Bayesian statistics with R, 1.5 HEC (SM00116)

Spring 2021

Innehållsförteckning

General information

Time table

Activity	Date	Time
Lecture 1	Mon 15/3	9-11
Lecture 2	Tues 16/3	9-11
Computer lab 1	Tues 16/3	14-16
Lecture 3	Fri 19/3	9-11
Lecture 4	Mon 22/3	9-11
Computer lab 2	Mon 22/3	14-16
Lecture 5	Wed 24/3	9-11
Computer lab 3	Wed 24/3	14-16

Zoom links available on Canvas course page and will be distributed via email.

Course contents

Below are the topics/concepts listed that will be briefly covered during the course:

Probability and statistical models
Inference on statistical models
Frequentist Sampling distribution
Recap on Logistic regression
P-value
Definition of probability
Prior probability
Likelihood
Bayes formula
Calculation of the posterior distribution
Estimation, interval estimation and hypotheses testing
Bayes factors
Posterior predictive distribution
Different types of prior distributions
Bayesian learning
Frequentist violation of the likelihood principle
Multi-level models

Suggested reading/videos

Below reading/watching is not mandatory but only suggestions.

You can start by reading *Wagenmakers* and then *van de Schoot*. Then you can look at the videos marked with a red star (*)

The videos with lectures of the McElreath course are great and enjoyable:

https://youtube.com/playlist?list=PLDcUM9US4XdNM4Edgs7weiylguLSToZRI

General

Wagenmakers E-J, Morey RD, Lee MD. Bayesian Benefits for the Pragmatic Researcher. Current Directions in Psychological Science. 2016;25(3):169-176. https://doi.org/10.1177/0963721416643289

van de Schoot, R., Depaoli, S., King, R. *et al.* Bayesian statistics and modelling. *Nat Rev Methods Primers* **1,** 1 (2021). https://doi.org/10.1038/s43586-020-00001-2

(some parts in this article are a bit hard I think. You can read page 1-7 and 13-16).

Kruschke, J.K 2015, Doing Bayesian Data Analysis, Chapter 2.

R code for available here: https://bookdown.org/content/3686/introduction-credibility-models-and-parameters.html

Frequentist sampling distribution

* This video: https://youtu.be/7WOxSh-QcA0

Calculation of the posterior distribution

* This video: https://youtu.be/EHqU9LE9tg8

* This Video: https://youtu.be/CfpRdmddVPM

Hypothesis testing and bayes factor

Makowski, D., Ben-Shachar, M. S., Chen, S. H. A., & Lüdecke, D. (2019). *Indices of Effect Existence and Significance in the Bayesian Framework*. 10.3389/fpsyg.2019.02767

Makowski, D., Ben-Shachar, M. S., & Lüdecke, D. (2019). *bayestestR: Describing Effects and their Uncertainty, Existence and Significance within the Bayesian Framework*. Journal of Open Source Software, 4(40), 1541. https://doi.org/10.21105/joss.01541

Frequentist violation of the likelihood principle

This topic is more advanced and optional to study

This Video (especially starting at 7:15 minutes) : https://youtu.be/lh5btlAvrLs

Wagenmakers, E-J et al, Bayesian Versus Frequentist Inference (in: *Bayesian Evaluation of Informative Hypotheses*, pp 181-207) , 2008, ISBN 978-0-387-09612-4:

https://www.ejwagenmakers.com/2008/BayesFreqBook.pdf

Hierarchical (multi-level models) models

This topic is more advanced and optional to study

McElreath, R. Statistical Rethinking, 2nd ed, Chapter 13. (or 1st ed, Ch 12)

Video presentation:

Part 1:

https://youtu.be/AALYPv5xSos

R code for available here:

https://bookdown.org/content/4857/models-with-memory.html#example-multilevel-tadpoles

https://bookdown.org/content/3890/multilevel-models.html

Additional optional material

An Introduction to Bayesian Thinking. A Companion to the Statistics with R Course:

https://statswithr.github.io/book/

Bayesian Basics, Clark, M.:

https://m-clark.github.io/bayesian-basics/

Statistical rethinking with brms, ggplot2, and the tidyverse: Second edition, Kurz, S:

https://bookdown.org/content/4857/

Doing Bayesian Data Analysis in brms and the tidyverse, Kurz, S:

https://bookdown.org/content/3686/

An Introduction to Bayesian Data Analysis for Cognitive Science, Nicenboim, B, et al:

https://vasishth.github.io/bayescogsci/book/

An introduction to Bayesian multilevel models using brms, Nalborczyk, L:

https://www.barelysignificant.com/phd_thesis/appendix-brms.html