



Subject card

Subject name and code	Computational Intelligence, PG_00047442						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2022/2023		
Education level	second-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	1	Language of instruction			English		
Semester of study	1	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Decision Systems and Robotics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Tomasz Białaszewski					
	Teachers	dr inż. Tomasz Białaszewski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	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		6.0		24.0	75
Subject objectives	Widening the students knowledge about the selected methods of artificial intelligence						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W03] Knows and understands, to an increased 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 explains learning methods of parameters of Bayesian networks	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_W21] Knows and understands, to an advanced extent, methods and techniques of design and operation of automatic control systems, control and robotics systems, as well as the use of computers in the control and monitoring of dynamic objects	Student explains learning methods of structure of Bayesian networks Student explains learning methods of Bayesian networks based on the pattern	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Student apply radial artificial neural networks in machine learning problems Student prepares programs in the LISP language	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
	[K7_W01] Knows and understands, to an increased extent, mathematics to the extent necessary to formulate and solve complex issues related to the field of study.	Student explains the genetic programming method,	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
[K7_K02] is ready to provide critical evaluation of received content and to acknowledge the importance of knowledge in solving cognitive and practical problems	Student uses learning methods for example tasks.	[SK5] Assessment of ability to solve problems that arise in practice	
Subject contents	1. Organization of the course and assessment criteria 2. Modern research trends in computational intelligence – symbolic and connectionist paradigms 3. Overview of scope and schedule of lectures, practice and laboratory 4. LISP – introduction 5. LISP – advanced construction of language 6. LISP – application in artificial intelligence 7. Genetic programming – basic algorithms 8. Genetic programming – representation of programs in LISP language 9. Genetic programming – examples and application 10. Bayesian networks – inference methods 11. Bayesian networks – parameters learning 12. Bayesian networks – parameters learning with incomplete data 13. Bayesian networks – structure learning. 14. Radial artificial neural networks - basic concepts. 15. Radial artificial neural networks - applications in machine learning problems.		
Prerequisites and co-requisites	No requirements		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory	25.0%	40.0%
	Exam	50.0%	60.0%
Recommended reading	Basic literature	1. Neapolitan R.: Learning Bayesian Networks, Prentice Hall, 2003 2. Koza J., et al: Genetic Programming IV, Spriger, 2005 3. <a href="http://www.scheme.com/tspl4/">http://www.scheme.com/tspl4/</a> The Scheme Programming Language Fourth Edition R. Kent Dybvig 4. <a href="https://racket-lang.org/">https://racket-lang.org/</a> 5. <a href="http://www.genetic-programming.org/">http://www.genetic-programming.org/</a> 6. <a href="https://www.mathworks.com/help/deeplearning/ug/radial-basis-neural-networks.html">https://www.mathworks.com/help/deeplearning/ug/radial-basis-neural-networks.html</a>	
	Supplementary literature	<a href="https://htdp.org/">https://htdp.org/</a>	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1. Explain a mechanism of mutation by changing the intermediate node in genetic programming?. Show an example of the situation. Write a mutant program as a s-expressions of LISP. 2. Define the procedure power-list, which takes a nonnegative integer n and a list of numbers and returns a new list, each element of which is the number of the power n 3. Explain the Bayes network parameter learning algorithm for incomplete data.		
Work placement	Not applicable		