

Role of Artificial Intelligence in Speech Disorder Assessment

Lin Wei*

Department of Hearing Sciences, Eastern Medical University, Shanghai, China.

ABOVE THE STUDY

Artificial Intelligence (AI) is reshaping the assessment of speech disorders, moving the field toward more scalable, data-driven, and potentially earlier identification of communication difficulties. From a clinical perspective, the promise is substantial: automated analysis of speech samples, objective measurement of acoustic features, and continuous monitoring outside the clinic. Yet the value of AI will ultimately depend on how well it complements clinical judgment, respects variability in human speech, and addresses issues of equity and ethics.

One of the most significant contributions of AI lies in acoustic and pattern analysis. Machine learning models can process large volumes of speech data to detect subtle deviations in articulation, fluency, prosody, and voice quality. Features such as pitch variation, speech rate, pause patterns, and formant frequencies can be quantified with a level of precision difficult to achieve through perceptual judgment alone. This is particularly useful in early screening, where small deviations may not be easily noticeable but could indicate underlying disorders. For example, AI systems can flag atypical phoneme production in children or detect early vocal changes associated with neurological conditions in adults.

Another advantage is scalability. Traditional assessment relies heavily on trained speech-language pathologists, who may be scarce in many regions. AI-powered tools delivered via smartphones or web platforms can extend screening to larger populations, including rural or underserved communities. Parents, teachers, or primary care providers can collect speech samples, which are then analyzed automatically. This can shorten the time between first concern and formal evaluation, a critical factor in improving outcomes, especially for children.

AI also enables longitudinal monitoring. Instead of relying on periodic clinic visits, speech can be tracked over time in natural environments. This provides a more ecologically valid picture of communication abilities and allows clinicians to observe progress or emerging issues with greater sensitivity. For conditions that fluctuate or evolve, such as motor speech

disorders or progressive neurological diseases, continuous data can inform more responsive intervention planning.

However, the integration of AI into assessment is not without limitations. Speech is inherently variable, influenced by age, dialect, language background, and context. AI models trained on limited or homogeneous datasets may misclassify typical variations as disordered or fail to detect genuine impairments in underrepresented populations. This raises concerns about bias and fairness. A system that performs well for one linguistic group may be inaccurate for another, potentially leading to misdiagnosis or delayed support.

Clinical validity is another critical issue. While AI can identify patterns, it does not inherently understand the underlying causes of those patterns. Differentiating between phonological, motor, or language-based disorders requires nuanced interpretation that integrates case history, cognitive factors, and functional impact. Overreliance on automated outputs risks reducing assessment to a set of scores, overlooking the holistic nature of communication disorders. AI should therefore be viewed as a decision-support tool rather than a replacement for professional expertise.

Ethical considerations further complicate implementation. Speech data is highly personal, and its collection, storage, and analysis raise privacy concerns. Ensuring informed consent, secure data handling, and transparency about how data is used is essential. Additionally, there is a need to manage expectations; AI tools are often marketed as quick solutions, but without proper validation and clinical integration, they may offer a false sense of accuracy.

From a practical standpoint, successful adoption depends on usability and clinician acceptance. Tools must integrate seamlessly into clinical workflows, provide interpretable results, and align with established assessment frameworks. Training clinicians to understand both the capabilities and limitations of AI is crucial for responsible use.

In perspective, AI has the potential to enhance speech disorder assessment by improving efficiency, objectivity, and access. Its greatest strength lies in augmenting human expertise-handling

Correspondence to: Lin Wei. Department of Hearing Sciences, Eastern Medical University, Shanghai, China. E-mail: lin.wei@emu.edu.cn

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large-scale data analysis while clinicians provide interpretation, contextual understanding, and individualized decision-making. The future of assessment will likely be hybrid, combining technological precision with clinical insight. Ensuring that this

integration is equitable, ethical, and evidence-based will determine whether AI becomes a transformative force or simply another tool with unrealized potential.