I069	**Natural Language Processing with Deep Learning**	L	P	S	ECTS
		3	2	1	8

Course objectives. Natural language processing belongs to fundamental areas of artificial intelligence therefore, students in this course will learn how to model problems of natural language processing using advanced machine learning techniques. Students will learn theoretical approaches to different applications and language models. They will develop practical deep learning models for natural language processing using modern Python libraries for deep learning and evaluate on actual applications.

Prerequisites. Undergraduate university study programme of mathematics and/or computer science.

Course content.

1. Introduction to natural language processing and deep learning techniques. Word vectors and methods. Language models.
2. Simple word vector representations: word2vec, GloVe.
3. Neural networks and backpropagation. Dependency Parsing. Named entity recognition.
4. Recurrent and recursive neural networks for language modelling.
5. Machine translation, Seq2seq and attention models.
6. Convolutional Networks for sentence classification.
7. Constituency parsing and sentiment analysis using tree recursive neural nets.
8. Dynamic memory neural networks for question answering.

LEARNING OUTCOMES

No.	LEARNING OUTCOMES
1.	Describe fundamental applications of natural language processing in machine inference.
2.	Describe different word vector representations and language models.
3.	Define different deep learning architectures in natural language processing applications.
4.	Choose appropriate deep learning models for specific natural language processing tasks.
5.	Develop and implement optimization algorithms for different neural network models.
6.	Analyse and evaluate performance of deep learning models.
7.	Design and evaluate own deep learning models for natural language processing.

RELATING THE LEARNING OUTCOMES, ORGANIZATION OF THE EDUCATIONAL PROCESS AND ASSESSMENT OF THE LEARNING OUTCOMES

TEACHING ACTIVITY	ECTS	LEARNING OUTCOME **	STUDENT ACTIVITY*	EVALUATION METHOD	POINTS	
					min	max
Attending lectures and exercises	1	1-7	Lecture attendance, discussion, teams work, independent work on given tasks and short written exams	Attendance lists, tracking activities, closed form exercises	0	10
Homework assignments	2	1-7	Independent work on given problems	Evaluation	15	25
Written exam	2	1-7	Preparing for written exam	Evaluation	15	25

(Mid-terms)						
Final project	3	6-7	Independent work on given problems	Written or oral disseminaton	20	40
TOTAL	8				50	100

Teaching methods and student assessment. Lectures and exercises are obligatory. The exam consists of a written and an oral part. Upon completion of the course, students can take the exam. Successful midterm exam scores replace the written exam. Exercises are both auditory and laboratory. Laboratory exercises include the usage of computers. Students can improve their grades by writing homework assignments and seminars.

Can the course be taught in English: Yes

Basic literature:

1. Y. Goldberg, Neural Network Models for Natural Language Processing,Morgan & Claypool Publishers, 2017
2. P. Goyal, S. Pandey, K. Jain, Deep Learning for Natural Language Processing: Creating Neural Networks with Python, Apress, 2018

Recommended literature:

1. L. Deng, Y. Liu, Deep Learning in Natural Language Processing, Springer, 2018
2. A. Clark, C. Fox, S. Lappin, Computational Linguistics and Natural Language Processing, Wiley-Blackwell, 2010.