Novel accelerometer-based algorithm detects early signals of AD in everyday motion behavior

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The projected substantial increase in Alzheimer's disease due to the higher life expectancy in modern societies is one of the great future challenges of health care systems worldwide. Alzheimer's disease leads to significant changes in the temporal structure of activities that impair everyday activities. Abnormal motion behavior and degeneration of the sleep-waking cycle are among the most severe behavioral symptoms. An early detection and even a prediction of these behaviors would allow a timely onset of interventions that aim to delay the manifestation or exacerbation of symptoms and reduce the need of institutionalized care.

An interdisciplinary joint study by the Medical Faculty and the Faculty for Computer Science and Electrical Engineering of Rostock University and the German Center for Neurodegenerative Diseases (DZNE) Rostock has now established a novel sensing algorithm that allows detecting the effect of Alzheimer's disease in unconstrained everyday motion behavior. In a dyad study with n=46 subjects (23 diagnosed with Alzheimer's dementia, 23 healthy controls), the method achieves an accuracy of 91% when labeling an unknown subject as "AD" or "healthy control". The algorithm uses spectral features of motion signals that are obtained by unobtrusive accelerometers worn by the subjects during their normal everyday activities.

"The method shows a substantially higher sensitivity than established behavioral rating scales, such as Cohen-Mansfield Agitation Index"

emphasizes Prof. Teipel, head of DZNE Rostock and responsible for the study design. "This means, we now have a more sensitive instrument for detecting changes in behavior that allows us to monitor disease progress and the efficacy of interventions." He adds: "And the measure we obtain is objective, it does not require the assessment by a human observer."

"It is fascinating that our approach is able to work with unconstrained everyday motion behavior," says Prof. Kirste from the Computer Science Department, who has designed the analysis algorithm. "Considering the high variance of everyday activities, we think that the ability to detect the influence of Alzheimer's disease on the temporal structure of this behavior is a very important result." He remarks: "On a practical level this means we can use low-cost sensing devices and we do not require the patients to perform specific controlled activities. Prospectively, it might even be possible to use the data of established devices such as mobile phones or navigation support devices for this purpose."

More information: The results of this study will be presented in the paper "Detecting the Effect of Alzheimer's Disease on Everyday Motion Behavior," scheduled for publication in issue 38(1) of the *Journal of Alzheimer's Disease*. An early online version of this paper is available at DOI: 10.3233/JAD-130272

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