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Background: There are few tools to assess objective measures of caregiving for patients with dementia. Current tools primarily use subjective questionnaires that can be subject to inaccuracies in self-reporting. Home-based, remote-sensing computer systems are able to capture outcome measures related to cognition and everyday functioning and could provide more accurate and unbiased measures related to time and effort spent on caregiving. Here we present preliminary data on sensor-based outcome measures that differ between care partners with reported low and high levels of care burden. **Methods:** Data is derived from EVALUATE-AD, a clinical trial to detect standard dementia treatment transitions enrolling 30 homes with participants who have mild cognitive impairment or early-stage Alzheimer's disease and their care partner (60 total participants). A pervasive sensing and computing system is deployed in each couple's home continuously providing data on measures related to caregiver engagement (e.g. time together, sleep disruption). Care partners respond weekly on-line to queries regarding changes to their health and medications and complete questionnaires related to burden level (Zarit Burden Interview) and factors that may influence burden, including patient functional status (FAQ) and neuropsychiatric symptoms (NPI), at baseline and every 3 months during the trial. **Results:** Preliminary data to date from eleven homes is comprised of sleep data from 774 nights and step counts from 899 days. Care partners (n=11) were on average 69 years old, with a mean ZBI score of 10.2 (range 1-19). Completion rate for the weekly health survey by care partners was 85%. Care partners reporting a high level of burden (n=8) had longer total sleep time (median: 8.4 vs. 7.9 hrs/night; $p<0.001$) with no difference in sleep latency (median: 10.0 vs. 11.0 mins; $p=0.27$) compared to those with low burden (n=3). Care partners with high self-reported burden also had higher total daily step counts (median: 5144 vs. 2769 steps/day; $p<0.001$). **Conclusions:** Care partners are accepting of the unobtrusive home-based assessment system including completing a weekly health survey regularly. This system provides a novel method to objectively assess and quantify ecologically valid measures that could be used to identify changes in levels of care need and burden.

TD-P-013 ASSESSMENT OF DUAL-TASK MOTOR FUNCTION DETERIORATION FOR DETECTING COGNITIVE IMPAIRMENT

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Background: Simultaneous assessment of motor and cognitive "dual tasks" has been demonstrated as a promising method to identify the cognitive status of older adults. Our objective was to develop a novel dual-task cognitive function test incorporating a validated gait equivalent upper-extremity function (UEF) test simultaneously performed with counting backwards as a cognitive challenge. **Methods:** Older adults (≥65 years) were recruited and stratified into three clinically confirmed groups: 1) cognitively healthy (CN), 2) mild cognitive impairment (MCI), and 3) early Alzheimer's disease (AD). Elbow angular velocity was measured using three-dimensional gyroscopes attached to the wrist and upper-arm. Participants completed six trials of single-task and dual-task UEF at two elbow flexion speeds (rapid and self-paced) and three cognitive counting tasks (no counting, backwards by ones, and backwards by threes). The outcome of interest was motor function performance (coefficient of variation between flexion time intervals to assess pauses/delays in motor task execution) per condition. Between group comparisons were made using ANCOVA models while controlling for age, sex, and body mass index. Subsequently, the UEF condition with the highest effect size was used in an ordinal logistic model for group discrimination. **Results:** Thirty participants were recruited (10 CN: age=86.3±2.9, 10 MCI: age=87.2±3.0, and 10 AD: age=86.5±5.3). ANCOVA models showed significant associations between cognition groups and elbow flexion variability in all four dual-task conditions ($p<0.04$; effect size=0.57-1.47). The highest effect size was observed for self-paced plus counting backward by one, with variability coefficients 10±5%, 16±14%, and 50±17% for CN, MCI, and AD groups, respectively. Using this same single motor task variability parameter (self-paced and counting backward by one) in a logistic model, MCI and AD group assignment was predicted with a receiver operating characteristic area under the curve of 0.82 and 0.97, respectively. **Conclusions:** Accurate, objective, and rapid cognition screening strategies are needed for use in research and clinical settings. The reported method has high screening potential, and could be likewise employed to measure change over time. Our preliminary findings should be further explored in a larger study.

TD-P-014 COGID: A SPEECH RECOGNITION TOOL FOR EARLY DETECTION OF ALZHEIMER'S DISEASE

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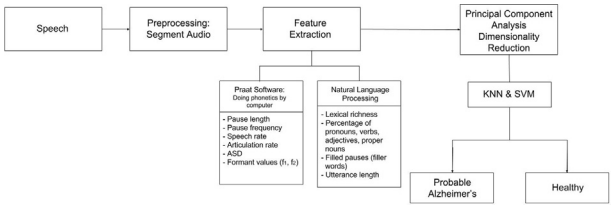
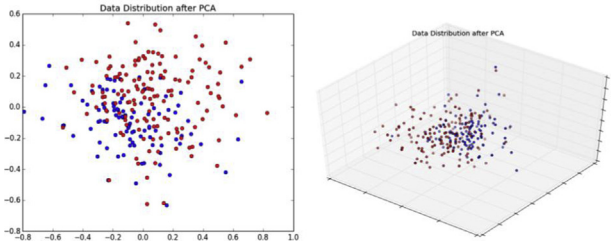
Background: Due to the variety of symptoms and progression, dementia and Alzheimer's disease (AD) can often go undiagnosed. The diagnostic process is complicated, expensive, requires repeated testing in an unfamiliar environment and can cause added stress and confusion. Language can often be early signs of the disease. A tool that analyzes acoustic and semantic properties of speech and recognizes characteristics of AD could be a diagnostic aid to make the process more accessible. We combined findings from literature in attempt to create a robust AD detection tool. **Methods:** The tool was built using audio from the Dementia Bank's Pitt Corpus which includes audio and transcriptions from 142 subjects with diagnosed AD and 96 healthy elderly controls. A portion of subjects have repeat visits over time, totaling 223 control interviews and 234 from individuals with AD. We used the Cookie Task which allows us to ensure a controlled context which should elicit the same type of vocabulary and speech. We extracted features based on the linguistic abilities affected by AD. Transcription based features captured a decline of vocabulary and semantic processing and included features of lexical richness, utterance length, frequency of filler words, pronouns, verbs, adjectives and proper nouns.





Acoustic features focused on word finding errors, fluidity and rhythm of speech and included pause frequency and duration, speech rate, and articulation rate. Principal Component Analysis (PCA) was used for feature reduction. Classification was done using SVM and KNN, and we used leave-one-out cross validation to evaluate the models. **Results:** The best model used data from all visits for each subject, PCA components = 3, SVM with RBF kernel and achieves an F1 of 0.73. This model has a recall of 0.83. **Conclusions:** Analyzing characteristics of speech has the potential to act as a diagnostic aid for Alzheimer's Disease. We are particularly motivated by the high recall rate, which is important for medical applications as false negatives could be dangerous. With further work, it's possible this tool could help differentiate between the various types of dementia, and help track changes over time. References: [1] D'Arcy, S., Rapcan, V., Penard, N., Morris, M. E., Robertson, I., & Reilly, R. B. (2008). Speech as a means of monitoring cognitive function of elderly speakers. School of Electrical, Electronic and Mechanical Engineering, University College Dublin, Rep of Ireland., Trinity College Institution of Neuroscience (TCIN), Trinity College Dublin, Rep of Ireland, Digital Health Group, Intel Corporation, Beaverton, Oregon, USA., Department of Electrical Engineering, Trinity College Dublin, Rep of Ireland. Interspeech 2008. [2] Haakani-Tür, D., Vergyri, D., & Tur, G. (2010). Speech-Based Automated Cognitive Status Assessment. International Computer Science Institute, Berkley, CA., SRI International, Speech Technology and Research Lab, Menlo Park, CA. Interspeech 2010: pages 258-261. [3] Jarrold, W., Peintner, B., Wilkins, D., Vergryi D., Richey, C., Gorno-Yempini, M. L., & Ogar, J. (2014). Aided Diagnosis of Dementia Type through Computer-Based Analysis of Spontaneous Speech. Association for Computational Linguistics. Workshop on Computational Linguistics and Clinical Psychology: From Linguistic Signal to Clinical Reality: pages 27-37. Yaruss, J. (1998), 'Real-time analysis of speech fluency: Procedures and reliability training', American Journal of Speech-Language Pathology 7(2),25. [4] Davis, B. & Maclagan, M. (2009), 'Examining pauses in Alzheimer's discourse', American journal of Alzheimer's Disease and other dementias 24(2), 141-154. [5] Snover, M. Dorr, B & Schwartz, R. (2004), A lexically driven algorithm or disfluency detection, in 'Proceedings of HLT-NAACL 2004: Short Papers; pp. 157-160. [6] Bortfeld, H, Leon, S, Bloom, J, Schober, M & Brennan, S. (2001), 'Disfluency rates in conversation: Effects of age, relationship, topic, role and gender'. [7] http://talkbank.org/DementiaBank/. [8] https://dementia.talkbank.org/access/English/Pitt.html.

TD-P-015 CONTINUOUS MONITORING OF GAIT: WHAT CAN IT TELL US ABOUT DEMENTIA?

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Background: Gait impairment has been associated with cognitive impairment and dementia, and may reflect the condition-specific neurodegeneration. Lab-based gait analysis is useful in predicting and aiding dementia diagnosis. However, gait laboratories are expensive and require specialist knowledge. Advances in technology have allowed body-worn sensors to provide similar information regarding gait impairment and walking activity in an individual's home and everyday environment. Continuous monitoring of gait impairment and activity is important for identification and monitoring of different types of dementia. This study aimed to assess both gait impairment and walking activity differences across dementia subtypes and controls. **Methods:** 87 participants were recruited across three groups; 33 Alzheimer's Disease (AD;(mean$\pm$sd) Age: 78$\pm$7; MMSE: 23$\pm$4), 27 Lewy Body Dementia (LBD; Age: 78$\pm$7; MMSE: 24$\pm$3) and 27 controls (Age:74$\pm$9; MMSE: 29$\pm$1). Dementia subtypes ranged from mild cognitive impairment to moderate dementia. A tri-axial accelerometer (Axivity AX3) recorded data pertaining to gait and walking activity over 7 days. One way ANOVAs and non-parametric equivalents assessed group differences. **Results:** Preliminary results report significant gait impairments in both disease groups compared to controls for pace (step velocity, step length; ($p \leq .05$)) and asymmetry (step, stance and swing time asymmetry ($p \leq .05$); Figure 1). LBD alone were more variable in gait (step, stance, swing time and step velocity variability; ($p \leq .05$)) compared to both AD and controls. People with LBD were also more variable than AD for step velocity and step length variability ($p \leq .05$). LBD spent less time walking compared to controls and AD ($p \leq .05$; Figure 2). AD took fewer average steps per day compared to controls ($p \leq .05$). LBD and AD were less variable in their walking bouts, and LBD performed a greater proportion of shorter walking bouts (higher alpha) compared to controls. **Conclusions:** Body-worn sensors provide an individualised representation of gait with information about discrete characteristics of gait impairment and changes in walking activity across all stages of cognitive impairment. This is important for both diagnostic and