

INF-BSc-292: Fachprojekt „Empirical Methods in Machine Learning Research“					BOSS-Nr.
Englischer Modultitel: Undergraduate Project „Empirical Methods in Machine Learning Research“					
Studiengänge: Bachelorstudiengang Informatik, Bachelorstudiengang Angewandte Informatik, Bachelorstudiengang Wirtschaftsinformatik					
Turnus: alle 2 Semester	Dauer: 1 Semester	Studienabschnitt: ab 4. Semester		Credits: 7	Aufwand: 210 (60/150)
1	Modulstruktur				
	Nr.	Element / Lehrveranstaltung	Typ	Credits	SWS
	1	Fachprojekt „Empirical Methods in Machine Learning Research“	Fachprojekt	7	4
2	Lehrveranstaltungssprache: englisch				
3	<p>Lehrinhalte</p> <p>Advances in Machine Learning are commonly measured by performing so-called benchmarks, i.e., evaluating machine learning methods on a set of tasks and comparing them against each other. Additionally, questions such as “what is the impact of feature selection on performance”, “does our new optimization algorithm perform better than AdamW”, “does our new machine learning algorithm improve over a simple baseline on a specific dataset” or “is hyperparameter optimization using Bayesian optimization superior to using evolutionary algorithms” can only be answered empirically. The goal of this Fachprojekt is to understand the necessity for empirical research and its limitations, and to be able to conduct large-scale experimental comparisons of machine learning methods. By participating in this Fachprojekt students will learn to implement a reproducible machine learning research project using Python, including experiment tracking and parallelization. This includes:</p> <ul style="list-style-type: none"> • come up with interesting research questions in machine learning, • implement machine learning pipelines and methods, • select relevant datasets and baseline methods, • analyse and present the outcomes, • present the results in the form of a presentation and project report. <p>The project is divided into two phases. In the first phase we will focus on foundational topics for empirical research in the field of machine learning. We will cover these in bi-weekly meetings and the students will then work on their implementation in Python. In the second phase the students will work in small groups to answer a scientific question in machine learning using empirical research methods.</p>				
4	<p>Kompetenzen</p> <p>After successfully completing this module, students are able to:</p> <ul style="list-style-type: none"> • Formulate and motivate empirical research questions in machine learning, grounded in current scientific literature, and translate them into well-defined experimental hypotheses. • Design and implement reproducible large-scale machine learning experiments using Python, including experiment tracking, parallelization, and systematic control of randomness and configuration. • Implement, configure, and compare machine learning pipelines and methods, including appropriate baselines, datasets, feature processing, optimization strategies, and hyperparameter optimization techniques. • Critically analyze and statistically evaluate experimental results, assess the limitations of empirical findings, and reason about validity, robustness, and reproducibility of machine learning benchmarks. • Document and communicate empirical research results effectively, both in written project reports and oral presentations, and collaborate responsibly in small teams by planning, reflecting on, and managing project progress. 				
5	<p>Prüfungen</p> <p>Voraussetzung für den Modulabschluss:</p> <ul style="list-style-type: none"> • Erfolgreiche Bearbeitung der Aufgaben, aktive Mitarbeit • Abschlusspräsentation • Einreichung eines Technical Reports über ein durchgeführtes Experiment (inkl. Code) 				

6	Prüfungsformen und -leistungen [x] Modulprüfungen [] Teilleistung		
7	Teilnahmevoraussetzungen Erfolgreich abgeschlossen: <ul style="list-style-type: none"> • Wahrscheinlichkeitsrechnung und mathematische Statistik (WRUMS) • Probabilistic Reasoning and Machine Learning (PRML) oder Big Data Analytics (BDA) Vorausgesetzte Kenntnisse: <ul style="list-style-type: none"> • Python-Programmierenkenntnisse Wünschenswerte Kenntnisse: <ul style="list-style-type: none"> • Programmierung von ML-Lösungen 		
8	Modultyp und Verwendbarkeit des Moduls Wahlpflichtmodul in den Bachelorstudiengängen Informatik, Angewandte Informatik, Wirtschaftsinformatik		
9	Modulbeauftragte/r Jun.-Prof. Dr. M. Feurer und Prof. Dr. Katharina Eggenesperger	Zuständige Fakultät: Informatik	Beschluss Fakultätsrat: Voraussichtlich 29.04.2026