Chapter 7
A Multimodal AI-Powered Web Platform for Autism Spectrum Disorder Assessment

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ABSTRACT

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition marked by challenges in communication, social interaction, and repetitive behaviours. Early diagnosis is crucial but often limited by subjective, labour-intensive assessments. This chapter introduces an AI-driven, web-based platform that automates ASD screening using multimodal data - speech, audio, text, and video. It employs Wav2Vec 2.0 for speech, BERT for text, LSTM for audio sequences, and 3D-CNNs for video analysis. By integrating these models, the system offers a comprehensive behavioural assessment. Validated on public datasets, it demonstrates high accuracy and potential for scalable, accessible early intervention, especially in resource-constrained settings.

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INTRODUCTION

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder that affects communication, social interaction, and behaviour. The prevalence of ASD has been increasing globally over the past decade, highlighting the need for effective and scalable diagnostic methodologies. Traditional diagnostic procedures, including the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R), remain the gold standard. However, these approaches are labour-intensive, expensive, and require significant clinical expertise, which makes them less accessible to under-resourced populations. This growing demand has accelerated research and development in leveraging artificial intelligence (AI) and web technologies for autism assessment. These technologies can process vast amounts of multimodal data far more quickly and accurately than traditional approaches, thereby enhancing the precision of diagnosis and reducing the subjectivity of clinical evaluations. Moreover, they facilitate the automation of many diagnostic processes, which increases efficiency and allows for large-scale deployment. Web-based platforms further enhance these capabilities by offering remote access, real-time data collection, and interactive interfaces, thereby overcoming geographical and logistical barriers to diagnosis. Particularly in the wake of the COVID-19 pandemic, the shift toward telemedicine and digital health solutions has underscored the value of online platforms in healthcare delivery. These platforms allow caregivers and clinicians to conduct assessments through mobile apps and websites, upload videos and audio samples, and receive AI-driven diagnostic feedback without requiring physical presence in clinical settings. Such capabilities are invaluable in expanding access to early autism diagnosis (Alateyat et., 2022). As awareness has grown, so too has the demand for effective, early, and scalable diagnostic methodologies (Albahri et al., 2023). This growing demand has accelerated research and development in leveraging artificial intelligence (AI) and web technologies for autism assessment. AI technologies, such as machine learning (ML), deep learning (DL), and natural language processing (NLP), are revolutionizing healthcare diagnostics by offering data-driven, predictive, and scalable solutions (Song et al., 2022). Specifically, for ASD, AI models can analyse various forms of data - including behavioural patterns, facial expressions, speech characteristics, and eye movement - to detect atypical developmental signs (Wei et al., 2022). These models process large volumes of data quickly and objectively, improving diagnostic precision. Moreover, they facilitate the automation of many diagnostic processes, which increases efficiency and allows for large-scale deployment.

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