

# Driving behaviors harbor early signals of dementia

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Using naturalistic driving data and machine learning techniques, researchers at Columbia University Mailman School of Public Health and Columbia's Fu Foundation School of Engineering and Applied

Science have developed highly accurate algorithms for detecting mild cognitive impairment and dementia in older drivers. Naturalistic driving data refer to data captured through in-vehicle recording devices or other technologies in the real-world setting. These data could be processed to measure driving exposure, space and performance in great detail. The findings are published in the journal *Geriatrics*.

The researchers developed random forests models, a statistical technique widely used in AI for classifying disease status, that performed exceptionally well. "Based on variables derived from the naturalistic driving data and basic demographic characteristics, such as age, sex, race/ethnicity and education level, we could predict [mild cognitive impairment](#) and dementia with 88 percent accuracy," said Sharon Di, associate professor of civil engineering and [engineering mechanics](#) at Columbia Engineering and the study's lead author.

The investigators constructed 29 variables using the naturalistic driving data captured by in-vehicle recording devices from 2977 participants of the Longitudinal Research on Aging Drivers (LongROAD) project, a multisite cohort study sponsored by the AAA Foundation for Traffic Safety. At the time of enrollment, the participants were active drivers aged 65-79 years and had no significant cognitive impairment and degenerative medical conditions. Data used in this study spanned the time period from August 2015 through March 2019.

Among the 2977 participants whose cars were instrumented with the in-vehicle recording devices, 33 were newly diagnosed with mild cognitive impairment and 31 percent with dementia by April 2019. The researchers trained a series of machine learning models for detecting mild cognitive impairment/dementia and found that the model based on driving variables and demographic characteristics was 88 percent accurate, much better than models based on demographic characteristics only (29 percent) and driving variables only (66 percent). Further

analysis revealed that age was most predictive of mild cognitive impairment and dementia, followed by the percentage of trips traveled within 15 miles of home, race/ethnicity, minutes per trip chain (i.e., length of trips starting and ending at home), minutes per trip, and number of hard braking events with deceleration rates of 0.35 g.

"Driving is a complex task involving dynamic cognitive processes and requiring essential cognitive functions and perceptual motor skills. Our study indicates that naturalistic driving behaviors can be used as comprehensive and reliable markers for mild cognitive impairment and dementia," said Guohua Li, MD, DrPH, professor of epidemiology and anesthesiology at Columbia Mailman School of Public Health and Vagelos College of Physicians and Surgeons, and senior author. "If validated, the algorithms developed in this study could provide a novel, unobtrusive screening tool for early detection and management of mild cognitive impairment and [dementia](#) in older drivers."

**More information:** Xuan Di et al. Using Naturalistic Driving Data to Predict Mild Cognitive Impairment and Dementia: Preliminary Findings from the Longitudinal Research on Aging Drivers (LongROAD) Study, *Geriatrics* (2021). [DOI: 10.3390/geriatrics6020045](https://doi.org/10.3390/geriatrics6020045)

Provided by Columbia University's Mailman School of Public Health

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