



Subject card

Subject name and code	Intelligent Decision Systems, PG_00055276						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2021	Academic year of realisation of subject			2023/2024		
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 dr hab. inż. Józef Kotus dr inż. Michał Lech prof. dr hab. inż. Andrzej Czyżewski					
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_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, automatization and optimisation.	[SW1] Assessment of factual knowledge
	[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_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.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
Subject contents	<p>1. Introductory issues. General characteristics of soft computing, machine learning, cognitive methods and algorithms. The notion of expert system. Methodological fundamentals of automatic knowledge discovery. Data mining. Machine learning. 2. Knowledge representation and discovery. Data types and data preprocessing. 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 defuzzifying. 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. Interpreting of partially conflicting data. Methods of reducts determining inducing certain rules. Methods of inducing uncertain rules. Decision 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 representation methods. Knowledge acquisition. Interpreting, planning, prognostic, controlling, diagnostics, testing and designing systems. 11. Expert systems constructions and architectures. Programming languages of expert systems. 12. Selected applications of machine learning and expert systems in telecommunications. Automatic analysis of network repositories. Applications to distributed computing. Intelligent data flow controlling in telecommunication networks. Transmission error correction methods employing intelligent decision feedback. 13. Localizing of network operation faults on the basis of router log contents. 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 generating. Semantic query. Machine translation. Natural language understanding. Designs of available natural language processing software.</p>		
Prerequisites and co-requisites	No requirements		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	51.0%	50.0%
	Practical laboratories	51.0%	50.0%
Recommended reading	Basic literature	<ul style="list-style-type: none"> CHANDRA, HAREENDRAN. Artificial intelligence and machine learning . PHI Learning, 2014 Gupta, Forgie, Intelligent Decision-making Support Systems. Springer, 2007 	
	Supplementary literature	No requirements	
	eResources addresses	Adresy na platformie eNauzanie: Inteligentne Systemy Decyzyjne 2024 - Moodle ID: 38276 https://enauzanie.pg.edu.pl/moodle/course/view.php?id=38276	

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable