Bayesian Data Analysis (m62213p)

Instructor: **I. Ntzoufras**

Elective Course, 4th semester, 5 ECTS units

Course level: Graduate (MSc)

Language: Greek (or English if foreign students attend)

Course Description

This course provideσ an introduction to the Bayesian statistics and data analysis both from the theoretic and the computational perspective using R and WinBUGS/STAN. The course syllabus includes Bayesian inference, conjugate Analysis, simulation and random number generation, Markov chain Monte Carlo (MCMC) methods, Introduction to WinBUGS/STAN, Bayesian inference for Regression and GLMs, Hierarchical models, Bayesian model and variable selection. All methods are used to analyze real datasets and cases.

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/STAN
4) Build models (glm and hierarchical) in WinBUGS/STAN
5) Perform Bayesian variable selection using WinBUGS/STAN and 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/STAN
- Evaluation of current knowledge using quizizz 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.