Reasoning under Uncertainty

Academic Year: (2024 / 2025) **Review date: 11-03-2024**

Department assigned to the subject: Statistics Department

Coordinating teacher: CABRAS , STEFANO

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Basic knowledge of descriptive statistics, elements of probability and inference.

OBJECTIVES

The main objective is to use the concepts related to Bayesian inference for their subsequent application to problems related to IA, by means of appropriate techniques of approximation of a posteriori distribution of Bayesian models. These concepts will be illustrated within the scope of some inference models related to regression problems.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Bayesian inference (D. Hoff Chap 1 to 2):
1.1. Probability concepts associated with Bayesian statistics
1.2 Fundamentals.

2. Computational problems associated with Bayes' formula (D. Hoff Ch. 3 to 6):
2.1 Conjugate and non-conjugate priors.
2.2 Numerical methods:
2.2.1. Laplace approximation of the a posteriori distribution.
2.2.2. MCMC.

LEARNING ACTIVITIES AND METHODOLOGY

Training Activities:
AF1: Synchronous theoretical teaching presentations accompanied by electronic material, such as digital presentations.
AF2: E-learning activities
AF3: Theoretical-practical synchronous teaching classes
AF4: Laboratory practicals
AF5: Tutorials
AF6: Group work
AF7: Individual student work
AF8: Partial and final exams

ASSESSMENT SYSTEM

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

* The use of Artificial Intelligence tools is selectively allowed in this subject.*

The faculty may indicate a list of works and exercises that the student can perform using AI tools, specifying how they should be used, and how the student should describe the use made of them. If the use of AI by the student gives rise to academic fraud by falsifying the results of an exam or work required to accredit academic performance, the provisions of the Regulation of the University Carlos III of Madrid of partial development of the Law 3/2022, of February 24th, of University Coexistence will be applied.

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

BASIC BIBLIOGRAPHY

- Peter D. Hoff A First Course in Bayesian Statistical Methods, Springer, 2009

BASIC ELECTRONIC RESOURCES

- Virgilio Gómez-Rubio . Bayesian inference with INLA: https://becarioprecario.bitbucket.io/inla-gitbook/