SYLLABUS

Name: ***Artificial intelligence (MakAu>SI5AI18)***
Name in Polish:
Name in English: ***Artificial intelligence***

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

ZAL

Language:

English

Course homepage:

https://platforma2.polsl.pl/rau3/course/view.php?id=51

Short description:

The aim of the course is to provide students with an in-depth understanding of intelligent systems and their practical applications. Participants will become familiar with key areas such as artificial neural networks (including deep learning), evolutionary algorithms, fuzzy systems, swarm intelligence, artificial immune systems, and generative artificial intelligence. The course integrates theoretical foundations with practical tasks, placing particular emphasis on the development of programming skills, problem-solving abilities, and critical thinking.

Pre-requisite qualifications: students should have a solid foundation in algebra, calculus, and basic statistics. In particular, they are expected to be familiar with derivatives and integrals, probability theory, and descriptive statistics. Additionally, basic experience in computer programming is required.

Form of classes: contact (in-person).

Description:

ECTS credits: 4.

Total workload: 100 hours (65 contact hours, 35 hours of student's individual work).

Forms of contact hours:
- lecture: 30 hours,
- laboratory: 30 hours,
- other (e.g. test and report revision, discussion): 5 hours.

Student's individual work includes: preparation for classes, implementation of AI methods, report writing, and preparation for tests.

Lecture:
- Introduction to artificial intelligence: history, definitions, and domains.
- Fundamentals of machine learning: data preprocessing and model evaluation.
- Artificial neural networks, deep learning, and generative artificial intelligence.
- Selected supervised learning methods.
- Statistical learning theory and support vector machines.
- Ensemble classifiers.
- Unsupervised learning and data clustering.
- Evolutionary algorithms.
- Swarm intelligence.
- Artificial immune systems.
- Expert systems. Fundamentals of fuzzy set theory and linguistically interpretable AI methods.
- Software tools for building AI models.

Laboratory:
- ECG modelling by genetic algorithms.
- Neural networks in signal analysis.
- Kohonen networks.
- Deep neural networks: basic structure implementation, image recognition.
- Evolution strategies: basics and implementation, system identification.
- Swarm intelligence: basics and implementation, combinatorial optimization.
- Unsupervised learning: hard k-means, fuzzy c-means.

Bibliography:

- E. Alpaydin, Introduction to Machine Learning, MIT Press; 4th Edition, 2020.
- L. Moroney, AI and Machine Learning for Coders: A Programmer's Guide to Artificial Intelligence, O'Reilly Media, 2020.
- S. Pattanayak, Pro Deep Learning with TensorFlow, Apress, 2017.
- S.J. Russell, Human Compatible: Artificial Intelligence and the Problem of Control, Viking, 2019.
- S.J. Russell, P. Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson, 2010.
- P.H. Winston, Artificial Intelligence, Addison-Wesley, 1993.

Learning outcomes:

At the completion of the course, the student:
- knows methods for evaluating artificial intelligence models (test, final test) - K1A_W09,
- understands the principles of various machine learning methods (test, final test) - K1A_W09,
- understands the requirements for designing and implementing neural networks, evolutionary algorithms, and clustering methods in computational environments (laboratory report) - K1A_W09,
- is able to extract knowledge from experimental data (laboratory report) - K1A_U10, K1A_U20,
- is able to prepare documentation of a problem solution and formulate relevant conclusions (laboratory report) - K1A_U10.

Assessment methods and assessment criteria:

Students are required to pass the final written test (T), complete all laboratory exercises, and achieve a passing grade on each laboratory report (minimum 3.0 points per report).

The passing criterion for the final test is achieving a minimum score of 2.75 points, which corresponds to at least 55% correct answers. A student may be exempted from the final test based on the results of quizzes (tests). Quizzes are graded on a scale from 2.0 to 5.0, in 0.5-point increments. To qualify for exemption, the student must obtain at least three grades of 3.0 or higher and achieve an average score of at least 2.75 across all quizzes. Absence during a quiz results in a score of 0.

Laboratory exercises (reports) are graded on a scale from 2.0 to 5.0, in increments of 0.5. The final laboratory grade (L) is calculated as the arithmetic mean of the grades obtained for individual laboratory tasks. Missed laboratory classes can be made up on dates specified in the course schedule.

The final grade (FG) is calculated as the average of the written test grade (T) and the laboratory grade (L), according to the formula:
FG = (T + L) / 2.

Final grades are rounded based on the following rules:
[3.00 – 3.25) → 3.0,
[3.25 – 3.75) → 3.5,
[3.75 – 4.25) → 4.0,
[4.25 – 4.75) → 4.5,
[4.75 – 5.00] → 5.0.

The syllabus is valid from academic year 2025/26 and its content cannot be changed during the semester.

Element of course groups in various terms:

Course group description	First term	Last term
Interdisciplinary Studies: Automatic Control and Robotics, Electronics and Telecom., Informatics (5) (MakAu>SI5-18)	2020/2021-Z	

Course credits in various terms:

<without a specific program>

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	4	2020/2021-Z	