Methods 4: Bayesian Computational Modelling

Overview

This course wraps up the series of methods courses. We look at modelling from a birds-eye view, introducing advanced concepts and revisiting methods introduced in earlier courses from a comprehensive Bayesian perspective. We introduce causal reasoning using 8 (DAGs), mixture models, Gaussian processes, learn to deal with measurement error and missing data; and we revisit regression modelling, generalized linear models, multilevel modelling, Markov chain Monte Carlo sampling, learning to implement them using probabilistic programming.

Materials and Literature

The course is based on the textbook *Statistical Rethinking* (2nd edition, 2020) by Richard McElreath[1]. Please get a copy. The book's homepage contains lots of additional resources. In particular, please install the R package `rethinking`. Slides and recordings of the author's current course and of a previous version from 2019 are also available.

[1]McElreath, R. (2020). *Statistical Rethinking: A Bayesian Course with Examples in R and Stan (2nd ed.)*. Chapman and Hall/CRC. doi:10.1201/9780429029608

Lesson Plan

Course week	Week of year	Topics and readings
1	5	Statistical models (chapters 1,2)
2	6	Distributions and sampling (chapters 2,3)
3	7	Gaussian models and linear regression (chapter 4)
4	8	Several predictors, directed acyclic graphs (chapters 5)
5	9	Causal inference (chapter 6)
6	10	Model comparison (chapter 7)
7	12	Interactions (chapter 8)
8	13	Markov chain Monte Carlo, maximum entropy (chapters 9, 10)
9	14	Generalized linear models (chapters 11)
10	16	Mixture models, ordered categorical outcomes/predictors (chapter 12)
11	17	Multilevel models (chapter 13)
12	18	Varying slopes, Gaussian processes (chapter 14)
13	19	Measurement error, missing data, theory-driven models (chapters 15, 16)