TD-P-016 STUDYING NEURODEGENERATION WITH AUTOMATED LINGUISTIC ANALYSIS OF SPEECH DATA

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Background: Recorded changes in the language and speech of aging individuals offer a new means of quantifying neurodegeneration. By analyzing linguistic features such as parts-of-speech, word length, word frequency, and acoustic variables, automated techniques in computational linguistics make it possible to classify groups of differing linguistic ability. **Methods:** We extract features from audio recordings, and their respective transcripts, of participants recalling the narrative of Cinderella. These features identify

significant characteristics for each of four populations: aphasic stroke (ST; N=19), primary progressive aphasia (PPA; N=11), mild cognitive impairment and Alzheimer's disease (MCI/AD; N=9 and N=2, respectively), and healthy elderly controls (CT; N=26). We then use these features to train a machine-learning classifier to correctly distinguish healthy individuals from patients (CT vs. ST+PPA+MCI), MCI/AD patients from ST and PA patients, and controls from each individual patient group (e.g., CT vs. ST). **Results:** Our decision tree model is able to classify CT versus ST+PPA+MCI with 76.1% accuracy. We classify controls from MCI/AD patients with 89.2% accuracy, controls from PPA with 91.9% accuracy, and controls from stroke patients with 71.1% accuracy. Finally, the MCI/AD patients versus the combined stroke and PPA groups were classified with 80.5% accuracy. Word length and filled pauses were found to serve as prominent features in identifying pathology; however, when comparing controls and the MCI/AD group, acoustic features were selected more often than for the other populations' feature sets. **Conclusions:** Binary classification between groups was between 13% and 21% more accurate than baseline values, and 4-way classification was 14.9% better. It appeared that linguistic features yielded better predictions than did the addition of acoustic features. Ongoing work aims to explain these phenomena and further evaluate the possible use of speech to serve as diagnostic criteria.

a simple drawing platform, and hypothesized that this platform can be used for preliminary screening for dementia. **Methods:** Patients with Alzheimer's disease (AD) and Montreal Cognitive Assessment (MoCA) score below 22 were recruited from the Geriatric Research Clinic, and subjects without AD and with MoCA score at least 22 were recruited from the Osteoporosis Research Centre. An automated scoring platform for interlocking pentagons was developed. All drawing behaviour was digitalized as spatial and temporal data, such as the time of drawing for each line, hesitation moments between the drawing lines. Some features of the drawing image were automatically identified, including overlapped and closure pentagons, asymmetric shape, and irregular line by a shaking hand. All time and image features between AD and control were compared by T-test or Chi-square test. Multivariate logistic regression model was fitted as the predictors on AD. **Results:** A total of 93 subjects were recruited, and 67 of them (72%) were AD patients. The mean age of AD patients was 79.7 (SD=5.4), and with average 11.2 MoCA scores (SD=4.9). In the 26 subjects without AD, the mean age was 82.7 (SD=3.4), and with average 24.4 MoCA scores (SD=1.7). Compared with control subjects, AD patients are less capable of drawing 10 angles in the interlocking pentagon (20.9% vs 57.7%) (OR=4.86 95% CI [1.47-16.12], p=0.010); and longer drawing time on the first pentagon (4.7 vs 3.8 seconds) (OR=2.09 95% CI [1.25-3.50], p=0.005) [Table 1]. **Conclusions:** Analytics on the digital behaviour of simple drawing is an effective method for dementia screening. Further investigation with machine learning techniques may increase data interpretability