Bayesian Item Response Modeling 2016 (27-28 October, IOPS 2016)

Lecturer Jean-Paul Fox, University Of Twente.

Tests are used more and more in different fields for various purposes. Together with the increasing demand for testing, improved computer technology made it possible to collect more data, more efficiently, and of higher quality. Parallel to the availability of high-quality data, researchers often need to address challenges such as complex (multilevel) sampling designs, missingness and nonresponse, and complex response behavior. To address these challenges, a Bayesian approach to item response modelling was started in the 1980s. Nowadays, the Bayesian modeling framework is widely used for item response data analysis.

This course will introduce the Bayesian methodology for modelling and analyzing item response data. The important features of the Bayesian approach will be discussed; (1) the powerful simulation-based methods for estimating models and (2) the possibility of incorporating prior information into the analysis. Data examples will be given of basic and more complex item response theory models. Posterior predictive assessment tools will be discussed for model evaluation and specific implementations will be discussed to evaluate the fit of Bayesian item response theory models.

An important extension of the common item response theory models will be discussed, which is typically useful for educational research. For the specific situation where respondents are assumed to be clustered, a multilevel population model will be considered. This leads to a three-level IRT model (multilevel IRT model), where item observations are nested in respondents and respondents nested in clusters. The multilevel modelling framework as well as the integration into the measurement model will be discussed.

The software programs OpenBUGS and R will be introduced and used in the practical sessions. The practical sessions will focus on standard applications but the opportunity will be given to get further acquainted with Bayesian modeling software.

Prior Requirements
To take active part in the practical session, you need to bring your own laptop with OpenBugs (http://www.openbugs.net) and R (http://www.r-project.org/) installed. Some will prefer to work with RStudio (https://www.rstudio.com/products/rstudio).

Literature (recommended):
Fox, J.-P. (2010). Bayesian Item Response Modeling: Theory and Applications. Springer, New York.
Albert, J.H. (1992). Bayesian estimation of normal ogive item response curves using Gibbs sampling. *Journal of Educational Statistics, 17*, 251-269.
Fox, J.-P. and Glas, C.A.W. (2001). Bayesian estimation of a multilevel IRT model using Gibbs sampling. *Psychometrika, 66*, 269-286.
Patz, R.J. and Junker, B. (1999). A straightforward approach to Markov Chain Monte Carlo methods for item response models. *Journal of Educational and Behavioral Statistics, 24*, 146-178.

Short Resume: Jean-Paul Fox (www.Jean-PaulFox.com)

Jean-Paul Fox works at the department of research methodology, measurement and data analysis, at the University of Twente, the Netherlands. He is a researcher in the area of Bayesian item response modelling and author of the monograph Bayesian Item Response Modeling published in 2010. He is known for his work on multilevel IRT modelling, where a multilevel survey design is integrated in the psychometric model. He received the 2001 Psychometric Association Dissertation award for his work on multilevel IRT modelling. He received two personal grants from the Netherlands Organization for Scientific Research to develop psychometric models for large-scale survey research.

A) Thursday (27-10-2016).

1) Lecture.

    a) Introduction to Bayesian Inference (slides).

    b) OpenBUGS (Bayesian Inference Using Gibbs Sampling) (slides).

    c) Bayesian Item Response Modeling (slides).

2) Practical. Exercises.

    a) Learn Bayesian software (Bayes rule, Bayesian inference).

    b) Bayesian IRT in OpenBUGS.

    c) IRT Modeling Exercises.

B) Friday (28-10-2012).

1) Lecture.

    a) Multilevel IRT Modeling (slides).

    b) Response Time Modeling (slides).

2) Practical. Exercises.

    a) Bayesian Model Assessment.

    b) Response Times.

    c) Multilevel IRT Modeling.