Bayesian Statistics – AS 2021

People, Place, Time

Lecturer: Fabio Sigrist, fabio.sigrist@math.ethz.ch

Place: HG G 3 (Zoom link: https://ethz.zoom.us/j/99792909658)

Time: Tuesday, 16.15 – 18.00

Course Schedule (subject to minor modifications)

Week	Date	Topic
1	21.09.2021	Introduction, Bayes formula, basics of Bayesian statistics, interpretations of probability
2	28.09.2021	Point estimation and decision theory, testing, Bayes factor
3	05.10.2021	Credible sets, Bayesian asymptotics, likelihood principle, conjugate priors
4	12.10.2021	Non-informative priors, improper priors, Jeffreys prior
5	19.10.2021	Reference prior, expert priors, priors as regularizers
6	26.10.2021	Hierarchical Bayes models
7	02.11.2021	Empirical Bayes
8	09.11.2021	Bayesian linear regression model & model selection
9	16.11.2021	Laplace approximation, independent Monte Carlo methods
10	23.11.2021	Rejection sampling, importance sampling, basics of Markov chain Monte Carlo
11	30.11.2021	MCMC, Gibbs sampler, Metropolis-Hastings algorithm
12	07.12.2021	Adaptive MCMC, Hamiltonian Monte Carlo
13	14.12.2021	Sequential Monte Carlo, approximate Bayesian computation, Gaussian processes
14	21.12.2021	reserve / buffer

Exercise Schedule

There are no exercise lessons for this course. Nonetheless, exercise series will be provided on the course webpage. Solutions will also be provided on the course webpage, but they will not be discussed in class. For some of the exercises, the statistical software R is recommended.

Series	Topic	Hand out	Hand in
1	Posterior predictive distribution, Bayesian decision theory, Bayesian testing, Bayes factor	28.09.2021	05.10.2021
2	Credible intervals, conjugate priors, improper priors	12.10.2021	19.10.2021
3	Jeffreys prior, reference prior, expert priors	26.10.2021	02.11.2021
4	Empirical Bayes, Bayesian regression model	09.11.2021	16.11.2021
5	MCMC: Gibbs sampler, random walk Metropolis algorithm	30.11.2021	07.12.2021
6	Hamiltonian Monte Carlo	14.12.2021	21.12.2021

Software

Some examples in the lecture and exercises will be based on the statistical software R. This is a freely available open-source software that works on all platforms. It can be downloaded from CRAN (http://cran.r-project.org/).

Written Material

A script as well as the slides used in the course are available on the course webpage. Exercises as well as solutions will also be provided on the course webpage.

Exam

There will be a 20-minutes oral exam during the regular ETH exam sessions. It covers all topics which were discussed and/or applied during either the lectures or the exercises. Upon successfully passing the exam, the students will be awarded 4 ECTS credit points.

PhD students who would like to obtain credit points but do not need to take the exam and thus obtain no grade need to hand in at least five well-solved exercises no later than the corresponding due date. Exercises should be handed in by email to **Drago Plecko (drago.plecko@stat.math.ethz.ch).**

Literature

- Christian Robert, The Bayesian Choice, 2nd edition, Springer 2007.
- I A. Gelman et al., Bayesian Data Analysis, 3rd edition, Chapman & Hall (2013)