Bayesian Models in Statistics (61206)

Instructors: I. NTZOUFRAS

Core Course, 2nd semester, 4 ECTS units
Course level: Graduate (MSc)
Language: English

Course Description

This course will provide the introduction to the Bayesian approach in statistics both from the theoretic and the computational perspective using R and WinBUGS.
The course syllabus includes:
Bayesian inference. Conjugate Analysis. Simulation and random number generation. Markov models and hidden Markov (MCMC) methods. Metropolis-Hastings algorithm, Gibbs sampling. Introduction to WinBUGS. Bayesian inference for Regression and GLMs. Hierarchical models. Bayesian model and variable selection.

Prerequisites

The students should have a good quantitative and computational background. Specifically, knowledge in the fields of calculus, probability/distribution theory, statistical modelling and R programming will be necessary for this course.

Target Learning Outcomes

Upon completion of the course, students will be able to:
1) Understand the basic theory and philosophy of Bayesian Statistics
2) Understand the basic notions of Bayesian computation
3) Analyze data using WinBUGS
4) Build models (glm and hierarchical) in WinBUGS
5) Perform Bayesian variable selection using WinBUGS and BAS package in R.

Recommended Bibliography

- Ntzoufras, I. (2009). Bayesian Modeling Using WinBUGS. Wiley. Hoboken. USA.
- Carlin B. and Louis T. (2008), Bayes and Empirical Bayes Methods for Data Analysis. 3rd Edition, London: Chapman and Hall.
- Gelman A., Carlin J.B., Stern H.S., Dunson, D.B., Vehtari, A. and Rubin D.B. (2013). Bayesian Data Analysis. Third Edition. Chapman and Hall/CRC.
- P. Dellaportas and P. Tsiamyrtzis, "Introduction to Bayesian Statistics" (in Greek)

Teaching and Learning Activities

- Live teaching in a lecture room or computer labs
- Informal labs for using R and WinBUGS/OpenBUGS/JAGS
- Evaluation of current knowledge using Kahoot web game
- Interim optional exercises
- Personalized assignment/project

Assessment and Grading Methods

The course is examined by a big project/assignment that contributes 100% of the final grade. The students can break the final outcome/assignment in smaller landmark exercises (optional) that will help him to construct the final project report.