GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Machine learning in decision-making processes for autonomous electric vehicles, PG_00066221		
Field of study	Electrical Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Electric Drives and Energy Conversion -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Drzewiecki	
	Teachers	dr inż. Marcin Drzewiecki	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	10.0	0.0	10.0	0.0	0.0	20

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	20	5.0	25.0	50

Subject objectives

The aim of the course is to provide students with knowledge and skills related to machine learning enabling image recognition, that is applicable in the decision-making processes of autonomous electric vehicles.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W06] has in-depth knowledge of industrial electronics, microprocessor control systems, programmable logic systems and printed circuit design and prototyping computer-aided prototyping	Implements artificial neural networks and machine learning algorithms in a programming language. Selects and implements solutions enabling image recognition, applicable in the decision-making processes of autonomous electric vehicles.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
[K7_U03] is able to obtain information from literature, databases and other sources, also in English, draw conclusions, formulate and fully justify opinions. substantiate opinions; is able to identify directions for further learning and implement the process of self-education	Obtains training data sets and programming libraries needed to train multilayer neural networks from publicly available databases.	[SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment
[K7_U02] is able to prepare and deliver a short oral presentation on a selected technical topic	Discusses selected issues related to machine learning in the decision-making processes of autonomous electric vehicles.	[SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information

Subject contents

Lecture:
Introduction to machine learning, applicable to decision-making processes of autonomous electric vehicles. Autonomous electric vehicles. Image recognition. ADALINE model. Rosenblatt perceptron model. McCulloch-Pitts neuron model. Multilayer neural networks and their training algorithms. Deep learning. Backpropagation algorithm. Training an artificial neural network. Convolutional (convolutional) neural networks in image recognition. Use of a high-level, general-purpose programming language: Python in machine learning.

Lab:
Practical exercises in the field of machine learning enabling image recognition, applicable to decision-making processes of autonomous electric vehicles. Performing practical exercises in Python using programming libraries. Implementation of the backpropagation algorithm to train a multilayer neural network. Training a multilayer neural network for image recognition. Use of available training sets for machine learning algorithms. Image recognition with a convolutional neural network using the TensorFlow library.

Prerequisites and co-requisites

Basic knowledge of electric drives, automation and structured programming.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Test	60.0%	50.0%
	Practical exercises	60.0%	50.0%
Recommended reading	Basic literature	1. S. Raschka, V. Mirjalili: Python. Uczenie maszynowe. Wydanie 2. Wyd. Helion, 2019. 2. P. Wawrzyński. Systemy adaptacyjne i uczące się. Oficyna Wydawnicza Politechniki Warszawskiej, 2009. 3. D. Rutkowska, M. Piliński, L. Rutkowski: Sieci neuronowe, algorytmy genetyczne i systemy rozmyte. Wyd. Naukowe PWN, 1997.	
	Supplementary literature	1. M. Pilgrim: Dive Into Python 3. Wyd. Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, 2009. 2. J. Korbicz, A. Obuchowicz, D. Uciński: Sztuczne sieci neuronowe. Podstawy i zastosowania, Akademicka Oficyna Wydawnicza, 1994. 3. R. Tadeusiewicz: Sieci neuronowe. Akademicka Oficyna Wydawnicza, 1993.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	Implementation of multi-layer neural network in Python. Training of multi-layer neural network using available training sets. Recognition of images or characters by trained multi-layer neural network. Recognition and classification of image using multi-layer neural network using TensorFlow library.		
Work placement	Not applicable		

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