GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Intelligent Decision Systems, PG_00055276		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	6	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Multimedia Systems -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Piotr Szczuko	
	Teachers	dr hab. inż. Piotr Szczuko	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	30.0	0.0	0.0	45

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	45	4.0	26.0	75

Subject objectives

Aim of the course is to present and familiarize the student with theoretical basis and applications of methods and algorithms of decision systems, based on: fuzzy logic, artificial neural networks, decision trees, AdaBoost classifiers, genetic algorithms and other. The laboratories give practical skill of selecting and applying the tools, preparing data for classification and drawing conclusions.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U07] can apply methods of process and function support, specific to the field of study	Student is able to use modules and algorithms in practical problems. Can apply fuzzy logic, neural networks, decision trees, cascaded classifiers, genetic algorithms, and other methods. Student knows how to properly prepare datasets, preprocess data, filter data, and adapt for given methods. Student is able to draw conclusions from conducted experiments.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[K6_W03] Knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	Student is able to describe theoretical basis, principles of operation and provide examples for decision systems, based on fuzzy logic, neural networks, decision trees, cascaded classifiers, genetic algorithms, and other methods.	[SW1] Assessment of factual knowledge
[K6_W05] Knows and understands, to an advanced extent, methods of supporting processes and functions, specific to the field of study	Student is able to describe theoretical basis, principles of operation and provide examples for decision systems to be applied in selected processes of classification, automatisation and optimisation.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>1. Introductory issues. General characteristics of soft computing, machine learning, cognitive methods and algorithms. The notion of expert sys-tem. Methodological fundamentals of automatic knowledge discovery. Data mining. Machine learning. 2. Knowledge representation and discovery. Data types and data prepro-cessing.Methods for attribute quantizing. Blind, heuristic and non-deterministic search. Agents. 3. Knowledge representation - Fuzzy logic I. Fundamentals of fuzzy logic. Fuzzy interpreter. Fuzzy decision systems. 4. Knowledge representation - Fuzzy logic II. Fuzzification. Rule aggregation. Methods of defuzzyfying. Fuzzy Takagi-Sugeno systems. Examples and applications of fuzzy logic systems. 5. Knowledge representation III Rough Sets theory. Non-Cantor set theory interpretation. Selected non-Boolean logic systems and their applications. Dempster-Schafer theory elements. 6. Intrepreting of partially conflicting data. Methods of reducts determin-ing inducing certain rules. Methods of inducing uncertain rules. Deci-sion system based on rough sets. 7. Machine learning I. Supervised learning. Unsupervised learning. Behavioral learning, Inductive learning. Methods based on similarity. Decision trees. 8. Machine learning II neural networks. Unilateral neural networks. Classic form of error backpropagation algorithm. Training methods of single layer neural networks. Methods of weights initializing. Methods of learning rate defining. Optimal NN architecture selection. 9. Machine learning V Genetic algorithms. Fundamentals and characteristics of genetic algorithms. Basic genetic operators. Reproduction. Crossing-over. Mutation. 10. Machine learning VI Comparison of genetic algorithms with other optimising methods. Evolutionary computing. Examples of genetic algorithms applications, Expert systems. Facts and heuristics. Selection of knowledge represen-tation methods. Knowledge acquisition. Interpreting, planning, prognos-ing, controlling. diagnostics, testing and designing systems. 11. Expert systems constructions and architectures. Programmimg languag-es of expert systems. 12. Selected applications of machine learning and expert systems in tele-communications. Automatic analysis of network repositories. Applications to distribured computing. Intelligent data flow controlling in telecommunication net-works. Transmission error correction methods employing intelligent decision feedback. 13. Localizing of network operation faults on the basis of router log con-tents. Intelligent analysis of boundary constraints in mobile networks 14. Analysis and detection of alert sequences in networks. Intelligent noise and echo reduction methods. Intelligent navigation methods. 15. Natural language processing. Language analysis stages. Text generat-ing. Semantic query. Machine translation. Natural language understanding. Designs od available natural language processing software.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>No requirements</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Practical laboratories</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>Written exam</td><td>51.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>CHANDRA, HAREENDRAN. Artifical intelligence and machine learning . PHI Learning, 2014
Gupta, Forgionne, Intelligent Decision-making Support Systems. Springer, 2007</td></tr>
<tr><td>Supplementary literature</td><td>No requirements</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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