



Subject card

Subject name and code	Machine Learning I, PG_00053428						
Field of study	Automation, Robotics and Control Systems						
Date of commencement of studies	February 2022	Academic year of realisation of subject				2022/2023	
Education level	second-cycle studies	Subject group					
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				3.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Michał Grochowski					
	Teachers						
Lesson type and method of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	0.0	30
	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	30		10.0		35.0	75
Subject objectives	The aim of the course is to introduce students to a comprehensive knowledge of the dynamically developing field of Machine Learning and to indicate its practical applications in widely understood automation and computer science.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	K7_W08						
	K7_W06						
	K7_U03						
	K7_U04						
	K7_U07		Students will be able to apply known artificial intelligence tools and algorithms to solve research problems e.g. to design a neural classifier.			[SU4] Assessment of ability to use methods and tools	
K7_W11		The student in a small team is able to design, prepare and carry out an experiment, and then draw appropriate conclusions. For example, he/she is able to prepare a diagnostic system, which allows to identify damage to a selected system.			[SW3] Assessment of knowledge contained in written work and projects		
Subject contents	The programme contents will be realised in three thematic blocks: 1. Data analysis, among others:- exploratory research- data grouping, clustering - feature selection and extraction, - dimension reduction, - data normalization,- multidimensional data visualization. 2. Models and methods of their learning, e.g:- regression models, - Support vector machines, - Neural networks, - recurrent neural networks,- deep neural networks, - learning: supervised, unsupervised, semi-supervised, reinforcement learning- decision trees- random forests- ensembling and gradient boosting methods- automatic machine learning (AutoML)3. Model performance analysis and improvement, including- quality measures of model performance, - regularization techniques,- model validation,- selection of hyperparameters for models,- analysis of algorithm performance using explanatory artificial intelligence (XAI).						
Prerequisites and co-requisites	Basic knowledge of artificial intelligence methods and optimisation						
Assessment methods and criteria	Subject passing criteria		Passing threshold			Percentage of the final grade	
	Ocena projektu		50.0%			50.0%	
	Kolokwium		50.0%			50.0%	

Recommended reading	Basic literature	<ul style="list-style-type: none"> • Bonaccorso, G. Algorytmy uczenia maszynowego. Zaawansowane techniki implementacji. Helion, 2019 • Szeliga, M. Data Science i uczenie maszynowe. Wydawnictwo Naukowe PWN, 2017. • Grus, J. Data science od podstaw. Analiza danych w Pythonie. Helion, 2019. • Bengio, Y., Courville A., Goodfellow I. Deep Learning. Systemy uczące się. Wydawnictwo Naukowe PWN, 2018. • Alpaydin, E. Introduction to Machine Learning. The MIT Press Cambridge, Massachusetts London, England 2010. • Chollet, F. Deep Learning. Helion, 2019
	Supplementary literature	<ul style="list-style-type: none"> • Haykin, S. Neural Networks and Learning Machines (3rd Edition), Prentice Hall, 2009. • Bishop C. M. Pattern Recognition and Machine Learning. Springer, 2006. • MATLAB Statistics and Machine Learning Toolbox User's Guide, 2021. • James, Gareth, et al. An introduction to statistical learning. Vol. 112. New York: springer, 2013. • Murphy, Kevin P. Machine learning: a probabilistic perspective. MIT press, 2012.
	eResources addresses	
Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none"> • Feature mining and knowledge extraction from large data sets, data normalisation, treatment of missing data, dimension reduction, visualisation of multidimensional data. • Analysis of footballers' characteristics in terms of their suitability for a given team/position. • System of analysis and recommendation of purchases on the basis of previous customer activity. • Assessment of human health based on data from sports/medical wristbands. • Scene analysis issues on the example of a driver assistance system or for autonomous vehicles (e.g. detection and classification of road signs and traffic lights, detection of pedestrians and other vehicles) • Prediction of product sales volumes • Prediction of number of bike rentals • Detection of anomalies/diagnosis of processes on the basis of multidimensional analysis of signals from measuring devices. Issues of predictive maintenance (Predictive Maintenance). 	
Work placement	Not applicable	