Graphical and Hidden Markov Models

Academic Year: (2019 / 2020) **Review date: 29-04-2020**

Department assigned to the subject: Statistics Department

Coordinating teacher: WIPER , MICHAEL PETER

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

OBJECTIVES

Graphical representation of conditional independence; Learning when to use and how to fit both discrete and Gaussian graphical models; fitting and interpreting log linear models; hidden Markov models; estimation and interpretation of hidden Markov models; use of statistical software for model fitting.

DESCRIPTION OF CONTENTS: PROGRAMME

1) Basic concepts of graphical models
a) Directed and non-directed graphs.
b) Conditional independence and its graphical representation
c) Representing graphical models in R
d) The naive Bayes classifier as a graphical model
2) Log-linear models
a) Representation as graphical models
b) Fitting log-linear models
c) Practical example
3) Bayesian networks
a) Representation
b) Classical and Bayesian approaches
c) How to infer causality
d) Practical example
4) Gaussian networks and mixed networks
a) Representation and adjustment
b) Practical example
5) More complex graphical models
a) Algorithms
b) Examples
6) Hidden Markov models
a) Structure.
b) Algorithms for estimation.
c) Interpretation of hidden states.
d) Practical examples.
e) Quick fitting of hidden Markov models: filters.

LEARNING ACTIVITIES AND METHODOLOGY

Theoretical and computer practical classes with presentation and resolution of real problems, individual and group work.

ASSESSMENT SYSTEM

Participation in class: 10%
Individual work: 60%
Group project: 30%

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

BASIC BIBLIOGRAPHY

- D. Bellot Learning Probabilistic Graphical Models in R, PACKT Publishing, 2016

- J. Chapmann Markov Models: Introduction to Markov Chains, Hidden Markov Models and Bayesian Networks, CreateSpace Independent Publishing Platform, 2017

- L. Sucar Probabilistic Graphical Models: Principles and Applications, Springer, 2015

- S. Hojsgaard, D. Edwards, S. Lauritzen Graphical Models with R, Springer, 2012

BASIC ELECTRONIC RESOURCES

- . R Studio: https://www.rstudio.com/

- CRAN . The R Project for Statistical Computing: https://www.r-project.org/