Syllabus

Course Description

Course Title	Machine Learning
Course Code	76279
Course Title Additional	
Scientific-Disciplinary Sector	IINF-05/A
Language	Italian
Degree Course	Bachelor in Computer Science
Other Degree Courses (Loaned)	
Lecturers	dr. Ivan Donadello, Ivan.Donadello@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/45237
Teaching Assistant	
Semester	Second semester
Course Year/s	2
CP	6
Teaching Hours	30
Lab Hours	30
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	• Data understanding and preprocessing • Classification: Decision Trees, Rule-based classification, KNN, Naïve Bayes, Support Vector Machines, Perceptron, Introduction to Neural Networks • Ensemble learning, boosting, bagging (Random Forests) • Evaluation of Machine Learning algorithms • Regression analysis • K-Means Clustering
Course Topics	The course focuses on fundamental Machine Learning techniques, combining theoretical instruction with practical application. The

	course covers basic supervised and unsupervised learning methods, with lectures devoted to conceptual understanding and labs aimed at hands-on implementation using real-world datasets. Students begin by learning to represent data and manage various feature types, then progress to building predictive models through supervised learning and discovering data groupings through unsupervised learning. Emphasis is placed on evaluating model quality and addressing challenges related to generalization. A significant portion of the course involves implementing algorithms using Python libraries such as Scikit-learn and SciPy, enabling students to tackle a variety of machine learning tasks across diverse application domains.
Keywords	data preprocessing, supervised machine learning, unsupervised machine learning, model selection, model evaluation, Python
Recommended Prerequisites	Probability and statistics, linear algebra, calculus
Propaedeutic Courses	
Teaching Format	This is a project and lab-based module. It consists of frontal lectures, exercises in lab, case study analysis and the development of a project.
Mandatory Attendance	Attendance is not compulsory but recommended. Non-attending students have to contact the lecturer at the start of the course to agree on the modalities of the independent study.
Specific Educational Objectives and Learning Outcomes	Knowledge and Understanging: - D1.10: Know the principles of artificial intelligence and potentials and limits of intelligent systems in various application domains. Applying knowledge and understanding: - D2.12: Be able to adopt programming techniques of artificial intelligence to solve problems of computer science. - D2.14: Be able to apply the tools of statistics and probability theory to solve information technology issues Making judgements: - D3.1: Be able to collect and interpret useful data and to judge information systems and their applicability. - D3.2: Be able to work autonomously according to the own level of knowledge and understanding.

	Communication skills: - D4.1: Be able to use one of the three languages English, Italian and German, and be able to use technical terms and communication appropriately. Learning skills: - D5.1: Have developed learning capabilities to pursue further studies with a high degree of autonomy. - D5.3: Be able to follow the fast technological evolution and to learn cutting edge IT technologies and innovative aspects of last generation information systems.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	The course includes a written exam, worth 50% of the final grade, consisting of knowledge-check questions and problem-solving tasks, and a series of assignments, worth the remaining 50%, involving the implementation of machine learning algorithms on real-world datasets, the conduct of experiments, and the presentation of the results.
Evaluation Criteria	The exam is assessed based on the correctness and clarity of the answers, the ability to summarize and critically evaluate the content, the ability to establish connections between topics, the quality of the argumentation, and the ability to solve problems. To pass the exam, students must obtain a minimum score of 18 out of 30 in both the theory and practical components.
Required Readings	David L. Poole and Alan K. Mackworth. Artificial Intelligence. Cambridge University Press, Cambridge, 3rd revised ed. edition edition, July 2023. ISBN 978-1-009-25819-7. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar. Introduction to Data Mining. Pearson, NY NY, 2nd edition edition, January 2018. ISBN 978-0-13-312890-1.
Supplementary Readings	Stuart Russell e Peter Norvig. Intelligenza artificiale: A Modern Approach. Pearson, Hoboken, quarta edizione, aprile 2020. ISBN 978-0-13-461099-3.

	Aurélien Géron. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems. O'Reilly Media, Beijing China ; Sebastopol, CA, 2a edizione, ottobre 2019. ISBN 978-1-4920-3264-9.
Further Information	
Sustainable Development Goals (SDGs)	Industry, innovation and infrastructure, Quality education