Libera Università Internazionale
degli Studi Sociali Guido Carli

LUISS

Syllabus

Academic Year	2021/2022
Program	Data Science and Management
course	Machine Learning
Term	II semester
Year	1
SSD	ING-INF/05 - Sistemi di elaborazione delle informazioni
Credits	6

INSTRUCTIONAL GOALS	The course provides an in-depth understanding of the foundations, scope and approaches of machine learning and it focuses on their application to problems in various disciplines, particularly in business and management. This provides students with the basic ideas and intuition behind modern machine learning methods as well as an understanding of how, why, and when they work. Students in this course will not only gain a deep understanding of the foundational aspects of machine learning, but they will also acquire the practical skills necessary for their successful applications to problems in science and industry.
INTENDED LEARNING OUTCOMES They describe what a learner is expected to know, understand and be able to demonstrate after completion of a learning path.	**Knowledge and understanding**: The course will offer key machine learning tools and techniques to manage, maintain, analyze and visualize data so as to build effective predictive models that can help to extract knowledge and insights from large volumes of data in a business world. In particular, the course will provide a good understanding of the fundamental issues and challenges of machine learning and a deep understanding of the strengths and weaknesses of different machine learning approaches. **Applying knowledge and understanding**: On successful completion of this course students will be able to: • Appreciate the underlying mathematical relationships within and across machine learning algorithms and apply effectively the paradigms of supervised, unsupervised and reinforcement learning to maintain and analyze big volumes of data in different application areas. • Select, design and implement the most appropriate machine learning algorithms in a range of real-world applications. • Design innovative solutions using data-driven analytics and deep learning for data science. **Making judgements**: Students are expected to be able to analyze different quantitative approaches and models and to demonstrate an in-depth, critical understanding of the scope and challenges of machine learning and data-driven analytics. Throughout the entire course, students will be invited to assess critically strengths and weaknesses of all different methods presented in class. **Communications Skills**: This course will give the students the possibility to acquire and to understand major terms and concepts so as to communicate effectively their ideas, findings, proposals, analysis and critical reasoning in the area of data-driven analytics. A special emphasis will be given to oral presentations and pitches in project group works, and to writing technical reports and documentation.

	Learning skills: This course will empower students with the capability to learn several analytical tools for maintaining and analyzing data, and to apply them to real-world problems in an independent and critical way. A strong emphasis will be given to the application of the techniques and tools covered in the course to complex business problems that are typical of today's data-driven companies.
Pre-requisites	Basic knowledge of fundamental algorithms and computer programming skills. Working knowledge of Python is strongly recommended.
Course content	The course will cover the following topics: • Supervised Learning. • Unsupervised Learning. • Reinforcement Learning. • Artificial Neural Networks. • Convolutional Neural Networks. • Recurrent Neural Networks. • Generative Adversarial Networks.
Reference Books	Lecture notes, research papers and course material will be made available on the e-learning platform. Recommended reading: François Chollet, "Deep Learning with Python", 2nd Edition, Manning.
Teaching Methods	The course consists of lectures complemented by practical lab sessions and group project works.
Assessment	There will be a written midterm exam, a written final exam and a project. In the midterm and final exams students are required to demonstrate that: • they have acquired a deep understanding of the main machine learning techniques; • they can apply effectively the general paradigms of supervised, unsupervised and reinforcement learning in different application areas; • they are able to select, design and implement the most appropriate machine learning algorithms in a range of real-world applications. Midterm and final will count for 30% of the grade each. Students that will not take the midterm and final during the course are required to take an oral exam after the course, where they are required to demonstrate the same skills described above. In the project students are required to demonstrate that: • they are able to design innovative solutions using data-driven analytics and deep learning techniques. • they are able to analyze and assess critically strengths and weaknesses of different machine learning techniques for solving concrete problems; • they can apply machine learning techniques to data-driven problems in an independent and critical way; • they can communicate effectively their ideas, findings, proposals, analysis and critical reasoning. The project will count for 40% of the grade. The overall assessment will take into account the level of knowledge and understanding of machine learning techniques acquired by the students; their capacity for thinking creatively, innovatively, analytically, logically and critically; their capacity to design and evaluate solutions for concrete data-driven problems, making reasoned judgements about these; and their capacity to present effectively findings and conclusions.