esade

TEACHING GUIDE - 2025-2026

Computational Decision Science

UGRA_016192

Departments	Data, Analytics, Technology and Artificial Intelligence (DATA), Dept. of Operations, Innovation & Data Sciences
Teaching Languages	English
ECTS	4
Teacher responsible	German Sánchez Hernández - german.sanchez@esade.edu

Course Goals

By the end of this course, students will acquire the following skills:

- Understanding the Fundamentals of Computational Modelling: Learn the fundamental principles of computational modelling and its applications in solving complex business problems.
- Applying Python and Computational Thinking: Gain practical skills in Python programming and computational thinking, and understand their relevance in modern business contexts.
- Understanding Monte Carlo Simulation: Develop an understanding of Monte Carlo simulation and its role in risk assessment, forecasting, and optimising complex systems.
- Solving Real-World Business Problems: Apply computational thinking and Python programming skills to address real-world business challenges.
- Tackling Advanced Business Problems: Develop the ability to handle complex business issues that require advanced computational thinking and programming skills.
- Training, Evaluating, and Understanding Various Modelling Techniques: Master several modelling techniques, both supervised and unsupervised, to extract crucial insights from data for application in business contexts.

Previous knowledge

This course does not assume any prior knowledge of computational decision science or programming. However, a basic familiarity with using computers is expected.

Prerequisits

In this course, we will use Python to apply the techniques covered in class. This will be done using Jupyter notebooks, which can be executed in Google Colab through your preferred web browser, or using a local editor and engine such as Visual Studio Code.

Teaching

The course employs a blend of theoretical instruction and practical application to facilitate comprehensive learning. Key methodologies include:

methodology

- Lectures: Core concepts and theories will be introduced and explained in lectures.
- Hands-On Exercises: Students will engage in practical exercises using Python and Jupyter notebooks to apply the concepts learned in lectures.
- Case Studies: Real-world business problems will be presented as case studies, allowing students to apply their skills to solve practical challenges.
- Group Discussions: Collaborative discussions will help deepen understanding through peer interaction and shared insights.
- Projects: Individual and group projects will provide opportunities to develop and demonstrate problem-solving skills in real-world scenarios.
- Continuous Assessment: Regular quizzes and assignments will be used to monitor progress and provide feedback for improvement.

This multi-faceted approach ensures that students not only grasp the theoretical aspects of computational decision science but also gain practical experience and problem-solving abilities.

NOTE: Students must achieve a minimum grade of 5.0 on the final exam(s) of a course to be eligible to pass the course: a grade lower than 5.0 in the exam will become the student's final grade without averaging in other assessments. This rule applies to retake exams as well.

Description

Course contribution to program

This technical course within the BITLASI programme aims to equip students with the skills to use computational models for solving complex business problems. These skills are invaluable in today's data-driven business environment, impacting areas ranging from operations to marketing.

By the end of the course, students will:

- Develop Computational Modelling Skills: Learn how to utilise computational models to address and solve complex business issues.
- Gain Proficiency in Python: Acquire practical knowledge of Python programming, which is essential for modern data analysis and problem-solving.
- Understand Monte Carlo Simulation: Gain insights into Monte Carlo simulation and its applications in risk assessment and decision-making.
- Master Machine Learning Fundamentals: Get introduced to the basics of both supervised and unsupervised machine learning techniques, enhancing their ability to extract and apply data-driven insights.
- Ethical Awareness: Develop a critical understanding of the ethical implications of algorithmic decision-making in business contexts.

This course will consistently integrate technical knowledge with business

strategy, ensuring students can apply what they learn to real-world business scenarios.

Short description

Explore the world of computational decision science with our comprehensive introductory course. In today's data-driven business landscape, mastering computational models is essential for solving complex problems and making informed decisions.

Learn the fundamentals of Python programming and computational thinking, and discover the power of Monte Carlo simulation and machine learning techniques. Gain practical skills in both supervised and unsupervised learning methods, while maintaining a critical perspective on ethical implications.

Through interactive sessions, hands-on exercises, and real-world case studies, you'll develop the confidence to apply computational principles to business challenges. Join us to utilise data effectively and enhance your decision-making capabilities in a business context.

Activities

Programming exercises
Concrete exercises using real-world data to familiarise ourselves with some computational modelling techniques.

Teamwork
Collaborate on team projects applying computational models to solve real business challenges. Use Python and machine learning techniques to analyse data and propose solutions, enhancing teamwork and data-driven decision-making skills.

Quizzes/tests
Multiple-choice quizzes designed to solidify the fundamentals of computational decision science.

Content

#	Topic
1	Introduction to Computational Modelling Key concepts in computational modelling, exploration of Artificial Intelligence principles, and consideration of ethical implications.
2	Monte Carlo Simulation Explore practical examples where Monte Carlo simulations are used to address complex problems or uncertainties, enhancing decision-making capabilities.
3	Introduction to Python Practical introduction to Python programming language, focusing on data preparation techniques essential for analysis and modelling tasks.
4	Supervised Machine Learning Study classification and regression techniques in supervised machine learning, enabling predictive modelling and pattern recognition applications.
5	Unsupervised Machine Learning Explore clustering and association rule mining techniques in unsupervised machine learning, facilitating data exploration and pattern discovery without predefined labels.

Assessment

Tool	Assessment tool	Category	Weight %
Individual or team exercises	Individual work and involvement	Retake and ordinary round	15.00%
Written and/or oral exams	Final exam	Retake and ordinary round	40.00%
Group project	Team Activities	Retake and ordinary round	25.00%
Quizzes/tests	Individual quizzes	Retake and ordinary round	20.00%

PROGRAMS

BITLASI22-Bachelor in Transformational Leadership and Social Impact (Undergraduates: Business)

BITLASI22 Year 2 (Basic)