Chapter 1
Screening and Diagnosis of Autism Spectrum Disorder via Assistive Tools: Classification Algorithms

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ABSTRACT

Autism spectrum disorder (ASD) is a challenging developmental condition that involves restricted and/or repetitive behaviors and persistent challenges in social interaction and speech and nonverbal communication. There is not a standard medical test used to diagnose ASD; therefore, diagnosis is made by looking at the child's developmental history and behavior. In recent years, due to the increase in diagnosed cases of ASD, researchers proposed software-based tools to aid in and expedite the diagnosis. Considering the fact that most of these tools rely on the use of classifiers, in study, random forest, decision tree, k-nearest neighbors, and zero rule algorithms are used as classifiers, and their performances are compared using well-known performance metrics. As proven in the study, random forest algorithm can provide higher accuracy than the others in the classification of ASD and can be integrated into a computer- or humanoid-robot-based system for automated prescreening and diagnosis of ASD in preschool children groups.

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INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder with an increasing prevalence around the world. Therefore, it is expressed as a problem of global concern (Centers for Disease Control and Prevention, 2016; Charron *et al.*, 2017). According to the results published in the Center for Disease Control and Prevention (CDC) 2016 report, 1 in 54 children in the United States of America was diagnosed with ASD. In addition, it is noted that this disorder is 4-5 times more common in boys than in girls (Baio *et al.*, 2018; Fombonne, 2003; Yapko, 2003). Among the possible causes and factor risks of ASD, neurobiological, genetic and environmental factors are mentioned. However, there is no definite conclusion as to which of these factors affect to what extent ASD (Kırcaali-İftar, 2012). Also, ASD starts manifesting itself at very low ages (Boucher, 2017). However, diagnosing it early is generally difficult due to the unavailability of a specific exam or trial and mainly depends on the expertise used to assess the patient behavior during direct interviews (McCarty & Frye, 2020).

ASD causes a broad range of learning disabilities unique to each child. Because, each child has different executive function levels and sensory processing difficulties that play a critical role in the type and severity of learning disabilities. Therefore, classrooms must be equipped enough to help every student work around their difficulties. With the right classroom accommodations, barriers to learning can be overcome and children with ASD can be helped to tackle schoolwork with confidence.

Children with ASD need opportunities to participate in classroom activities that model and allow them to understand societal expectations. In the classroom activities, sufficient opportunities should be provided to them so that they can practice acceptable behavior and then generalize it to broader settings (Humphrey & Symes, 2013). It is expected with these activities and also by this way they can acquire an understanding of their strengths and their interrelationships with others. In addition to improved social acceptance and improved social communication, inclusion may also reduce symptoms and allow for social learning. However, for some children with ASD, social experiences are negative and these children are reported to feel lonely, socially excluded, and bullied.

It is critical to reduce unnecessary referral for ASD evaluations by a sequence of primary and secondary screening tools (Aresti-Bartolome & Garcia-Zapirain, 2014). Because unnecessary evaluations can create more stress on the family and generally lead to a significant delay in the evaluation and start of the appropriate treatments (Zunino *et al.*, 2018). It is known that diagnosing children with ASD in the early period, providing care and education services immediately after the diagnosis process, and intensive behavioral education in the first years have a significant effect on the development of children with ASD (Autism Research Program, 2010; Bodur

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