



Valid from 2026.HS

Module description: Introduction to Machine Learning	
Module Code	t.BA.XX.ML-EN.26HS
ECTS Credits	4
Language of Instruction/Examination	English
Organizational Unit	CAI
Module Coordinator	Alisa Rupenyan-Vasileva
Legal Framework	The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.
Module Characteristic	Type 3a 2 lecture lessons per semester week and class+ 2 weekly lab lessons per semester and half-class
Module Description	Machine learning is the basis of successful data products. In this module, you will learn the prerequisites for its use, and various important machine learning algorithms. Both theoretical fundamentals and practical implementations of the methods will be taught.
Module Content	<ul style="list-style-type: none"> From the recommendation algorithms that curate social media feeds to the AI systems powering autonomous vehicles, machine learning and AI reshape every interaction with technology. Currently, in any kind of engineering studies, ML expertise becomes essential for career success. This module transforms students from understanding ML concepts to building, deploying, and evaluating ML systems. The course involves working with real datasets, implementing algorithms from scratch, and solving authentic problems that mirror industry challenges, via the project assignments. The following outcomes are envisioned: 1. Technical Implementation: Students will write Python code to preprocess data, implement core ML algorithms (supervised, unsupervised, and ensemble methods), and build end-to-end ML pipelines. 2. Problem-Solving Strategy: The course develops skills in framing business problems as ML problems, selecting appropriate algorithms, and defending choices with data-driven evidence. 3. Professional Practice: Students learn to validate model performance using industry-standard metrics, handle common pitfalls like overfitting and data leakage, and present results to both technical and non-technical audiences. 4. Real-World Application: The module includes applying skills to domains like healthcare prediction, financial modeling, or computer vision—building portfolio projects that demonstrate capabilities to future employers. Finally, the course prepares students for more advanced AI courses and enables meaningful contributions to ML projects in internships or entry-level positions.
Prerequisite Knowledge	<ul style="list-style-type: none"> Programming 1&2: Reliable control of a higher procedural or object-oriented programming language Linear Algebra: Vector- and Matrix calculations, inverse Matrix, eigendecomposition Statistic and Stochastic: Fundamentals of probability calculation, distributions, correlations Algorithms and Data Structures: Algorithmic Thinking

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Learning Objectives (Competencies)	Students...		Competencies	Taxonomies		
	can critically interpret ML results, identify limitations of their models, and document and present their methodological decisions and results in a comprehensible manner for a technical audience.		M, F	K1, K2, K3, K4		
	can independently implement, train, and evaluate ML models (such as linear/logistic regression, decision trees, support vector machines, neural networks) using appropriate metrics, while applying best practices such as train-test split, cross-validation, and hyperparameter tuning.		M, F	K1, K2, K3		
	can recognize and quantify overfitting in ML models and address it through appropriate regularization techniques (L1/L2, pruning, feature selection) to improve the generalization capability of their models.		F	K1, K2		
	can identify and justify appropriate machine learning approaches for given data problems by analyzing the problem type (regression, classification, clustering), evaluating data requirements, and weighing the strengths and weaknesses of different algorithms.		M, F	K1, K2, K3		
	can name and describe fundamental machine learning concepts and the mathematical foundations of common algorithms.		M, F	K1, K2		
Performance Assessment	End-of-module exam	Assessment	Length (min.)	Weighting	Social Form	Scenario/Format
	written exam		90	70%	acc. to module agreement	
		Assessment	Length (min.)	Weighting	Social Form	Scenario/Format
	Graded labs (coding exercises) and/or quizzes	Grade	0	20%	acc. to module agreement	
	Written Exam	Grade		10%	acc. to module agreement	
Classroom Attendance Requirement	None					
Comments	During the first week of the semester a written and communicated supplement can specify the module description in more detail.					