UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Bayesian Statistics M

2627-1-F8206B020

Learning objectives

The course aims at giving the fundamental concepts of the Bayesian approach to inference together with an overview of some widespread models.
The course, by introducing the fundamentals of Bayesian inference, contributes to the achievement of the educational objectives in the learning area of the degree program: "Statistics". In particular, it enhances the knowledge and application of the main probabilistic models and Bayesian statistical methodology, with special focus on the analysis of high-dimensional and complex data.

Contents

- Introduction to Bayesian modeling.
- Prior selection.
- Bayesian calculations (MCMC).
- Decision-theoretic foundations.
- Bayesian inference.
- Linear model

Detailed program

1. Introduction to Bayesian modeling: prior distribution, likelihood function, posterior distribution. From prior to posterior: Bayes theorem.
2. Prior selection: subjective determination, non informative priors, conjugate priors, predictive distribution based priors.
3. Bayesians calculations: Monte Carlo and Markov chain Monte Carlo methods

4. Decision-theoretic foundations: loss functions, optimality criteria, risk functions, posterior expected loss.
5. Bayesian inference: estimation, credible regions, hypothesis testing and Bayes factor.
6. The linear model

Prerequisites

Elements of inferential statistics, stochastic processes and R programming.
The course is not suitable for undergraduate students enrolled in the Erasmus Program. Erasmus postgraduate students are invited to contact the teacher at the beginning of the course.

Teaching methods

Class lessons and lab sessions with R.
The lectures provide an overview of the main theoretical concepts as well as their formalization.
The computer lab sessions offer technical support (using the R programming language) to make students operational.

There will be a total of six lab lectures, which will be conducted remotely.
The remaining lectures will be held in person

Assessment methods

Written and lab examination including theory, numerical exercises and R script.

During the exam, the use of books or any other materials is not allowed, with the exception of the codes provided by the instructor at the beginning of the exam.
The use of mobile phones is not permitted during the exam.

Textbooks and Reading Materials

- Berger J.O., Statistical Decision Theory and Bayesian Analysis, Springer-Verlag, 1985.
- Lee P.M., Bayesian Statistics: an Introduction, Arnold, 2004.
- Piccinato L., Metodi per le Decisioni Statistiche, Springer-Verlag Italia, 1996.
- Robert C.P., The Bayesian Choice, 2nd edition, Springer, 2001.
- Additional material (R-codes and past exams) are made available through the e-learning web page of the course.

Semester

First term (six weeks) of the second semester.

Teaching language

Italian

Sustainable Development Goals

QUALITY EDUCATION