing AI applications that are not only technologically sophisticated but also equitable, ethically grounded, clinically interpretable, and empirically validated. Future research should prioritize inclusive accessibility, interdisciplinary collaboration, and longitudinal evaluation to ensure that AI-based innovations contribute meaningfully and sustainably to the advancement of ASD diagnosis, intervention, and long-term support systems. Greater attention should also be directed toward culturally responsive AI frameworks and the development of standardized evaluation protocols capable of assessing the real-world effectiveness and scalability of AI-assisted interventions across diverse populations and contexts.

In addition, the findings of this review demonstrate that AI possesses transformative potential to reshape the landscape of ASD care by enabling more personalized, adaptive, and evidence-driven approaches across clinical, educational, and therapeutic environments. Nevertheless, the successful integration of AI into real-world practice requires careful consideration of ethical governance, accessibility, interdisciplinary usability, and human-centered design to ensure that technological innovations remain aligned with the diverse needs of individuals with ASD and their support networks. Consequently, continued efforts toward responsible innovation, transparent algorithmic development, and evidence-based implementation are essential for maximizing the long-term benefits of AI in supporting the well-being, inclusion, independence, and developmental outcomes of individuals with ASD.

Limitations and Future Research

The study also highlights several limitations that warrant attention. A primary limitation is the restricted access to AI-based technologies in resource-limited regions, where inadequate technological infrastructure and the high cost of devices significantly hinder adoption. Furthermore, the absence of a comprehensive ethical framework for regulating the collection and use of sensitive data from individuals with ASD raises concerns about privacy and algorithm transparency. Another notable limitation is the predominant focus of existing research on children, leaving substantial gaps in understanding and addressing the needs of adults with ASD, who also require tailored interventions, particularly in areas such as social skills and independence. Additionally, the lack of longitudinal studies limits the ability to evaluate the long- term effectiveness and sustainability of AI-based interventions. Most of the studies analyzed were conducted in high-income countries, which poses challenges in generalizing findings to resource- constrained regions, such as developing nations. Addressing these limitations will guide future research toward becoming more inclusive, globally relevant, and responsive to the diverse needs of the ASD population.

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