AI-Powered Support System to Help Neurotypical Individuals Understand and Interact with Autistic Individuals Using ML and NLP

Abstract

Neurotypical caregivers often struggle to interpret the behaviors and emotions of autistic individuals. This research introduces an AI-powered support system that simplifies communication, recognizes emotional states, and adapts feedback in real time. Using transformer-based NLP (BERT), affective computing, reinforcement learning, and federated learning, it empowers parents, educators, and therapists to engage more effectively with neurodivergent children and teens. A secure, moderated platform fosters community support. Evaluation combines technical metrics and user feedback to ensure a robust, impactful solution.

Vision and Motivation

This research is focused on bridging the communication gap between neurodivergent individuals and the neurotypical people around them. Rather than trying to 'fix' autistic behavior, the goal is to empower parents, educators, and caregivers with AI tools that help them understand, respond to, and connect with autistic children or teens more effectively. The system interprets behavior, simplifies communication, and adapts feedback based on individual needs, allowing non-autistic individuals to support and engage with empathy and clarity.

Introduction

Autism Spectrum Disorder (ASD) presents unique challenges in communication and emotional expression. While autistic individuals are often highly intelligent, neuro typical individuals, parents, teachers, caregivers frequently struggle to interpret their behavior. This research proposes an AI-powered tool to assist neurotypical people in understanding, adapting to, and communicating better with neurodivergent individuals. It will provide simplified instructions, real-time emotional feedback, and a safe support platform to bridge the understanding gap.

Research Gap and Literature Review

Existing tools such as Noora, Embodied Conversational Agents, and chatbot-based systems have targeted social skill development for autistic individuals. However, these tools:
- Focus mostly on adolescents or adults
- Are rule-based, not adaptive
- Lack emotional intelligence and personalization

- Do not support parents or caregivers directly

This research improves on those by creating an adaptive system for all ages that supports non-autistic individuals in better interpreting autistic behavior.

Research Objectives
- To simplify communication for neurotypical users interacting with autistic individuals
- To detect and interpret emotional states through speech/text inputs
- To personalize interaction strategies using reinforcement learning
- To build a safe and moderated digital support space
- To ensure data privacy through federated learning

Methodology
- NLP (BERT): Simplify complex communication
- Emotion Classifier: Detect emotional tone from speech/text
- RL Agent: Adapt system feedback based on user behavior
- K-means Clustering: Group users for personalization
- Federated Learning: Train securely on-device without raw data sharing

Algorithms and Evaluation
Each algorithm is chosen to perform specific functions within the system:

1. BERT: Input = complex sentence → Output = simplified version
   Metrics: BLEU Score, SARI

2. Emotion Classifier: Input = user text → Output = emotion label
   Metrics: Accuracy, F1 Score, Confusion Matrix

3. RL Agent: Input = user reaction logs → Output = improved response strategy
   Metrics: Reward Score, Response Time

4. K-Means: Input = app usage behavior → Output = cluster label
   Metrics: Silhouette Score, Davies-Bouldin Index

5. Federated Learning: Input = local device model updates → Output = secure global model
   Metrics: Accuracy vs Privacy Tradeoff, Training Time

Use Case Scenario
A 2.5-year-old child named Kavin is recently diagnosed with autism. His mother struggles to understand his emotions and give clear instructions. Using the proposed system:

- The app detects Kavin's mood and suggests calm responses
- It simplifies her instructions automatically
- Over time, the app adapts to Kavin's communication pattern

This way, the system helps the parent—not just the child—learn how to respond better.

Expected Outcomes
- A communication tool that helps neurotypical individuals understand autistic responses
- Simplified, empathetic AI support in real-time
- Personalized feedback based on behavior
- Emotional awareness and privacy-respecting design

Research Timeline

Year 1: Literature review, data collection, prototype design
Year 2: System development, model training, testing with mock data
Year 3: Evaluation, real-world pilot testing, thesis submission

Conclusion

This research is rooted in empathy, innovation, and impact. It does not aim to change or correct autistic behavior, but to empower those around neurodivergent individuals with tools to understand and support them better. As the research progresses, various algorithms will be tested and evaluated using real-world data and metrics. Based on performance, the most suitable model whether it is BERT, reinforcement learning, or a hybrid approach will be selected for final implementation.

To create an AI-powered system that is not only technically sound, but truly helpful in real life. With this commitment, the research will evolve with flexibility, ensuring that the chosen methods always serve the ultimate goal making communication between autistic individuals and the world around them smoother, safer, and more meaningful.

References
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