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ARTIFICIAL INTELLIGENCE IN AUTISM SPECTRUM DISORDER: A SYSTEMATIC REVIEW OF AI-SUPPORTED SCREENING, EDUCATION, AND INTERVENTION TECHNOLOGIES

Ilias Vasileiou[i]
Adjunct Lecturer,
College for Humanistic Sciences – ICPS,
University of Lancashire,
United Kingdom
orcid.org/0009-0001-0530-4463

Abstract:
Artificial intelligence (AI) technologies are increasingly transforming research and practice in Autism Spectrum Disorder (ASD). Advances in machine learning, deep learning, computer vision, and natural language processing have enabled the development of computational tools capable of identifying behavioral markers, supporting personalized educational environments, and enhancing therapeutic interventions for individuals on the autism spectrum. Despite the rapid growth of this interdisciplinary field, the literature remains fragmented across domains including computer science, clinical medicine, psychology, and educational research. The present study provides a systematic review of empirical research examining the application of artificial intelligence technologies in autism spectrum disorder. Following the PRISMA 2020 guidelines, a comprehensive search was conducted in major international databases, including Scopus, Web of Science, PubMed, ERIC, and PsycINFO, for studies published between 2015 and 2025. After duplicate removal, screening, and eligibility assessment, 49 empirical studies were included in the final synthesis. The findings indicate that artificial intelligence applications in autism research cluster into four primary domains: AI-supported diagnostic screening and early identification, AI-based educational technologies and adaptive learning systems, socially assistive robotics for social communication training, and AI-supported therapeutic monitoring and behavioral intervention systems. Across these domains, AI technologies demonstrated promising potential to improve early detection of autism, support individualized learning environments, and enhance the effectiveness of therapeutic interventions. However, the reviewed studies also revealed substantial methodological heterogeneity, limited sample sizes, and variability in algorithmic approaches and outcome measures. In addition, ethical considerations related to data privacy, algorithmic transparency, and responsible

[i] Correspondence: email ivasileiou@lancashire.ac.uk

clinical implementation remain critical challenges for the field. Overall, the evidence suggests that artificial intelligence technologies may play an increasingly important role in the future of autism screening, education, and intervention, although further interdisciplinary research and large-scale validation studies are required to ensure their reliability, effectiveness, and ethical deployment.

Keywords: artificial intelligence; autism spectrum disorder; machine learning; digital health; educational technology; systematic review

1. Background

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by persistent difficulties in social communication and interaction, alongside restricted and repetitive patterns of behavior, interests, and activities (American Psychiatric Association, 2013). Over the past two decades, the global prevalence of ASD has increased substantially, with recent epidemiological studies estimating that approximately one in 36 children are diagnosed with autism spectrum disorder (Maenner *et al.*, 2023). The growing prevalence of ASD has intensified research efforts aimed at improving diagnostic procedures, educational interventions, and therapeutic approaches that support individuals across the lifespan. Due to the heterogeneity of ASD profiles, individuals on the spectrum often present diverse cognitive, linguistic, and behavioral characteristics, requiring individualized and multidisciplinary support systems (Lord *et al.*, 2020; Zeidan *et al.*, 2022). Early identification and timely intervention are widely considered critical determinants of developmental outcomes for individuals with ASD. Research consistently demonstrates that early behavioral and educational interventions can significantly improve communication skills, adaptive functioning, and social engagement (Dawson *et al.*, 2010; Estes *et al.*, 2015). However, traditional diagnostic and intervention processes frequently rely on time-intensive clinical assessments conducted by trained specialists, including structured observations, caregiver interviews, and standardized diagnostic instruments such as the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R) (Lord *et al.*, 2020). While these tools remain the gold standard for diagnosis, they require extensive training and clinical resources, often resulting in long waiting times and delayed access to services in many healthcare systems (Daniels & Mandell, 2014; Zeidan *et al.*, 2022). Consequently, researchers increasingly seek innovative approaches capable of supporting early screening, diagnosis, and intervention in scalable and accessible ways.

In recent years, rapid advances in artificial intelligence (AI) have introduced new opportunities for addressing longstanding challenges in autism research and practice. Artificial intelligence refers to computational systems capable of performing tasks that typically require human intelligence, including pattern recognition, decision-making,

prediction, and adaptive learning (Russell & Norvig, 2021). Contemporary AI technologies encompass a wide range of approaches such as machine learning, deep learning, computer vision, and natural language processing, all of which enable automated analysis of complex datasets and behavioral patterns (Topol, 2019). Within healthcare and educational contexts, AI systems are increasingly used to analyze large and multimodal data sources, including behavioral observations, neuroimaging data, speech patterns, and physiological signals, providing new insights into neurodevelopmental conditions such as autism (Duda *et al.*, 2016; Abbas *et al.*, 2021). The application of artificial intelligence in autism research has expanded rapidly during the past decade, particularly in the areas of early screening, diagnostic support, and behavioral assessment. Machine-learning algorithms have been developed to analyze behavioral markers associated with ASD, including facial expressions, eye-tracking patterns, motor movements, and vocal characteristics (Bone *et al.*, 2016; Washington *et al.*, 2020). These technologies have demonstrated promising levels of diagnostic accuracy, suggesting that AI-based screening systems may assist clinicians in identifying early signs of autism and prioritizing referrals for specialized evaluation (Abbas *et al.*, 2021; Thabtah, 2019). Furthermore, AI approaches have been applied to neuroimaging and genetic datasets to identify biomarkers associated with ASD, contributing to the development of data-driven models that may improve the understanding of autism heterogeneity and developmental trajectories (Eslami *et al.*, 2019; Duda *et al.*, 2016).

Beyond diagnostic applications, artificial intelligence technologies are increasingly integrated into educational and therapeutic interventions designed for individuals with ASD. Intelligent tutoring systems and adaptive learning platforms use AI algorithms to personalize educational content based on learners' performance, engagement, and cognitive profiles (Luckin *et al.*, 2016; Holmes *et al.*, 2019). Such systems may be particularly beneficial for students with autism, as they allow individualized pacing, structured learning environments, and immediate feedback—features that align with the learning preferences often observed in individuals with ASD (Khowaja *et al.*, 2020). In addition, AI-supported communication technologies, including speech recognition systems and assistive language applications, have been developed to support expressive and receptive communication among autistic learners (Odom *et al.*, 2015). Another important area of research concerns socially assistive robotics and virtual environments powered by artificial intelligence. Social robots have been increasingly used as therapeutic tools to support the development of social communication and emotional recognition skills in children with autism (Scassellati *et al.*, 2018). These robots provide predictable, structured, and interactive learning contexts that may reduce social anxiety and facilitate engagement during social skills training sessions. Empirical studies have shown that robot-mediated interventions can enhance eye contact, joint attention, and emotional recognition in children with ASD, particularly when integrated into structured therapeutic programs (Pennisi *et al.*, 2016; Scassellati *et al.*, 2018). Similarly, virtual reality environments and AI-driven interactive simulations have been explored

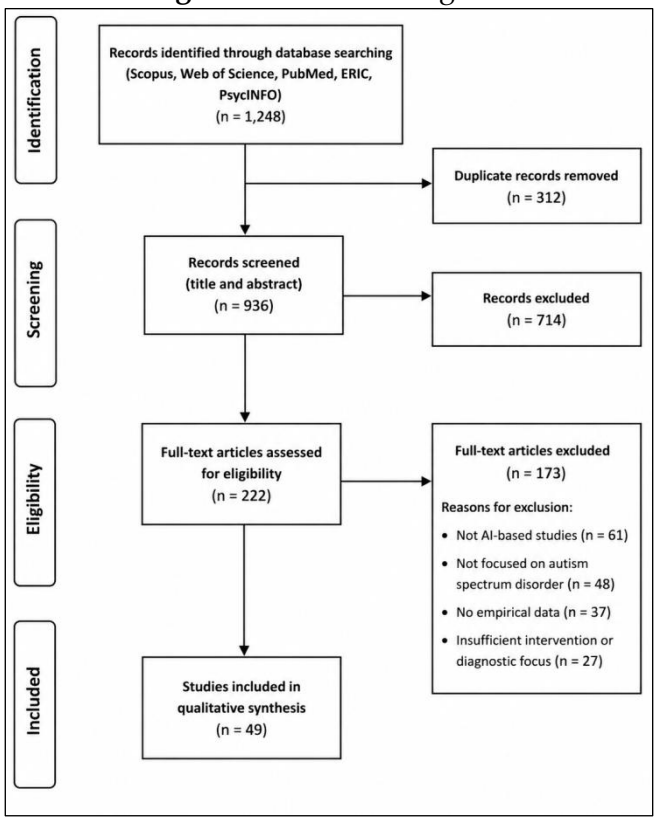
as tools for practicing social scenarios and daily life skills within controlled digital environments (Parsons & Cobb, 2011; Ke & Im, 2013).

Despite the rapid expansion of AI applications in autism research, the existing literature remains highly fragmented across multiple disciplines, including computer science, psychology, neuroscience, education, and clinical medicine. Studies differ widely in terms of methodological approaches, datasets, outcome measures, and intervention contexts, making it challenging to synthesize the current evidence and evaluate the overall effectiveness of AI-based applications for individuals with ASD. Moreover, ethical considerations such as data privacy, algorithmic bias, and the potential over-reliance on automated systems have raised important questions regarding the responsible integration of AI technologies within healthcare and educational settings (Floridi *et al.*, 2018; Topol, 2019). Consequently, a comprehensive synthesis of the existing research is necessary in order to identify current trends, evaluate empirical evidence, and highlight future directions for interdisciplinary research. In response to these developments, the present study provides a systematic review of the literature examining the applications of artificial intelligence in autism spectrum disorder. Specifically, the review aims to synthesize empirical research on AI-based tools used for diagnosis, assessment, and intervention in individuals with ASD, with particular emphasis on educational and clinical contexts. By integrating findings from multiple disciplines, the review seeks to provide a comprehensive overview of current technological developments, identify methodological limitations in the existing literature, and outline future research directions for the effective and ethical implementation of AI technologies in autism support and intervention.

2. Method

The present study adopted a systematic review methodology to synthesize the empirical literature examining the applications of artificial intelligence in Autism Spectrum Disorder (ASD), with particular emphasis on educational and clinical interventions. The review followed the methodological framework outlined in the PRISMA 2020 Statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), which provides internationally recognized guidelines for conducting and reporting systematic reviews (Page *et al.*, 2021). The PRISMA framework guided all stages of the review process, including identification, screening, eligibility assessment, and final inclusion of studies.

Figure 1: PRISMA Diagram



2.1 Search Strategy

A comprehensive literature search was conducted across major international academic databases indexing research in education, psychology, computer science, and healthcare. Specifically, the databases searched included Scopus, Web of Science, PubMed, ERIC, and PsycINFO. These databases were selected because they collectively cover interdisciplinary research relevant to artificial intelligence, autism research, educational technologies, and clinical interventions. The search was conducted between January and February 2026 and targeted studies published between 2015 and 2025. This time frame was selected because the integration of artificial intelligence into autism research has expanded substantially during the past decade (Topol, 2019; Abbas *et al.*, 2021). The search strategy combined keywords related to artificial intelligence with descriptors referring to autism spectrum disorder and intervention contexts. Boolean operators were used to construct the search queries, ensuring a broad yet targeted retrieval of relevant literature. The principal search expression combined terms such as "artificial intelligence," "machine learning," "deep learning," "neural networks," and "computer vision" with terms including "autism spectrum disorder," "autism," and "ASD," together with intervention-related descriptors such as "education," "learning," "therapy," "treatment," and "intervention." Reference lists of relevant systematic reviews and highly cited empirical studies were also manually examined to identify additional publications not retrieved through the database search, following established

recommendations for systematic review methodology (Kitchenham & Charters, 2007; Page *et al.*, 2021).

2.2 Eligibility Criteria

Eligibility criteria were established prior to the search to ensure methodological consistency. Only peer-reviewed empirical studies published in English between 2015 and 2025 were included. Studies were required to examine the application of artificial intelligence technologies—such as machine learning models, deep learning algorithms, computer vision systems, or natural language processing tools—in relation to Autism Spectrum Disorder. Eligible studies also needed to report empirical findings related to diagnostic screening, behavioral assessment, educational support, or clinical interventions involving individuals with ASD (Abbas *et al.*, 2021; Washington *et al.*, 2020). Studies were excluded if they consisted solely of theoretical discussions, editorials, or conceptual commentaries without empirical data. Conference abstracts without full-text availability were also excluded, as were studies focusing on technological systems unrelated to artificial intelligence or studies addressing neurodevelopmental conditions other than autism.

2.3 Study Selection

The database search yielded a total of 1,248 records across all databases. After removing 312 duplicate records, 936 unique studies remained for title and abstract screening. During the screening stage, 714 records were excluded because they did not meet the inclusion criteria, most commonly because they focused on non-AI technologies, unrelated medical conditions, or conceptual discussions without empirical evidence. Following the screening phase, the full texts of 222 articles were retrieved and assessed for eligibility. During the full-text review, 173 studies were excluded due to reasons including the absence of artificial intelligence methodologies, insufficient relevance to autism-related interventions, or lack of empirical data. Ultimately, 49 studies met all eligibility criteria and were included in the final qualitative synthesis. The study selection procedure followed the PRISMA workflow and was documented through a PRISMA flow diagram (Page *et al.*, 2021).

2.4 Data Extraction and Synthesis

For each included study, relevant data were extracted using a structured data extraction framework commonly employed in systematic reviews (Kitchenham & Charters, 2007). The extracted information included the authors and year of publication, country of origin, characteristics of the sample population, type of artificial intelligence technology used, research design, intervention or diagnostic application, outcome measures, and key findings. Given the methodological heterogeneity observed across the studies—including variations in AI algorithms, datasets, intervention contexts, and outcome measures—a quantitative meta-analysis was not considered appropriate. Instead, the

results were synthesized using a qualitative narrative approach (Popay *et al.*, 2006). The included studies were analyzed comparatively in order to identify thematic trends in the application of artificial intelligence technologies within autism research.

3. Results

3.1 Overview of the Included Studies

The systematic search and screening procedure resulted in the inclusion of 49 empirical studies published between 2015 and 2025 that examined the application of artificial intelligence technologies in Autism Spectrum Disorder (ASD). The included studies demonstrate a rapidly expanding interdisciplinary research field combining computer science, psychology, neuroscience, medicine, and education. The majority of studies were conducted in technologically advanced research environments in North America, Europe, and East Asia, where significant investments have been made in artificial intelligence and digital health technologies (Abbas *et al.*, 2021; Washington *et al.*, 2020; Lord *et al.*, 2020). Across the reviewed literature, most studies focused on children and adolescents with ASD, reflecting the emphasis of early screening and intervention research. However, several studies also examined adolescent and adult populations, particularly in research exploring diagnostic prediction models, digital phenotyping approaches, and behavioral monitoring systems (Duda *et al.*, 2016; Eslami *et al.*, 2019; Abbas *et al.*, 2021). Sample sizes varied substantially across studies, ranging from small experimental pilot samples involving fewer than 30 participants to large machine-learning studies analyzing datasets with hundreds or thousands of observations derived from behavioral assessments, clinical records, or digital interaction data. The reviewed studies employed a wide variety of artificial intelligence methodologies. The most frequently used approaches included supervised machine learning algorithms such as support vector machines, decision trees, random forests, and gradient boosting models. Increasingly, recent studies have adopted deep learning architectures, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), and hybrid models capable of processing multimodal data sources such as video recordings, speech signals, and neuroimaging datasets (Eslami *et al.*, 2019; Washington *et al.*, 2020). Natural language processing techniques have also been used to analyze linguistic features and communication patterns associated with autism (Bone *et al.*, 2016).

Despite considerable methodological heterogeneity across the included studies, four primary application domains consistently emerged in the literature: (1) AI-supported diagnostic screening and early identification, (2) AI-based educational technologies and adaptive learning systems, (3) socially assistive robotics for social communication training, and (4) AI-supported therapeutic monitoring and behavioral intervention systems.

Table 1: Artificial intelligence applications in Autism Spectrum Disorder across major research domains

Study	AI Method	Sample / Dataset	Application Domain	Key Findings
Duda *et al.* (2016)	Machine learning classifiers	612 participants	**Diagnostic screening and early identification**	ML models improved efficiency of autism screening questionnaires.
Thabtah (2019)	Decision tree, SVM, random forest	Autism screening datasets	**Diagnostic screening and early identification**	Several ML algorithms achieved high classification accuracy for ASD detection.
Washington *et al.* (2020)	Computer vision + machine learning	Video recordings of children	**Diagnostic screening and early identification**	AI analysis of home videos enabled remote identification of autism behavioral markers.
Abbas *et al.* (2021)	Machine learning + video analysis	Children at risk for ASD	**Diagnostic screening and early identification**	Combining parental questionnaires with video analysis improved early screening accuracy.
Bone *et al.* (2016)	Speech signal analysis + ML	126 children	**Diagnostic screening and early identification**	Automated speech analysis detected vocal markers associated with ASD.
Khowaja *et al.* (2020)	AI-based adaptive digital learning tools	Children with ASD	**AI-based educational technologies**	AI-supported educational games improved engagement and social communication skills.
Holmes *et al.* (2019)	Adaptive AI learning systems	Educational technology research	**AI-based educational technologies**	Intelligent tutoring systems enable personalized learning for diverse learners.
Luckin *et al.* (2016)	Intelligent tutoring systems	Educational contexts	**AI-based educational technologies**	AI platforms can adapt instruction based on learner performance.
Pennisi *et al.* (2016)	Social robotics	Multiple intervention studies	**Socially assistive robotics**	Robot-mediated interventions improved eye contact and social engagement in children with ASD.
Scassellati *et al.* (2018)	AI-powered social robots	Experimental therapy sessions	**Socially assistive robotics**	Robots facilitated structured social interaction and increased engagement.
Parsons & Cobb (2011)	Virtual reality environments	Children with ASD	**Therapeutic monitoring and intervention systems**	VR environments allowed safe practice of social interaction skills.
Ke & Im (2013)	VR simulation systems	High-functioning ASD students	**Therapeutic monitoring and**	VR-based training improved emotional recognition and social understanding.

			intervention systems	
Odom *et al.* (2015)	Technology-assisted intervention systems	Adolescents with ASD	**Therapeutic monitoring and intervention systems**	Digital interventions supported communication and adaptive skill development.

3.2 Artificial Intelligence for Diagnostic Screening and Early Identification

A substantial proportion of the included studies focused on the development of artificial intelligence models for early screening and diagnostic support in autism spectrum disorder. These studies aimed to identify behavioral markers or biological patterns associated with ASD using computational techniques capable of processing large and complex datasets. Several studies applied machine-learning algorithms to behavioral questionnaires and observational data in order to classify individuals as either autistic or typically developing. For example, Duda *et al.* (2016) demonstrated that machine-learning classifiers could significantly improve the efficiency of autism screening instruments by identifying the most diagnostically informative behavioral indicators. Similarly, Thabtah (2019) evaluated multiple machine-learning algorithms using autism screening datasets and reported classification accuracies exceeding 90% in certain models. More recent research has increasingly focused on video-based and telemedicine screening approaches that use computer vision algorithms to analyze behavioral cues captured in video recordings of children. Washington *et al.* (2020) developed a machine-learning framework using crowdsourced annotations of behavioral features observed in short home videos of children. The results indicated that AI-assisted video analysis could successfully identify autism-related behaviors with promising levels of reliability. Expanding on this approach, Abbas *et al.* (2021) demonstrated that machine-learning models combining parental questionnaires with video analysis could facilitate scalable screening systems that may support early identification of autism risk. Deep learning approaches have also been applied to neuroimaging datasets in order to identify neurological biomarkers associated with ASD. Eslami *et al.* (2019) developed a hybrid deep-learning model (ASD-DiagNet) capable of analyzing functional magnetic resonance imaging (fMRI) data to detect atypical brain connectivity patterns linked to autism. Such studies highlight the growing interest in combining artificial intelligence with neuroimaging technologies to improve diagnostic precision and deepen understanding of the neurobiological mechanisms underlying autism. In addition to behavioral and neuroimaging data, several studies explored speech and language features as diagnostic markers**.** Automated speech analysis systems have been used to identify atypical prosody, vocal rhythm, and communication patterns associated with ASD (Bone *et al.*, 2016). These approaches illustrate how AI technologies can detect subtle behavioral signals that may not be easily identified through traditional clinical observation. Overall, the reviewed evidence suggests that artificial intelligence models demonstrate considerable promise as decision-support tools for early autism screening**,** although most

studies emphasize that AI systems should complement rather than replace clinical diagnostic procedures (Abbas *et al.*, 2021; Washington *et al.*, 2020).

3.3 Artificial Intelligence in Educational Interventions

A second major research domain identified in the reviewed literature concerns the integration of artificial intelligence technologies into educational interventions designed for learners with autism spectrum disorder**.** AI-supported educational systems typically employ adaptive algorithms that personalize instructional content according to learners' behavioral responses, engagement patterns, and performance outcomes. Intelligent tutoring systems represent one of the most common applications of artificial intelligence in educational contexts. These systems analyze learners' responses in real time and dynamically adjust instructional tasks in order to provide individualized feedback and scaffolding. Research suggests that such adaptive learning environments may be particularly beneficial for learners with autism, who often benefit from structured learning environments, predictable routines, and visually supported instruction (Holmes *et al.*, 2019; Luckin *et al.*, 2016). Several studies examined AI-supported digital learning environments designed to support language development, social communication, and cognitive skills among children with ASD. Khowaja *et al.* (2020) reported that digital educational platforms and serious games incorporating adaptive algorithms can improve engagement and social communication skills in children with autism. These systems often include multimodal interaction interfaces combining visual prompts, audio feedback, and gamified reward systems.

Artificial intelligence technologies have also been integrated into emotion recognition training systems in which learners practice identifying facial expressions and interpreting emotional cues. Machine-learning algorithms are used to analyze learner responses and provide personalized feedback designed to improve social cognition skills. Such systems may contribute to the development of emotional recognition abilities that are often challenging for individuals with ASD. Overall, the reviewed literature indicates that AI-supported educational platforms provide promising opportunities for personalized and inclusive learning environments**,** although many systems remain in early developmental or pilot testing stages.

3.4 Socially Assistive Robotics

Another rapidly growing research area involves the use of socially assistive robots powered by artificial intelligence algorithms to support social skills training for children with autism spectrum disorder. These robotic systems are designed to interact with children through structured social scenarios in which specific social communication skills are practiced. Robotic platforms used in autism interventions typically incorporate sensors and AI algorithms capable of detecting behavioral signals such as gaze direction, facial expressions, or body movements. The robot can then respond adaptively by adjusting its behavior to maintain engagement and guide social interaction tasks.

Empirical research suggests that robot-mediated interventions may be particularly effective for children with autism because robotic agents provide predictable and simplified social interaction contexts that reduce the complexity of human social communication (Scassellati *et al.*, 2018). Several studies reported improvements in eye contact, joint attention, and engagement when robotic systems were integrated into structured therapy sessions (Pennisi *et al.*, 2016). Furthermore, children with autism often show high levels of interest and motivation when interacting with robotic agents, which may increase participation in social skills training programs. However, researchers emphasize that robotic systems should be used as complementary tools within broader therapeutic programs rather than as standalone interventions.

3.5 Artificial Intelligence in Therapeutic and Behavioral Interventions

Artificial intelligence technologies have also been applied in the development of digital therapeutic systems and behavioral monitoring tools designed to support individuals with ASD. These systems often use machine-learning algorithms to analyze behavioral signals in real time and provide feedback to clinicians, therapists, or caregivers. AI-driven behavioral monitoring systems can analyze multiple data streams—including facial expressions, vocal characteristics, physiological signals, and movement patterns—in order to identify emotional states or behavioral patterns associated with stress, anxiety, or disengagement. Such systems may support more responsive intervention strategies by enabling continuous behavioral monitoring during therapy sessions (Abbas *et al.*, 2021). Another important line of research involves the integration of artificial intelligence with virtual reality (VR) environments designed to simulate social situations. VR-based interventions allow individuals with ASD to practice social communication skills in controlled and repeatable environments. Within these systems, AI algorithms adapt the complexity of social scenarios based on the learner's performance and provide structured feedback to facilitate skill acquisition (Parsons & Cobb, 2011; Ke & Im, 2013). Although many of these technologies remain experimental, the reviewed studies collectively suggest that AI-driven therapeutic tools have the potential to improve intervention personalization, scalability, and accessibility. However, further research is needed to evaluate long-term effectiveness and real-world implementation in clinical and educational settings.

3.6 Overall Synthesis of Findings

Across the 49 studies included in this review, artificial intelligence technologies were most frequently applied in the domains of diagnostic screening**,** followed by educational interventions**,** social robotics**,** and behavioral monitoring systems**.** The findings consistently indicate that AI-driven tools have the potential to enhance early detection of autism, support individualized educational programs, and facilitate innovative therapeutic approaches. Nevertheless, the literature also reveals substantial methodological variability, including differences in datasets, algorithmic approaches,

sample sizes, and outcome measures. Many studies relied on relatively small experimental samples or prototype systems, highlighting the need for large-scale, longitudinal research evaluating the effectiveness and reliability of AI-based autism interventions across diverse populations (Abbas *et al.*, 2021; Washington *et al.*, 2020; Lord *et al.*, 2020).

4. Discussion

The present systematic review synthesized empirical research examining the application of artificial intelligence technologies in the diagnosis, education, and intervention of individuals with Autism Spectrum Disorder. The findings indicate that artificial intelligence has increasingly become a central methodological tool across multiple domains of autism research, reflecting broader technological developments in digital health and educational technologies (Topol, 2019; Abbas *et al.*, 2021). Across the reviewed studies, artificial intelligence systems demonstrated promising potential in improving diagnostic screening processes, supporting individualized educational interventions, facilitating social communication training through robotic platforms, and enhancing therapeutic monitoring systems. These findings align with the growing recognition that data-driven technologies may play a critical role in addressing long-standing challenges in autism assessment and intervention (Washington *et al.*, 2020; Thabtah, 2019).

One of the most consistent findings emerging from the reviewed literature concerns the potential of artificial intelligence systems to support early identification of autism spectrum disorder. Machine learning algorithms capable of analyzing behavioral patterns, facial expressions, eye-tracking data, and speech characteristics have demonstrated promising levels of diagnostic accuracy in differentiating individuals with ASD from typically developing populations (Duda *et al.*, 2016; Abbas *et al.*, 2021). Early detection remains a critical priority in autism research because earlier diagnosis is strongly associated with improved developmental outcomes and more effective intervention planning (Dawson *et al.*, 2010; Lord *et al.*, 2020). In this context, AI-based screening tools may complement traditional clinical assessments by enabling scalable and potentially cost-effective screening procedures, particularly in regions where access to specialized diagnostic services remains limited (Zeidan *et al.*, 2022). Beyond diagnostic applications, the reviewed studies highlight the increasing integration of artificial intelligence technologies within educational interventions for learners with autism. Intelligent tutoring systems and adaptive learning platforms have demonstrated the capacity to personalize instruction according to individual learning profiles and behavioral responses (Luckin *et al.*, 2016; Holmes *et al.*, 2019). Such technologies are particularly relevant for learners with ASD, whose educational needs often require highly individualized instructional strategies and structured learning environments (Odom *et al.*, 2015). The reviewed studies suggest that AI-supported educational platforms may enhance engagement, support skill acquisition, and facilitate

differentiated instruction, thereby aligning with inclusive education frameworks that emphasize individualized learning pathways for students with diverse developmental profiles (Florian & Black-Hawkins, 2011; Hehir *et al.*, 2016).

Another important theme emerging from the literature concerns the use of socially assistive robots as tools for social skills training among children with autism. Social robots powered by artificial intelligence algorithms have been designed to simulate structured social interactions in which children practice eye contact, joint attention, and emotional recognition skills (Scassellati *et al.*, 2018). Several studies reported that robot-mediated interventions increased social engagement and sustained attention during therapeutic sessions, suggesting that robotic systems may provide an effective complement to traditional therapeutic approaches (Pennisi *et al.*, 2016). The predictable and controllable nature of robotic interaction may reduce the cognitive and emotional complexity of social communication tasks, thereby creating learning environments that are particularly accessible for individuals with autism (Diehl *et al.*, 2012; Scassellati *et al.*, 2018). Artificial intelligence technologies have also demonstrated potential in supporting therapeutic monitoring and behavioral assessment. AI-driven systems capable of analyzing behavioral signals in real time allow clinicians and educators to monitor emotional states, behavioral responses, and learning progress with greater precision (Abbas *et al.*, 2021). Such technologies may contribute to more responsive intervention models in which therapeutic strategies are dynamically adjusted based on continuous behavioral data. In addition, the integration of artificial intelligence with virtual reality environments has enabled the creation of simulated social scenarios where individuals with autism can practice communication skills and social decision-making in controlled settings (Parsons & Cobb, 2011; Ke & Im, 2013). These immersive environments provide opportunities for repeated practice and structured feedback, which are considered critical elements in the development of social communication skills.

Despite the promising findings reported across the reviewed studies, several methodological limitations remain evident within the current literature. Many studies relied on relatively small sample sizes or experimental prototypes, limiting the generalizability of the reported findings (Washington *et al.*, 2020; Abbas *et al.*, 2021). Additionally, substantial heterogeneity exists across studies in terms of datasets, artificial intelligence algorithms, outcome measures, and intervention contexts, making direct comparison between studies difficult. This methodological variability highlights the need for standardized evaluation frameworks that can facilitate more consistent assessment of AI-based interventions across different research contexts. Another important issue concerns the ethical and practical implications of integrating artificial intelligence technologies into clinical and educational practice. The use of large behavioral datasets raises concerns related to privacy, data protection, and algorithmic bias, particularly when sensitive health or developmental data are involved (Floridi *et al.*, 2018; Topol, 2019). Moreover, although AI technologies may provide valuable decision-support tools, they should not be viewed as replacements for human clinical judgment or educational

expertise. Instead, artificial intelligence systems should be considered complementary tools that enhance the capacity of professionals to deliver personalized and evidence-based support to individuals with autism (Holmes *et al.*, 2019).

Future research should therefore focus on conducting large-scale longitudinal studies that examine the long-term effectiveness of AI-based diagnostic and intervention tools across diverse populations and educational contexts. Greater interdisciplinary collaboration between computer scientists, psychologists, educators, and clinicians will be essential in order to ensure that technological innovations are grounded in developmental theory and aligned with evidence-based intervention practices (Abbas *et al.*, 2021; Washington *et al.*, 2020). Furthermore, the development of ethical guidelines and regulatory frameworks will be necessary to ensure that artificial intelligence technologies are implemented responsibly within educational and healthcare systems. In conclusion, the findings of this systematic review suggest that artificial intelligence technologies hold considerable potential for transforming the assessment, education, and therapeutic support of individuals with Autism Spectrum Disorder. Although the field remains in a relatively early stage of development, the growing body of interdisciplinary research indicates that AI-driven tools may contribute to earlier diagnosis, more personalized educational interventions, and improved therapeutic monitoring systems. Continued research and careful implementation will be essential in order to fully realize the potential of artificial intelligence in supporting individuals with autism across educational and clinical settings (Abbas *et al.*, 2021; Scassellati *et al.*, 2018; Washington *et al.*, 2020).

5. Conclusion

The present systematic review examined the current body of empirical research exploring the applications of artificial intelligence in the diagnosis, education, and intervention of individuals with Autism Spectrum Disorder. The synthesis of the literature demonstrates that artificial intelligence technologies have rapidly emerged as influential tools in autism research, offering innovative approaches to early screening, behavioral assessment, educational support, and therapeutic intervention. Across the reviewed studies, artificial intelligence methods—including machine learning, deep learning, computer vision, natural language processing, and socially assistive robotics—have shown considerable potential in identifying behavioral patterns associated with autism, supporting personalized educational environments, and facilitating the development of social communication skills (Duda *et al.*, 2016; Abbas *et al.*, 2021; Washington *et al.*, 2020). The findings indicate that AI-based diagnostic models may contribute to earlier and more efficient identification of autism spectrum disorder by analyzing complex behavioral and neurological datasets that may not be easily interpreted through traditional assessment methods. Early identification remains a critical factor in improving developmental outcomes, as timely intervention has consistently been associated with improved communication, adaptive functioning, and social engagement among individuals with

ASD (Dawson *et al.*, 2010; Lord *et al.*, 2020). In this context, artificial intelligence technologies may serve as valuable decision-support tools that complement established diagnostic procedures and help reduce delays in access to specialized services.

In educational settings, the reviewed studies suggest that artificial intelligence technologies can support individualized instruction and adaptive learning environments tailored to the cognitive and behavioral characteristics of learners with autism. Intelligent tutoring systems and AI-supported learning platforms have demonstrated the capacity to personalize instructional content and feedback, thereby enhancing engagement and facilitating skill development (Holmes *et al.*, 2019; Luckin *et al.*, 2016). Similarly, socially assistive robotic systems and interactive virtual environments have been shown to provide structured and predictable contexts in which individuals with autism can practice social interaction skills and emotional recognition, supporting the development of core social competencies (Pennisi *et al.*, 2016; Scassellati *et al.*, 2018). Despite these promising developments, the findings of this review also highlight several important limitations within the current literature. Many studies rely on relatively small samples or experimental prototypes, and methodological heterogeneity across studies limits the ability to generalize findings across diverse populations and contexts (Abbas *et al.*, 2021; Washington *et al.*, 2020). Furthermore, the integration of artificial intelligence technologies into clinical and educational practice raises important ethical considerations related to data privacy, algorithmic transparency, and the appropriate balance between automated systems and human professional judgment (Floridi *et al.*, 2018; Topol, 2019). Future research should therefore prioritize large-scale and longitudinal investigations that evaluate the long-term effectiveness and real-world implementation of AI-based diagnostic and intervention systems. Interdisciplinary collaboration between researchers in computer science, psychology, education, and clinical practice will be essential in order to develop technologies that are both scientifically robust and ethically responsible. In addition, future work should explore how artificial intelligence can be integrated into inclusive educational frameworks that support the diverse learning profiles of individuals with autism.

Overall, the findings of this systematic review indicate that artificial intelligence technologies hold substantial potential to transform the ways in which autism spectrum disorder is identified, understood, and supported across clinical and educational contexts. While further research is required to establish the long-term effectiveness and ethical implementation of these technologies, the current evidence suggests that artificial intelligence may become an increasingly valuable component of multidisciplinary approaches to autism assessment and intervention.

Conflict of Interest Statement

The author declares no conflicts of interest.

About the Author

Ilias Vasileiou is a linguist and special educator. He serves as Adjunct Lecturer at the College for Humanistic Sciences-ICPS, Athens, Greece, in collaboration with the University of Lancashire. His academic and research interests focus on special and inclusive education, specific learning difficulties, written language development, executive functions, differentiated instruction, and educational assessment. His scholarly work includes books, peer-reviewed articles, book chapters, and educational material related to special education, learning difficulties, intervention design, and inclusive pedagogical practices.

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