

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		Deep Learning		
Lecturer (for lectures)		Milosavljević Lj. Aleksandar		
Lecturer/associate (for exercises)		Milosavljević Lj. Aleksandar		
Lecturer/associate (for OFE)				
Number of ECTS		4	Course status (obligatory/elective)	Elective
Prerequisites				
Course objectives		Introduce students to the field of deep learning. Getting acquainted with basic concepts, training techniques, and deep neural network architectures.		
Course outcomes		Getting to know basic architectures, techniques, and algorithms used in the training of deep neural networks. Understanding the benefits of deep learning versus traditional approaches. Getting to know the domains where deep learning techniques are applicable and produce good results.		
Course outline				
Theoretical teaching		Introduction to the deep learning and historical context. A model of the artificial neuron and artificial neural networks. Neural network training, loss function and parameter optimization. Backpropagation algorithm. Convolutional neural networks. Activation functions, initialization of parameters, dropout, batch normalization. Updating training parameters, network ensembles and voting, data augmentation, transfer learning. Hardware and software for deep learning. Architectures of Convolutional Neural Networks (AlexNet, VGG, GoogLeNet, ResNet, ...). Recurrent neural networks. Semantic segmentation, object detection, separation of instances. Generative models, auto-encoders, Generative Adversarial Networks (GAN). Visualization and understanding of deep neural networks. Deep reinforcement learning.		
Practical teaching (exercises, OFE, study and research)		Practical work on the implementation of deep neural networks using TensorFlow and Keras libraries.		
Textbooks/references				
1	Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.			
2	Francois Chollet, Deep Learning with Python, Manning, 2018.			
3				
4				
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, auditory exercises, independent student work on a project.		
Grade (maximum number of points 100)				
Pre-exam duties		Points	Final exam	Points
Activity during lectures			Written exam	
Exercises		30	Oral exam	40
Colloquia				
Projects		30		