COURSE DESCRIPTION CARD - SYLLABUS

Course name
Non-deterministic models and machine learning in data analysis [S2ETI2>MNiUMwAD]

Course

Field of study
Education in Technology and Informatics

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge in mathematics and artificial intelligence methods, programming skills.

Course objective

The aim of the course is to broaden students' knowledge in statistical methods and machine learning in data analysis.

Course-related learning outcomes

Knowledge:
1. The student should be familiar with advanced non-deterministic models and machine learning techniques
2. The student should be familiar with the basic applications of non-deterministic models and machine learning techniques in exemplary engineering applications

Skills:
1. The student is able to obtain information on non-deterministic models and machine learning techniques

2. The student is able to apply a selected machine learning technique in a selected programming environment
3. The student is able to plan the application of a selected machine learning technique to a given engineering problem

Social competences:
1. The student is ready to critically evaluate their knowledge and the content they receive in the field of non-deterministic models and machine learning
2. The student is ready to recognise the importance of knowledge in solving cognitive and practical problems and to seek expert advice

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Credit for the lecture based on the points earned on the test in the last class
Assessment criteria/assessment: in accordance with the study regulations

Programme content

Selected non-deterministic models in statistics and artificial intelligence methods, as well as machine learning techniques in data analysis - theory, implementation, applications.

Course topics

1. Selected non-parametric tests in data analysis.
2. Evolutionary algorithms as non-deterministic models.
3. Implementation of selected evolutionary algorithms.
4. Applications of evolutionary algorithms in engineering problems.
5. The Monte Carlo method and its applications as an example of a probabilistic algorithm .
6. Naive Bayes classifier.
7. PCA analysis.
8. k-nearest neighbours method.
9. Support vector machines (SVM).
10. Decision trees and regression trees.
11. Neural networks.
12. Convolutional neural networks.
13. Selected applications of artificial neural networks in data analysis.
14. Large language models (LLM).
15. Final test.

Teaching methods

Lecture: multimedia presentation supporting by practical programming examples.

Bibliography

Basic:
1. Marcin Szeliga: Praktyczne uczenie maszynowe. Wydawnictwo Naukowe PWN, 2019 [in Polish].
2. Aurelien Geron: Uczenie maszynowe z użyciem Scikit-Learn, Keras i TensorFlow. Wydawnictwo Helion, 2023 [in Polish].
3. Jacek Tabor, Marek Śmieja, Łukasz Struski, Przemysław Spurek, Maciej Wołczyk: Głębokie uczenie. Wprowadzenie. Wydawnictwo Helion, 2022 [in Polish].
4. Moroney Laurence: Sztuczna inteligencja i uczenie maszynowe dla programistów. Praktyczny przewodnik po sztucznej inteligencji. Wydawnictwo Helion, 2021 [in Polish].

Additional:
1. Larry Wasserman: All of Nonparametric Statistics. Springer, 2007.
2. Jean Dickinson Gibbons, Subhabrata Chakraborti: Nonparametric Statistical Inference. CRC, 2003.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00