Syllabus

Course Description

Course Title	Data Mining and Decision Making
Course Code	76439
Course Title Additional	
Scientific-Disciplinary Sector	IINF-05/A
Language	English
Degree Course	Bachelor in Informatics and Management of Digital Business
Other Degree Courses (Loaned)	
Lecturers	Prof. Antonio Liotta, Antonio.Liotta@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/41903 Prof. Giuseppe Di Fatta, Giuseppe.DiFatta@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/46582
Teaching Assistant	
Semester	All semesters
Course Year/s	3
CP	12
Teaching Hours	80
Lab Hours	40
Individual Study Hours	180
Planned Office Hours	36
Contents Summary	- Introduction to Knowledge Discovery in Data - Programming for Data Science - Data quality and data preparation - Data Mining tasks and algorithms - Methods and techniques for data analysis, visualization and decision support - Projects/Case studies on data-driven decision making

	- Decision Theory and Human Decision Making - Introduction to Artificial Intelligence - Machine Learning and Deep Learning algorithms - AI frameworks and tools - Ethical and social implications of AI - Projects/Case studies on AI-driven decision making
Course Topics	This course equips students with professional skills and knowledge essential for exploring and analyzing datasets. It introduces the complete data mining workflow—from data ingestion to analysis and modeling—focusing on extracting actionable insights that support data-driven decision making. Module 1: Introduction to Data Mining Module 2: Data-driven decision making
Keywords	Data Analysis, Data Mining, Data Science, Machine Learning, Codeless Machine Learning
Recommended Prerequisites	Basic programming concepts. Linear algebra. Basic Statistics.
Propaedeutic Courses	
Teaching Format	Frontal lectures, lab assignments, project work.
Mandatory Attendance	Attendance is not compulsory, but non-attending students have to contact the lecturers at the start of the course to agree on the modalities of the independent study.
Specific Educational Objectives and Learning Outcomes	The course belongs to the type "caratterizzante - informatica". The course is designed to acquire professional skills and knowledge useful when exploring datasets. It introduces the whole data mining workflow, from data ingestion to analysis, making insights which are essential for data-driven decision making. Module 1: Introduction to Data Mining In this module, the students will learn how to organize and analyze data by writing programs. More specifically, the students will practically learn how to import, manipulate, analyze, visualize, and model a dataset. The students will also get familiar with libraries that can be effectively used for data preparation, mining, analytics, and visualization. The student will be able to get insights from the data and make data-driven decisions, learning how to avoid common pitfalls that can mislead the analysis. These concepts are explored through projects and case studies, using the Python programming language, following the best practices of reproducible research.

	Module 2: Data-driven decision making In this module, students will learn more advanced data mining methods, to make inference on the data and create regression and classification models. Decision theory and human decision-making methods are combined with artificial intelligence, machine learning and deep learning to address data-intensive, data-driven decision making. These concepts are explored through projects and case studies, using the KNIME analytics platform, to manage complex data-intensive scenarios. The students will also learn how to integrate Python and Keras in KNIME. Knowledge and understanding: • D.12 - Know methodologies for data analysis, machine learning and their application to decision making in the business context. Applying knowledge and understanding: • D2.3 - Ability to analyse business problems and to develop proposals for solutions with the help of IT tools. • D2.6 - Ability to design, describe and present IT solutions to policy makers. • D2.9 - Ability to support the management of IT departments and software companies by providing information as needed. • D2.11 - Ability to analyse large amounts of data on economic facts and processes. Making judgments • D3.1 - Ability to collect and interpret data useful for forming independent judgments on IT and economic aspects of information systems. Communication skills • D4.5 - Ability to collaborate in interdisciplinary teams to achieve IT objectives. Learning skills • D5.3 - Ability to follow rapid technological developments and to learn about innovative aspects of the latest generation of information technology and systems.
Specific Educational Objectives and Learning Outcomes (additional info.)	

Assessment	The exam modalities are the same for both the attending and the non-attending students. Project work (70% of the final grade) and oral exam (30% of the final grade). All project works must have been submitted, at the very latest, 15 days ahead of the oral exam. In case of a positive mark, the projects will count for all 3 regular exam sessions.
Evaluation Criteria	Project work (70% of the final grade) and oral exam (30% of the final grade). • Relevant for project work: clarity of presentation, ability to gain useful and novel insights from data, creativity, critical thinking, ability to adhere to reproducible research best practices. • Ability to use Python to employ (understand, recall and use) data analytics methods in practical settings, starting from data collection, preparation, exploration tasks and going to coherent and insightful data analysis and visualization. • Ability to employ and choose a range of machine learning methods to make inference on the data and create regression and classification models. • Ability to evaluate machine learning models in the context of data-intensive, data-driven decision making. • Ability to implement and critically evaluate complete data science workflows in KNIME, integrating Python and Keras.
Required Readings	*Introduction to Data Mining*, by Pan-Ning Tang, M. Steinbach, A. Karpatne, V. Kumar. Pearson Education Ltd (2nd Edition, 2020). *Python Data Science Handbook*, by Jake VanderPlas. O'Reilly Media (1st Edition, 2016). Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it
Supplementary Readings	*Fundamentals of Data Visualization*. Wilke. Available online
Further Information	Software used Jupyter Notebook (for Python programing) https://jupyter.org/ KNIME https://www.knime.com/

Sustainable Development Goals (SDGs)	Industry, innovation and infrastructure, Quality education

Course Module

Course Constituent Title	Introduction to Data Mining
Course Code	76439A
Scientific-Disciplinary Sector	IINF-05/A
Language	English
Lecturers	Prof. Antonio Liotta, Antonio.Liotta@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/41903
Teaching Assistant	
Semester	First semester
CP	6
Responsible Lecturer	
Teaching Hours	40
Lab Hours	20
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	• Introduction to Knowledge Discovery in Data • Programming for Data Science • Data quality and data preparation • Data Mining tasks and algorithms • Methods and techniques for data analysis, visualization and decision support • Projects/Case studies on data-driven decision making
Course Topics	Module 1: Introduction to Data Mining In this module, students will learn how to organize, explore, and analyze data through programming. The focus is on practical skills: students will gain hands-on experience in importing, manipulating, analyzing, visualizing, and modeling datasets using the Python programming language. Students will become familiar with key Python libraries commonly used in data preparation, mining, analytics, and visualization (e.g., Pandas, NumPy, Matplotlib, Seaborn, Scikit-learn). Emphasis is

	placed on extracting meaningful insights from data and making informed, data-driven decisions. The module also addresses common pitfalls in data analysis and how to avoid misleading interpretations. Learning is reinforced through projects and case studies, following best practices in reproducible research and scientific computing.
Teaching Format	Frontal lectures, lab assignments, project work.
Required Readings	*Introduction to Data Mining*, by Pan-Ning Tang, M. Steinbach, A. Karpatne, V. Kumar. Pearson Education Ltd (2nd Edition, 2020). *Python Data Science Handbook*, by Jake VanderPlas. O'Reilly Media (1st Edition, 2016).
Supplementary Readings	*Fundamentals of Data Visualization*. Wilke. Available online

Course Module

Course Constituent Title	Data-driven Decision Making
Course Code	76439B
Scientific-Disciplinary Sector	IINF-05/A
Language	English
Lecturers	Prof. Giuseppe Di Fatta, Giuseppe.DiFatta@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/46582
Teaching Assistant	
Semester	Second semester
CP	6
Responsible Lecturer	
Teaching Hours	40
Lab Hours	20
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	• Decision Theory and Human Decision Making • Introduction to Artificial Intelligence • Machine Learning and Deep Learning algorithms

	• AI frameworks and tools • Ethical and social implications of AI • Projects/Case studies on AI-driven decision making
Course Topics	Module 2: Data-driven decision making In this module, students will learn more advanced data mining methods, to make inference on the data and create regression and classification models. Decision theory and human decision-making methods are combined with artificial intelligence, machine learning and deep learning to address data-intensive, data-driven decision making. These concepts are explored through projects and case studies, using the KNIME analytics platform, to manage complex data-intensive scenarios. The students will also learn how to integrate Python and Keras in KNIME.
Teaching Format	Frontal lectures, lab assignments, project work.
Required Readings	*Introduction to Data Mining*, by Pan-Ning Tang, M. Steinbach, A. Karpatne, V. Kumar. Pearson Education Ltd (2nd Edition, 2020). *Python Data Science Handbook*, by Jake VanderPlas. O'Reilly Media (1st Edition, 2016).
Supplementary Readings	*Fundamentals of Data Visualization*. Wilke. Available online