Course guide
200629 - ASA - Advanced Topics in Survival Analysis

Last modified: 08/06/2023

Unit in charge: School of Mathematics and Statistics
Teaching unit: 715 - EIO - Department of Statistics and Operations Research.

Degree: MASTER'S DEGREE IN STATISTICS AND OPERATIONS RESEARCH (Syllabus 2013). (Optional subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: GUADALUPE GÓMEZ MELIS

Others: Segon quadrimestre:
GUADALUPE GÓMEZ MELIS - A
KLAUS GERHARD LANGOHR - A

PRIOR SKILLS

Students must know the basic concepts of survival analysis These concepts include: Censored data, Likelihood in the presence of censoring, Continuous parametric distributions other than normal, Kaplan-Meier survival estimator, Log-rank test, Accelerated Failure Time Model, Cox proportional hazards model and Diagnostic of the Cox Regression model. The student can find these concepts in chapters 2-4, 7-8, 11-12 in the book "Survival analysis: techniques for censored and truncated data" by Klein and Moeschberger. These topics could have been self-learnt, in the first semester Lifetime Data Analysis course or in other undergraduate or postgraduate courses.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE-1. Ability to design and manage the collection of information and coding, handling, storing and processing it.
2. CE-2. Ability to master the proper terminology in a field that is necessary to apply statistical or operations research models and methods to solve real problems.
3. CE-3. Ability to formulate, analyze and validate models applicable to practical problems. Ability to select the method and / or statistical or operations research technique more appropriate to apply this model to the situation or problem.
4. CE-4. Ability to use different inference procedures to answer questions, identifying the properties of different estimation methods and their advantages and disadvantages, tailored to a specific situation and a specific context.
5. CE-5. Ability to formulate and solve real problems of decision-making in different application areas being able to choose the statistical method and the optimization algorithm more suitable in every occasion.
Translate to english
6. CE-6. Ability to use appropriate software to perform the necessary calculations in solving a problem.
7. CE-7. Ability to understand statistical and operations research papers of an advanced level. Know the research procedures for both the production of new knowledge and its transmission.

Transversal:
8. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

9. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

TEACHING METHODOLOGY

Lectures are organized into two types:

a) Theoretical sessions in which the teacher presents and discusses the general learning objectives and basic concepts. These concepts are motivated with real case studies. The support material used will be published in advance in Atenea (syllabus, content, slides, examples, scheduled assessment activities, references, ...)
Students will give a presentation of their own data (if any) if related with the contents of the course.

b) Laboratory classes. These sessions focus on the practical aspects of the methodology. Software R is available for the students and they can continue laboratory sessions in their hours of self study.

Students must devote enough time to complement the lectures by reading research papers, solving problems, learning relevant software, etc.

LEARNING OBJECTIVES OF THE SUBJECT

The course Advanced Survival Analysis prepares students to address situations, often based on teachers' experience, in which the data presents complex patterns of censoring, where the covariates could vary over time, the multivariate analysis of two or more times to an event as well as competing risks and multistate models.

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	24.00
Hours small group	15,0	12.00
Self study	80,0	64.00

Total learning time: 125 h

CONTENTS

B1: Beyond the Cox Model

Description:
B1. Assessing the PH assumption. The stratified Cox model. Cox proportional model for time-dependent covariates. Frailty models.

Full-or-part-time: 30h 30m
Theory classes: 7h 30m
Laboratory classes: 3h
Self study : 20h

B2: Multivariate Survival Analysis

Description:
B2. Multivariate parametric models. Copulas. Sequential and parallel data.

Full-or-part-time: 41h 40m
Theory classes: 12h
Laboratory classes: 3h
Self study : 26h 40m

B3. Competiting Risk Analysis and Multistate Models

Description:
Cumulative incidence function, cause-specific hazards, transition probabilities and intensities,, Chapman-Kolmogorov equations, prediction.

Full-or-part-time: 27h 10m
Theory classes: 6h
Laboratory classes: 3h
Self study : 18h 10m

B4: Interval Censoring

Description:
B3. Interval censoring
Interval censoring types. Nonparametric estimation of the survival function. Self-consistency algorithm. Comparison of survival curves. Regression models. Interval censoring in the covariants.

Full-or-part-time: 25h 40m
Theory classes: 6h
Laboratory classes: 3h
Self study : 16h 40m

GRADING SYSTEM

CONTINUOUS EVALUATION: Blocks B1, B2, B3 and B4 of the subject will be evaluated independently on the dates provided in the planning document, resulting in grades N1, N2, N3 and N4. The final grade of the course, NF, will be the average of these scores, ie NF = (N1 + N2 + N3 + N4) / 4.

SINGLE EVALUATION: A final exam is planned that will jointly evaluate the contents of the 4 blocks.

EXAMINATION RULES.

The student will be informed at the beginning of the course on the dates of each deliverable

BIBLIOGRAPHY

Basic:
- Crowder, Martin J. Multivariate survival analysis and competing risks. Chapman & Hall book, cop. 2012. ISBN 9781138199606.
- Hougaard, Philip. Analysis of multivariate survival data. New York: Springer, cop. 2000. ISBN 0387988734.
- Sun, Jianguo. The Statistical analysis of interval-censored failure time data [on line]. Springer, cop. 2006 [Consultation: 04/07/2023]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/0-387-37119-2. ISBN 9780387329055.
- Kleinbaum, David G.; Klein, Mitchel. Survival Analysis. A self-learning text. 3d. New York: Springer, cop. 2012. ISBN 9781441966452.
- Cook, Richard J.; Lawless, Jerald F. Multistate models for the analysis of life history data. Taylor & Francis Group, 2020. ISBN 9780367571726.

Complementary:
- Li, Jialiang; Ma, Shuangge. Survival analysis in medicine and genetics [on line]. Boca Raton: Chapman & Hall/CRC biostatistics series, cop. 2013 [Consultation: 04/07/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=1683205. ISBN 9781439893111.
- O'Quigley, John. Proportional hazards regression [on line]. New York: Springer, cop. 2008 [Consultation: 04/07/2023]. Available on:

http://link.springer.com.recursos.biblioteca.upc.edu/book/10.1007%2F978-0-387-68639-4. ISBN 9780387251486.
- Gómez, G.; Calle, M.L.; Oller, R.; Langohr, K.. "Tutorial on methods for interval-censored data and their implementation in R". Tutorial on methods for interval-censored data and their implementation in R [on line]. 2009; 9(4): 259¿297 [Consultation: 07/07/2023]. Available on: https://www.proquest.com/docview/203142212?parentSessionId=stlkK%2BTCikeBUj8MX8dhoIBLT66sinjUmm3t9AMfzhQ%3D&pq-origsite=primo&accountid=15300.- Lawless, Jerald F. Statistical models and methods for lifetime data. 2n ed. Wiley, cop. 2003. ISBN 0471372153.
- Nelsen, Roger B. An Introduction to copulas [on line]. 2nd. New York: Springer, 2006 [Consultation: 04/07/2023]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/0-387-28678-0. ISBN 9780387286785.
- Hout, Ardo Van den. Multi-state survival models for interval-censored data [on line]. Boca Raton: Chapman & Hall/CRC, 2017 [Consultation: 04/07/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=4748347. ISBN 9781466568402.