

Table 5.2. Course specification

Study program : Advanced Data Analytics in Business			
Course title: Deep Learning			
Teachers: Nebojša Gvozdenović, Olivera Grljević, Ronald Hohrajter			
Status of the course: Elective			
Number of ECTS: 7			
Condition: Basic python programming			
Goal of the course			
<p>Modern data analytics in business increasingly relies on machine learning techniques, i.e. quality business decisions are made after data being processed by machine learning methods. Having this in mind, machine learning and especially the segment of deep learning in business analysis represents an important apparatus of modern economic sciences, and the subject itself provides the basis for successfully mastering their basics. Particular attention is paid to the connection between theory and business, as well as the application of methods through computer work. The aim of the course for the student is to learn the basics of deep neural networks, to understand how to apply and develop a neural network and lead projects in the field of machine learning.</p>			
Learning outcome			
<p>By mastering the content of the course, students will be able to identify problems from business analysis that can be solved by machine learning techniques. The problems will come from a case study and will be equivalent to problems from practice. Theoretical and practical knowledge acquired through this course will enable them to recognize the nature of the problem, to recognize models and techniques by which the problem is solved and to look for appropriate tools. They will be able to prepare data for the model, translate the model into a form that existing tools can handle, select algorithms to solve, solve the problem and interpret the results, and propose decisions based on the results. Students will also be able to develop different neural network architectures, such as CNN, RNN, LSTM in Python programming language, to understand key parameters of neural network architecture, and to realize photo classification and perform textual data analysis using neural networks.</p>			
Content of the course			
<i>Theory classes</i>			
1-3. <i>Fundamentals of machine learning;</i>			
4-5. <i>Applications of different types of neural networks;</i>			
6-8. <i>Optimization of parameters and training of neural networks;</i>			
9-10. <i>Basics of working in a programming language;</i>			
11. <i>Data transformation;</i>			
12-13. <i>Projects in Python programming language;</i>			
14-15. <i>Modeling.</i>			
<i>Practice and Exercises</i>			
<i>Preparation of assignments and seminar work in the areas listed in the theory classes and mastering the Python programming language and selected libraries for deep neural networks (such as Keras, Tensorflow) in the computer lab</i>			
Literature			
Литература			
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville. (2016). Deep Learning (Adaptive Computation and Machine Learning series). The MIT Press.			
2. Andrew Ng. (2018). Machine Learning Yearning - Technical strategy for AI engineers, in the era of deep learning. deeplearning.ai			
3. Francois Chollet. (2017). Deep Learning with Python. Manning Publications.			
4. V Kishore Ayyadevara. (2019). Neural Networks with Keras Cookbook: Over 70 recipes leveraging deep learning techniques across image, text, audio, and game bots. Packt Publishing.			
5. Richard S. Sutton, Andrew G. Barto. (2018). Reinforcement Learning: An Introduction (Adaptive Computation and Machine Learning series) second edition. A Bradford Book.			
Number of hours of active teaching	Theoretical teaching:2	Practical teaching:2	
Teaching methods			
Lecturing, exercises, discussions, case study analysis in a computer lab.			
Assessment (maximum number of points 100)			
Pre-exam obligations	Points	Final exam	Points

Activities during semester	5	Written exam	
Practical part	5	Oral exam	30
Colloquium (2 times 20 points)	40	
Seminar paper	20		