

Study program: Information Technology			
Course title: MACHINE LEARNING			
Teacher(s): Vladimir M. Mladenović, Danijela G. Milošević			
Course status: elective			
Number of ECTS credits: 6			
Prerequisite courses: none			
Course objectives			
Introduction to the basic concepts and algorithms of machine learning including their theoretical foundations, analysis, and practical applications. Students will be able to understand and apply basic supervised and unsupervised learning algorithms with good practice examples and tips for applying the algorithms.			
Learning outcomes			
Students will be able to identify problems that are solved by machine learning approaches. They are able to interpret and analyze different machine learning algorithms, implement them in the Python programming language, and evaluate their performance. They will learn to combine algorithms and compile a workflow from the data preprocessing procedure to the evaluation of the used approaches. Gaining the necessary experience to overcome problems during the application of algorithms.			
Content of the course			
<i>Theoretical teaching</i>			
Learning by example: Forms of learning. Supervised learning. A decision tree for learning. Model selection and optimization. Theory of learning. Linear regression and classification. Non-parametric models. Combining several basic learning models. Development of machine learning systems. Knowledge in learning: A logical formulation of learning. Knowledge in learning. Explanation-based learning. Learning uses relevant information. Inductive logic programming. Probabilistic learning models: Statistical learning. Learning with full data. Learning with hidden variables: The EM algorithm. Deep Learning: Simple Feedforward Networks. Computational graphs for deep learning. Convolutional networks. Learning algorithms. Generalization. Recurrent neural networks. Unsupervised learning and transfer of learning. Emergent learning: Learning from reward. Passive learning with emergence. Active learning with emergence. Generalization in learning with emergence. Search Guidelines. Professional practice and inverse learning with emergence. Applications of Emergence Learning.			
<i>Practical teaching</i>			
Practical lessons are carried out at exercises and at home, in the form of homework. At the end of each lecture, students are given homework that they should do until the practice, two days later. During the exercises, homework solutions are discussed (each student gets a different homework), so problems that some students had with their homework are discussed.			
Literature			
[1] Yaser S. Abu-Mostafa, Malik Magdon-Ismail, LEARNING FROM DATA, AMLbook.com, 2023			
[2] Mladen Nikolić Anđelka Zečević, MAŠINSKO UČENJE, Beograd, 2019.			
[3] Bishop, C.M. Pattern Recognition and Machine Learning Springer, New York 2006			
Number of active teaching classes: 4		Theoretical teaching: 2	Practical teaching: 2
Teaching methods			
Lectures, exercises (Matlab, Python), homework, active learning, learning through project and research			
Evaluation of knowledge (maximum number of points 100)			
Pre-exam obligations	Points	Final exam	Points
Activities during teaching process	20	Final exam (written):	50
Project	30		