COURSE DESCRIPTION CARD - SYLLABUS

Course name
A THEORETICAL PERSPECTIVE ON MACHINE LEARNING

Course

Proposed by Discipline
Information and communication technology
Type of studies
Doctoral School
Form of study
full-time

Year/Semester
II/3, III/5
Course offered in
English
Requirements
elective

Number of hours

Lecture
4

Tutorials

Projects/seminars

Number of credit points

1

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

Knowledge: Basic knowledge of university-level mathematics (calculus, linear algebra), probabability calculus, basics of statistics, algorithmics and programming

Skills: Fluent English, ability to read and understand scientific articles, fluency in mathematics at a level taught at Computer Science faculty, programming skills.

Social competencies: Integrity, ability to work systematically, scientific curiosity.

Course objective

The basics of machine learning from a theoretical perspective

Course-related learning outcomes

Knowledge

A PhD student who graduated from doctoral school knows and understands:

1) Current achievements in the field of machine learning, covering theoretical basis as well as general and selected specific issues related to that discipline [P8S_WG/SzD_W01]
2) Key development trends in machine learning [P8S_WG/SzD_W02]

Skills

A PhD student who graduated from doctoral school can:

1) Use the knowledge from different branches of science to creatively identify, formulate and to innovatively solve complex problems or to execute research tasks in machine learning [P8S_UW/SzD_U01]
2) Critically analyze and asses scientific research results, work of experts and other creative activities together with their contribution into knowledge development [P8S_UW/SzD_U02]

Social competencies

A PhD student who graduated from doctoral school is ready to:

1) Acknowledge the importance of machine learning methods by designing a research question involving their own discipline that can be addressed by these methods [P8S_KK/SzD_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

PQF code	Methods for verification of learning outcomes	Assessment criteria
W01, W02	Writing an essay on how machine learning methods can answer scientific questions relevant to student's own discipline	Quality of the text and proposed research questions
U01, U02	Writing an essay on how machine learning methods can answer scientific questions relevant to student's own discipline	Quality of the text and proposed research questions
K03	Writing an essay on how machine learning methods can answer scientific questions relevant to student's own discipline	Quality of the text and proposed research questions

Programme content

1. **Statistical decision theory**: Supervised learning. Statistical learning framework. Making optimal decisions. Classification, regression. Learning paradigms.
2. **Machine learning algorithms**: Histogram-based methods. Decision trees. Nearest-neighbor methods. Naive Bayes. Linear models.

Course topics

Statistical decision theory
Machine learning algorithms

Teaching methods

Lecture: multimedia presentation including illustrations and examples.

Bibliography

Basic

1. Hastie, Tibshirani, Friedman: The Elements of Statistical Learning. Springer, 2009.

Additional

1. Abu-Mostafa, Magdon-Ismail, Lin: Learning from Data. AMLBook, 2012.
2. Shalev-Shwartz, Ben-David: Understanding Machine Learning:From Theory to Algorithms. Cambridge University Press, 2014

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,0
Classes requiring direct contact with the teacher	4	0
Doctoral student's own work (literature studies, preparation for tutorials, project preparation) [1]	21	1,0

[1] delete or add other activities as appropriate