Statistical Analysis of Information

ECTS credits
4 credits

Semester
Spring

In brief

Course langage: French

Presentation

Prerequisites

Common core courses

Learning objectives

The objective is to enable students to acquire the foundations of information theory, physical and statistical information analysis methods, and classification techniques (supervised and unsupervised). The fields of application are those of numerical, physical and pattern recognition.

Description of the programme

Physical and statistical information extraction.
Statistical techniques are particularly well suited for information extraction. Particular attention is paid to numerical data and physical quantities. The topics covered are based on in-depth studies of applied probability, statistics and adapted optimization methods. Techniques for characterizing fluctuations, estimating and analyzing data are covered both in their foundations and their applications.

Foundations of information theory and classification.
Information theory provides a quantitative measure of the notion of information brought by a message or an observation. The fundamental elements of information theory will be presented not only for its applications in the field of information processing but also by showing the links with other scientific fields and in particular with those of data classification, physics and, more generally, statistics. Notions related to entropy, information, complexity will thus be addressed in a broad perspective.

Statistical pattern recognition.
The objective of this module is to present the problematic of statistical decision around the objectives of detection, classification with or without a priori probabilistic model. This teaching is structured around practical work to illustrate from examples how the analysis of performances allows to choose among different techniques.

Generic central skills and knowledge targeted in the discipline

-Develop technical and scientific innovations (ability to stimulate one's imagination, ability to analyze the context, ability to extend a tool or a concept to other uses, ability to collect and analyze information with logic and method, ability to mobilize a scientific/ technical culture)
-Solve complex and transdisciplinary problems (ability to understand and formulate the problem, ability to recognize the specific elements of a problem, ability to identify the interactions between elements, ability to take into account the uncertainty generated by complexity)
-Develop and conduct international scientific and technical projects (ability to rapidly deepen a field).

How knowledge is tested

CC1 (part " Extraction of physical and statistical information ") : 1 written paper which contributes for 37 % of the final mark
CC2 (part "Foundations of Information Theory and Classification"): 1 written paper that contributes 26% of the final grade
CC3 (part "Statistical Pattern Recognition"): a robust average of reports that contributes to 37% of the final grade

Bibliography

Ph. Réfrégier « Noise theory and application to physics » - Springer 2003.
T.M. Cover and J.A. Thomas « Elements of information theory» - Wiley 2006.
R.O. Duda, P.E. Hart and D.G. Stork « Pattern Classification » - Wiley 2001.

Teaching team

* G.Bérardi
* Frédéric Galland
* Timothée Justel
* Ph. Réfrégier
* M. Roche

Total des heures		**60h**
CM	Master class	36h
TD	Directed work	8h
TP	Practical work	16h

Useful info

Name responsible for EU

Lead Instructor
Muriel Roche
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