Specification for the book of courses

Study program	Computing and Informatics		
Module	Data Science		
Type and level of studies	Master studies		
The name of the course	Machine Learning		
Lecturer (for lectures)	Stoimenov V. Leonid		
Lecturer/associate (for exercises)	Stoimenov V. Leonid		
Lecturer/associate (for OFE)			
Number of ECTS	4	**Course status (obligatory/elective)**	Elective
Prerequisites			
Course objectives	Provide students with knowledge regarding machine learning, its meaning and its role in implementing intelligent systems, in analyzing data from various domains in engineering and science. Provide students with insights into the fundamental methods of modern machine learning. Provide information on how to implement and apply individual machine learning techniques.		
Course outcomes	An insight into the fundamental methods of modern machine learning. Acquiring knowledge regarding the role of machine learning for the realization of intelligent systems. Theoretical knowledge regarding machine learning basics, the most important algorithms for supervised and unsupervised learning. Practical application and implementation of machine learning algorithms and / or the use of existing open source libraries.		
Course outline			
Theoretical teaching	Introduction to machine learning, approaches and types of machine learning. The role of machine learning for the realization of intelligent systems, the role in the big data analysis. Algorithmic learning models. Statistical approaches. Classifiers, functions, relationships, probability models. Bayesian environments. Decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models, Markov and Hidden Markov models. Associative rules, nearest neighbor classifiers. Reduction of dimensionality and visualization. Clustering, k-means clustering, hierarchical clustering, distribution clustering. Reinforcement learning. Learning from heterogeneous distributed data and knowledge sources.		
Practical teaching (exercises, OFE, study and research	Practical implementation of systems based on machine learning or systems using machine learning. Implementation of selected applications related to data mining, automated knowledge acquisition, pattern recognition, program synthesis, text and language processing, internet-based information systems, human-machine interaction, bioinformatics etc.		
Textbooks/references			
1	S. Russel, P. Norvig, Artificial intelligence - A Modern Approach, Pearson, 3rd edition, (2016), ISBN-10: 1292153962, ISBN-13: 978-1292153964		
2	G. Hulten, Building Intelligent Systems: A Guide to Machine Learning Engineering, 1st ed. edition (2018), ISBN-10: 1484234316, ISBN-13: 978-1484234310		
3	C. Sammut (Editor), G. I. Webb (Editor), Encyclopedia of Machine Learning and Data Mining, Springer, 2nd ed. (2017), ISBN-10: 148997685X, ISBN-13: 978-1489976857		
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5			

Number of classes of active education per week during semester/trimester/year				
Lectures	**Exercises**	**OFE**	**Study and research work**	**Other classes**
2	1	0		
Teaching methods	Lectures, exercises, independent homework and projects			

Grade (maximum number of points 100)			
Pre-exam duties	**Points**	**Final exam**	**Points**
Activity during lectures		**Written exam**	
Exercises	40	**Oral exam**	40
Colloquia			

Projects	20		