MODULE DESCRIPTION CARD – SYLLABUS

This module is a part of the Intensive International Education Programs in the field of the Artificial intelligence organised at Poznan University of Technology as part of the „IMPACT – Innowacyjne Międzynarodowe Programy w AI, Cyberbezpieczeństwie i Teleinformatyce" project implemented SPINAKER Program of the National Agency for Academic Exchange, financed by the European Social Development Fund 2021–2027 (ESDF).

Module name:	Number of hours:	Lecturer:
Machine Learning	10	Iwo Błądek, PhD

Module Descriptions:

The module introduces students to the foundations of machine learning, with a focus on supervised and unsupervised learning. It presents key concepts, including overfitting, data preprocessing, model evaluation, and bias-variance tradeoff. Students become acquainted with representative supervised methods: decision tree induction, k-nearest neighbours, Bayes classification, support vector machines; and representative unsupervised methods: k-means, agglomerative hierarchical clustering, DBSCAN. Throughout the course, concepts and algorithms are illustrated using simplified datasets to provide a better intuition behind a particular approach.

Purpose of the support under Module:

The overall objective of the Innovative International Education Program in Artificial Intelligence within the IMPACT project is to raise the competencies of international students in key digital technologies and to support personalized, flexible, and modern education aligned with current global needs in the area of machine learning.

The specific objective of the module is to provide competencies and promote activities carried out at the Poznań University of Technology in the area of machine learning, particularly regarding fundamental theoretical background, techniques, and approaches used in contemporary machine learning.

Method of support under Module:

Support within the module is provided with the participation of the instructor and divided into the following elements:

- 6-week self-study program using teaching materials provided by the instructor on the e-learning platform;
- 6 weeks of support from the instructor in the form of online consultations using tools that enable meetings to be held;
- a test to verify the acquisition of competences.

Module-related learning outcomes:

Descriptions of the new competences:

Students gain new skills in machine learning, including knowledge of how to

handle and preprocess different data types, apply appropriate supervised and unsupervised learning techniques, and evaluate effectiveness of a machine learning model and how well it generalizes to the unseen data.

Knowledge:

Student:

1. has structured and theoretically grounded knowledge of key concepts in machine learning, including supervised/unsupervised learning, data preprocessing, overfitting, and model evaluation;
2. understands principles, assumptions, and basic procedures of selected machine learning methods, including: induction of decision trees,k-nearest neighbours, Bayes classification, support vector machines, k-means, hierarchical clustering, DBSCAN.

Skills:

Student:

1. can use appropriate data preprocessing techniques;
2. can propose, based on the characteristics of the problem, effective machine learning solutions, and evaluate their effectiveness;
3. can interpret results of evaluation of supervised and unsupervised machine learning models;
4. can independently continue learning in the field of machine learning and follow advancements in this field.

Social competences:

Student:

1. is aware of the very fast progress in machine learning, and understands that knowledge requires continuous updating.

Criteria for verifying learning outcomes

Students are expected to know the material presented on the lectures, with the emphasis put on the general ideas behind the presented approaches and the fundamentals of machine learning. In particular, students should have good understanding of evaluating machine learning models, data preprocessing techniques, and the presented supervised and unsupervised machine learning algorithms.

Method of verification/validation of learning outcomes

Learning outcomes are verified through a single-choice test. A minimum of **51%** of correct answers is required to pass.

Workload

25 h (including work with teaching materials provided by the lecturer, consultation, and the student's own work) – 1 ECTS point

Level of the European Qualifications Framework