Cunice
EUROPEAN UNIVERSITY

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EUROPEAN UNIVERSITY FOR CUSTOMISED EDUCATION

STUDY GUIDE

MACHINE LEARNING

Organised by

University of Vaasa

b-tu Brandenburg University of Technology Cottbus - Senftenberg
UC Universidad de Cantabria
Università di Catania
Université Polytechnique HAUTS-DE-FRANCE
UMONS University of Mons
UNIVERSITY OF THE PELOPONNESE
Vaasan yliopisto UNIVERSITY OF VAASA
Politécnico de Viseu

1. IDENTIFYING DATA.	
· Course Name.	*Machine Learning*
· Coordinating University.	*University of Vaasa*
· Partner University(ies) Involved.	-
· Course Field(s).	*Information, Communication, and Automation Technology*
· Related Study Programme.	*Energy and Information Technology; Industrial Systems Analytics; Smart Energy*
· Course Code.	*ICAT3120*
· ISCED Code.	*0618*
· SDG.	*Goal 4: Quality education* *Goal 9: Industry, Innovation and Infrastructure*
· Study Level.	*M*

· Number of ECTS credits allocated.	*5*
· Mode of Delivery.	*Online synchronous*
· Language of Instruction.	*English*
· Delivery Period.	*Spring semester 2025*
· Course Dates.	*14 January 2025 - 5 March 2025*
· Precise Schedule of the Lectures.	*16 online sessions in total within 8 weeks, two times per week, lasting 2 hours each* **Time zone: Europe/Helsinki** *14 Jan 2025 12.00 - 14.00* *16 Jan 2025 12.00 - 14.00* *21 Jan 2025 12.00 - 14.00* *23 Jan 2025 12.00 - 14.00* *27 Jan 2025 12.00 - 14.00* *29 Jan 2025 12.00 - 14.00* *5 Feb 2025 12.00 - 14.00* *6 Feb 2025 12.00 - 14.00* *10 Feb 2025 12.00 - 14.00* *12 Feb 2025 14.00 - 16.00* *17 Feb 2025 12.00 - 14.00* *19 Feb 2025 14.00 - 16.00* *24 Feb 2025 12.00 - 14.00*

	25 Feb 2025 12.00 - 14.00 *3 Mar 2025 12.00 - 14.00* *5 Mar 2025 14.00 - 16.00* *Any potential changes to the timetable will be announced in Moodle*
· 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.
-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 and Applications*

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.

Lecturer Notes

E. Alpaydin: Introduction to Machine Learning, 3rdEdition, MIT Press, 2014

S. Rogers and M. Girolami, "A First Course in Machine Learning", 2nd Edition, CRC Press 2017