Flexible penalized hazard model for time-to-event data

Instructor
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Full-day course

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Abstract

Regression models often deal with one or several continuous covariates whose functional forms and interaction structure are crucial elements in the modelling process. The analysis of time-to-event data is no exception as it requires modelling baseline hazard, nonlinear functional forms, time-dependent (or non-proportional) effects, and interactions between continuous covariates. Fully parametric flexible hazard models, for which all the above elements are parametrically specified, are attractive because they allow efficient inference via full likelihood and provide a useful measurement of the absolute effect through the description of the dynamics of the hazard.

This course will present a recent method that allows modelling in a flexible way the baseline hazard, the functional forms, the time-dependent effects, and the interactions between continuous covariates using penalized splines. The method will be accompanied by several examples in R. Extension to excess hazard models will also be addressed and illustrated in the context of cancer epidemiology.

All applications will be performed with R package survPen.

Course Outline

The course will include a theoretical and a practical session.

1. In the theoretical session, we will present key aspects of flexible parametric hazard models focusing on the notion of dynamics of the hazard. Then we will present penalized hazard models and their extension to excess hazard models.

2. In the practical session, participants will learn how to fit suitable models on real data using R package survPen, how to properly predict various outcomes from their fitted models and how to graphically assess the validity of their models.

Target Audience

The course is presented at a level that can be handled by all statisticians/biostatisticians, or epidemiologists and medical researchers who are familiar with regression analyses, including survival models. Experience with R software is also required.

For the practical session, participants should bring their laptop with R and the package survPen (https://CRAN.Rproject.org/package=survPen) installed prior to the course.

References:

Fauvernier M., Roche L., Uhry Z., Tron L., Bossard N., Remontet L. Multi-dimensional penalized hazard model with continuous covariates: applications for studying trends and social inequalities in cancer survival. Journal of the Royal Statistical Society, Series C (Applied Statistics). 2019 ;doi: https://doi.org/10.1111/rssc.12368.

Remontet, L., Uhry, Z., Bossard, N., Iwaz, J., Belot, A., Danieli, C., Charvat, H., Roche, L., and the CENSUR Working Survival Group (2019). Flexible and structured survival model for a simultaneous estimation of non-linear and non-proportional effects and complex interactions between continuous variables : Performance of this multidimensional penalized spline approach in net survival trend analysis. Statistical Methods in Medical Research, 28(8) :2368–2384. doi : https://doi.org/10.1177/0962280218779408.

Fauvernier M., Remontet L., Uhry Z., Bossard N., Roche L. survPen: an R package for hazard and excess hazard modelling with multidimensional penalized splines. Journal of Open Source Software. 2019;doi: https://doi.org/10.21105/joss.01434.