

Machine learning analysis of voice in stuttering

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Background: Stuttering is a childhood-onset neurodevelopmental disorder affecting speech fluency. Given the lack of standardized acoustic analysis, stuttering is currently evaluated by means of perceptual examination with dedicated clinical scales. Advanced voice analysis techniques based on machine learning would improve the diagnostic accuracy of stuttering, as suggested by previously unreported results in movement disorders [1,2,3,4].

Objective: We aimed to detect objectively stuttering-related voice abnormalities through automatic machine learning techniques. Also, we investigated the relevance of speech-tasks as well as technological apparatus (i.e., smartphone) for the objective assessment of stuttering.

Methods: Thirty-three people with stuttering and 40 age- and gender-matched controls were recruited. Sustained emission of vowel /e/ and two sentences of the connected speech were recorded through smartphones. Voice samples were analysed using machine learning procedures to compare controls and people with stuttering.

Results: Machine learning algorithm objectively discriminated with high accuracy between controls and people with stuttering, as shown by the receiver operating characteristic (ROC) curves calculated during the sustained emission of the vowel /e/ (accuracy: 87.7; AUC: 0.934), sentence 1 (Acc.: 83.6; AUC: 0.906) and finally, sentence 2 (Acc.: 81.1; AUC: 0.881).

Conclusions: Machine learning-based analysis of human voice through smartphone represents a reliable tool for the automatic detection of stuttering-related changes of voice features in patients with stuttering. Future studies would disclose whether machine learning analysis here proposed would help clinicians in the objective diagnosis of developmental disorders of speech, including stuttering.

References:

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