Artificial intelligence could be 'game changer' in detecting, managing Alzheimer's disease

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A team of researchers at Florida Atlantic University's College of Engineering and Computer Science, SIVOTEC Analytics, HAPPYneuron, MemTrax, and Stanford University School of Medicine introduce supervised machine learning as a modern approach and new value-added complementary tool in cognitive brain health assessment and related patient care and management. Credit: Florida Atlantic University

Worldwide, about 44 million people are living with Alzheimer's disease (AD) or a related form of dementia. Although 82 percent of seniors in the United States say it's important to have their thinking or memory checked, only 16 percent say they receive regular cognitive assessments.

Many traditional memory assessment tools are widely available to health professionals, though deficiencies in screening and detection accuracy and reliability remain prevalent. But even with the increasingly favorable instrument MemTrax, a very simple online memory test using images recognition, the clinical efficacy of this new approach as a memory function screening tool has not been sufficiently demonstrated or validated. In practice, there are numerous integrated and complex factors to consider in interpreting memory evaluation test results, which presents a real challenge for clinicians. All these factors stand as a collective barrier to suitably addressing the growing and widespread prevalence of AD and those affected by the disease.

Could artificial intelligence be the solution for testing and managing this complex human health condition? A team of researchers at Florida Atlantic University's College of Engineering and Computer Science, SIVOTEC Analytics, HAPPYneuron, MemTrax, and Stanford University School of Medicine, think so, and put their theory to the test.

The researchers employed a novel application of supervised machine learning and predictive modeling to demonstrate and validate the cross-sectional utility of MemTrax as a clinical decision support screening tool for assessing cognitive impairment.

Results of the study, published in the *Journal of Alzheimer's Disease*, introduce supervised machine learning as a modern approach and new value-added complementary tool in cognitive brain health assessment

and related patient care and management.

Findings demonstrate the potential valid clinical utility of MemTrax, administered as part of the online Continuous Recognition Tasks (M-CRT) test, in screening for variations in cognitive brain health. Notably, a comparison of MemTrax to the recognized and widely utilized Montreal Cognitive Assessment Estimation of mild cognitive impairment underscores the power and potential of this new online tool and approach in evaluating short-term memory in diagnostic support for cognitive screening and assessment with a variety of clinical conditions and impairments including dementia.

"Machine learning has an inherent capacity to reveal meaningful patterns and insights from a large, complex inter-dependent array of clinical determinants and the ability to continue to 'learn' from ongoing utility of practical predictive models," said Taghi Khoshgoftaar, Ph.D., co-author and Motorola Professor in FAU's Department of Computer and Electrical Engineering and Computer Science. "Seamless use and real-time interpretation will enhance case management and patient care through innovative technology and practical and readily usable integrated clinical applications that could be developed into a hand-held device and app."

For the study, the researchers used an existing dataset (18,395) from HAPPYneuron. They examined answers to general health screening questions (addressing memory, sleep quality, medications, and medical conditions affecting thinking), demographic information, and test results from a sample of adults who took the MemTrax (M-CRT) test for episodic-memory screening. MemTrax performance and participant features were used as independent attributes: true positive/negative, percent responses/correct, response time, age, sex, and recent alcohol consumption. For predictive modeling, they used demographic information and test scores to predict binary classification of the health-

related questions (yes/no) and general health status (healthy/unhealthy), based on the screening questions.

"Findings from our study provide an important step in advancing the approach for clinically managing a very complex condition like Alzheimer's disease," said Michael F. Bergeron, Ph.D., senior author and senior vice president of development and applications, SIVOTEC Analytics. "By analyzing a wide array of attributes across multiple domains of the human system and functional behaviors of brain health, informed and strategically directed advanced data mining, supervised machine learning, and robust analytics can be integral, and in fact necessary, for health care providers to detect and anticipate further progression in this disease and myriad other aspects of cognitive impairment."

AD is the sixth leading cause of death in the United States, affecting 5.8 million Americans. According to the Alzheimer's Association, this number is projected to rise to 14 million by 2050. In 2019, AD and other dementias will cost the nation $290 billion. By 2050, these costs could rise as high as $1.1 trillion.

"With its widespread prevalence and escalating incidence and public health burden, it is imperative to ensure that the tools clinicians use for testing and managing Alzheimer's disease and other related cognitive conditions are optimal," said Stella Batalama, Ph.D., dean of FAU's College of Engineering and Computer Science. "Results from this important study provide new insights and discovery that has set the stage for future impactful and significant research."

Provided by Florida Atlantic University

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