



THE DOCTORAL SCHOOL OF IPPT PAN

COURSE OFFERED IN THE DOCTORAL SCHOOL OF IPPT PAN

Name of the course	Polish	Uczenie maszynowe I				
	English	Machine Learning I				
Type of the course	laboratory					
Course coordinator	Tomasz Steifer			Course teacher	Tomasz Steifer, Manuel Vargas Guzman	
Implementing unit	LEP	Scientific discipline / disciplines		Computer science		
Level of education	doctoral		Semester	Winter 2025/2026		
Language of the course	English					
Type of assessment	Activity during classes		Number of hours in a semester	60	ECTS credits	3
Type of classes		Lecture	Auditory classes	Project classes	Laboratory	Seminar
Number of hours	in a week	0	0	0	4	0
	in a semester	0	0	0	60	0

1. Prerequisites

Basic linear algebra & analysis, basic programming.

2. Course objectives

This course introduces students to the fundamentals of machine learning. Students will gain the knowledge and practical skills to build, train, and evaluate models using Python and TensorFlow/PyTorch for diverse data types, including images, time series, structured datasets, and text. Topics cover mathematical foundations, key algorithms, neural network architectures, and hands-on applications.

3. Course content (separate for each type of classes)

Lecture

Laboratory

Course Topics

1. Gradient descent, linear algebra, and probability theory essentials
2. Basic Python programming for machine learning
3. Linear regression and logistic regression as foundational supervised learning models
4. Loss functions, empirical vs. generalization error, Empirical Risk Minimization (ERM)
4. Perceptron algorithm
5. Feed Forward Networks/Multi-layer Perceptrons (MLPs)
6. Overfitting/underfitting and hyperparameter tuning
7. Recurrent neural networks (RNNs)
8. Convolutional neural networks (CNNs) and transfer learning



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9. Transformers

10. Introduction to unsupervised learning

4. Learning outcomes			
Number of the learning outcome	Learning outcomes description	Reference to the learning outcomes according to the 8 th level of PRK	Learning outcomes verification methods*
Knowledge			
1	Student has basic knowledge about machine learning methods.	P8S_WG	Project evaluation
2			
3			
Skills			
1	Student can implement the basic machine learning method and apply it in practice	P8S_WG	Project evaluation
2			
3			
4			
Communication			
1			
2			
3			
Social competences			
1			
2			

*Allowed learning outcomes verification methods: exam; oral exam; written test; oral test; project evaluation; report evaluation; presentation evaluation; active participation during classes; homework; tests

5. Assessment criteria

Project

6. Literature

Materials will be delivered during the lectures.

7. PhD student's workload necessary to achieve the learning outcomes**



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No.	Description	Number of hours
1	Hours of scheduled instruction given by the lecturer in the classroom	60
2	Hours of consultations with the lecturer, exams, tests, etc.	4
3	Amount of time devoted to the preparation for classes, preparation of presentations, reports, projects, homework	20
4	Amount of time devoted to the preparation for exams, test, assessments	
Total number of hours		84
ECTS credits		3

** 1 ECTS = 25–30 hours of the PhD students work (2 ECTS \approx 60 hours; 4 ECTS \approx 110 hours, etc.)