Chapter 2
Harnessing Artificial Intelligence for Early Identification of Autism Spectrum Disorder

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ABSTRACT

Early detection and intervention are crucial for improving outcomes in individuals with Autism Spectrum Disorder (ASD). Traditional diagnostic methods often face delays due to the complexity of the disorder and the need for specialized resources. This work explores an AI tool designed to identify autism red flags in children aged 6-18 months. Using ML techniques, the tool analyzes data from parent/caregiver questionnaires and short audiovisual recordings to identify behavioral deviations indicative of ASD, achieving accuracy above 80%. It addresses key challenges in current diagnostics, including accessibility, cost, and the need for specialized personnel. By providing a scalable and efficient solution, this AI tool can significantly reduce diagnostic delays, facilitate timely intervention, and encourage early help-seeking while maintaining anonymity. The potential for improving diagnostic accuracy, reducing healthcare costs, and enhancing early intervention strategies is discussed, highlighting AI and ML's transformative potential in developmental disorders.

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Autism Spectrum Disorder (ASD) is a complex and heterogeneous neurodevelopmental condition characterized by persistent deficits in social communication and interaction, alongside restricted, repetitive patterns of behavior, interests, or activities (American Psychiatric Association, 2013). Early identification of ASD is crucial as it opens the door to timely intervention, which can significantly enhance developmental outcomes.

Research has consistently shown that early intervention can lead to significant improvements in cognitive, language, and social skills (Dawson et al., 2010). For example, early behavioral interventions, such as Applied Behavior Analysis (ABA), have been shown to enhance intellectual functioning, language development, and adaptive behavior in young children with autism (Lovaas, 1987). The brain's plasticity is at its peak during the first few years of life, meaning that early intervention can capitalize on this period to foster better developmental trajectories (Dawson, 2008). The severity of the disorder and the absence of biological treatments, despite certain developments (Hong et al., 2019), make the search for preventive interventions imperative, something that the accumulated relevant literature appears to make feasible (Francis et al., 2021).

Early identification can also alleviate the stress and uncertainty experienced by families. Parents often notice developmental delays or atypical behaviors before a formal diagnosis is made (Ozonoff et al., 2009). Providing a clear diagnosis early on can help families access appropriate resources and support systems, thereby reducing anxiety and improving family functioning (Keenan et al., 2010).

Despite the benefits of early identification, traditional diagnostic methods face several challenges. Diagnosing ASD typically involves comprehensive evaluations by multidisciplinary teams, which include developmental pediatricians, psychologists, speech-language pathologists, and occupational therapists (Zwaigenbaum et al., 2015). These evaluations are often time-consuming, costly, and require specialized training. Moreover, access to such multidisciplinary teams can be limited, especially in rural or underserved areas, leading to significant delays in diagnosis (Daniels & Mandell, 2014).

Furthermore, the symptoms of ASD can vary widely among individuals and may overlap with other developmental disorders, complicating the diagnostic process (Lord et al., 2000). The current gold-standard diagnostic tools, such as the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R), though reliable, are resource-intensive and may not be feasible for large-scale screening (Lord et al., 2000; Rutter et al., 2003).

Detecting signs of autism within the critical age range of 6 to 18 months is particularly important. Research indicates that this period is optimal for identifying early behavioral markers that distinguish ASD from typical development (Zwaigenbaum et al., 2015). Waiting until 18 months for diagnosis, while useful, often means relying