uc3m Universidad Carlos III de Madrid

Bayesian Methods

Academic Year: (2022 / 2023) Review date: 28-04-2022

Department assigned to the subject: Statistics Department

Coordinating teacher: WIPER , MICHAEL PETER

Type: Compulsory ECTS Credits: 6.0

Year: 4 Semester: 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Statistical Inference Techniques I Statistical Inference Techniques II Regression Methods Stochastic Processes

OBJECTIVES

- 1. To understanding the ideas of Bayesian statistics and the differences between this approach and the classical or frequentist approach in Statistics.
- 2. To know and use the main conjugate families of distributions.
- 3. Use specific Bayesian statistical software to solve problems.
- 1. Capacity for analysis and synthesis.
- 2. Model and solve problems.
- 3. Oral and written communication skills.

DESCRIPTION OF CONTENTS: PROGRAMME

- 1. Introduction and review of basic concepts of probability theory.
- 1.1 Definitions and basic theorems
- 1.2 Bayes theorem
- 1.3 Applications of the Bayes thorem
- 2. Conjugate families of distributions.
- 2.1 Beta-binomial family
- 2.2 Normal-normal family
- 2.3 Applications
- 3. Estimation and tests.
- 3.1 Beta-binomial models
- 3.2 Normal-normal models
- 3.3 Examples
- 4. Regression and linear models.
- 4.1 Normal linear models
- 4.2 General linear models
- 5. Simulation methods for Bayesian statistics.
- 5.1 Bayes factors
- 5.2 Introduction to MCMC methods
- 5.3 Examples

LEARNING ACTIVITIES AND METHODOLOGY

Theory (4 ECTS). Theoretical classes with support material available on the Web. Practice (2 ECTS) problem-solving classes. Computing practices in computer labs. Presentations and debates.

ASSESSMENT SYSTEM

25% Midterm exam

25% Exercises and Practices.

50% Final exam.

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals):	50

BASIC BIBLIOGRAPHY

- Antelman, G. Elementary Bayesian Statistics, Cheltenham, 1997
- Bernardo, J.M. Bioestadística una perspectiva Bayesiana, Vicens Viven, España, 1981
- Boldstad, W.M. Introduction to Bayesian Statistics, Wiley, 2007
- Gill J. Bayesian Methods: A Social and Behavioral Sciences Approach (3ed), Chapman & Hall. , 2015

ADDITIONAL BIBLIOGRAPHY

- Albert J. Bayesian Computation with R (Use R), Springer, 2009
- Lee, P.M. Bayesian Statistics: An Introduction, Arnold, Londres, 2004

BASIC ELECTRONIC RESOURCES

- Michael Wiper . Teaching Page: http://halweb.uc3m.es/esp/Personal/personas/mwiper/eng/docencia.html