

Neuropsychology/computerized neuropsychological assessment

Early diagnosis of Alzheimer's dementia with the artificial intelligence-based Integrated Cognitive Assessment

Mohammad Hadi Modarres¹ | Vahid Reza Khazaie² | Mohammad Ghorbani² |
Amir Mohammad Ghoreyshi² | Alireza AkhavanPour² | Reza Ebrahimpour² |
Zahra Vahabi³ | Chris Kalafatis¹ | Seyed-Mahdi Khaligh Razavi^{1,4}

¹ Cognetivity Ltd, London, United Kingdom

² Shahid Rajaei Teacher Training University, Tehran, Iran

³ Department of Geriatric Medicine, Ziaei Hospital, Tehran, Iran

⁴ Royan Institute, Tehran, Iran

Correspondence

Mohammad Hadi Modarres, Cognetivity Ltd, London, United Kingdom.

Email: hadi@cognetivity.com

Abstract

Background: We have developed the Integrated Cognitive Assessment (ICA), a 5-minute, self-administered, computerised test that is independent of language, cultural background and education and aims at screening for cognitive impairment in a way that can simplify and accelerate the diagnosis of Alzheimer's Dementia (AD) and Mild Cognitive Impairment (MCI). The ICA utilises artificial intelligence to analyse high-dimensional clinical and demographic data.

Method: We carried out head-to-head studies comparing classification performance of the ICA with widely used cognitive assessments (MoCA and ACE) in participants with MCI and mild AD. The ICA test measures patterns of reaction time and categorisation accuracy which are utilised by an AI engine, alongside demographic data, to provide a predictive score about participant's cognitive status. We also investigated the use of a deep (50 layers) neural network to extract informative features from the ICA test response patterns.

Result: On a population of 200 participants (84 healthy, 68 MCI, 48 mild AD), the ICA achieved an area under the ROC accuracy of 91% in distinguishing between healthy and impaired (MCI and mild AD) participants. In comparison MoCA achieved an AUC of 82%, and ACE 84%. Utilising the deep learning network for automatic feature extraction significantly improved the specificity and sensitivity compared to only using a linear classifier. The ICA Spearman correlation of 0.67 (p-value <0.0001) with MoCA, and 0.73 (p-value <0.0001) with ACE establishes convergent validity with these cognitive tests. ICA results were not biased by participants level of education (i.e. no significant correlation), whereas MoCA and ACE had correlations of 0.31 (p <0.0001) and 0.31 (p <0.001) respectively with the level of education in the same set of subjects.

Conclusion: The ICA can support clinicians by aiding accurate diagnosis of MCI and AD and is appropriate for large-scale screening of cognitive impairment. The ICA has advantages over MoCA and ACE because of its shorter duration, automatic scoring and potential for medical record or research database integration. ICA's AI engine is able to learn from additional data and utilise deep learning, further improving the predictive power of the ICA test.

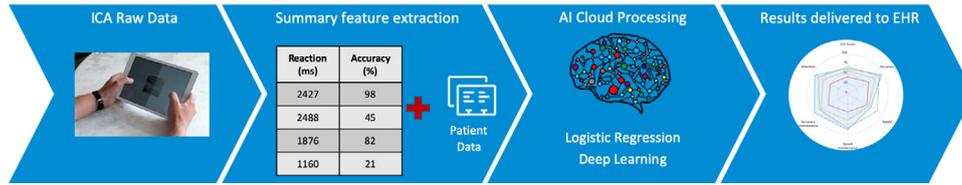


FIGURE 1