Syllabus

Course Description

Course Title	Artificial Intelligence Laboratory
Course Code	73069
Course Title Additional	
Scientific-Disciplinary Sector	INFO-01/A
Language	English
Degree Course	Master in Computing for Data Science
Other Degree Courses (Loaned)	
Lecturers	dr. Alessandro Daniele, Alessandro.Daniele@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/53891
Teaching Assistant	
Semester	Second semester
Course Year/s	1
CP	6
Teaching Hours	20
Lab Hours	40
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	- AI and data/information processing, historical perspective and state of the art - Overview of main AI techniques: exact and approximate methods, handling imperfect information, use and model domain knowledge - Tools and systems for AI based programming - Short projects on AI topics, such as: natural language processing, information extraction, games, automated planning, applications of constraint solving
Course Topics	This laboratory course introduces students to a broad set of AI

	techniques used to support human decision-making in complex domains and to design autonomous or semi-autonomous systems. The course follows a project-oriented, capstone-style structure, in which students progressively design, implement, and evaluate an applied AI system addressing a real or realistic problem. The main component of the course is dedicated to the development of software prototypes using the AI methods introduced during the lectures. Students will work on hands-on challenges involving techniques such as supervised machine learning, natural language processing, information extraction, search and optimization methods, automated planning, constraint solving, and heuristic-based reasoning. The aim of this active participation is to give students a deeper understanding of the strengths, limitations, and practical issues that arise when applying AI methods to real-world tasks. Throughout the course, students will build a toolbox of computational methods and methodological skills enabling them to analyze, model, and solve a variety of practical problems. The hands-on approach will complement theoretical concepts with the practical know-how required to design and deploy concrete, functioning AI solutions.
Keywords	Artificial Intelligence (AI), AI Techniques, Machine Learning, Applied AI, Decision Support, Autonomous Systems, Information Extraction, Search and Optimization, Automated Planning, Constraint Solving, Problem-Solving Methodologies.
Recommended Prerequisites	The course requires solid programming skills (Python will be the primary language) and a general Computer Science background. Students should be familiar with discrete mathematics or logic, basic probability theory, and fundamental AI concepts such as search algorithms (e.g., A*, breadth-first and depth-first search, greedy and local search). Prior exposure to machine learning fundamentals, data processing, and algorithmic problem-solving is recommended, as the course includes hands-on projects involving supervised learning, information extraction, optimization methods, automated planning.

Propaedeutic Courses	
Teaching Format	Frontal lectures introduce the core AI concepts and techniques, while interactive lab sessions provide hands-on practice with the methods presented in class. Throughout the semester, students work on project assignments, partially developed during lab sessions, which guide them through the design, implementation, and evaluation of applied AI solutions. This blended format ensures a balance between theoretical understanding and practical, project-oriented experience.
Mandatory Attendance	The course requires an active participation in the form of timely delivery of assignments, in-class discussion, and presentations. These activities constitute a relevant part of the assessment and must be completed within the required time frames. Most of the work is organised in groups and non-attending students are encouraged to collaborate with attending colleagues to coordinate their contributions.
Specific Educational Objectives and Learning Outcomes	The course belongs to the type "caratterizzanti – discipline informatiche". The general aim of the course is to provide the student with a toolbox of computational instruments and methodologies enabling the tackling of a variety of practical problems. The hands-on approach will complement the understanding of the main concepts with the necessary know-how to deploy concrete solutions. Knowledge and understanding: - D1.1 - Knowledge of the key concepts and technologies of data science disciplines - D1.7 - Knowledge of artificial intelligence techniques and methods for the implementation of intelligent systems Applying knowledge and understanding: - D2.2 - Ability to address and solve a problem using scientific methods - D2.11 - Ability to develop intelligent software systems for decision support

	Making judgments - D3.2 - Ability to autonomously select the documentation (in the form of books, web, magazines, etc.) needed to keep up to date in a given sector Communication skills - D4.1 - Ability to use English at an advanced level with particular reference to disciplinary terminology. - D4.3 - Ability to structure and draft scientific and technical documentation - D4.5 - Ability to interact and collaborate in the implementation of a project or research with peers and experts Learning skills - D5.1 - Ability to autonomously extend the knowledge acquired during the study course. - D5.2 - Ability to autonomously keep oneself up to date with the developments of the most important areas of data science. - D5.3 - Ability to deal with problems in a systematic and creative way and to appropriate problem solving techniques.
Specific Educational Objectives and Learning Outcomes (additional info.)	In addition to the institutional learning outcomes, the course aims to strengthen the students' ability to design, implement, and evaluate applied AI solutions through a project-oriented laboratory approach. Students will learn how to translate real-world problems into computational models, select appropriate AI techniques, and develop functioning prototypes using methods such as supervised learning, search and optimization methods. Through iterative project work, students will acquire practical experience in problem decomposition, data processing, experimental evaluation, and the integration of multiple AI components into a coherent software system. The course also fosters collaborative skills and technical communication through team-based assignments and project presentations, enabling students to work effectively in multidisciplinary environments. By the end of the course, students will be able to autonomously manage the full development cycle of an applied AI solution. From problem formulation to implementation and evaluation, while reflecting critically on methodological choices, limitations, and ethical considerations in AI applications.

Assessment	The assessment is entirely based on a group project, developed throughout the course. Project work: Students will work individually or in a group of 2 members, with the same group maintained for the entire duration of the course. Groups should be formed and agreed upon during the first week. Late-enrolling students should join an existing group or, if several late enrolments occur, form a new group. The project will guide students through the full development cycle of an applied AI solution, including problem formulation, data preparation, implementation of AI techniques (e.g., supervised learning, NLP, planning, constraint solving), testing, evaluation, and documentation. Students are expected to collaborate actively, maintain clear records of their work, and produce a final project deliverable, including code, documentation, and a report describing methods, results, and reflections on the solution. Note: The same assessment criteria apply to non-attending students.
Evaluation Criteria	The evaluation of the course is based entirely on the group project and its associated deliverables. 1. Group Project + Presentation (100%) The project is assessed collectively, taking into account the following criteria: Originality and creativity: the novelty and innovativeness of the proposed solution. Technical quality: correctness, robustness, and efficiency of the implemented AI methods (e.g., supervised learning, NLP, planning, constraint solving). Completeness and documentation: clarity, structure, and thoroughness of code, reports, and supplementary materials. Collaboration and teamwork: active participation, coordination, and contribution of all team members throughout the project.

	Problem-solving and methodology: ability to analyze the problem, select appropriate methods, and justify design choices. Each project deliverable may be evaluated separately, and the final grade will reflect the overall quality and completeness of the project. Deadlines: Failure to submit a deliverable within the required deadline will result in a score of 0 for that deliverable. Prerequisite for passing: A minimum threshold (e.g., 50%) in the project evaluation is required to pass the course.
Required Readings	**Hands-on Python and AI libraries:** • Géron, Aurélien. *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 2nd Edition, O'Reilly, 2019 • VanderPlas, Jake. *Python Data Science Handbook: Essential Tools for Working with Data*, O'Reilly, 2016 **Deep Learning:** • Chollet, François. *Deep Learning with Python*, 2nd Edition, Manning, 2021 *Additional material covering specific topics and advanced techniques may be provided during the course, tailored to the students' project work.* Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it and Ilaria Miceli, Ilaria.Miceli@unibz.it
Supplementary Readings	**Project / Business Intelligence / Data Apps:** Hugging Face documentation and tutorials (***https://huggingface.co/docs***) • Streamlit documentation (*https://docs.streamlit.io/*) • Flask documentation (*https://flask.palletsprojects.com/*) • Git / GitLab tutorials (official docs and online guides)

	Notes: Students are encouraged to use online tutorials, official documentation, and practical guides for libraries and frameworks to complement their project work.
Further Information	
Sustainable Development Goals (SDGs)	Quality education