Antedependence Models for Longitudinal Data

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Longitudinal data analysis has become an extremely important area of statistics, and this is reflected both in the diversity of the real life applications and in the depth of the methods developed for this type of data. This book is the first one dedicated entirely to antedependece models, which are a very rich family of conditional independence models for serially correlated data. Following the ideas of Diggle et al. (2002), the inference problem in longitudinal data is approached first by selecting an appropriate covariance structure (which in most applications is considered as a set of nuisance parameters) and then making inferences on the mean parameters (which generally are the ones of primary interest).

The material presented is well organized. The first chapter presents motivational examples and the concept of antedependence models. The second chapter characterizes more formally the unstructured antedependence models, and shows equivalent ways of defining them. The structured models are presented and discussed in chapter 3, together with related models for serially correlated data. Chapter 4 presents exploratory techniques to identify these models, and shows examples of both numerical and graphical diagnostic tools. Formal likelihood-based inference is presented in chapters 5-7. Chapter 5 introduces estimation techniques for different mean models, both for complete and incomplete data (including several patterns of missing data common in longitudinal data). Chapter 6 presents hypothesis tests and related tools (such as penalized likelihood criteria) for the covariance structure, and chapter 7 approaches the problem of testing hypotheses on the mean parameters. The use of most of the techniques presented is illustrated in the four data sets presented in chapter 1, and chapter 8 integrates these examples into case studies for each of the data sets. Chapter 9 presents some additional topics and extensions. Several matrix results and more technical proofs are presented as appendices.

Several relevant R functions are available for download from the first author's webpage (http://www.stat.uiowa.edu/∼dzimmer), and the authors are making available and documenting more in the near future. This is very important for applications, since there is little software developed for these models, and applied researchers will be very satisfied with the availability of R functions to fit antedependence models to their data.

The book is geared towards statisticians (both theoretical and applied) and other researchers in application areas (medicine, epidemiology, animal science, forestry, ecology) with experience in linear models, multivariate analysis, and/or longitudinal data analysis. For graduate students in statistics or biostatistics, the book is very useful as a supplementary material in a course on longitudinal data analysis, or it could be the basis of a special topics course on antedependence models.

In summary, this book is a welcome addition to the bibliography of longitudinal data, combining rigorous statistical presentation with interesting real life examples.

References

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

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