INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

SEMESTER 7_4th YEAR ModIA

Practical info

Location(s)

Toulouse

Modelling & Scientific Computing

ECTS
4 crédits

Hourly volume
73h

Location(s)

Toulouse

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

-How to model a problem in physics, biology, economics, etc. using a system of ode or pde
-How to numerically solve such a problem in simple cases

The student should be able to:
-model a problem via ode or pde
-classify problems according to their mathematical structure and choose appropriate numerical methods of solution
-implement (in PYTHON or JULIA) these numerical methods

Necessary prerequisites

Undergraduate courses in analysis and linear algebra.
Basics of Physics
PYTHON language

Practical info

Statistical modelling

ECTS
3 crédits

Hourly volume
76h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

-The principle of nonparametric statistical tests for goodness-of-fit, independence, comparison of two populations
-The characteristics of a linear model and a generalized linear model, and their use for statistical modelling

At the end of this module, the student should be able to:

-Choose a test procedure suited to a given problem
-Build nonparametric test procedures to compare two populations
-Build goodness-of-fit tests for a single distribution or a family of distributions
-Choose a linear model or a generalized linear model suited to a given problem
-Estimate the parameters in a linear model and a generalized linear model
-Use statistical tests to validate or invalidate hypotheses on these linear models and generalized linear models.
-Implement a variable selection strategy
-Perform a complete statistical analysis on a real data set using a linear model or a generalized linear model

Necessary prerequisites

Probability: random variables, usual probability laws, expectation, variance, cumulative distribution function, limit theorems, Gaussian vectors, ¿
Inference statistics: moment estimators, maximum likelihood estimators, confidence interval for the mean / the variance for a Gaussian / non-Gaussian sample.
Basics of R software

Practical info

Location(s)

Toulouse

Optimization and Stochastic Optimization

ECTS
4 crédits

Hourly volume
86h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

-The theory aiming at caracterise local/global minimum of a real function with or without respect to constraints.

-The main first-order methods in optimisation.

-How to find a subdifferential of a convex function, and a subgradient.

-The worst-case complexity of an algorithm.

At the end of this module, the student should be able to:

-Model and solve an optimisation problem numerically with/without constraint.

Necessary prerequisites

Linear algebra, Calculus, Unconstrained optimisation, Newton and Gauss-Newton algorithms.

Practical info

Location(s)

Toulouse

Data analysis

ECTS
3 crédits

Hourly volume
62h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

-The main steps of a data science analysis: preparation, visualization & exploration, prediction, interpretation.
-The main methods in data exploration.
-The main concepts / dangers of statistical learning.
-The main methods of statistical learning on vector data, requiring little expert knowledge / tuning.
-The functioning of R and Python software for data science.

At the end of this module, the student should be able to:

-Solve simple exercises about the underlying mathematical theory.
-Put in action the data science methodology on case studies with R and Python.
-Criticize the assumptions and results, summarize the main conclusions.

Necessary prerequisites

Statistics: descriptive statistics
Probability: random vectors, probability distribution, Bayes law, multivariate normal distribution.
Algebra: vector spaces, Euclidean spaces, matrix calculus, eigenvalue decomposition.
Geometry / mecanics: barycenter, inertia, Huygens formula.

Practical info

Location(s)

Toulouse

Human sciences S7

ECTS
4 crédits

Hourly volume
45h

Introducing

Objectives

ENGLISH
- Develop awareness of scientific publications and presentations
- Prepare students for technical courses given in English on Artificial Intelligence
- Linguaskill preparation for the weakest students

LAW
- Understand the legal structures of companies and how they operate
- Understand the concepts of risk and the resulting responsibilities

Practical info

Location(s)

Toulouse

[FRANCAIS] Formation en entreprise 1

ECTS
12 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] FLE Semestre 7

ECTS

Hourly volume
12h

Practical info

Location(s)

Toulouse

[FRANCAIS] Accompagnement recherche d'entreprise

ECTS

Hourly volume
24h

Practical info

Location(s)

Toulouse