

Course title	Code No.
Data science and machine learning applications in management	

Semester	Course status (mandatory or optional)
1st semester	Mandatory

Lecturer(s)	E-Mail
Marko Valčić	mvalcic@unizd.hr

Contact hours per week	Credit Points	Workload		
			Presence	Self-study
2+1	5	Lecture	30	60
		Seminar		30
		Practice	15	
		Laboratory		
		Simulator		

Media	Teaching aids
Overhead projector, white board, PC/laptop, graphic tablet, software environment for data science and machine learning (MATLAB, Python)	Presentations (ppt/pdf), references (pdf), video materials (mp4), e-learning materials (online), small group work.

Enrolment requirements and entry competences required for the course
None.

Conditions for permission to take the exam
Completed/solved exercises/problems and successfully presented seminar paper.

Assessment methods and criteria
Assessment is carried out by means of evaluation of: Seminar paper and presentation (35 %) Written exam (35 %) Final (oral) exam (30 %)

Learning outcomes at the programme level to which the course contributes
Students should be able: – to critically discuss the mechanisms that underlie digital and industrial transformations and technical changes as well as their implications on development and society

- to evaluate theoretical and applicative concepts and current research from the field of data science and machine learning for dealing with industrial engineering and management problems
- to recognize the capabilities and challenges of data science and machine learning models and systems,
- to communicate effectively in a multi-cultural environment.

Learning Outcomes

Professional competence	Key skills
<ol style="list-style-type: none"> 1. To classify and compare various concepts and methods of data science and machine learning from engineering and management point of view 2. To explain and discuss the key principles of selected data science and machine learning concepts and methods 3. To identify problems and propose appropriate solutions in implementing various data science and machine learning strategies 4. To analyse the process of building and developing machine learning projects in industry and identify the main issues and obstacles 5. To compare and discuss application of different machine learning methods and provide guidelines for selecting the most appropriate one depending on predefined criteria 6. To distinguish various advance approaches of machine learning and deep learning and evaluate their capabilities for solving complex problems 7. To evaluate the results of risk assessment related to adopted models 	<ul style="list-style-type: none"> - communication in English - basic competence in data science and machine learning; - basic competence in scientific research: - effective learning; - social and civic competences; - sense of initiative and entrepreneurship; - cultural awareness and expression.

Applicability in other courses/programs

This module is suitable for study programs in technical universities dealing with data science, machine learning and deep learning applications, Industry 4.0, and industrial and engineering management.

Content

- Introduction to data science, machine learning and deep learning. Concepts, terminology and application areas.
- Machine learning and deep learning topics. The impact of machine learning and deep learning on technology and society.

- **Data-driven modelling vs first principle modelling. Predictive models and learning from data.**
- **Scoping and managing machine learning initiatives and projects. Building and developing machine learning projects in industry.**
- **Digitization and digitalization. From digital transformation to semi-autonomous and fully autonomous systems. Artificial intelligence (AI) and Industry 4.0.**
- **The Internet of Things (IoT). Cyber-physical systems and emerging technologies. Advanced data analytics.**
- **Industry 4.0 and associated concepts: Management 4.0, Logistics 4.0, Supply Chain 4.0, Predictive maintenance 4.0, Maritime 4.0. Trends and perspectives.**
- **From data to decisions: descriptive, diagnostic, predictive and prescriptive approaches. Data analytics workflow.**
- **Data preparation: importing, cleaning, aggregation, big data handling, reduction, transformation, discretization, feature extraction, visualization.**
- **Machine learning methods in a nutshell. Supervised and unsupervised learning. Regression and classification. Clustering.**
- **From linear and logistic regression to neural networks. Programming languages and software environments for data science and machine learning.**
- **Building the machine learning model.**
- **Machine learning vs. deep learning. Deep learning methods in a nutshell. Applications in engineering and management.**
- **Beyond machine and deep learning. Reinforcement learning. Applications in engineering and management.**
- **Sensitivity and uncertainty analysis of machine and deep learning models. Risk analysis.**

Literature

- **Sharda, R., Delen, D., Turban, E. (2020). Analytics, Data Science, & Artificial Intelligence: Systems For Decision Support, 11th Ed. Pearson Education, Inc., Hoboken, NJ, USA.**
- **Kroese, D.P., Botev, Z.I., Taimre, T., Vaisman, R. (2020). Data Science and Machine Learning: Mathematical and Statistical Methods. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.**
- **Somogyi, Z. (2021). The Application of Artificial Intelligence: Step-by-Step Guide from Beginner to Expert. Springer Nature, Cham, Switzerland.**
- **Kordon, A.K. (2020). Applying Data Science: How to Create Value with Artificial Intelligence. Springer Nature, Cham, Switzerland.**
- **Hudgeon, D., Nichol, R. (2020). Machine Learning for Business: Using Amazon Sagemaker and Jupyter. Manning Publications Co., Shelter Island, NY, USA.**

– Reagan, J.R., Singh, M. (2020). Management 4.0: Cases and Methods for the 4th Industrial Revolution. Springer Nature Singapore Pte Ltd., Singapore.

Amendment Log			
Version No.:	Date:	Changes:	Name:
1.0	1 April 2021	1st version	Marko Valčić