Study program:Artificial intelligence

Name of the subject: Deep Learning

Teacher(s):Srdjan Skrbic

Status of the subject: obligatory

Number of ECTS credits:6

Conditions: none

Subject goal

Deep learning has been widely recognized as one of the most popular and fastest growing field of artificial intelligence. It is a tool to deliver high accuracy in tasks such as object detection, speech recognition, language translation and others. The objective of this course is to study the principles, models, tools, and techniques for creating and applying a wide variety of deep neural networks.

Outcome of the subject

Minimal: At the end of the course, it is expected that students understand and show the ability to discuss various models of deep neural networks. Minimal outcome also includes knowledge of using appropriate software tools to build, train and apply deep neural networks in practice.

Desirable: It is expected that a successful student understands solutions to key problems in deep learning and shows ability to identify the optimal way of solving given problem using deep neural networks. Another priority outcome is active knowledge of advanced concepts of deep neural networks programming using appropriate software tools.

Subject content

Theory

The course starts with a brief overview of history of neural network usage and repetition of key mathematical concepts used throughout the course. Next, the course focuses on various models of deep neural networks, starting from perceptrons, through which basic concepts are introduces, building up towards recurrent neural networks including Long short-term memory architecture (LSTM), convolutional neural networks and autoencoders. Various neural network models are introduced through motivating examples and are presented with the focus on their applications.

Practical learning

Practical exercises start with a brief overview of existing software tools for deep learning. As the course progresses towards deep neural network models, practical exercises cover programming methods for building, training, and application of all presented neural network models through various real-world examples. At the end of the practical exercises, students develop and present individual deep learning projects in a competitive environment.

Expert from the industry will be included into the project assignment realization as an external tutor.

Literature

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, Aurélien Géron, O'Reilly Media, Inc., September 2019.
2. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville,MIT Press, 2016.
3. Deep Learning with Python, François Chollet, 1st Edition, Manning 2017.
4. Deep Learning, By John D. Kelleher, The MIT Press, 2019.
5. Deep Learning with PyTorch, Eli Stevens, Luca Antiga, and Thomas Viehmann, Manning 2020.

Number of active teaching classes	**Theoretical teaching:3**	**Practical teaching:2**

Method of carrying out the teaching

During theoretical classes, classical methods of teaching with the use of a video beam are used to present stated topics with focus on their application. Practical classes are done using video beam and computers with appropriate software installed to master the skillful usage of suggested tools through individual development of deep neural networks. A premise for successful practical exercises is the existence of enough computers so that every student may work individually and previous knowledge of programming language Python.

Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	points	**Final exam**	points
Colloquia	30	Oral exam	40
Project	30		