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Prediction of Alzheimer's Disease Based on Blood Biomarkers and Machine Learning Algorithms

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Abstract : Alzheimer's disease (AD) is the public health crisis of the 21st century. AD is a degenerative brain disease and the most common cause of dementia, a costly disease on the healthcare system. Unfortunately, the cause of AD is poorly understood, furthermore; the treatments of AD so far can only alleviate symptoms rather cure or stop the progress of the disease. Currently, there are several ways to diagnose AD; medical imaging can be used to distinguish between AD, other dementias, and early onset AD, and cerebrospinal fluid (CSF). Compared with other diagnostic tools, blood (plasma) test has advantages as an approach to population-based disease screening because it is simpler, less invasive also cost effective. In our study, we used blood biomarkers dataset of The Alzheimer's disease Neuroimaging Initiative (ADNI) which was funded by National Institutes of Health (NIH) to do data analysis and develop a prediction model. We used independent analysis of datasets to identify plasma protein biomarkers predicting early onset AD. Firstly, to compare the basic demographic statistics between the cohorts, we used SAS Enterprise Guide to do data preprocessing and statistical analysis. Secondly, we used logistic regression, neural network, decision tree to validate biomarkers by SAS Enterprise Miner. This study generated data from ADNI, contained 146 blood biomarkers from 566 participants. Participants include cognitive normal (healthy), mild cognitive impairment (MCI), and patient suffered Alzheimer's disease (AD). Participants' samples were separated into two groups, healthy and MCI, healthy and AD, respectively. We used the two groups to compare important biomarkers of AD and MCI. In preprocessing, we used a t-test to filter 41/47 features between the two groups (healthy and AD, healthy and MCI) before using machine learning algorithms. Then we have built model with 4 machine learning methods, the best AUC of two groups separately are 0.991/0.709. We want to stress the importance that the simple, less invasive, common blood (plasma) test may also early diagnose AD. As our opinion, the result will provide evidence that blood-based biomarkers might be an alternative diagnostics tool before further examination with CSF and medical imaging. A comprehensive study on the differences in blood-based biomarkers between AD patients and healthy subjects is warranted. Early detection of AD progression will allow physicians the opportunity for early intervention and treatment.

Keywords : Alzheimer's disease, blood-based biomarkers, diagnostics, early detection, machine learning
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