New Machine Learning program shows promise for early Alzheimer's diagnosis

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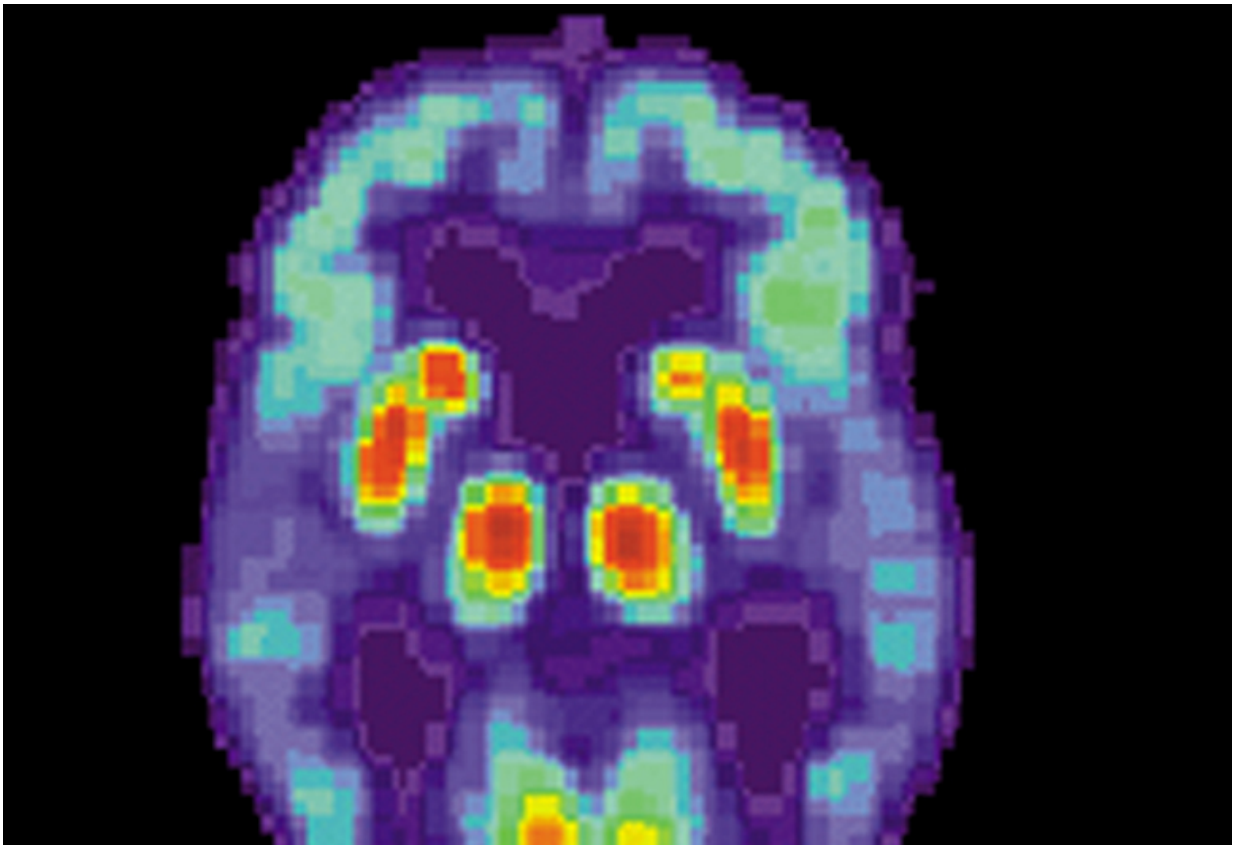

PET scan of a human brain with Alzheimer's disease. Credit: public domain

A new machine learning program developed by researchers at Case Western Reserve University appears to outperform other methods for diagnosing Alzheimer's disease before symptoms begin to interfere with

every day living, initial testing shows.

More than 5 million Americans may have Alzheimer's disease, according to estimates, and the numbers are growing as the population ages. The disease is an irreversible, progressive brain disorder that slowly destroys memory and thinking skills. And while there is no cure, several drugs can delay or prevent symptoms from worsening for up to five years or more, according to the National Institute on Aging and published research.

Meanwhile, early diagnosis and treatment—the goal of the new computer based program—is key to allowing those with the disease to remain independent longer.

The computer program integrates a range of Alzheimer's disease indicators, including mild cognitive impairment. In two successive stages, the algorithm selects the most pertinent to predict who has Alzheimer's.

"Many papers compare the healthy to those with the disease, but there's a continuum," said Anant Madabhushi, F. Alex Nason professor II of biomedical engineering at Case Western Reserve. "We deliberately included mild cognitive impairment, which can be a precursor to Alzheimers, but not always."

In a study published in the journal *Scientific Reports*, Madabhushi, Asha Singanamalli, who recently earned her biomedical engineering master's degree and Haibo Wang, a former postdoctoral researcher, tested the algorithm using data from 149 patients collected via the Alzheimer's Disease Neuroimaging Initiative.

The team developed what it calls Cascaded Multi-view Canonical Correlation (CaMCCo) algorithm, which integrates measurements from

magnetic resonance imaging (MRI) scans, features of the hippocampus, glucose metabolism rates in the brain, proteomics, genomics, mild cognitive impairment and other parameters.

Madabhushi's lab has repeatedly found that integrating dissimilar information is valuable for identifying cancers. This is the first time he and his team have done so for diagnosis and characterization of Alzheimer's disease.

"The algorithm assumes each parameter provides a different view of the disease, as if each were a different set of colored spectacles," Madabhushi said.

The program then assesses the variables in a two-stage cascade. First, the algorithm selects the parameters that best distinguish between someone who's healthy and someone who's not. Second, the algorithm selects from the unhealthy variables those that best distinguish who has mild cognitive impairment and who has Alzheimer's disease.

"The remaining views are combined to give the best picture," Madabhushi said.

In predicting which patients in the study had Alzheimer's disease, CaMCCo outperformed individual indicators as well as methods that combine them all without selective assessment. It also was better at predicting who had mild cognitive impairment than other methods that combine multiple indicators.

The researchers continue to validate and fine-tune the approach with data from multiple sites. They also plan to use the software in an observational mode: As a collaborating neurologist compiles tests on patients, the computer would run the data. If CaMCCo proves useful in predicting early Alzheimer's, Madabhushi expects to pursue a clinical

trial for prospective validation.

Provided by Case Western Reserve University