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EUROPEAN UNIVERSITY FOR CUSTOMISED EDUCATION

STUDY GUIDE

MACHINE LEARNING

Organised by

University of Vaasa

1. IDENTIFYING DATA.		
· **Course Name.**	Machine Learning	
· **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.	19 January 2026 - 11 March 2026
· Precise Schedule of the Lectures.	***Time zone: Europe/Helsinki*** Mon 19.01.2026 14.00 - 16.00 EET Wed 21.01.2026 14.00 - 16.00 EET Mon 26.01.2026 14.00 - 16.00 EET Wed 28.01.2026 14.00 - 16.00 EET Mon 02.02.2026 14.00 - 16.00 EET Wed 04.02.2026 14.00 - 16.00 EET Mon 09.02.2026 14.00 - 16.00 EET Wed 11.02.2026 14.00 - 16.00 EET Mon 16.02.2026 14.00 - 16.00 EET Wed 18.02.2026 14.00 - 16.00 EET Mon 23.02.2026 14.00 - 16.00 EET Wed 25.02.2026 14.00 - 16.00 EET Mon 02.03.2026 14.00 - 16.00 EET Wed 04.03.2026 14.00 - 16.00 EET Mon 09.03.2026 14.00 - 16.00 EET Wed 11.03.2026 14.00 - 16.00 EET
· 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
· 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.

The main concepts as well as the different types of machine learning are covered in this course. The approach of this course is to cover machine learning from an algorithmic point of view. The aim of this approach is to understand the theories/algorithms behind machine learning algorithms and how to select the best one for our specific problem, to know their limits, and even how to modify it to fit our specific problem.

4. LEARNING OUTCOMES.

After completing the course, the student will be

-Able to explain the manifestation of machine learning and its possible applications. Furthermore, they will be familiar with several concepts like data modeling, overfitting, underfitting, generalization, memorization, learning data, and validating data.
-Aware of supervised learning algorithms and their different kinds and applications
-Able to apply different regression methods as well as neural networks to capture hidden relations in supervised learning
-Able to explain probabilistic models and Bayesian-based machine learning algorithms.
-Aware of data quality in machine learning and how to improve and clean data.
-Able to explain classification algorithms as well as apply them in simple scenarios.
-Aware of unsupervised learning concepts and clustering.
-Able to define reinforcement learning and its main differences between supervised and unsupervised machine learning.
-Aware of the applications as well as limitations of machine learning algorithms.
- Aware of the challenges of ethics in AI and Machine learning
-Finally, the course develops lifelong learning, Oral, written, and interpersonal skills (Group Work, English), critical and analytical thinking, problem modeling and solving skills, IT skills, and optimized decisions. The issue of professional ethics, norms of handling big data, and data protection protocol are considered as an integral part of the machine learning process.

5. OBJECTIVES.

Machine learning is related to the technologies of making computing devices learn and extract

"hidden" information from input-data patterns. Extracted information could be used to make reasonable output (it can be in the form of suggestions, conclusions, or decisions), or to gain deep knowledge (by exploring data) about a specific behavior.

This course is highly useful wherever there is data to be analyzed. Hence, the application area is huge either in industry, factories, power plants, social science, business, finance, etc.

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.

Online 15 Quizzes. A Written report could be submitted for Bonus (optional).

Grading: On a scale of 1-5, or fail (0)

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