OpenMx: A Modular Research Environment for Item Response Theory Method Development

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Abstract

There are many item response theory software packages designed for users. Here, the authors introduce an environment tailored to method development and simulation. Implementations of a selection of classic algorithms are available as well as some recently developed methods. Source code is developed in public repositories on GitHub; your collaboration is welcome.

Keywords

item response theory, computer program, simulation

While open-source software packages for item response theory (IRT) are available (e.g., Chalmers, 2012), the software tends to be designed for users as opposed to methodological researchers. This is a small, but important distinction. For instance, the latter group may have more demands for modularity and greater need for high performance to efficiently run large-scale simulations. Here, the authors introduce OpenMx (Pritikin et al., 2015), rpf (Pritikin, 2020), and affiliated packages that, together, they regard as a modular IRT methodology development environment for R (R Core Team, 2020). Performance critical parts are written in C++. An optimized implementation of marginal maximum likelihood by quadrature (Bock & Aitkin, 1981) can fit a model with 1,536 dichotomous items and 2,500 responses in about 12 s on an Intel i7-8550U CPU running at 1.80 GHz.

A selection of popular fit diagnostic tests are available, including the *S-X2* statistic (Orlando & Thissen, 2000), a pairwise test of local dependence (Chen & Thissen, 1997), a multinomial fit test (Bartholomew & Tzamourani, 1999), and a sum-score expected a posteriori test (Li & Cai, 2018). The menu of features is organized in the style of à la carte as opposed to table d'hôte. Each diagnostic can be run separately to facilitate simulation studies. Since the initial publication of rpf, a suite of monotonic polynomial models have been contributed (e.g., Falk, 2020; Falk & Cai, 2016).

As with all IRT packages, additional methods and features are under development, yet users are encouraged to contribute or develop additional modules. There is already enough modeling flexibility to combine IRT with a kernel smoother (Hunter & Bard, 2018), and a point-and-click user interface for model construction is available from the ifaTools package (Pritikin &

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Schmidt, 2016). The software runs on all major operating systems. Source code is developed in public repositories on GitHub.

Declaration of Conflicting Interests

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Supplemental Material

Supplementary material is available for this article online.

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