Statistics and Data Science II

Academic Year: (2022 / 2023) **Review date: 13-11-2022**

Department assigned to the subject: Statistics Department

Coordinating teacher: NOGALES MARTIN, FRANCISCO JAVIER

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Statistics and Data Science I (19140)

OBJECTIVES

Core Competences:

- Students know how to apply their acquired knowledge and problem-solving skills in new or unfamiliar settings within broader (or multidisciplinary) contexts related to their field of study.
- Students are able to integrate knowledge and to face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.
- Students know how to communicate their conclusions and the knowledge and ultimate reasons behind them to specialised and non-specialised audiences in a clear and unambiguous way.
- Students have the learning skills that will enable them to continue studying in a way that will be largely self-directed or autonomous.

General Competences:

- Ability to identify, define and formulate social science problems and solve them using computational techniques. This includes the ability to assess all the factors involved, not only technical but also legal.
- Ability to apply theoretical and methodological knowledge of computational social sciences to the analysis and resolution of specific cases and empirical problems.
- Ability to address issues raised under new or unfamiliar environments, within the context of computational social sciences.
- Ability to plan and carry out research in the field of computational social sciences in an autonomous way.

Specific Competences:

- Ability to understand and use the most relevant methods and techniques of statistical analysis for computational social sciences at an advanced level.

Learning Outcomes:

- Knowledge of the main methods and techniques in computational social sciences.
- Ability to test hypotheses using data and the most appropriate tools.
- Ability to estimate linear regression models with cross-sectional data, as well as to understand and explain the statistical principles underlying the estimations.
- Ability to apply robustness tests to regression model estimates.
- Ability to interpret the parameters of a linear regression, obtain predictions and evaluate the goodness of fit.
- Ability to use relevant machine learning concepts and methods to formulate, structure and solve practical problems involving massive or complex data.
- Ability to apply basic machine learning models for prediction and decision making.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Generalized Linear Models (GLM)
1.1. Regression models for categorical dependent and independent variables
1.2. Other models for other types of qualitative dependent variables: binary, ordered, multinomial, counting, etc.

2. Generalized Linear Mixed Models (GLMM)

3. Real Life Examples

LEARNING ACTIVITIES AND METHODOLOGY

Training Activities:

- Theoretical-practical classes

Teaching Methods:

- Presentations in the professor's lecture room with computer and audiovisual support, in which the main concepts of the subject are developed and a bibliography is provided to complement the students' learning.
- Resolution of practical cases, problems, etc. raised by the professor, either individually or in a group.

ASSESSMENT SYSTEM

- Participation in class (15%)
- Developing pieces of work and reports, individually or in group (40%)
- Final exam (45%)

% end-of-term-examination:	45
% of continuous assessment (assigments, laboratory, practicals…):	55

BASIC BIBLIOGRAPHY

- Charles E. Mcculloch,John M. Neuhaus Generalized Linear Mixed Models, Wiley, 2014

- G. James, D. Witten, T. Hastie and R. Tibshirani. An Introduction to Statistical Learning with Applications in R, Springer, 2021

- Julian J. Faraway Extending the Linear Model with R: Generalized Linear, Mixed Effects and Nonparametric Regression Models, Taylor & Francis, 2016