AI-Based Emotion Regulation Monitoring in Autistic Children

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***Abstract*—Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by difficulties in communication, social interaction, and emotional regulation. Traditional therapeutic approaches often demand significant human involvement, making them resource-intensive and inconsistent. This paper introduces an AI-based multi-stage framework designed to support autistic children by combining child classification, autism detection, and facial emotion recognition into a unified pipeline. Leveraging transfer learning and deep learning models such as MobileNetV2 and RetinaFace, the framework provides adaptive interventions that can be integrated into robotic or chatbot systems. The proposed approach establishes a foundation for practical, scalable, and empathetic AI-driven emotional support tools.**

***Index Terms*—Autism Spectrum Disorder, Emotion Recognition, Deep Learning, MobileNetV2, Artificial Intelligence, Assistive Robotics**

I. Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by difficulties in communication, social interaction, and emotional regulation. According to the World Health Organization, approximately one in 100 children worldwide is diagnosed with autism, and this has continued to rise over the years [1]. In fact, about 1 in 31 (3.2%) children aged 8 years has been identified with ASD according to estimates from CDC's ADDM Network publication as of May 2025 [2]. For many autistic children, challenges in recognizing and expressing emotions create obstacles to effective learning, therapy, and social interaction [3]. Traditional therapeutic approaches rely heavily on human intervention, which can be resource-intensive, time-consuming, and inconsistent.

Artificial Intelligence (AI) offers a promising opportunity to bridge this gap by enabling automated, adaptive, and real-time emotional support systems. In recent years, Facial Emotion Recognition (FER), a technology that analyzes facial expressions to identify and interpret human emotions, has shown significant progress through the use of deep learning models [4], especially convolutional neural networks (CNN) and lightweight architectures such as MobileNetV2 [5], EfficientNet [6] and ResNet [7]. However, most existing systems are designed for general emotion recognition and do not specifically address the needs of autistic children. Furthermore, very few frameworks integrate autism classification with emotion detection, creating a gap in developing targeted solutions for this population.

To address these challenges, this research introduces an AI-based emotion regulation and monitoring framework specifically designed for autistic children. The framework employs a multi-stage pipeline that first identifies a face using RetinaFace [8], then determines if the face belongs to a child, classifies whether the child is autistic or not, and finally examines their emotional state using FER+ transfer learning [9]. Based on the detected emotion, the system provides adaptive interventions, such as therapeutic suggestions or empathetic dialogue responses.

This work makes three primary contributions:

1. A novel five-phase AI pipeline that combines child classification, autism detection, and emotion recognition into a unified system.

2. The use of transfer learning from FER+ for improved emotion recognition accuracy in autistic facial datasets.

3. A practical foundation for developing assistive robots and AI-driven companions that support emotional regulation in autistic children.

II. Literature Review

A. Autism Detection Using AI

Recent advances in machine learning have enabled automated detection of Autism Spectrum Disorder (ASD) from various modalities such as facial features, voice, and behavioral patterns. Traditional approaches relied on structured behavioral questionnaires and clinical diagnosis, which are often subjective and time-intensive. Deep learning has shifted this paradigm by providing automated feature extraction from images and videos.

For instance, Siddiqui et al. [10] applied convolutional neural networks (CNNs) to classify autistic versus non-autistic children using facial image datasets, achieving an accuracy of 91% compared to handcrafted feature-based approaches. Similarly, Hazlett et al. [11] utilized neuroimaging combined with deep learning to predict autism risk in infants, demonstrating the potential of AI-driven early diagnosis. However, most of these works do not incorporate emotional understanding, which is critical for supporting real-time therapeutic interventions.