SURVIVAL ANALYSIS. TECHNIQUES FOR CENSORED AND TRUNCATED DATA (2nd ed.)

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This book is a second edition of a good reference on survival analysis. It combines theoretical concepts with real data sets helping to understand key concepts defined in each section. Moreover there are two special subsections at the end of sections: *Practical Notes* and *Theoretical Notes.* The first one is about examples used in the literature related with the main issue of each section, or software indications and program code for techniques not include in standard software. The second one includes some theoretical extensions of the key concepts defined in the section. At the end of each chapter there is a good collection of exercises with a selection of solutions in Appendix E, a new section of this second edition of the book.

Because all of these points emphasized above, the book is suitable for teaching specialized courses on survival analysis and as a support in practical research, mainly in biology and medicine.

The book includes five major themes:

- Basic concepts and terminology
- Estimation of summary survival statistics based on censored and /or truncated data
- Hypothesis testing
- Regression analysis for censored and/or truncated data
- Multivariate models for survival data

These issues are divided into thirteen chapters summarized as follows:

The first chapter contains a brief introduction to censoring and presents 19 datasets of survival data used throughout the book.

Chapter 2 defines the basic tools used in modeling survival data as well as common parametric models for time and regression models for survival data with covariates. A new section about models for competing risks has been added to this second edition of the book.

Chapter 3 deals with the issued of censoring and truncation. Various categories of censoring are introduced, mainly centered on types of left and right censoring schemes. Truncation is also defined as a feature of survival data. The last two sections are about some theoretical results of survival analysis: likelihood construction for censored and truncated data and counting processes.

Chapter 4 is about nonparametric estimation of the distribution of time to some event, based on right-censored data. Apart from the known Kaplan-Meier curve, we emphasize the sections about confidence intervals for survival function and the point and interval estimates of mean and median survival time. This second edition of the book includes a new section on nonparametric estimation of time for the case of competing risks.

Basic tools for other types of censoring such as left, double or interval censored are introduced in chapter 5.

In chapter 6 there are two issues for the univariate estimation of the survival time: how crude estimates of the hazard rate can be smoothed to provide a better estimator of the hazard rate, and a Bayesian nonparametric approach as an alternative to the classical approach to estimating survival curves.

Hypothesis testing for survival and hazard functions are introduced in chapter 7. There is a detailed list of statistics used for one-sample tests and two and more sample tests to compare hazard rates and survival curves. The last section is new with respect to the previous edition. It introduces tests for comparing survival curves at a predetermined fixed point in time

Chapters 8 and 9 are about the proportional hazards model. Here we emphasize the second and the sixth sections in chapter 8. Section two is about coding and interpreting qualitative variables as covariates in a proportional hazards model. Section 6 is about discretizing continuous variables in order to draw conclusions like qualitative variables.

Main differences of this edition are in chapter 10 about additive hazards regression models. In this edition two models are presented: Aalen's nonparametric additive hazard model and Lin and Ying's additive hazard model. In this chapter there are included sections about additive hazards models of chapter 11 of the first edition.

Chapter 11 introduces methods to obtain regression diagnostics for the Cox model based on residual plots: checking the adequacy of the proportional hazards assumption, checking the accuracy of the proportional hazards model for predicting the survival of a given subject and, examining the influence that each subject has on the model fit.

Alternative regression models to Cox's proportional hazards are introduced in chapter 12. Apart from the usual accelerated failure-time models a linear model in log-time is also considered.

The last chapter deals with multivariate survival analysis. The starting point is on frailty models as a method to control the association between individual survival times. The final section gives a very brief introduction to marginal modeling for each individual.

The book finishes with appendices about specialized issues.

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