EXPLORATORY ANALYSIS OF SPEECH FEATURES RELATED TO DEPRESSION IN ADULTS WITH APHASIA

Stephanie Gillespie[1], Elliot Moore[1], Jacqueline Laures-Gore[2], Matthew Farina[2]

[1] Georgia Institute of Technology, [2] Georgia State University

{sgillespie6,em80}@gatech.edu; jlaures@gsu.edu; mfarina2@student.gsu.edu

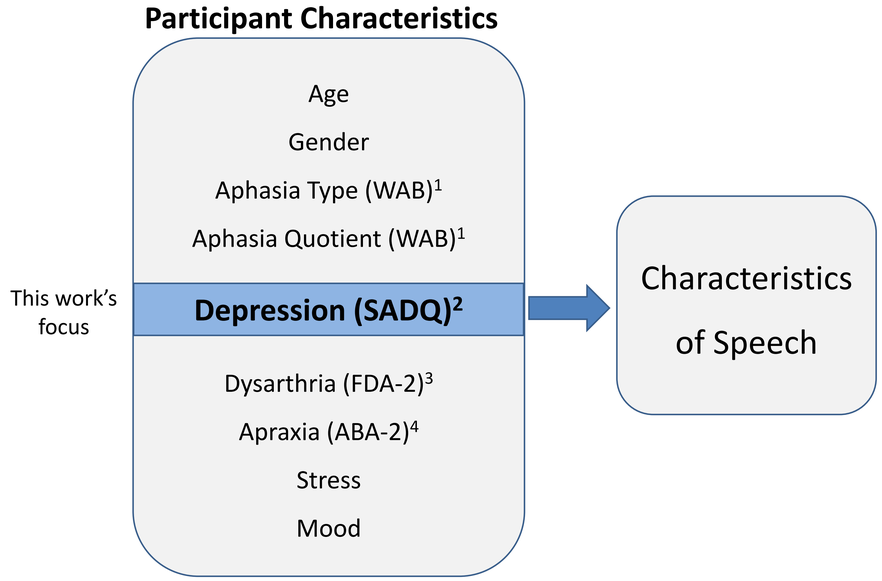
Background

Aphasia is an acquired communication disorder resulting from brain damage and impairs an individual's ability to use, produce, and comprehend language. Loss of communication skills can be stressful and may result in depression, yet most depression diagnostic tools are designed for adults without aphasia. This project is a research effort to examine acoustic profiles of adults with aphasia who have been assessed as having possible depression based on tools completed by their caretakers.

Data Collection

Recording Material:
- 2 Picture Descriptions
- Speech components of the Western Aphasia Battery Protocol[1]

Data Analyzed:
- 14 Participants selected:
  6 female, 8 male
  50% depressed from each gender
- Balance participants based on gender and depression label
- Used only phrase responses
- 33 utterances per person



Feature Extraction and Classification

Pre-Processing
- Segment recordings into individual responses
- Voiced Speech Detection

Feature Extraction
- Pitch + Jitter
- Root Mean Square (RMS) Energy
- Harmonic-to-Noise Ratio (HNR)
- Cepstral Peak Prominence (CPP)
- Mel-Frequency Cepstral Coefficients (MFCC)
- Line Spectral Frequencies (LSF)

Experiment Setup in Weka
- Feature Selection
- Leave-one-participant-out train/test sets

Results and Discussion

Table 1: Classification results by feature subtype in assigning the correct depression label to each utterance. All categories except 'All' are based on the reduced feature subset after feature-selection

Features (no. of features)	Avg. Recall	Avg. Precision	Avg. Accuracy (standard dev.)
All (874)	0.359	0.411	0.422 (0.264)
Reduced (41)	0.459	0.447	0.446 (0.325)
Pitch + Jitter (7)	0.394	0.399	0.400 (0.303)
RMS-Energy (8)	0.814	0.487	0.478 (0.478)
HNR (10)	0.545	0.472	0.468 (0.311)
CPP (6)	0.563	0.634	0.619 (0.190)
MFCC+delta (19)	0.432	0.588	0.502 (0.349)
LSF+delta (20)	0.308	0.286	0.374 (0.246)

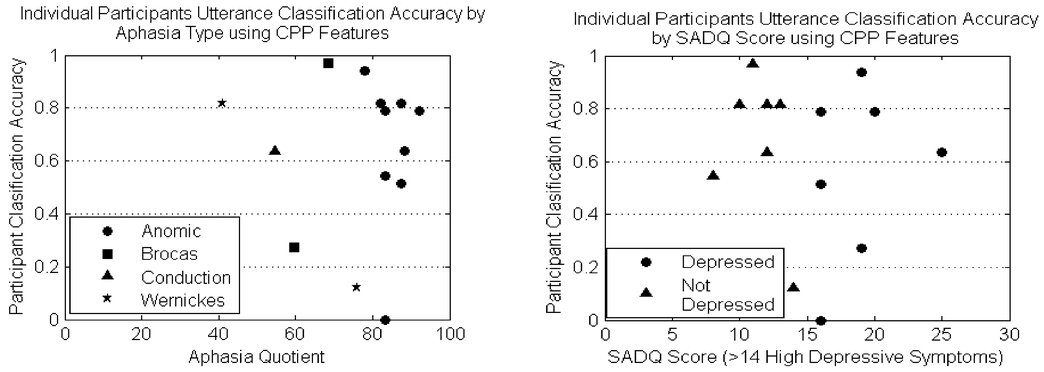


Figure 1: Classification accuracy of each participant plotted against their aphasia quotient and aphasia type (left) and against their SADQ-score and depression label (right)

- Cepstral Peak Prominence was highest performing individual feature set overall
- Further study needed to determine if features are identifying characteristics unique to depression or are being influenced by motor disorders or other clinical differences
- Potential that the threshold for "high depressive symptoms" at SADQ>14 results in misclassifications on either side of threshold- may suggest a need for a non-binary classification

References

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