Cunice
EUROPEAN UNIVERSITY

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EUROPEAN UNIVERSITY FOR CUSTOMISED EDUCATION

STUDY GUIDE

MACHINE LEARNING, 26-27 S2

Organised by

University of Vaasa

1. IDENTIFYING DATA.		
· Course Name.	Machine Learning, 26-27 S2	
· Coordinating University.	University of Vaasa	
· Partner Universities Involved.	-	
· Course Field(s).	Information, Communication, Automation Technology	
· Related Study Programme.	IT for Smart and Sustainable Mobility, Energy and Information Technology; Industrial Systems Analytics; Smart Energy	
· ISCED Code.	0618	
· SDG.	Goal 4: Quality education Goal 9: Industry, Innovation and Infrastructure	
· Study Level.	Master	
· EUNICE Key Competencies	Problem solving	Strongly
	Teamworking	Partially
	Communication	Partially
	Self-management	Strongly
	Cognitive flexibility	Moderately
	Digital competence	Strongly
	Technical competence	Strongly
	Global intercultural competence	-

· Number of ECTS credits allocated.	5
· Mode of Delivery.	Online synchronous

· Language of Instruction.	English
· Course Dates.	02.03.2027-22.04.2027
· Precise Schedule of the Lectures.	Time zone: Europe/Helsinki Eastern European (Summer) Time (All times are one hour ahead of Central European Time (CET/CEST).) 02.03.2027 12.00–14.00 (13.00–15.00 CET/CEST) 04.03.2027 12.00–14.00 (13.00–15.00 CET/CEST) 09.03.2027 12.00–14.00 (13.00–15.00 CET/CEST) 11.03.2027 12.00–14.00 (13.00–15.00 CET/CEST) 16.03.2027 12.00–14.00 (13.00–15.00 CET/CEST) 18.03.2027 12.00–14.00 (13.00–15.00 CET/CEST) 23.03.2027 12.00–14.00 (13.00–15.00 CET/CEST) 25.03.2027 12.00–14.00 (13.00–15.00 CET/CEST) 30.03.2027 12.00–14.00 (13.00–15.00 CET/CEST) 01.04.2027 12.00–14.00 (13.00–15.00 CET/CEST) 06.04.2027 12.00–14.00 (13.00–15.00 CET/CEST) 08.04.2027 12.00–14.00 (13.00–15.00 CET/CEST) 13.04.2027 12.00–14.00 (13.00–15.00 CET/CEST) 15.04.2027 10.00–12.00 (11.00–13.00 CET/CEST) 20.04.2027 12.00–14.00 (13.00–15.00 CET/CEST) 22.04.2027 10.00–12.00 (11.00–13.00 CET/CEST)
· Key Words.	Machine Learning, Computing, Information, Modelling, Algorithms, Data, Bayesian Inference, Reinforcement learning, hidden Markov Models
· Catchy Phrase.	Students will be able to explain the manifestation of machine learning and its possible applications.

· Prerequisites and co-requisites.	- Be enrolled at any of the EUNICE partner universities. - English B2 - It is recommended to know: the fundamentals of probability theory, linear algebra, optimization theory, matrix calculus, and some programming skills.
· Number of EUNICE students that can attend the Course.	100
· Number of EUNICE students that can attend the course per institution.	10

· Course inscription procedure(s).	Enrolment via the EUNICE website

2. CONTACT DETAILS.	
· Department.	School of Technology and Innovations
· Name of Lecturer.	Mohammed Elmusrati
· E-mail.	mohammed.elmusrati@uwasa.fi
· Other Lecturers.	-

3. COURSE CONTENT.

This course covers the fundamental concepts of machine learning as well as its different types. It adopts an algorithmic perspective, focusing on the underlying theories and methods behind machine learning techniques.
The objective of this approach is to enable a deeper understanding of how these algorithms work, how to select the most suitable one for a given problem, and to recognize their limitations. Furthermore, the course aims to equip students with the ability to adapt and modify existing algorithms to better suit specific applications.

4. LEARNING OUTCOMES.

- Explain the fundamentals of machine learning and identify its key applications across different domains.
- Demonstrate understanding of core concepts such as data modeling, overfitting, underfitting, generalization, memorization, training data, and validation data.
- Describe major supervised learning algorithms, their variants, and typical application areas.Apply regression methods and neural networks to model and capture underlying relationships in data.Explain probabilistic models and apply Bayesian-based machine learning approaches.Assess data quality issues and apply basic techniques for data preprocessing and cleaning.Explain and apply classification algorithms in simple problem settings.Describe the principles of unsupervised learning, including clustering techniques and their use cases.Explain the fundamentals of reinforcement learning and distinguish it from supervised and unsupervised learning paradigms.
- Recognize ethical challenges in AI and machine learning, including issues related to fairness, bias, and data privacy.
- Develop lifelong learning skills and critical, analytical thinking.
- Strengthen problem modeling and problem-solving abilities.

5. OBJECTIVES.
Machine learning focuses on enabling computing systems to learn from data and to extract hidden patterns and meaningful information. The knowledge derived from data can be used to generate informed outputs such as predictions, recommendations, or decisions or to gain deeper insights into underlying behaviors and processes through data exploration. This course is highly relevant in any domain where data is generated and analyzed. Consequently, its applications span a wide range of fields, including industry, manufacturing, energy systems, biotechnology, social sciences, governmental, business, and finance.

6. COURSE ORGANISATION.	
UNITS	
1.	Introduction to machine learning and data modeling
2.	Supervised learning algorithms and neural networks
3.	Probability theory and Bayesian-based algorithms
4.	Parametric Algorithms
5.	Enhance data quality and Principal component analysis
6.	Unsupervised machine learning and clustering
7.	Kernel machines and SVM
8.	Hidden Markov Models
9.	Reinforcement learning
10.	Combine Algorithms, Generative AI, and Ethics of Machine learning
LEARNING RESOURCES AND TOOLS.	
Lecturer notes, books, articles, and videos.	
PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.	
Teaching method: Flipped learning. Lectures 32 h, independent work 103 h.	

7. ASSESSMENT METHODS AND CRITERIA.

15 online quizzes

Grading: Pass/Fail

- Requires achieving more than 65% in quizzes and active participation in online sessions.

OBSERVATIONS.

Recognition-related issues:

Please contact your home university's International Relations Office if you encounter any issues related to the recognition of the ECTS at the end of the course. Lecturers are not in charge of the recognition process.

8. BIBLIOGRAPHY AND TEACHING MATERIALS.

1. Lecture Notes
2. E. Alpaydin "Introduction to Machine Learning", 4ed Edition, MIT Press 2020,
3. M. Elmusrati, Modelling Stochastic Uncertainties: From Monte Carlo Simulations to Game Theory, De Gruyter 2025
4. S. Rogers, A First Course in Machine Learning, 2ed, Taylor & Francis Group