GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Machine Learning Systems, PG_00058859		
Field of study	Informatics		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
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	Polish
Semester of study	2	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Intelligent Interactive Systems -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Jerzy Dembski	
	Teachers	dr inż. Jerzy Dembski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	15.0	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	8.0	47.0	100

Subject objectives	The skills in the data mining domain, object classification, genetic algorithms and reinforcement learning usage in optimal strategy searching.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by:n-appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation,n-application of appropriate methods and toolsn	Student models real systems to optimize their parameters using machine learning methods.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K7_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions	The student can carry out experiments to obtain information on decision-making systems quality and based on conclusions choose the right solutions for the staked problem.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[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.	The student has knowledge of theoretical foundations and with scope of construction and the use of Bayesian networks and decision trees, and also knows theoretical foundations and understands the operations of genetic algorithms genetic and reinforcement learning systems in multi-stage decision problems.	[SW1] Assessment of factual knowledge
[K7_U41] can select methods of modelling and analysis of information systems and applications using selected elements of theoretical computer science and modern programming tools	The student is able to choose the right one model and training method for the problem that requires learning and for the type of data held. For example in decision-making problems if he has information about right decisions in specific situations he will select decision trees or another learning method which require learning example sets. If he has only overall performance evaluation he wiil choose genetic algorithms genetic or reinforcement learning when the decision process making can be divided into many stages.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K7_W05] Knows and understands, to an increased extent, methods of process and function support, specific to the field of study.	The student has knowledge of acceleration and optimization of calculations in machine learning systems.	[SW1] Assessment of factual knowledge

Subject contents

1. Introduction to Machine Learning 2. Decision trees - introduction (example, tree structure, terminology, notation, advantages and disadvantages) 3. Attribute selection criteria 4. Stopping criteria and pruning decision trees 5. Discretization of continuous attributes 6. Some problems with tree construction (missing attributes, large data sets) 7. Bayesian networks - introduction 8. Estimating the parameters of a bayesian network of a given structure 9. Learning the structure of a bayesian network 10. Clustering methods - introduction 11. K-means algorithm 12. Hierarchic clustering 13. Gaussian mixture model 14. Fuzzy c-means algorithm 15. Probabilistic clustering - COBWEB algorithm 16. Genetic algorithms - introduction 17. Coding methods 18. Advanced genetic search methods 19. Genetic based machine learning (GMBL) 20. Reinforcement learning in multistage decision prosesses - introduction 21. Exploitation and exploration 22. Markov decision processes 23. Time differences method with discrete and continuous representation

Prerequisites and co-requisites

No requirements

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Seminar	60.0%	20.0%
Project	60.0%	20.0%
Theoretical knowledge (lecture)	60.0%	40.0%
Activity	0.0%	20.0%

Recommended reading	Basic literature	P. Cichosz, "Systemy uczące się", Wydawnictwa Naukowo-Techniczne, Warszawa 2000, T. M. Mitchell, "Machine learning", The McGraw-Hill Companies, Inc, 1997, David E. Goldberg, ***Algorytmy genetyczne i ich zastosowania***, WNT, Warszawa 1995, Richard Sutton, Andrew G. Barto, ***Reinforcement Learning: An Introduction***,MIT Press, Cambridge, MA, 1998.
	Supplementary literature	No requirements
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	