Accent or Impediment? Using Machine Learning to Prevent Speech Misdiagnosis in Children

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Bilingual children are frequently misdiagnosed in schools and clinics because speech patterns shaped by second-language acquisition can resemble speech sound disorders. As a result, a typical bilingual accent may be incorrectly labeled as a disorder, or a true speech impediment may be dismissed as accent-related. With millions of U.S. children growing up as dual language learners, screening tools that can distinguish accent-related variation from impairment are urgently needed. This study developed a machine learning model to distinguish speech sound disorders from typical and bilingual-accented speech using publicly available recordings. The dataset included three impairment datasets, two bilingual datasets, and two control datasets, totaling 35,182 utterances, with 60% typical or bilingual-accented speech and 40% impaired speech. A total of 150 acoustic features were extracted from each utterance to capture timing, rhythm, spectral structure, resonance, and pitch-related variation. Multiple models were evaluated, and the best-performing approach was a multilayer perceptron, which achieved 97.6% accuracy. The model can reliably distinguish speech disorders from healthy and bilingual-accented speech without confusing accent-related variation with impairment. The most important predictors included pausing and rhythm patterns, the strength of speech frequencies across the spectrum, the consistency of those frequency patterns, alternation between voiced speech and noisier segments, moment-to-moment changes in spectral shape, vowel resonance variability, and lower-range pitch behavior. By improving differentiation between disorder and accent, this project aims to support the development of more reliable screening tools for linguistically diverse populations.

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