COURSE DESCRIPTION CARD - SYLLABUS

Course name
Basics of artificial intelligence and machine learning [S1Cybez1>PSIiUM]

Course

Field of study
Cybersecurity

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
24

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Knowledge of linear algebra, mathematical analysis, discrete mathematics, probability and statistics. Ability to program in Python. Basic knowledge of algorithms and data structures. Knowledge of English at least B1 level. The student should also be able to independently search for information and be willing to work in a team. The student should be characterized by honesty, and responsibility.

Course objective

The purpose of the course is to teach students about the basic problems of artificial intelligence and machine learning, and methods of solving them. The graduate of the course should be able to independently solve simple problems from these classes, primarily using ready-made tools, and be able to verify the quality of the obtained solutions. The graduate should have the necessary knowledge and skills to speak competently with specialists in the areas of artificial intelligence and machine learning.

Course-related learning outcomes

Knowledge:
K1_W01: The student has a general knowledge of linear algebra, mathematical analysis, discrete mathematics, probability and statistics, in areas relating to regression problems, artificial neural networks, performance metrics in machine learning, probabilistic modeling and logic.
K1_W04: The student has a basic knowledge of the principles of computer program development, the structures of programming languages and the algorithms used in artificial intelligence and machine learning.
K1_W14: The student has a basic knowledge of artificial intelligence systems, machine learning and artificial neural networks; has a structured knowledge of the principles and methods of solving decision and optimization problems using heuristic and non-heuristic state space search algorithms.

Skills:
U1_02: The student is able to use properly selected methods and tools, and develop simple applications or configure simple machine learning and artificial intelligence systems.
U1_04: The student can plan and conduct experiments in the field of artificial intelligence and machine learning, visualize and interpret their results.
U1_09: The student can, using appropriately selected methods and tools, critically analyze and evaluate the performance of existing solutions used in software, data processing.

Social competences:
K1_K01: The student understands the importance of improving professional, personal and social competence; is aware that knowledge and skills in the field of artificial intelligence and machine learning are rapidly evolving.
K1_K02: The student understands the importance of knowledge in solving problems in the field of artificial intelligence and machine learning; is aware of the need to use the knowledge of experts when solving engineering tasks beyond their own competence.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
A written exam relating to all the knowledge, skills and competencies acquired in the course, conducted under conditions of controlled independence. Each task is assigned a number of points, given on the examination sheet. The conversion of the obtained points into a grade is carried out in accordance with the table:
% of points Grade
<=50 2.0
(50, 60] 3.0
(60, 70] 3.5
(70, 80] 4.0
(80, 90] 4.5
>90 5.0
Laboratories:
The laboratory sessions are divided into two parts: the artificial intelligence part and the machine learning part. The learning outcomes in each part are assessed through tasks and tests independently completed by students. To pass each part, a student must achieve more than 50% of the possible points. The final grade for the laboratory is based on the arithmetic average of the percentages obtained in both parts and is converted into a grade according to the same scale as used for the lecture. Plagiarism in a task solution will result in a failing grade for the laboratory.

Programme content

Selected classes of artificial intelligence problems and methods for solving them. Selected topics in supervised learning, unsupervised learning, and artificial neural networks.

Course topics

Lectures:
• Introduction to artificial intelligence

• Solving problems by search
• Solving problems with a numerical objective function
• Solving problems by deductive reasoning
• Solving problems by factorization
• Solving problems by probabilistic inference
• Introduction to machine learning
• Supervised learning
• Unsupervised learning
• Classifier ensembles
• Linear and logistic regression
• Neural networks
• Anomaly detection
Laboratories:
• Modeling search problems using automated planning tools
• Implementation of selected local search algorithms
• Modeling problems for deductive reasoning
• Modeling problems through factorization
• Modeling Bayesian networks
• Basic machine learning tools, data preprocessing, data visualization, and methods for testing learning models
• Example algorithms for supervised learning
• Example algorithms for unsupervised learning
• Algorithms based on classifier ensembles
• Linear and logistic regression
• Neural networks

Teaching methods

Lecture: multimedia presentation, brainstorming, presentation illustrated with examples provided on the board.
Laboratory: practical exercises, discussion, multimedia presentation, presentation illustrated with examples provided on the board.

Bibliography

Basic:
1. Stuart Russell, Peter Norvig, Sztuczna inteligencja. Nowe spojrzenie. Wydanie IV. Tom 1 Helion, 2022.
2. Tom Mitchell, Machine learning, McGraw Hill, 1997.
3. Peter A. Flach, Machine learning: The Art and Science of Algorithms that Make Sense of Data. Cambridge Press, 2012.
4. Tadeusz Morzy, Eksploracja danych. Metody i algorytmy. Wydawnictwo Naukowe PWN, 2013.
5. Krzysztof Krawiec, Jerzy Stefanowski, Uczenie maszynowe i sieci neuronowe. Wyd. Politechniki Poznańskiej, 2004.

Additional:
1. Mordechai Ben-Ari, Logika matematyczna w informatyce Wydawnictwo Naukowo-Techniczne, 2006
2. Malik Ghallab et al., Automated Planning and Acting Cambridge University Press, 2016
3. Shai Ben-David, Shai Shalev-Shwartz, Understanding Machine Learning. Cambridge University Press, 2014.
4. A. Muller, S. Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists, 1st Edition, O'Reilly Media, 2016.

Breakdown of average student's workload

	Hours	ECTS
Total workload	109	4,00
Classes requiring direct contact with the teacher	54	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	55	2,00