Statistical Analysis with Latent Variables

ED231E, Spring 2004

Syllabus

Course Overview:

Analysis with latent variables is a common theme in mainstream statistics, although the term latent variable is not always used to describe such analysis. The term latent variable is more typically encountered in psychometric analyses of social and behavioral science data, where latent variables are used to represent variables without measurement error or hypothetical constructs measured by multiple indicators. This course explores more general features of latent variable analysis. Topics include factor analysis, latent class analysis, random effect growth modeling, multilevel analysis, missing data, finite mixture modeling, and general latent variable analysis with a combination of continuous and categorical latent variables. A unified framework will be presented drawing on the Mplus program.

There is no suitable textbook covering all the topics of the course, but the course content will be covered by lecture notes. The course covers a wide range of topics in order to present relevant analysis opportunities, which means that each topic is presented concisely. Given this, *student attendance at all lectures is necessary* with absences accepted only for strong reasons.

Parts of the categorical variable modeling material is covered in the 1990 Wiley book by Agresti (Categorical Data Analysis), parts of the latent class modeling material is covered in the 1987 Sage Quantitative Applications book (#64) by McCutcheon (Latent Class Analysis) and in the 1987 Griffin book by Bartholomew (Latent Variable Models and Factor Analysis), and parts of the structural equation modeling material is covered in the 1989 Wiley book by Bollen (Structural Equations with Latent Variables). It is up to the student to order any of these books.

Suitable background for the course is regression analysis, categorical data analysis, multivariate analysis, and matrix algebra. Good knowledge of regression analysis is the only required background, but students will clearly get more out of the course the more courses he/she has taken, including structural equation modeling and multilevel modeling.

Assignments typically involve data analyses using the new Version 3 of the Mplus program. For a free demo version of the program, see www.statmodel.com. A user's guide is not necessary, but a summary can be found at the same web site and also in the help menu of the demo version.

A pdf of the handout for the first lecture is available here. For non-UCLA students, handouts for the rest of the course can be ordered from the Mplus web site, www.statmodel.com - see Mplus Short Course Handouts.

WEEK 1 (April 5 & 7)

- **Lecture 1: Overview of course content. A general latent variable modeling framework**

- **Lecture 2: Confirmatory factor analysis**

Muthén, B. (1992). Latent variable modeling in epidemiology. Alcohol Health & Research World, 16, 286-292.

Muthén, B. (2002). Beyond SEM: General latent variable modeling. Behaviormetrika, 29, 81-117. Available as pdf at www.statmodel.com.

WEEK 2 (April 12 & 14)

- **Lecture 3: Multiple-group confirmatory factor analysis**

- **Lecture 4: Structural equation modeling**

WEEK 3 (April 19 & 21)

- **Lecture 5: Introductory growth modeling**

Muthen, B. & Khoo, S.T. (1998). Longitudinal studies of achievement growth using latent variable modeling.

Muthén, B. (2000). Methodological issues in random coefficient growth modeling using a latent variable framework: Applications to the development of heavy drinking. In Multivariate Applications in Substance use Research, J. Rose, L. Chassin, C. Presson & J. Sherman (eds.), Hillsdale, N.J.: Erlbaum, pp. 113-140. (#81)

- **Lecture 6: Growth modeling, cont'd**

  Muthén, B. & Curran, P. (1997). General longitudinal modeling of individual differences in experimental designs: a latent variable framework for analysis and power estimation. Psychological Methods, 2, 371-402.

WEEK 4 (April 26 & 28)

- **Lecture 7: Growth modeling, cont'd**

- **Lecture 8: Growth modeling, cont'd**

WEEK 5 (May 3 & 5)

- **Lecture 9: Introduction to modeling with categorical dependent variables**

- **Lecture 10: Modeling with a preponderance of zeros (zero inflation)**

WEEK 6 (May 10 & 12)

- **Lecture 11: Discrete-time survival analysis**

- **Lecture 12: Discrete-time survival analysis**

WEEK 7 (May 17 & May 19)

- **Lecture 13: Cross-sectional mixture modeling - latent class analysis**

- **Lecture 14: Cross-sectional mixture modeling - latent class regression analysis**

Dillon, W. R. & Goldstein, M. (1984). Multivariate Analysis. Methods and Applications. New York: John Wiley & Sons. Chapter 13: Latent structure analysis.

Hagenaars, J.A. & McCutcheon, A.L. (2002). Applied latent class analysis. Cambridge, UK: Cambridge University Press

Rindskopf. D. & Rindskopf, W. (1985). The value of latent class analysis in medical diagnosis. Statistics In Medicine, 5, 21-27.

WEEK 8 (May 24 & 26)

- **Lecture 15: Longitudinal mixture modeling – latent transition analysis**

- **Lecture 16: Longitudinal mixture modeling - growth mixture modeling**

Muthén, B. (2001). Latent variable mixture modeling. In G. A. Marcoulides & R. E. Schumacker (eds.), New Developments and Techniques in Structural Equation Modeling (pp. 1-33). Lawrence Erlbaum Associates. (#86)

Muthén, B. (2004). Latent variable analysis: Growth mixture modeling and related techniques for longitudinal data. In D. Kaplan (ed.), Handbook of quantitative methodology for the social sciences. Newbury Park, CA: Sage Publications, in press. (#100)

WEEK 9 (June 2)

- **May 31 cancelled due to Memorial Day**

- **Lecture 17: Latent variable modeling with missing data**

WEEK 10 (June 7 & 9)

- **Lecture 18: Multilevel latent variable modeling**

- **Lecture 19: Multilevel latent variable modeling cont'd**

FINAL's WEEK (June 14)

- **Lecture 20: Multilevel mixture modeling**