Introduction

At the end of this chapter, students should be able to

- formulate the null and alternative hypotheses attached to a problem statement;
- undertake hypothesis tests;
- understand and correctly interpret p-values and confidence intervals;
- perform an exploratory data analysis and list the most important features of a dataset.

Linear regression

At the end of the chapter, students should be able to

- interpret the coefficients of a linear model (binary, continuous and categorical variables);
- fit the model by least squares (using dedicated software), correctly accounting for categorical variables;
- test for statistical significance of model parameters as well as global significance;
- list the assumptions of the linear model and understand their meaning;
- use graphical diagnostic tools to validate the model assumptions;
- obtain predictions from the model using software; understand the distinction between estimated mean and predicted values;
- interpret the coefficients of the log-linear model on a meaningful scale;
- interpret and test the significance of interaction terms between continuous and categorical variables, as well as between two categorical variables;
- conceptualize the notion of collinearity and understand its impacts on statistical inference.
- test for equality of means in multiple (sub-groups) and also mean differences between groups with one or two factors;

Likelihood-based modelling

At the end of the chapter, students should be able to:

- understand what the likelihood represents;
- understand the maximum likelihood principle;
- perform likelihood ratio tests for two nested models using software output;
- use information criteria to compare two non-nested models.

Generalized linear models

At the end of the chapter, students should be able to

- write the equation linking predictors and parameters for Poisson, binomial and normal generalized linear models with canonical link function;
- understand the relationship between mean and variance in generalized linear models;
- interpret parameters of the Poisson and negative binomial models;
- test for overdispersion in Poisson models using likelihood ratio tests;
- assess the quality of the fit of a Poisson model using the deviance statistic;
- test independence in contingency tables using a saturated Poisson model.
- interpret software output for generalized linear models and the respective merits of different functions;
- interpret parameters of logistic regression models in terms of log-odds.
- model success rate for aggregated data using a Poisson regression with an offset or a binomial generalized linear regression and correctly interpret the rates.

Compiled 29/06/2020 at 20:24

Correlated and longitudinal data

At the end of the chapter, students should be able to

- understand how correlation appears in grouped or longitudinal data;
- correctly calculate summary statistics for repeated data;
- adjust models with compound symmetry, first-order autoregressive or unstructured correlation structures;
- write correlation and covariance models for main models and understand their parametrization;
- perform tests to compare covariance structures (for nested models) or using information criteria;
- understand group heteroscedasticity and how to account for it.

Linear mixed models

At the end of the chapter, students should be able to

- understand the concept of group-effect;
- know in which context to use random group-effects as opposed to fixed group-effects (covariates constant within group, large number of groups with few observations in each);
- write down the equation of the mixed model with random-intercept(s) and random-slope(s);
- write down the model assumptions (linearity, covariance within-group and between-group, etc.);
- write the covariance matrix of observations given parameter estimates (sum of covariance matrices of random effects and errors);
- distinguish between the adequate structures for correlated and longitudinal data;
- distinguish predicted (marginal) mean and individual predictions with random effects (conditional);
- obtain predictions for new observations from mixed models using dedicated software.

Introduction to survival analysis

At the end of the chapter, students should be able to

- explain key concepts (truncation, censoring) arising in survival analysis in your own word;
- recognize scenarios with random right censoring and provide examples of the latter;
- interpret a Kaplan–Meier nonparametric estimate of the survival function;
- compare and test for equality of survival curves using a score test;
- adjust a Cox model and check for significance of the model parameters.

Compiled 29/06/2020 at 20:24