Determining the Most Cost-Efficient Indicators of Alzheimer's Disease Using Neural Networking

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Comparison of methods used to diagnose Alzheimer’s Disease (AD) via imaging, mental, and genetic data remains an open area of investigation. In this investigation, it was hypothesized that after designing and creating a full feed-forward neural network that accurately classifies cognitively normal (CN), mildly cognitively impaired (MCI), or Alzheimer’s Disease (AD) patients, the top 8 indicators of AD will include ApoE e4 and structural volumetric measures. A key public AD Neuroimaging Initiative dataset containing 68 potential indicators for 14,037 patients was cleaned, one-hot encoded, and normalized to 29 potential key indicators and 2,646 patients. A full feed-forward network was carefully designed, which employed a categorical cross-entropy loss function and Adam Stochastic Gradient Descent Optimizer to determine the most accurate indicators of AD. BigML Analysis and Principal Component Analysis were conducted to isolate top indicators of AD, and more than 1,000 trials were run using the created neural network to find the greatest accuracy that could be obtained using 8 indicators. A cost analysis was also conducted to assess the practicality and accessibility of these top indicators. The results partially supported the hypothesis, suggesting that ApoE E4, Clinical Dementia Rating Scale Sum of Boxes, the 11 and 13 item versions of ADAS-Cog, ADASQ4, the Mini-Mental State Examination, hippocampal volumetric measurements, and intracranial volume adjustment measurements most accurately indicate AD. Based on the cost analysis, getting a Mini-Mental State Examination ($79.35) and ApoE e4 testing ($99-$199) are the most cost-efficient indicators of AD.

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