Questions to Remember: An Analysis of Cognitive Data for Alzheimer's Disease Detection

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17 December 2012

Abstract

In this paper, we provide a statistical analysis of cognitive data on an aging population collected by Rush University in Chicago, IL. A cohort of 1513 patients who were identified to be at risk for Alzheimers disease (AD) has been followed over a decade. Each year, they are administered a neuropsychological survey which consists of 278 questions covering various aspects of cognitive function such as episodic memory, visuospatial ability and perceptual speed. Additionally, a clinical diagnosis on their degree of dementia is also provided by physicians at each visit. Thus, the aim of this study is to investigate the prognostic power of the cognitive questions in detecting the onset of AD and facilitate its early detection with the selection of a powerful subset of questions. We attempt to solve this problem using the following three steps: First, we implement time-varying sensitivity and specificity analyses to select informative questions and provide the Youden index curves over time. Second, we validate the reliability of the selection by calculating the correlations between the informative questions and the global cognitive scores, concurrently and n years in the future for various values of n. Finally, we examine the baseline covariate effects on the identified informative questions through a longitudinal item response theory model, capture the aging effect and its interaction with other covariates in terms of coefficient estimations, and summarize the individual cognitive functions of patients by using subject-level random coefficients.

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