COURSE DESCRIPTION CARD - SYLLABUS

Course name
Machine learning [S1SI1E>UMASZ]

Course

Field of study
Artificial Intelligence

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

5,00

Coordinators

prof. dr hab. inż. Jerzy Stefanowski
jerzy.stefanowski@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge regarding: calculus, linear algebra, probability theory and statistics, algorithms and data structures. The students should also be capable of finding information on their own and be willing to work as part of a team.

Course objective

To present basic methods and algorithms of machine learning. Due to coordination with the scope of other parallel courses, the particular attention is paid to supervised learning and the methods within learning symbolic representations from examples, statistical learning, combined prediction models and principles of an experimental evaluation of classifiers and predictive models. Moreover the students should gain some practical experiences with solving classification tasks during the classes.

Course-related learning outcomes

Knowledge:
The students:
K1st_W3: have a well-grounded knowledge of fundamental computer science problems within the scope of machine learning and data analysis

K1st_W4: know and understand the basic techniques, methods, algorithms, and tools used for solving computer problems as well as problems in machine learning, including decision trees, rules, similarity based learning, probabilistic approaches, linear models and regression/classification, SVM and ensemble classifiers
K1st_W5: have a basic knowledge of key directions and the most important successes of machine learning understood as an essential sub-domain of computer science, making use of the achievements of other scientific disciplines and providing solutions with a high practical impact; know the history and recent trends in ML

Skills:
The students:
K1st_U1: are capable of collecting information from multiple sources, analyzing, interpreting, and synthesizing it, as well as justifying their views, especially in the context machine learning
K1st_U3: can formulate and solve complex machine learning problems within the scope of computer science and, in particular, artificial intelligence, by applying appropriately selected methods such as, classification, regression techniques, similarity based learning, Bayes classifiers, Support Vector Machines, ensemble classifiers
K1st_U4: can efficiently plan and carry out experiments, including computer measurements and simulations, interpret the obtained results and draw conclusions based on the experimental outcomes in the context of machine learning tasks
K1st_U7: can carry out a critical analysis and an assessment of the functioning of machine learning methods
K1st_U8: can design - following a pre-defined specification - and create an IT system that uses machine learning by first selecting and then using the available methods, techniques and computer tools (including programming languages)
K1st_U9: can adapt the existing algorithms as well as formulate and implement the novel algorithms typical for different streams of machine learning, using e.g. Weka, Python
K1st_U10: can retrieve, analyze and transform different types of data, and carry out data synthesis to knowledge and conclusions useful for solving a variety of machine learning problems
K1st_U11: can adapt and make use of the models of intelligent behavior (e.g., prediction models) as well as computer tools simulating such a behavior
K1st_U16: can plan and carry out life-long learning, and is aware of the possibilities of MSc studies

Social competences:
The students:
K1st_K1: understand that machine learning is an ongoing field of study, and that one must keep learning to be up to date with the state-of-the-art
K1st_K2: are aware of the importance of scientific knowledge and research related to machine learning in solving practical problems which are essential for the functioning of individuals, firms, organizations as well as the entire society within such example application fields as transport, healthcare, education, home/service robots, public safety, and entertainment
K1st_K3: know the examples of poorly functioning machine learning systems, which led to the economic, social, or environmental losses
K1st_K5: can think and act in an enterprising way, finding the commercial application for the machine learning based systems, having in mind the economic benefits as well as legal and social issues

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: a written assessement involving multiple choice questions, short answer questions, and micro problems to be solved. At least 50% of points required to pass.
Tutorial classes: assessment based on students' solving theoretical and practical tasks. Tasks solved individually or in groups, during classes or as homework, with at least 50% of points required to pass.

Programme content

The course should cover the following topics: Basics of supervised learning; Classification trees; Induction of rules; Evaluating predictive models; Similarity based learning; Probabilistic approaches - Bayes classifiers; Linear models; Support Vector Machines; Ensembles of classifiers; Semi-supervised and active learning.

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Teaching methods

Lecture: multimedia presentations, whiteboard examples, brainstorming
Tutorial classes: multimedia presentations, whiteboard examples, quizzes, brainstorming, solving illustrative examples on board and in Weka, discussion on the chosen methods.

Bibliography

Basic:
Tom Mitchell, Machine learning, McGraw Hill, 1997.
Machine learning: The Art and Science of Algorithms that Make Sense of Data. Peter A. Flach. Caambridge Press 2012.
Uczenie maszynowe i sieci neuronowe. K.Krawiec, J.Stefanowski, Wyd. Politechniki Poznańskiej, 2004

Additional:
Machine Learning and Data Mining. I Kononenko., M. Kukar. Horwood Publishing, 2007.
Understanding Machine Learning. Shai Ben-David, Shai Shalev-Shwartz, Cambridge Univ. Press 2014.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	62	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	63	2,50