COURSE DESCRIPTION CARD - SYLLABUS

Course name
Machine learning systems [S2Inf1-SzInt>SUS]

Course

Field of study
Computing

Year/Semester
1/1

Area of study (specialization)
Artificial Intelligence

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Students should have knowledge concerning basics of artificial intelligence, optimization, statistical data analysis and mathematical algebraic calculus. Moreover, they should attend earlier non-obligatory 1st degree courses on elements of computational intelligence, including artificial neural networks. With respect to other competence, they should be sufficiently good at programming (in particular in Python) and they should be able to apply analytical and experimental methods, carry out an experimental analysis of algorithms, analyse their results and use statistical tests. Finally student should understand the needs to extend their knowledge and competences.

Course objective

Provide students knowledge on learning systems from examples – more advanced than in preliminary course during the first degree. Develop students' skills in solving real life problems related to applying machine learning methods to engineering and natural life sciences. Develop students' skills to carry out experiments with machine learning and using software libraries.

Course-related learning outcomes

Knowledge:

students should have:
1. well organized and theoretically founded knowledge related to key issues in the field of computer science, including artificial intelligence and elements of machine learning (k2st_w2)
2. knowledge about supervised, unsupervised and semi-supervised learning + dealing with complex data (k2st_w3)
3. knowledge about development trends and the most important cutting edge achievements in computer science and other selected and related scientific disciplines (k2st_w4)
4. knows advanced methods, techniques and tools used to solve complex tasks and conduct research in a selected area of computer science (k2st_w6)

Skills:
1. is able to obtain information from literature, and other sources (both in polish and english), integrate them, interpret and critically evaluate them, draw conclusions (k2st_u1)
2. is able to plan and carry out experiments, including learning systems, interpret the obtained results and draw conclusions and formulate and verify hypotheses (k2st_u3)
3. can use analytical, simulation and experimental methods to formulate and solve simple research problems corresponding to machine learning (k2st_u4)
4. can integrate knowledge from domains of computer sciences and related ones (k2st_u5)
5. is able to assess the suitability and the possibility of using new achievements (methods and tools) and new it products (k2st_u6)
6. is able - using among others conceptually new methods - to solve complex tasks, including a research component (k2st_u10)

Social competences:
1. understands that in the field of it the knowledge and skills quickly become obsolete (k2st_k1)
2. understands the importance of using the latest knowledge in the field of computer science in solving research and practical problems (k2st_k2)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: based on a written test including several questions on the scope of course
Laboratory: evaluation of student’s knowledge necessary to carry out the lab tasks; monitoring students’ activities during classes; evaluation of lab reports (partly started during classes, finished after them).

Programme content

It covers the following topics:
1. Supervised learning. An experimental evaluation of prediction models. Overfiting. Regression and linear models (bias-variance decomposition, regularization). Support vector machines and kernel methods. Ensembles and advanced classifiers. Structure outputs. Some practical issues of data pre-processing.
2. Unsupervised learning (clustering, Gaussian mixtures and EM, neural networks, association rules, subgroup discovery).
3. Semi-supervised learning
4. Temporal data mining (including data streams)
5. Intepretability of machine learning systems.

Course topics

none

Teaching methods

Lecture - learning methods based on multimedia presentation, illustrated with examples or case studies, solving together tasks
Laboratories – tasks, practical exercises also with programming, discussion, teamwork, case studies.

Bibliography

Basic
1. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, P.Flach, Cambridge University Press, 2012.
2. Pattern recognition and machine learning. Ch. Bishop, Springer, 2006.
3. Introduction to machine leaning. E. Alpaydin, MIT Press (3rd ed.), 2014.
Additional
1. Statystyczne systemy uczące się. J.Koronacki, J.Ćwik, EXIT, Warszawa 2008.
2. Uczenie maszynowe i sieci neuronowe, K.Krawiec, J.Stefanowski, Wydawnictwo PP, Poznań, 2004.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	65	2,50