Automatic Detection of Stroke-Induced Aphasia

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Stroke is a leading cause of long-term disability and aphasia is the most common symptom of stroke. Currently, aphasia assessment is done using the Western Aphasia Battery (WAB), which consists of many subtests on speech, fluency, comprehension, etc., by a trained speech pathologist taking several hours. To reduce the burden on stroke patients and also enable timely detection of symptoms for prompt treatment of stroke, this project studies the feasibility of quick and automatic assessment of aphasia without requiring a speech pathologist. Towards that end, a machine learning system based on Support Vector Machines (SVM) was developed in Python using the scikit-learn library for detecting aphasia with features extracted from speech transcripts. The system was trained and tested with a dataset from the C-STAR Aphasia Lab, consisting of speech transcripts of responses for three different prompts, i) describe a Broken Window picture sequence, ii) tell the Cinderella story, and iii) explain how to make a PBJ sandwich, from 69 stroke survivors with differing aphasia severity levels and 10 without aphasia. The system achieved aphasia or not classification accuracy of 81% and WAB aphasia quotient estimation R2 score of 0.57. Also, the features from the Broken Window prompt alone are predictive of aphasia similar to all prompt features combined. While these results are based on responses to prompts in a clinical setting as opposed to daily living, they show promise toward the creation of automatic at-home aphasia detection systems.

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