



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 2027	Academic year of realisation of subject				2026/2027	
Education level	second-cycle studies	Subject group				Optional subject group Specialty 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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jacek Rumiński					
	Teachers	mgr inż. Antoni Górecki prof. dr hab. inż. Jacek Rumiński					
Lesson types	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_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of study, and organization of work 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
	[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by: - appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation, - application of appropriate methods and tools	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

Subject contents	<p>Course content – lecture Introduction to machine learning (what is machine learning, classifications of machine learning methods)</p> <p>Methods of data acquisition and preparation: data cleansing, data transformation, data standardization and normalization</p> <p>Methods of data acquisition and preparation: data integration and reduction</p> <p>Methods of reducing multidimensionality (e.g. PCA, ICA, etc.)</p> <p>Data representation methods for machine learning</p> <p>The process of acquiring knowledge from data</p> <p>Generalizing characteristics generation methods</p> <p>Rule induction methods and rules evaluation parameters</p> <p>Classification methods (introduction) and classification quality assessment methods (measures, etc.)</p> <p>Supervised classification methods (decision trees, random forests)</p> <p>Supervised classification methods (from Bayes to minimum-distance classification)</p> <p>Supervised Classification (SVM) Methods,</p> <p>Unsupervised classification methods (k-means, ISO-DATA, etc.)</p> <p>Optimization methods - characteristics</p> <p>Optimization methods - gradient methods</p> <p>Linear Regression</p> <p>Logistic regression</p> <p>Artificial neural networks - introduction, perceptron, learning</p> <p>Artificial neural networks - MLP, activation functions, learning part 1.</p> <p>Artificial neural networks - MLP part 2.</p>												
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	<table border="1"> <thead> <tr> <th data-bbox="454 1830 794 1861">Subject passing criteria</th> <th data-bbox="799 1830 1139 1861">Passing threshold</th> <th data-bbox="1144 1830 1482 1861">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="454 1868 794 1899">Laboratory</td> <td data-bbox="799 1868 1139 1899">50.0%</td> <td data-bbox="1144 1868 1482 1899">50.0%</td> </tr> <tr> <td data-bbox="454 1906 794 1937">Assignments</td> <td data-bbox="799 1906 1139 1937">50.0%</td> <td data-bbox="1144 1906 1482 1937">10.0%</td> </tr> <tr> <td data-bbox="454 1944 794 1975">Exam</td> <td data-bbox="799 1944 1139 1975">50.0%</td> <td data-bbox="1144 1944 1482 1975">40.0%</td> </tr> </tbody> </table>	Subject passing criteria	Passing threshold	Percentage of the final grade	Laboratory	50.0%	50.0%	Assignments	50.0%	10.0%	Exam	50.0%	40.0%
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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		
Practical activities within the subject	Not applicable	

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