COURSE DESCRIPTION CARD - SYLLABUS

Course name
PO4: Advanced control systems in electromobility - Fundamentals of artificial intelligence

Course

Field of study
Electromobility

Year/Semester
3/5

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	15	
Tutorials	Projects/seminars	

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Wydział Automatyki, Robotyki i Elektrotechniki
ul. Piotrowo 3A, 60-965 Poznań, pokój 651

Responsible for the course/lecturer:
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ul. Piotrowo 3A, 60-965 Poznań

Prerequisites

The student starting this course should have basic knowledge of procedural and object-oriented programming, as well as knowledge of electronics and digital circuits.

A student starting this course should have high-level programming skills, such as C ++, C #, Java.

Course objective

The aim of the course is to familiarize the student with the basic issues related to artificial intelligence. Understanding the structures of both classic unidirectional neural networks and simple convolution models. Learning the basic methods of network learning. Creation of neural network models and implementation of algorithms allowing for their training.

Course-related learning outcomes

Knowledge

1. The student has knowledge of the application of artificial intelligence elements in various areas of life and research problems related to the subject of artificial intelligence.

2. The student knows the frameworks of machine learning applications, models and machine learning algorithms.

Skills

1. The student is able to use high-level languages to develop a model of classical and deep neural networks.

2. The student is able to use machine learning algorithms to create a fully functional project based on artificial neural networks.

Social competences

1. The student is aware that knowledge and skills in the field of electromobility are evolving rapidly.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: credit on the basis of a test consisting of general and test questions. Rating scale 51-60% points satisfactory, 61-70% points satisfactory+, 71-80% points good, 81-90% points good +, 91-100% points very good.

Laboratory: rewarding practical knowledge gained during previous laboratory exercises, checking practical programming skills in Java (final test), assessment of knowledge and skills related to the implementation of individual and group programming projects.

Obtaining additional points for activity during classes, especially for: the ability to cooperate as part of a team practically carrying out a detailed task in the laboratory, the use of elements and techniques that go beyond the material of the lecture and laboratory exercises, aesthetic diligence of completed projects.

Programme content

Basics of machine learning - artificial intelligence, machine learning, types of machine learning systems, regression and classification problems, main problems of machine learning.

Introduction to artificial neural networks - biological neurons, logical operations using neurons, perceptron, XOR problem.

Structures of artificial neural networks - neuron model (inputs, weights, activation functions) multilayer neural networks, recursive networks.

Training neural networks - error back propagation algorithm, simple gradient method, network quality assessment methods (sensitivity, efficiency, specificity of learning curves).

Tuning of hyperparameters of the neural network (number of layers, selection of activation functions, number of neurons in the layer, etc.)

Introduction to deep learning methods - deep learning, the problem of disappearing / exploding gradients, application frameworks (Tensorflow, Keras), optimizers, regularization.

Convolutional neural networks - architecture of the visual cortex, convolution layer, filters, connecting layer, architectures of convolutional neural networks.

Teaching methods

Lecture: presentation of issues with the use of multimedia resources and presentation of writing and executing selected programs presenting the basics of machine learning.

Laboratory exercises: practical exercises on machine learning, the use of Anaconda / Visual Studio environments to build a model and implement machine learning algorithms in the classification issue.

Bibliography

Basic

1. Stanisław Osowski, Sieci neuronowe do przetwarzania informacji, Oficyna Wydawnicza Politechniki Warszawskiej, 2020.

2. Aurélien Géron, Uczenie maszynowe z użyciem Scikit-Learn i TensorFlow, Helion, 2020.

3. Bharath Ramsundar, Reza Bosagh Zadeh, Głębokie uczenie z TensorFlow : od regresji liniowej po uczenie przez wzmacnianie , Helion, 2020.

4. Seth Weidman, Uczenie głębokie od zera : podstawy implementacji w Pythonie, Helion, 2020.

5. Giuseppe Bonaccorso, Algorytmy uczenia maszynowego : zaawansowane techniki implementacji, Helion, 2019.

Additional

1. Michał Białko, Podstawowe właściwości sieci neuronowych i hybrydowych systemów ekspertowych, Wydaw. Uczelniane Politechniki Koszalińskiej, 2000.

2. Piotr Grądzki, Klasyfikatory neuronowo-rozmyte w inteligentnych systemach wspomagania decyzji, Politechnika Poznańska, PP, 2000.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	20	0,5

[1] delete or add other activities as appropriate