
Survival Analysis

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TU Dortmund University

Based on earlier work by: F. Scheipl, M. Herrmann, A. Bender, L. Fahrmeir, T. Hothorn, G. Kauermann, H. Küchenhoff, B. Sischka, S. Thiemichen (all LMU Munich).

General Information

Suitable modules: MS 6 / 7; MD Methods; ME 7

Homepage:

- URL: <https://moodle.tu-dortmund.de/course/view.php?id=29346>
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General Information

Lecture (Andreas Groll):

Dates: Tuesday 16-18 pm, Thursday 16-18 pm

Please note that due to the ongoing SARS-CoV-2 pandemic the course is planned to take place as a live webinar via **Zoom**. The lecture will be transmitted at the above mentioned times. If it turns out that due to connection problems or other issues this is not working properly, the lecture mode might be changed.

Exercises (Guillermo Briseño Sanchez):

Date: t.b.a.

The exercises will consist of the usual sheets, solutions, as well as a time slot on Wednesdays dedicated to questions.

General Information

Final Exam:

- Date: to be announced
- ECTS: 9
- Room: to be announced
- Language: English
- **Mandatory:** Registration via BOSS opens \approx 1 month before the exam

What is Life-time Data Analysis (LDA)?

- LDA is a collection of statistical procedures to investigate data where “the outcome variable of interest is *time until an event occurs*” (Kleinbaum, 2005)
- A more general name would be *Time-to-Event Analysis*

What is Life-time Data Analysis (LDA)?

- Historically, the first applications of time-to-event analysis considered the outcome *time until death*, thus called *Survival Analysis*
- Other synonyms:
 - event history analysis
 - duration models
 - failure time models

What is Life-time Data Analysis (LDA)?

- **time** until an event can be measured on different scales
 - years
 - milliseconds
 - days
 - ...
- possible **events** include
 - Death after operation (yes/no)
 - Recidivism (Rearrest after release from prison)
 - Leaving a web page (after following a link on social media)
 - ...

→ In LDA we observe an outcome tuple $\langle time, event \rangle$

Outline

1. Introduction and basics

- Examples
- Duration time distributions
- Censoring

2. Estimation of survival function and hazard rate

- Non-parametric estimation
- Parametric estimation
- Log-rank test

Outline

3. Part a) **Regression models**

- Transformation models (AFT models)
- Cox Proportional Hazard Models
- Time-Dependent Covariates
- Time-Varying Effects

Outline

3. Part b) **Extending (semi-)parametric regression models**

- Time-discrete Survival Model
- Piece-wise Exponential (Additive Mixed) Model
- Frailty and Heterogeneity

4. (& 5.) **Further Models**

- Aalen Additive Hazard Model
- Competing Risk Model

6. **Extensions**

- ... (depending on how much time there will be left)

References

- Klein, John P., and Melvin L. Moeschberger (1997). *Survival Analysis: Techniques for Censored and Truncated Data*. Springer.
- Therneau, Terry M., and Patricia M. Grambsch (2001). *Modeling Survival Data: Extending the Cox Model*. Springer.
- Kleinbaum, David G. and Mitchel Klein (2011). *Survival Analysis*. Springer.
- Moore, Dirk F. (2016). *Applied Survival Analysis Using R*. Springer.
- Tutz, Gerhard, and Matthias Schmid (2016). *Modeling Discrete Time-to-Event Data*. Springer.
- Beyersmann, Jan, Arthur Allignol, and Martin Schumacher (2012). *Competing Risks and Multistate Models with R*. Springer.