Non-parametric Estimation

Academic Year: (2021 / 2022) **Review date: 09/06/2021 23:39:30**

Department assigned to the subject: Statistics Department

Coordinating teacher: GARCIA PORTUGUES, EDUARDO

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus I and II
Probability I and II
Statistical Inference Methods I and II
Programming I and II
Linear Algebra
Advanced Mathematics
Regression Methods
Advanced Regression Methods
Multivariate Analysis

OBJECTIVES

* General competences

- Description and data synthesis: Description of a set of data based on numeric and graphic measurements both at univariate and multivariate levels demonstrating possible relations between variables of interest.
- Modelling Ability to identify or create the appropriate model for a specific problem arising from each business activity (finance, marketing, production planning and control etc.).
- Model Analysis and Validation: Capacity to computationally manipulate established models, making the most of the power of statistical, optimisation methods etc. and analysing the results obtained.
- Drawing conclusions: Ability to perceive the nature of problems and interpret solutions provided by the corresponding models in a useful way, in order to improve performance in the various areas of a business (finance, production, quality, marketing, etc.).
- Presentation and communication of results: Ability to communicate results, conclusions of models and solutions proposed in a manner which is intelligible to the rest of the company, in order to ensure that they are accepted and implemented by decision makers.

* Specific competences

- Data description and synthesis.
- Modelling and statistical analysis of both static and dynamic data.
- Correct and rational use of software.
- Ability to devise and construct models and validate them.
- Graphic representation of data.
- Interpretation of results based on statistical models.

DESCRIPTION OF CONTENTS: PROGRAMME

ATTENTION: all the teaching materials are given in ENGLISH. Lessons are in Spanish.

This course is designed to give a panoramic view of several tools available for nonparametric estimation, at an intermediate level. This view covers in-depth the main concepts in the estimation of the distribution, density and regression function. The focus is placed on providing the main insights on the statistical/mathematical foundations of nonparametric estimation and on showing its effective

implementation with the use of the statistical software R.

1. Introduction and review
   1.1. Why nonparametric statistics?
   1.2. Review on statistical inference
   1.3. Review on probability
   1.4. Useful inequalities
   1.5. Landau's notation

2. Nonparametric estimation of the distribution function
   2.1. The empirical distribution function
   2.2. Properties of the empirical distribution function
   2.3. Applications

3. Nonparametric estimation of the density function
   3.1. The histogram
   3.2. The Parzen-Rosenblatt's estimator
   3.3. Properties of the estimator
   3.4. Selection of the smoothing parameter
   3.5. Modifications
   3.6. Multivariate density estimation

4. Nonparametric estimation of the regression function
   4.1. The regressogram
   4.2. The Nadaraya-Watson's estimator
   4.3. The local polynomial estimator
   4.4. Properties of the local polynomial estimator
   4.5. Selection of the smoothing parameter

The program is subject to modifications due to the course development and/or academic calendar.

LEARNING ACTIVITIES AND METHODOLOGY

The lessons combine theory sessions (methods description) and practical sessions (exercises, computational implementation and practical usage of methods). The implementation of the methods is done with the statistical language R, so a good knowledge of R is fundamental.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

The evaluation in the ordinary call is done entirely by continuous evaluation. This is done by a mixture of:

A) two group projects;
B) the presentation of the group projects;
C) participation in lessons.

The grade (in the scale 0-10) in the ordinary call is

min(0.70 * A + 0.30 * B + 0.10 * C, 10)

where

- A (in the scale 0-10) is the weighted grade of the two group projects. All the students in the same group are graded evenly.
- B (in the scale 0-10) is the individual presentation grade. Each member of the group must present individually during a brief period of time and answer questions about the project/subject.
- C (in the scale 0-10) is the degree of participation in the lessons

The grade in the extraordinary call is established by an exam and a practical exercise.

Further details are provided in the course materials. The evaluation is subject to modifications due to the course development and/or academic calendar.

BASIC BIBLIOGRAPHY

- Chacón, J. E. and Duong, T. Multivariate Kernel Smoothing and Its Applications, Chapman and Hall/CRC, 2018

- Wand, M. P. and Jones, M. C. Kernel Smoothing, Chapman & Hall, 1995

- Wasserman, L. All of Nonparametric Statistics, Springer-Verlag, 2006

- Wasserman, L. All of Statistics, Springer-Verlag, 2004