COURSE DESCRIPTION CARD - SYLLABUS

Course name

Data analysis and semantic networks for the Internet of Things

Course

Field of study	Year/Semester
Computing	1/1
Area of study (specialization)	Profile of study
Internet of Things	general academic
Level of study	Course offered in
Second-cycle studies	Polish
Form of study	Requirements
full-time	elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	30	
Tutorials	Projects/seminars	

Number of credit points

5

Lecturers

Responsible for the course/lecturer:	Responsible for the course/lecturer:
dr inż. Jarosław Bąk	dr inż. Tomasz Łukaszewski

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, discovering features, feature selection, cluster analysis.

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 during the lecture is verified on a written exam. Passing threshold: 50% of points. Final issues, on the basis of which the questions are developed, will be sent to students by e-mail using the university's e-mail system. The skills acquired during the laboratory classes are verified on the basis of the presentation resulting from the analysis of the indicated problem related to machine learning and semantic technologies.

Programme content

The data analysis lecture schedule includes: closest neighbors classifier, decision trees, naive Bayesian classifier, unknown feature value management, feature value mapping, feature value scaling, feature discovery, feature selection, cluster analysis (clustering) hierarchical and k-means. In the field of semantic networks, the program covers the following issues: the concept of the semantic web and the World Web of Things, the layered architecture of the semantic web languages, the ternary data model, the RDF resource description language, knowledge representation using an ontology, SPARQL query language, access to data via an ontology, metadata modeling and knowledge engineering, examples of current semantic data and knowledge integration initiatives (e.g. http://schema.org), sensor network ontologies and metadata schemas (W3C SSN), and the use of semantic technologies in the Internet of Things.

The laboratory program includes in-depth issues discussed during the lectures. In the field of data analysis, libraries for the Python language were used, allowing for effective implementation of the discussed solutions. Data representation in the RDF model. Modeling ontology with the use of the ontology editor (Protégé). Metadata modeling (schema.org, JSON-LD). Semantic data processing (triple repositories, Jena Fuseki). Data transformation into knowledge graph format. Querying heterogeneous sources of knowledge with SPARQL. Access to data via ontology (R2RML). Summary of the acquired knowledge in semantic technologies within the mini-project.

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	5,0
Classes requiring direct contact with the teacher	60	2,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	65	2,5

[1] delete or add other activities as appropriate