Item Response Theory for measurement and explanation

Leuven, June 3 and 4, 2013

Lecturer

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General Description

Item Response Theory (IRT) is a term for a set of models for categorical item response data from educational and psychological tests. The most common of these models are generalized linear and bilinear mixed models. They are typically used for the measurement of abilities, achievement levels, and latent variables in general. However, the range of application is broader than test data. Also other data can be analyzed with IRT models: data from surveys, experiments, and observational studies.

The models can be used also for other purposes than measurement. These other purposes are summarized as explanation: testing hypotheses and exploring the effects of factors one is interested in. For example, when the data are categorical and repeated measures, IRT modeling (logistic and probit mixed modeling) rather than analysis of variance is the more appropriate and more flexible approach.

The typical data set is a person-by-item data set. Also any kind of repeated observations other than item responses qualifies for an IRT analysis.

All models discussed in the course can be reformulated as linear or bilinear regression models with a link function, with covariates (predictors) that have fixed and/or random effects (weights). The models will be presented in four categories:
1. Models for binary data and item covariates, for example, the Rasch model, the linear logistic test model (LLTM), multidimensional extensions, and the two-parameter model.
2. Models for binary data and person covariates, for example, latent regression and multiple-group models, including multilevel models.
3. Models for binary data and person-by-item covariates, for example, models for differential item functioning (DIF) and for local dependence (e.g., serial dependence).
4. Models for ordered-category data, such as rating scale data: the graded-response model, the partial-credit model, and the sequential model.

All models will be explained with their equations and assumptions, and illustrated with an example data set. Three software packages in R will be used: lme4 (Bates, Maechler, & Bolker, 2012), irtoys (Partchev, 2012), and ltm (Rizopoulos, 2012). The models of categories 1, 2, and 3, the sequential model of category 4, and the use of lme4 for these models are explained in De Boeck et al. (2011) and

A hands-on approach will be followed for the course, so that the participants learn how to estimate the models and how to interpret the results. The participants are expected to bring a laptop with R installed and also the packages lme4, irtoys, and ltm. No advance knowledge of R is required. The participants will receive R scripts and data before they come to the training session.

**Schedule**

**Session 1** – Monday, June 3 from 9.30 a.m. till noon
- models of category 1, including the Rasch model and the two-parameter model
- coding of covariates
- model comparison
- item and test information
illustrations and exercises with lme4 and irtoys

**Session 2** – Monday, June 3 from 1.30 p.m. till 4 p.m.
- models of category 2
- estimation of person parameters (latent variables)
illustrations and exercises with lme4 and irtoys

**Session 3** – Tuesday, June 4 from 9.30 a.m. till noon
- models of category 3
- model estimation
illustrations and exercises with lme4

**Session 4** – day 2, Tuesday, June 4 from 1.30 p.m. till 4 p.m.
- models for ordered-category data
- extensions to partially ordered data
- testing the ordinal nature of response scales
illustrations with ltm and lme4

**References**


Practical issues

- Language: English
- It is necessary to sign up using the online form before May 30th.
- Maximum number of participants: 35
- Pricing:
  - PhD students, postdocs, and assistant professors: 20 euro
  - Members of VFO: 100 euro
  - Nonmembers of VFO: 200 euro
- Location:
  - PC room H2, VHI 02.09, in the Van Den Heuvelinstituut, Dekenstraat 2, 3000 Leuven.

  If you are in the Dekenstraat, take the second entrance of the building (see picture below). Take the stairs to the second floor. The PC room is just right of the hall way.

  The Van Den Heuvelinstituut is situated in Dekenstraat 2, 3000 Leuven, and is only 10 minutes walking from the Leuven railway station (see http://googlemapsinterface.kuleuven.be/index.cgi?nbol=50.87467746949778,4.70668515489097&zoomlevel=14&plaatsnaam=Gebouw%3a%20108-01%20Van%20Den%20Heuvelinstituut%20Dekenstraat%20%20LEUVEN &) or map below