Title: Joint Models for Longitudinal and Survival Data

Description:
In follow-up studies, multiple types of outcomes are typically measured for each subject. These include longitudinally measured responses (e.g., biomarkers) and the time until an event of interest occurs (e.g., death, cancer recurrence). These outcomes are often analyzed separately, but their interrelationship is frequently of scientific interest too, and joint models provide a means to explore it.

Joint models for longitudinal and time-to-event data are an attractive framework for analyzing follow-up data in two main settings. First, when the focus is on a survival outcome and we want to account for the effect of endogenous time-dependent covariates measured with error. Second, when the focus is on a longitudinal outcome and we need to correct for nonrandom dropout.

This course will provide a comprehensive introduction to the joint modeling framework. I will explain when these models should be used in practice, the key assumptions behind them, and how they can be utilized to extract relevant information from data. The course features some examples showcasing the use of JMbayes2.

JMbayes2 (https://drizopoulos.github.io/JMbayes2/) is a powerful and user-friendly R package for longitudinal and time-to-event data that aims to streamline analyses performed by applied researchers in their everyday practice. It enables the user to:

- include multiple longitudinal outcomes with different probability distributions;
- accommodate different event time processes, such as competing risks and multi-state or recurrent events;
- link the longitudinal outcomes to the risk of the events of interest using various functional forms, such as the underlying value or slope; and
- derive individualized dynamic predictions from the fitted joint models.

In addition to model-fitting functions, the package includes several tools for summarizing and visualizing results and performing model diagnostics.

At the end of the course, participants will be able to identify settings in which a joint modeling approach is required, define appropriate joint models to answer their research questions, fit joint models in R using JMbayes2, and correctly interpret the results.

Outline:

1. Introduction
2. Linear Mixed-Effects Models
3. Relative Risk Models
4. The Basic Joint Model
5. Extensions of Joint Models
6. Dynamic Predictions

Prerequisites:
This course assumes knowledge of basic statistical concepts, such as standard statistical inference using maximum likelihood and regression models. Basic knowledge of R will also be beneficial but is not required. Participants should bring their laptop with the battery fully

charged. Before the course, instructions will be provided on how to install the required software.