Syllabus

Course Description

Course Title	Artificial intelligence and machine learning
Course Code	42801
Course Title Additional	
Scientific-Disciplinary Sector	ING-INF/05
Language	English
Degree Course	Master in Smart Technologies for Sports and Health
Other Degree Courses (Loaned)	
Lecturers	Dr. Floriano Luca Zini, floriano.zini@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/29416 Prof. Antonio Liotta, Antonio.Liotta@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/41903 Prof. Dr. Oswald Lanz, Oswald.Lanz@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/46208
Teaching Assistant	
Semester	First semester
Course Year/s	1
CP	9
Teaching Hours	60
Lab Hours	30
Individual Study Hours	135
Planned Office Hours	27
Contents Summary	• Agent technologies; • Search space exploration; • Automated planning:

	• Data analysis; • Model selection; • Supervised and unsupervised learning; • Reinforcement learning; • Foundations of deep learning; • Computer vision. Examples of applications in the fields of health and sport will be given for each topic.
Course Topics	• What is artificial intelligence • Agents situated in Environments • Designing agents • What is data mining • Data curation, preparation, and augmentation • Feature engineering • State space search • Uninformed and Informed searching algorithms • Deterministic planning • Planning with uncertainty • Supervised learning: general concepts • Supervised learning: overfitting, model selection and evaluation • Supervised learning: classification algorithms • Supervised learning: ensamble algorithms • Unsupervised learning: general concepts • Unsupervised learning: clustering algorithms • Unsupervised learning: anomaly detection algorithms • Reinforcement learning: general concepts • Reinforcement learning: Markov decision processes • Reinforcement learning: exploration and exploitation • Reinforcement learning: off-policy and on-policy learning • Evaluating reinforcement learning algorithms • Social impact of Artificial intelligence • Neural networks • Deep learning basics • Computer vision basics A selection may be made from these topics during the course based on the teaching needs that arise. Examples of applications in the fields of health and sport will be given for each topic.
Keywords	Artificial Intelligence, Data Mining, Machine Learning, Health, Sport

Recommended Prerequisites	Knowledge in mathematical analysis and fundamentals of statistics
Propaedeutic Courses	
Teaching Format	Frontal lectures, homework, exercises, and laboratories
Mandatory Attendance	Preferrable. Non-attending students should 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 understanding • Knowledge and understanding of the basic methods of artificial intelligence and machine learning and their implementation. Applying knowledge and understanding • Application of the basic methods of artificial intelligent for the design of intelligent systems in the fields of health and sport. Making judgments • Ability to plan and re-plan the work of a technical project and to complete it within specified deadlines and objectives; • Ability to set work objectives that are realistic and compatible with available resources; • Ability to pursue project objectives, resolve conflicts and make compromises without losing sight of costs, resources, time, knowledge or risks; Communication skills • Ability to organize and write scientific and technical documentation for project descriptions; • Ability to develop and present technical content in English; • Ability to synthesize knowledge acquired through reading and studying scientific and technical documentation; preparation of reports and presentations. Learning skills: • Ability to independently expand on knowledge acquired during study by reading and understanding scientific and technical documentation in English; • Ability to independently and continuously update oneself on developments in the most important areas of smart systems for sport and health; • Ability to expand knowledge, including incomplete knowledge, in the area of problem solving, taking into account the primary objective of the project.
Specific Educational	The course belongs to the type "caratterizanti”.

Objectives and Learning Outcomes (additional info.)	Basic knowledge of supervised and unsupervised learning methods, reinforcement learning and deep learning, as well as their applications in the fields of sport and health
Assessment	Each lecturer will propose a project and conduct an oral exam, assessing the two parts with a score between 18 and 30 or a fail. The amount of work required for each part will be proportional to the number of teaching hours of the lecturer. Each part counts for 50% of the mark awarded by the lecturer. The exam is considered passed if the marks for all parts fall within the range 18-30. If the exam is passed, the student's final mark will be the average of the marks given by the lecturers, weighted according to the number of teaching hours of each. Otherwise, any valid marks for individual parts are retained for all 3 regular exam sessions, until all other parts are also completed with a valid mark. After the 3 regular exam sessions, all marks become invalid. The project verifies whether the student is able to apply the concepts presented in the course to solve concrete problems in the fields of health and sports. It is assessed through a final presentation, a demo, and a project report and can be carried out either individually or in a group of 2 students. The oral exam comprises questions to assess the knowledge acquired during the course and its application. Non-attending students have the same assessment criteria and requirements for passing the exam as attending students.
Evaluation Criteria	Relevant for the oral exam: clarity of answers; ability to recall principles and methods, and deep understanding about the course topics presented in the lectures; skills in applying knowledge to solve exercises about the course topics; skills in critical thinking. Relevant for the project: skill in applying knowledge in a practical setting; ability to summarize in own words; ability to develop correct solutions for complex problems; ability to write a quality report; ability in presentation; ability to work in teams. Non-attending students have the same evaluation criteria and requirements for passing the exam as attending students.

Required Readings	All the required reading material will be provided during the course and will be available in electronic format. Copy of the slides will be available as well.
Supplementary Readings	David Poole and Alan Mackworth. Artificial Intelligence: Foundations of Computational Agents. Cambridge University Press, 3rd Edition, 2023. ISBN: 9781009258197. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne and Vipin Kumar. Introduction to Data Mining. Pearson, 2nd Edition, 2019. ISBN: 9780273775324.
Further Information	Software used: Python, Scikit-Learn, PyTorch, Colab
Sustainable Development Goals (SDGs)	Decent work and economic growth, Good health and well-being