Longitudinal Modeling

Information

Instructor
•Ken Kelley, Ph.D.
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•Office Hours: Tuesday 8:00–9:30AM and by appointment.

Course
•Y655 (Education) & S655 (Statistics)
Number TBA (TBA–TBA).
•Web Page: `http://www.indiana.edu/~kenkel/courses`.

Time and Location
•Where: TBA.
•We will also meet in the computer laboratory, Room TBA, as indicated.
•When: TBA to TBA each Tuesday and Thursday of the TBA semester.
•Students are expected to attend all classes.

Prerequisites
•Successful completion of a multivariate statistics course.
•A solid understanding of multiple regression and analysis of variance.

Course Description

This course is designed to introduce students to methods of longitudinal data analysis and issues involved with the analysis of repeated measures data. Broadly speaking, the analysis of change is concerned with modeling a collection of trajectories from individuals who have been repeatedly measured on some variable or variables over time. We will discuss the rationale of measuring and trying to understand change and stability over time as a way to study various phenomena. An overview of the historical reasons why measuring change was once considered so difficult and how these difficulties were overcome will motivate the statistical models and techniques for analyzing change that will be covered.

The course will be based on multilevel models (also referred to as hierarchical models, mixed effects models, and random coefficient models) and latent change curves, with a major emphasis on modeling intraindividual change as a precursor to modeling interindividual differences in change. We will discuss how multilevel model and latent growth curve models can be considered special cases of a broader set of a general latent variable model. A major emphasis throughout the course will be on how to choose the appropriate model and technique so that specific questions of interest can be addressed in a methodologically sound way. An overview of time-to-event models will also be provided.

Evaluation

Student evaluation will be based on class participation (5%), quality of assignments (written/thought/laboratory) (35%), article summary and critique (15%), class presentation (10%), and the quality of the final project (35%).

Although the theoretical and abstract issues surrounding the analysis of nested data structures is an integral part of the course, so too is the application of the methods via computer programs (it is not generally possible to do "hand calculations" for longitudinal models). There will be several small and moderate written and thought assignments throughout the semester. Two article summaries of recent work where longitudinal models were used and an article critique are required. These five page double-spaced summaries of research that use multilevel modeling techniques are important in that it connects the course with applied research. Class presentations are required, where students will present an advanced topic that is not covered in the course or provide an in-depth discussion of a topic briefly covered in the course. The final project will require students to find an appropriate data set (ideally one that is in the public domain and related to his or her area of research), and conduct an appropriate set of analyses to answer an appropriate set of questions of interest (more details will be provided as the semester progresses).

The way in which a numeric grade will be determined is governed by the following equation:

$$Grade = .10Participation + .35Assignements + .10Summaries + .15Presentation + .30Project.$$

Because numeric grades are reported as ordinal variables represented by letters, the way in which the numeric grade maps onto letter grades will be as follows:

Numeric Score	*Letter Grade*	*Description of Achievement*
≥ 96	A+	Incredible achievement
91–95.99	A	Outstanding achievement
86–90.99	A−	Excellent achievement
81–85.99	B+	Very good achievement
76–80.99	B	Good achievement
71–75.99	B−	Fair achievement
66–70.99	C+	Not wholly satisfactory achievement
61–65.99	C	Marginal achievement
56–60.99	C−	Unsatisfactory achievement
51–55.99	D	Significant lack of achievement
< 51	F	Complete lack of achievement

Tentative Course Schedule

Date	Topic(s)	Reading(s)
	•Welcome •Discuss Syllabus	•Browse through Singer & Willett (SW)
	•Rationale of longitudinal analysis	•SW, Chapter 1
	•General linear model methods for longitudinal data	•Keselman, et al., 2001
	•Problems with measuring change	•Chronbach & Furby, 1970 •Lord 1956, 1958
	•Structure and Plotting Longitudinal Data	•SW, Chapter 2
	•Modern conceptualization of methods for handling longitudinal data •The multilevel model	•Baltes & Nesselroade, 1979 •Nesselroade, 1991 •Rogosa & Willett, 1985
	•The multilevel model	•SW, Chapter 3 •Bryk & Raudenbush, 1987 •Raudenbush & Bryk, 2002 •SW, Chapter 4
	•Application of longitudinal methods	•Karney & Bradbury, 1995 •Hedeker, Flay, & Petraitis, 1996
	•Missing data issues	•Twisk & de Vente, 2002 •Hedeker & Gibbons, 1997
	•Error structures for multilevel models	•SW, Chapter 7
	•Latent growth curves •Relation of latent growth curves and multilevel models	•SW, Chapter 8 •Curran, 2002 •Mehta & West, 2000
	•The growth mixture model	•Muthén, 2004
	•Nonlinear Multilevel Models	•SW, Chapter 6 •Cudeck, 1996
	•Overview of Dynamical Systems Models	•Boker, 2001
	•Models for time-to-event analyses	•SW, Chapter 9 & 10
	•Class presentations	
	•Epilogue	

References

Required Textbook

Singer, J. D. & Willett, J. B. (2003). *Applied longitudinal data analysis: modeling change and event occurrence.* Oxford University Press: New York, NY. Book web site: `http://gseacademic.harvard.edu/alda/`

Required Articles

See course web site.

Suggested Supplemental Text-Book Resources

Davidian, M. & Giltinan, D. M. (1995). *Nonlinear models for repeated measurement data.* Chapman & Hall: New York, NY

Diggle, P. J., Heagerty, P. J., Liang, K.-Y., and Zeger, S. L. (2002). *Analysis of longitudinal data* (2nd ed.). Oxford University Press: New York, NY

Pinheiro, J. C. & Bates, D. M. (2000). *Mixed-effects models in S and S-Plus.* Springer: New York, NY

Raudenbush, S. W. & Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and data analysis methods* (2nd ed.). Sage: Thousand Oaks, CA

Academic Honesty and Intellectual Integrity

Academic dishonesty of any kind (e.g., cheating, plagiarism, record altering, etc.) will not be tolerated. As stipulated in *General Principles and Policy* section of Indiana University's Academic Handbook (2005, pp. 174–175; which is available in Portable Document Format [i.e., a PDF file] at the following Internet address:
`http://www.indiana.edu/~deanfac/acadhbk/acad_handbk_2005.pdf`):

> The faculty member has a responsibility to foster the intellectual honesty as well as the intellectual development of students. He or she should carefully scrutinize methods of teaching and assignments in order to be sure that they encourage students to be honest....should the faculty member detect signs of plagiarism or cheating, it is his or her most serious obligation to investigate these thoroughly, to take appropriate action with respect to the grades of students, and in any event to report the matter to the Dean for Student Services (or equivalent administrator). The necessity to report every case of cheating, whether or not further action is desirable, arises particularly because of the possibility that this is not the students first offense, or that other offenses may follow it. Equity also demands that a uniform reporting practice be enforced; otherwise, some students will be penalized while others guilty of the same actions will go free. A university is devoted to the discovery and communication of knowledge. In this endeavor, intellectual integrity is of the utmost importance, and correspondingly, its absence is taken very seriously. By enrolling at Indiana University, students commit themselves to its ideals and must expect to find these ideals actively fostered and defended....in order to encourage learning and to judge its quality, examinations and assignments are employed. To evaluate these with justice and fairness, it is necessary that they be executed with complete honesty.

Thus, any incident of academic dishonesty will be reported and the student will be required to complete an alternate form of the particular assignment where the dishonesty occurred.

Syllabus Disclaimer

The information provided on this syllabus is tentative and subject to change. In fact, it will almost certainly change from time to time. Major changes to the syllabus will be noted during lecture.