Table 5.2 Subject Specification

Study program: MSc degree in Electrical Engineering and Computer Science			
Name of the subject: Advanced Machine Learning			
Teacher: Vladimir M. Milovanović			
Status of the subject: elective			
Number of ECTScredits: 6			
Conditions: none			
Subject goal Introduction to advanced methods and understanding of fundamental theoretical concepts of machine learning and statistical pattern recognition.			
Outcome of the subject Mastering the necessary knowledge and skills for designing systems based on machine learning, as well as the ability to apply contemporary techniques of statistical pattern recognition in solving specific engineering tasks and problems.			
Subject content *Theory* Introduction. Basic terms. Supervised learning. Linear regression of a single and multiple variables. Classification. Logistic regression. Regularization. Naïve Bayes classifiers. Support vector machines. Trade-off between bias and variance. VC theory. Perceptron. Artificial neural networks. Recurrent and convolutional neural networks. Deep learning. Unsupervised learning. K-means method. Principal component analysis. Independent component analysis. Anomaly detection. Recommender systems. Markov decision process. Semi-supervised learining. Reinforcement learning. *Practical learning* A brief review of linear algebra and numerical analysis. Examples of the application of machine learning in robot control, autonomous vehicles, bioinformatics, speech and text recognition or translation, as well as in in-depth analysis and processing of big data. Machine learning tools and libraries.			
Literature 1. T. Hastie, R. Tibshirani, J. Friedman, "The Elements of Statistical Learning", 2nd edition, Springer, 2016. 2. S. Shalev-Shwartz, S. Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014. 3. R. Duda, P. Hart, D. Stork, "Pattern Classification", 2nd edition, Wiley-Interscience, 2000. 4. R. Sutton, A. Barto, "Reinforcement Learning: An Introduction", A Bradford Book, 1998. 5. T. Mitchell, "Machine Learning", McGraw-Hill Education, 1997.			
Number of active teaching classes	**Theoretical teaching:** 30	**Practical teaching:** 30	
Method of carrying out the teaching Lectures, office hours and independent research work under the teacher's mentorship.			
Evaluation of knowledge (maximum number of points 100)			
Pre-exam obligations:	70 points	**Final exam:**	30 points