Developing an AI Makaton Tool for Inclusive Secondary Education: Implementation and Evaluation

Omotayo Emmanuel Omoyemi

[1] University of Derby

Abstract. This work introduces a prototype AI-based educational tool designed to support inclusive communication using Makaton, a language system that integrates signs and symbols. The system employs MediaPipe for real-time hand landmark detection and a rule-based classifier to recognize five core Makaton gestures. A pilot study in a UK secondary school involving eight participants demonstrated recognition accuracy ranging from 95% to 78%, with response latency under 850ms. Informal feedback highlighted ease of use and potential to enhance inclusive learning. While preliminary, this work establishes feasibility and outlines critical directions for advancing scalable, multimodal solutions.

Keywords: Makaton, Gesture Recognition, Assistive Technology

1 Introduction

Effective communication is central to education, yet students with speech and language difficulties often lack technological support in mainstream classrooms. Makaton, a multimodal language combining signs, symbols, and speech, enables inclusive communication but remains underutilized in technological interventions. Previous work highlights the importance of Augmentative and Alternative Communication (AAC) tools in supporting learners [1]. This study presents a prototype system addressing this gap by recognizing a limited set of Makaton gestures in real time using affordable hardware.

2. Prototype Design and Implementation

The system integrates MediaPipe for hand landmark detection with a rule-based classifier to identify five foundational Makaton gestures: Hello, Goodbye, Please, Thank You, and Yes. A browser-based interface provides immediate visual feedback. Developed in Python, the system runs efficiently on standard laptops with webcams, ensuring accessibility in secondary school settings. Recent advances in gesture recognition support the feasibility of such AI systems [2].

3. Pilot Evaluation

A pilot evaluation with eight participants (three students, five trained facilitators) assessed gesture recognition performance in a real-world classroom. Accuracy ranged from 95% for simple gestures to 78% for more dynamic movements. Average response latency was below 850ms. Informal feedback suggested the system was intuitive and engaging, though limitations were observed in gesture variability handling and the restricted gesture library.

4. Discussion and Future Work

This exploratory work demonstrates the potential of AI-driven gesture recognition for inclusive education while underscoring key challenges. Future development will focus on:
- Expanding the gesture library to cover a broader range of Makaton signs.
- Adopting machine learning-based recognition for greater scalability and robustness.
- Incorporating multimodal inputs (e.g., speech, symbols, facial expressions).
- Conducting systematic usability studies with larger and more diverse cohorts.

5. Discussion and Future Work

This prototype validates the feasibility of a low-cost, classroom-ready Makaton recognition tool and highlights pathways for enhancing assistive AI technologies in inclusive education. Iterative, user-centered design will be critical to realizing its full potential.

References

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