GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Machine Learning, PG_00053337		
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering		
Date of commencement of studies	February 2022	Academic year of realisation of subject	2021/2022
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	1	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jacek Rumiński	
	Teachers	dr Tomasz Neumann mgr inż. Natalia Kowalczyk mgr inż. Szymon Zaporowski prof. dr hab. inż. Jacek Rumiński	

Lesson type and method of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	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	4.0	26.0	75

Subject objectives	The aim of the course is to acquire knowledge and skills in the field of machine learning algorithms, data pre-processing methods as well as metrics and methods for the verification and validation of algorithms and models.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions	The effect of the learning process is the student's gaining the ability to apply the planning of a research experiment related to machine learning, the selection of data and parameters as well as model evaluation measures, interpretation of the results as well as introducing changes to the experiment or the developed model.	[SU1] Assessment of task fulfilment
	[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	The effect of the learning process is the student acquiring the skills of practical application of machine learning algorithms, formulas in the field of cost functions, model quality assessment metrics, etc., in order to solve problems related to data classification, object detection, generation of generalizing characteristics or regression models, in particular in biomedical applications. , personal safety, health prevention, etc.	[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.	The effect of the learning process is the student gaining knowledge in the field of understanding the definition of machine learning algorithms, formulas in the field of cost functions, model quality assessment metrics, etc., in order to solve problems related to data classification, object detection, generation of generalizing characteristics or regression models.	[SW1] Assessment of factual knowledge
	[K7_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices	The effect of the learning process is the student's acquisition of knowledge in the field of implementation or use of programming libraries regarding the practical application of machine learning algorithms, cost functions formulas, model quality assessment metrics, etc., in order to solve problems related to data classification, object detection, generation of generalizing characteristics. or regression models in particular in biomedical applications, human safety, health prevention, etc.	[SW1] Assessment of factual knowledge

Subject contents	Introduction to machine learning (what is machine learning, classifications of machine learning methods) Methods of data acquisition and preparation: data cleansing, data transformation, data standardization and normalization Methods of data acquisition and preparation: data integration and reduction Methods of reducing multidimensionality (e.g. PCA, ICA, etc.) Data representation methods for machine learning The process of acquiring knowledge from data Generalizing characteristics generation methods Rule induction methods and rules evaluation parameters Classification methods (introduction) and classification quality assessment methods (measures, etc.) Supervised classification methods (decision trees, random forests) Supervised classification methods (from Bayes to minimum-distance classification) Supervised Classification (SVM) Methods, Unsupervised classification methods (k-means, ISO-DATA, etc.) Optimization methods - characteristics Optimization methods - gradient methods Linear Regression Logistic regression Artificial neural networks - introduction, perceptron, learning Artificial neural networks - MLP, activation functions, learning part 1. Artificial neural networks - MLP part 2.
Prerequisites and co-requisites	- knows the basics of linear algebra, mathematical analysis and probability calculus with Bayes' theorem - knows the basics of software engineering (software life cycle, software design, testing, etc.). - knows the basics of data analysis methods - knows the basics of Python - can design and model object-oriented - can use databases
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory	50.0%	50.0%
Exam	50.0%	40.0%
Assignments	50.0%	10.0%

Recommended reading	Basic literature	Deisenroth Marc Peter, Mathematics for Machine Learning, Cambridge University Press, 2020 Sebastian Raschka, Vahid Mirjalili, Python Machine Learning, Packt Publishing, 2019. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems O'Reilly Media; 2nd edition, 2019.
	Supplementary literature	Chris A. Mattmann , Machine Learning with TensorFlow, Second Edition, Manning, 2020
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	