Statistical Signal Processing

Academic Year: (2022 / 2023) **Review date: 22-07-2022**

Department assigned to the subject: Computer Science and Engineering Department

Coordinating teacher: MIGUEZ ARENAS, JOAQUIN

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

STUDENTS ARE EXPECTED TO HAVE COMPLETED

The student should have basic knowledge of
- probability theory and statistics
- linear algebra.

OBJECTIVES

Basic competences

CB6 Having and understanding the knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
CB7 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.
CB9 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.

General competences

CG1 Ability to maintain continuous education after his/her graduation, enabling him/her to cope with new technologies.
CG2 Ability to apply the knowledge of skills and research methods related to engineering.
CG3 Ability to apply the knowledge of research skills and methods related to Life Sciences.
CG4 Ability to contribute to the widening of the frontiers of knowledge through an original research, part of which merits publication referenced at an international level.

Specific competences
CE1 Ability to know the peculiarities of data acquisition and information processing in the field of biomedical signals and images.
CE2 Ability to design and implement automatic learning systems for supervised and unsupervised problem solving.
CE3 Ability to design estimation and decision procedures from signals and images using statistical modeling.

DESCRIPTION OF CONTENTS: PROGRAMME

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· Parameter estimation
  - Method of moments
  - Maximum likelihood
  - Bayesian estimation

· Signal Estimation
  - MMSE estimation
  - Linear estimation and prediction
  - Optimal filtering

· Model-based signal Processing
  - Markov chains and processes

- State space models

· Hypothesis testing and classification
- Wald tests
- Likelihood ratio methods
- Bayesian tests

LEARNING ACTIVITIES AND METHODOLOGY

AF3	Theoretical practical classes
AF4	Laboratory practices
AF5	Tutorials
AF6	Team work
AF7	Student individual work
AF8	Partial and final exams

Activity code	total hours number	presencial hours number	% Student Presence
AF3	100	100	100%
AF4	32	32	100%
AF5	18	0	0%
AF6	90	0	0%
AF7	186	0	0%
AF8	12	12	100%
TOTAL SUBJECT	450	138	30,6%

ASSESSMENT SYSTEM

SE1	Participation in class
SE2	Individual or team works made during the course
SE3	Final exam

Evaluation systems (%)	Minimum weighting (%)	Maximum Weighting (%)
SE1	0	15
SE2	0	100
SE3	0	0

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

BASIC BIBLIOGRAPHY

- C. P. Robert, G. Casella Monte Carlo Statistical Methods, Springer, 2004

- H. Stark, J. W. Woods Probability and Random Processes with Applications to Signal Processing, Prentice-Hall, 2002

- L. Wasserman All of statistics, Springer, 2013

- V. Poor An introduction to signal detection and estimation, Springer, 1994