

## Bayesian learning

Academic Year: ( 2023 / 2024 )

Review date: 11-04-2023

Department assigned to the subject: Statistics Department

Coordinating teacher: WIPER , MICHAEL PETER

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 2

## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Basic statistics and probability  
Familiarity with R

## OBJECTIVES

Basic competences

To have and to include/understand knowledge that contribute to a base or opportunity of to be original at the development and/or application of ideas, to slight in an investigation context  
That the students know to apply to the acquired knowledge and their capacity of resolution of problems in new surroundings or little known within ampler contexts (or you will multidiscipline) related to their area study  
That the students are able to integrate knowledge and to face the complexity to formulate judgments from a information that, incomplete or being limited, includes reflections on tie the social and ethical responsibilities to the application of its knowledge and judgments  
That the students have the learning abilities that allow them to continue studying of a way that will be to be in great homing or independent measurement.

General competitions

To apply the theoretical foundations of the collection techniques , storage, treatment and presentation of information, specially for great volumes of data, as it bases for the development and adaptation of these techniques to concrete problems  
To identify different techniques to store, to talk back and to distribute great amounts of data, and to differentiate them based on its theoretical and practical characteristics  
To identify the techniques of analyses of data but adapted each problem and knowledge to apply them for the analysis, design and solution of such  
To obtain practical and efficient solutions for problems of treatment of great volumes of data, as much individually as in equipment  
To synthesize the obtained conclusions of these analyses and to as much present/display them of clear and convincing way in bilingual surroundings (Spanish and English) in writing as orally  
To be able to generate new ideas (creativity) and to anticipate new situations, in the contexts of the analysis of data and the decision making  
To use abilities for the work in equipment and to be related to others of independent form

Specific competitions

To use the basic results of inference and regression like foundation for advanced methods of prediction and classification  
To identify and to select the suitable software tools for the treatment of great amounts of data  
To use advanced statistical procedures for the treatment of great volumes of data in areas like the estimation, the inference, the prediction or the classification, as well as the way to apply them of efficient form  
To correctly identify the kind of statistical problem corresponding to certain objectives and data  
To know how to design systems for the processing of the data, from the obtaining and initial filtrate of such, its statistical analysis, to the presentation of the final results  
To use techniques and usable tools of operations research with massive data in procedures for its analysis, visualization of its results or within systems of support to decisions

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction
  - a) Probability and Bayes' Theorem
  - b) Application to "Big Data"
- 2) Bayesian networks
  - a) Graphic models and their learning
  - b) Application to "Big Data"
- 3) Linear and nonlinear regression
  - a) Linear models
  - b) Generalized linear models
  - c) Applications to "Big Data"
  - d) Non-linear regression
  - e) Application to "Big Data"
- 4) Classification and cluster analysis
  - a) Mixture models
  - b) Application to "Big Data"
- 5) Time Series
  - a) Space state models and filters
  - b) Application to "Big Data"

## LEARNING ACTIVITIES AND METHODOLOGY

Formative activities:

Theory classes  
Practical classes  
Computing practicals  
Individual student work

Teaching methodology:

Theory classes (with computing and audiovisual technology) presenting the main parts of the course and the associated bibliography.

Critical reading of texts recommended by the course teachers.

Practical and computing classes designed by the course teachers for group and individual work.

Group and individual homework projects.

## ASSESSMENT SYSTEM

Participation in class  
Individual and group work during the course  
The extraordinary evaluation will follow a similar design to the ordinary evaluation

<b>% end-of-term-examination:</b>	0
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	100

## BASIC BIBLIOGRAPHY

- Albert, J. Bayesian Computation with R, Springer, 2007

## BASIC ELECTRONIC RESOURCES

- . OpenBugs: <http://www.openbugs.net/w/FrontPage>
- . Stan: <http://mc-stan.org/>
- R project team . R software: <https://cran.r-project.org/>