POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Data Analysis and Semantic Web for IoT [S2Inf1-IP>ADISS]

Course

Field of study
Computing

Year/Semester
1/1

Area of study (specialization)
Internet of Things

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

A student starting this course should have basic knowledge of Internet technologies (including XML), the basics of logic and databases, Java and Python programming. He should also have the ability to obtain information from the indicated sources and be ready to handle cooperation within the team.

Course objective

Provide students with knowledge and skills in the field of data analysis using machine learning techniques: classification, managing unknown feature values, mapping feature values, scaling feature values. Provide students with basic knowledge in the field of semantic technologies, including the concept of Web 3.0 (semantic web) and semantic data integration methods. Developing students" problem-solving skills in the field of using and designing systems using machine learning and semantic technologies.

Course-related learning outcomes

Knowledge:

1. has advanced detailed knowledge of classification, data pre-processing, feature selection, cluster analysis, semantic technologies, and web 3.0.
2. has knowledge of development trends and new achievements in machine learning and semantic technologies.
3. knows advanced methods, techniques and tools used in solving complex engineering tasks in the field of computer science related to machine learning and semantic technologies.

Skills:
1. he can plan and carry out experiments in the area of machine learning, interpret the obtained results and draw conclusions.
2. can assess the usefulness of the methods and tools of semantic technologies in the internet of things.

Social competences:
understands that knowledge and skills become obsolete very quickly in computing.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired in the lecture will be tested in a credit test. Pass mark: 50% of the mark. Optionally, the mark can be increased by an oral examination. A list of topics will be given to students in advance.

The skills acquired in the laboratory classes are verified on the basis of mini-projects resulting from the analysis of a designated problem related to machine learning and semantic technologies.

Programme content

The data analytics programme includes machine learning: classification, data preprocessing.

The semantic web programme covers the semantic web: data models, knowledge representation, query language.

Course topics

Data analysis lecture topics: introduction to machine learning, classification problem as one of the machine learning paradigms, nearest neighbor classifier, decision trees and data preprocessing in terms of managing unknown feature values, feature value mapping, feature value scaling, feature discovery.

Semantic web lecture topics: concept of semantic web and web of things, layered architecture of semantic web languages, triple data model, RDF resource description language, knowledge representation using ontologies, querying heterogeneous knowledge sources using SPARQL, data access through ontology (R2RML), metadata modeling and knowledge engineering, examples of current semantic data and knowledge integration initiatives (e.g. http://schema.org), ontologies and metadata schemas for sensor networks (W3C SSN), and the use of semantic technologies in the Internet of Things.

Laboratory classes: deepening the issues discussed in lectures by solving practical problems. In the field of data analysis, the scikit-learn library for the Python language and the Jupyter environment (Jupyter notebooks), among others, were used. In the field of semantic networks, the ontology editor (Protégé), metadata modeling (schema.org, JSON-LD), OBDA mapping (using plugin for Protégé), H2 database, semantic data processing (triples repositories, Jena Fuseki), SPARQL language, among others, were used.

Teaching methods

Lecture: multimedia presentation
Laboratory exercises: practical exercises, discussion, team work

Bibliography

Basic
1. Python. Uczenie maszynowe, Wydanie II, Sebastian Raschka, Vahid Mirjalili, Helion 2019
2. Ontologie w systemach informatycznych, Krzysztof Goczyła, EXIT 2011

3. Linked Data: Evolving the Web into a Global Data Space (1st edition). Tom Heath and Christian Bizer, Synthesis Lectures on the Semantic Web: Theory and Technology, 1:1, 1-136. Morgan & Claypool, 2011, http://linkeddatabook.com/book
Additional
1. Naczelny Algorytm. Jak jego odkrycie zmieni nasz świat, Pedro Domingos, Helion 2016
2. Semantic Web for the Working Ontologist, Dean Allemang and Jim Hendler, Morgan Kaufmann 2008
3. Demystifying OWL for the Enterprise, Michael Uschold, Morgan & Claypool Publishers, 2018
4. An Introduction to Ontology Engineering. Keet, C.M. College Publications, volume 20, November 2018
5. Internet rzeczy. Budowa sieci z wykorzystaniem technologii webowych i Raspberry Pi, Dominique Guinard, Vlad Trifa, Helion, 2017
6. Semantic data mining. An ontology-based approach. Agnieszka Ławrynowicz. Studies on the Semantic Web, Vol. 29. IOS Pres/AKA Verlag 2017

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