Hochschule Konstanz
Technik, Wirtschaft und Gestaltung

Module Handbook of

Applied AI Transformation Management (MAI)

Master of Engineering

HTWG Konstanz

Refers to SPO No. 1
(study and examination regulations)
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Content

This module handbook provides an overview of the programme structure and the content of all modules. For each module, it specifies intended learning outcomes, content/topics, teaching and learning methods, workload (ECTS), assessment formats, prerequisites, and recommended literature. Learning outcomes are formulated in a competence- and outcome-oriented way and serve as the basis for selecting appropriate teaching and assessment methods.

Depending on the module's nature, assessments may include written exams, oral exams, reports, project/portfolio work, presentations, or combinations thereof. The detailed assessment modalities (requirements, deadlines, grading criteria) are announced by the instructor(s) at the beginning of the semester. Module descriptions may be updated as part of continuous curriculum development.

Classification

The Master's programme Applied AI Transformation Management (MAI) is a strongly practice-oriented consecutive degree designed to enable students to design, govern, and implement AI-driven transformation initiatives in organisations and engineering-based value chains. The programme combines technical foundations (e.g., data pipelines, machine learning, decision and integration systems) with competencies in transformation and change, organisational design and leadership, governance/compliance/ethics, and systems thinking from a value-chain perspective. Teaching and assessment formats emphasise implementation capability, integration skills, and measurable impact, including project-based labs and industry-embedded modules.

The learning outcomes are aligned with Master-level competence requirements (German Qualifications Framework, DQR level 7) and focus in particular on evidence-based methods, interdisciplinary collaboration, responsible AI use, and scientifically grounded problem-solving in dynamic and partly unpredictable contexts.

Qualification objectives and competency profile of the programme: The programme qualifies at DQR (German Qualifications Framework) level 7 for the design, evaluation, implementation and scaling of AI-driven transformation initiatives in organisations and value-creation systems. Graduates are able to design, steer and implement AI-driven transformation initiatives. They can systematically identify, assess and prioritise AI use cases, operationalise value-contribution hypotheses with KPIs and success criteria, and make well-founded go/no-go decisions.

The programme provides a solid technical foundation in applied machine learning, data pipelines and decision support, together with an understanding of the end-to-end lifecycle of AI-based systems. Graduates can move AI solutions from piloting into scalable, sustainably embedded regular operation, commanding methods and tools from MLOps, operating models, roll-out management, monitoring as well as incident and change management. They design governance, compliance and ethics into AI initiatives, interpret regulatory and normative frameworks (e.g. EU AI Act, data protection law, liability regimes), implement compliance-by-design and clarify data ownership. They apply classical and agile change-management approaches, lead transformational change in dynamic, AI-shaped contexts, and collaborate constructively in interdisciplinary and partly international, multicultural teams.

Methodologically, the programme fosters evidence-based work, the critical appraisal of research results and the scientifically grounded treatment of application-oriented questions. It prepares graduates for demanding specialist, project and leadership roles at the interface of technology, organisation and value creation, as well as for further academic qualification, e.g. within a cooperative doctorate.

The competency profile comprises 25 competency objectives across four categories: seven subject-specific (F1–F7, including transformation/change/organisational design, governance/ethics, use-case discovery, ML foundations, MLOps/scaling, sprint implementation, value creation), seven methodological (M1–M7), six self-competencies (SE1–SE6, including the MAI-specific SE6 "Entrepreneurial Thinking") and five social competencies (SO1–SO5). The competency matrix shows 86.1% of entries at Bloom levels 4–6, consistent with DQR level 7.

Legend

Abbreviations / Legend

MO = Module, LV = Course component, SWS = contact hours per week, ECTS = European Credit Transfer and Accumulation System

Module type: PM = Mandatory core module, WPM = Guided elective module

Teaching/assessment formats:

V = Lecture

Ü = Exercise / tutorial

PJ = Project / project work

S = Study project / portfolio- or project-based written/practical work

R = Report / research paper / reflection report (module-specific)

K90 = written exam (90 minutes)

Semester notation: A = Winter semester, B = Summer semester, C = final semester (thesis/colloquium)

Abbreviations

SWS	=	Semester credit hours
ECTS	=	European Credit Transfer System
PM	=	Compulsory module
WPM	=	Elective module
GS	=	Basic studies
HS	=	Main studies
V	=	Lecture
Ü	=	Tutorial (supervised)
LÜ	=	Laboratory exercise
W	=	Workshop, Seminar
P	=	Internship
E	=	Excursion
PSS	=	Integrated internship semester
Kx	=	Exam (x = duration in minutes)
Mx	=	Oral examination (x = duration in minutes)
R	=	Presentation
SP	=	Other written or practical work
AB	=	Papers/Reports
LP	=	Laboratory/Programming assignments
PR	=	Presentation
TE	=	Certificate
PJ	=	Project
S	=	Term paper, project work
L	=	Lab work, lab report, practical work

Document info

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Module 1	**AI Transformation & Change, Leadership & Organizational Design**			
Module coordination	**Start**	**Module code/no.**	**ECTS-points**	**Workload**
J. Wang	SS, WS	Modul 1	6	180 h
	Duration	**SWS**	**Contact hours**	**Self-Study hours**
	1 Semester	4	60 h	120 h

Usability in programs	**Intended degree**	**Type of module (compulsory PM/elective WPM)**	**Semester of study**	**SPO-version / year**
MAI	M.Eng.	PM	1	SPO 1 / 2027

Competence-based requirements for participation	Grundlegende Englischkenntnisse (Lehrsprache Englisch)
Usability in above-mentioned program	Prerequisite for: Keine. Recommended in combination with: Modul 3 (Use-Case Discovery & Value) und Modul 6 (Sprint Lab).

Method of evaluation		**Graded exam**	**Ungraded exam**	**Ungraded performance record**
	Module exam (MP)	K60 + SP		
	Submodule exam (MTP)			
Calculation of the final grade	☐ Grade of the graded module (part) examination ☒ ECTS-weighted arithmetic mean of the graded module part examinations ☐ Others:			

Learning objectives	Students name the central concepts, models and tools of AI-driven transformation, change management and organizational design. They explain the interdependencies between technology, data, processes, organizational structures and organizational culture in AI-shaped, dynamic environments. They apply established and agile change management frameworks to AI transformation initiatives. They design transformation and change architectures and develop organizational structures and processes with regard to AI adoption, agility and innovation capability. Students analyse complex transformation dynamics, classify them by maturity and context, and transfer their findings to unfamiliar organizational settings. They plan and structure transformation initiatives and relate resources, requirements and outcomes to one another. They assess the suitability of change and enablement measures for a given organizational context. Students assess the suitability of transformational leadership behaviours in technology- and AI-driven change contexts and select them in a situation-appropriate manner. They deal constructively with uncertainty, dynamics and resistance in transformation processes, integrate differing perspectives and communicate change processes reflectively. They critique their own role as well as the organizational and societal implications of AI-driven transformation. They weigh the entrepreneurial opportunities and risks of transformation initiatives.

Teaching and learning methods	☒ Lecture ☒ Practice ☒ Workshop/Seminar ☐ Project ☐ Laboratory ☐ Excursion ☐ Thesis ☒ Others: Flipped-Classroom-Elemente, strukturierte Lektürearbeit, Case-based Learning, Reflexions- und Transferaufgaben, moderierte Diskussionen, kurze Impulspräsentationen der Studierenden.

Submodule Lecturer	**Type**	**SWS**	**ECTS**	**Teaching content**

AI Transformation & Change J. Wang	V, Ü, LÜ, W	2	3	The sub-module AI Transformation & Change conveys a systemic understanding of transformation and change processes in socio-technical, AI-shaped organizational contexts. Building on established theories, models and tools of classical and agile change management, students analyse how technological developments — in particular the use of artificial intelligence — alter existing processes, structures, decision logics and cultural patterns. Particular emphasis is placed on the design, communication and sustainable embedding of change processes under dynamic and uncertain conditions. Motivational, resilience-oriented and learning-oriented perspectives are addressed alongside the specific challenges of AI-driven transformation dynamics between stability, agility and innovation. - Systemic thinking and action in socio-technical systems - Theories, models and tools of change management - Design, communication and sustainable embedding of change processes - Positive psychology, motivation and resilience in transformation - Specific dynamics of AI-driven organizational change
Leadership and Organizational Design Prof. Dr. C. Ungerer	V, Ü, LÜ, W	2	3	The Leadership and Organizational Design sub-module focuses on the organizational and leadership-related implementation of AI-based transformation initiatives. Students become familiar with management and leadership approaches that are suitable for digital and AI-driven transformation processes and engage with the foundations of modern and transformational leadership. A particular emphasis is placed on the role of leadership in agile, project-based, and innovation-oriented contexts, where target states are emergent, exploratory search processes are required, and interdisciplinary collaboration takes place. In this context, concepts such as organizational ambidexterity, corporate entrepreneurship, and open innovation are examined to understand how exploration and exploitation can be organizationally balanced and structurally embedded. Furthermore, students address the design of agile organizational forms, learning organizations, and modern work models, as well as the adaptation of organizational structures and processes with regard to the use of AI, sustainable innovation capability, and continuous improvement. The aim is to effectively support transformation initiatives, foster organizational learning processes, and embed change sustainably. **Topics** - Management and leadership approaches for digital and AI-driven transformation - Foundations of modern and transformational leadership - Leadership in agile, project-based and innovation-oriented contexts - Organizational ambidexterity, corporate entrepreneurship, open innovation - Design of agile organizational forms, learning organizations, modern work models - Adapting structures and processes to AI adoption and innovation capability

Literature	- Kotter, J. P. (1996). *Leading Change*. Harvard Business School Press. - Kotter, J. P. (2012). *Accelerate: Building Strategic Agility for a Faster-Moving World*. HBR Press. - Hiatt, J. (2006). *ADKAR: A Model for Change in Business, Government and our Community*. Prosci. - Bridges, W. (2009). *Managing Transitions: Making the Most of Change* (3rd ed.). Da Capo Press. - Schein, E. H., & Schein, P. (2017). *Organizational Culture and Leadership* (5th ed.). Wiley. - Edmondson, A. C. (2019). *The Fearless Organization: Creating Psychological Safety in the Workplace for Learning, Innovation, and Growth*. Wiley. - Senge, P. M. (2006). *The Fifth Discipline: The Art & Practice of the Learning Organization* (Rev. ed.). Doubleday. - Galbraith, J. R. (2014). *Designing Organizations: Strategy, Structure, and Process at the Business Unit and Enterprise Levels* (3rd ed.). Jossey-Bass. - Nadler, D. A., & Tushman, M. L. (1997). *Competing by Design: The Power of Organizational Architecture*. Oxford University Press. - O'Reilly, C. A., & Tushman, M. L. (2016). *Lead and Disrupt: How to Solve the*

	Innovator's Dilemma. Stanford Business Books. - Iansiti, M., & Lakhani, K. R. (2020). *Competing in the Age of AI*. HBR Press. - Davenport, T. H., & Ronanki, R. (2018). "Artificial Intelligence for the Real World." *Harvard Business Review*. - Vial, G. (2019). "Understanding digital transformation: A review and a research agenda." *Journal of Strategic Information Systems*. - Westerman, G., Bonnet, D., & McAfee, A. (2014). *Leading Digital*. Harvard Business Review Press. - Fountaine, T., McCarthy, B., & Saleh, T. (2020). *Building the AI-Powered Organization*. HBR Press.		
Language	English	**Last update**	18.01.2026

Module 2	**Governance & AI Compliance, AI Ethics & Data Ownership**			
Module coordination	**Start**	**Module code/no.**	**ECTS-points**	**Workload**
Prof. Dr. A. Kleinfeld	SS, WS	Modul 2	6	180 h
	Duration	**SWS**	**Contact hours**	**Self-Study hours**
	1 Semester	4	60 h	120 h

Usability in programs	**Intended degree**	**Type of module (compulsory PM/elective WPM)**	**Semester of study**	**SPO-version / year**
MAI	M.Eng.	PM	1	SPO 1 / 2027

Competence-based requirements for participation	keine
Usability in above-mentioned program	Prerequisite for: Recommended prerequisite for: CORE06 (AI Transformation Sprint Lab – Industry Project). Recommended in combination with: AI Use Case Discovery & Scoping

Method of evaluation		**Graded exam**	**Ungraded exam**	**Ungraded performance record**
	Module exam (MP)	AB, B, PR		
	Submodule exam (MTP)	B, PR, HA, R		
Calculation of the final grade	☐ Grade of the graded module (part) examination ☒ ECTS-weighted arithmetic mean of the graded module part examinations ☐ Others:			

Learning objectives	Students name governance models for AI and data ecosystems, including roles, decision rights and accountability, and the key regulatory and normative frameworks of data protection, liability and AI regulation. They explain the ethical implications of AI-supported decisions and the goal conflicts between innovation, regulation and societal values. They derive actionable requirements for AI projects from regulatory frameworks. They design a compliance-by-design approach comprising risk classification, controls, documentation, auditability and monitoring, and develop a governance regime for a concrete AI initiative. They outline the technical foundations of machine learning only insofar as they are required to derive governance requirements. Students analyse governance and compliance issues in concrete AI use cases and examine stakeholder constellations and risk exposure. They apply structured methods such as stakeholder analysis, risk assessment and decision matrices, and propose mitigation measures. Students assess ethical implications such as fairness, transparency and human oversight, and justify trade-offs between innovation, regulation and values. They communicate governance decisions and compliance reasoning to technical and non-technical stakeholders and defend well-founded positions in interdisciplinary decision-making contexts. They critique the societal, economic and ethical implications of AI systems and develop a professional sense of responsibility in dealing with data-driven decisions.

Teaching and learning methods	☐ Lecture ☒ Practice ☒ Workshop/Seminar ☐ Project ☐ Laboratory ☐ Excursion ☐ Thesis ☒ Others: Case-based learning (case studies, structured discussions, role-based decision simulations).

Submodule Lecturer	**Type**	**SWS**	**ECTS**	**Teaching content**

AI Ethics & Data Ownership – Case Studies Prof. Dr. M. Strittmatter	Ü	2	3	The course is designed as a **case-based exercise** focusing on ethical, legal and organizational challenges related to **AI ethics, data ownership, governance and compliance**. Students analyze and discuss real-world and realistic case studies in which ethical principles, regulatory requirements (e.g. data protection, accountability), organizational interests and technological capabilities intersect. The course emphasizes **stakeholder analysis, identification of value conflicts, and the development of well-reasoned decision options**. Through interactive formats such as **case discussions, group work, role-based perspectives and moderated decision scenarios**, students strengthen their ability to assess and justify responsible actions in complex AI- and data-driven decision contexts. **Topics** - Ethical principles of AI-supported decisions: fairness, transparency, accountability - Legal framework: data protection, liability, attribution of responsibility - Data ownership and conflicts of interest between organisations, users and society - Stakeholder and goal-conflict analysis based on real decision cases - Role perspectives in case discussions: management, legal, data owner, society - Developing and justifying responsible courses of action
Governance & AI Compliance Seminar Prof. Dr. M. Strittmatter	S	2	3	The course is designed as an academic seminar focusing on governance, compliance, ethics and data ownership in the context of AI systems. The seminar addresses theoretical foundations, normative frameworks and current scholarly debates on regulation, responsibility, transparency, fairness, liability and data governance in AI development and deployment. Students engage with academic literature, regulatory texts (e.g. the EU AI Act), policy papers and ethical guidelines. Through structured reading, discussion and reflection, they examine different perspectives from law, ethics, organizational studies and management. The seminar develops students' ability to critically analyze complex governance and compliance issues, synthesize interdisciplinary viewpoints and articulate well-founded academic arguments. **Topics** - Theoretical foundations of AI governance - Normative frameworks and regulation, including the EU AI Act and data protection law - Responsibility, transparency, fairness, liability and data sovereignty - Study and discussion of academic literature, policy papers and guidelines - Comparing perspectives from law, ethics, organisational studies and management - Seminar contribution, moderated discussion and written paper

Literature	Die Inhalte des Moduls basieren auf ausgewählten wissenschaftlichen Publikationen, regulatorischen Texten sowie praxisorientierten Leitfäden zu Governance, Compliance, Ethik und Data Ownership im Kontext von KI-Systemen. Ergänzend werden aktuelle Fallstudien, Normen, Richtlinien und Gesetzestexte (z. B. Datenschutz- und KI-Regulierung) herangezogen. Die konkrete Literaturliste wird zu Beginn des Moduls bekannt gegeben und projekt- bzw. fallbezogen aktualisiert.		
Language	English	**Last update**	20.01.2026

Module 3	**AI Use-Case Discovery & Value Realization (Process, Data & Stakeholders) – Project**			
Module coordination	**Start**	**Module code/no.**	**ECTS-points**	**Workload**
Prof. Dr. C. Ungerer	SS, WS	Modul 3	6	180 h
	Duration	**SWS**	**Contact hours**	**Self-Study hours**
	1 Semester	4	60 h	120 h

Usability in programs	**Intended degree**	**Type of module (compulsory PM/elective WPM)**	**Semester of study**	**SPO-version / year**
MAI	M.Eng.	PM	1	SPO 1 / 2027

Competence-based requirements for participation	Grundlegende Englischkenntnisse (Lehrsprache Englisch)
Usability in above-mentioned program	Prerequisite for: Grundkenntnisse Prozess-/Datenverständnis empfohlen Recommended in combination with: Modul 4 (Technical AI Foundations) und Modul 6 (Sprint Lab).

Method of evaluation		**Graded exam**	**Ungraded exam**	**Ungraded performance record**
	Module exam (MP)			
	Submodule exam (MTP)	K60, K60		
Calculation of the final grade	☐ Grade of the graded module (part) examination ☒ ECTS-weighted arithmetic mean of the graded module part examinations ☐ Others:			

Learning objectives	Students name structured discovery methods such as the problem and use-case canvas, stakeholder mapping, process modelling and pain-point analysis, together with value-contribution logics. They explain organisational, legal and technical constraints, including data availability, data quality, roles and compliance requirements. They apply discovery methods to domain problems and examine data readiness and feasibility. They assess value contributions against productivity, quality, risk and sustainability. They develop a value case with baseline, measurement approach and benefits tracking. Students derive robust requirements and implementation options from a domain problem. They prioritise use cases within a portfolio and justify decisions on whether to proceed. They devise the impact logic of an AI portfolio and create gate-review artefacts such as a use-case one-pager, a set of key indicators, a risk and assumption log and an implementation outline. Students collaborate in interdisciplinary teams across domain, data and management perspectives and integrate differing viewpoints when defining and assessing use cases. They communicate assumptions, risks and decision rationales in a stakeholder-appropriate manner and facilitate alignment and prioritisation processes. They take entrepreneurial responsibility for the resulting recommendation and act professionally under uncertainty, trade-offs and resource constraints.

Teaching and learning methods	☐ Lecture ☒ Practice ☒ Workshop/Seminar ☒ Project ☐ Laboratory ☐ Excursion ☐ Thesis ☒ Others: Case-based Learning, moderierte Workshops (Problem Framing, Prozessanalyse, Stakeholder-Mapping), Peer-Review, kurze Impulsinputs, betreute Projektarbeit in Teams, Feedback- und Gate-Reviews.

Submodule Lecturer	**Type**	**SWS**	**ECTS**	**Teaching content**

Value Case, KPI Baseline & Feasibility (Data & Constraints) J. Wang / Prof. Dr.-Ing. M. Bühler	V, Ü	2	3	Building on use-case discovery, this course assesses the identified use cases economically and technically. Students develop the benefit logic, derive indicators and a baseline, examine data readiness and boundary conditions, and consolidate the assessment into a well-founded go/no-go recommendation. **A. Value case & benefit logic (from output to outcome/impact)** - Distinguishing output, outcome, and impact; typical AI value levers (time, quality, risk, cost, revenue). - Identifying value drivers: where is measurable value created in processes and decisions? - Value hypothesis: assumptions, causal mechanisms, dependencies, and limits. **B. KPI design & baseline (making value measurable)** - Deriving KPIs from target state/OKRs; leading vs. lagging indicators. - Baseline measurement: data sources, time window, sampling, measurement error, variance/confidence. - Operationalization: definitions, formulas, granularity, ownership, reporting cadence. **C. Business case essentials (economic evaluation)** - Cost/benefit structure: one-time vs. recurring costs (build/buy, operations, maintenance, monitoring). - Quantification/monetization: cost of poor quality, cycle time, capacity, utilization, risk reduction. - Scenario analysis and sensitivities (best/realistic/worst case); break-even and payback. **D. Feasibility check: data readiness & model suitability** - Data readiness: availability, quality, completeness, timeliness, labeling effort, bias/representativeness. - Problem/model suitability: appropriate problem type, target variable, proxy risks, data leakage. - Quick checks: lightweight data audit, labeling plan, minimum data for an MVP (“thin slice”). **E. Constraints & boundary conditions (legal, security, operations)** - Privacy/compliance: personal data, purpose limitation, retention, roles and accountability. - IT/architecture constraints: systems, interfaces, latency, scaling, deployment options. - Operational aspects: monitoring, drift, human-in-the-loop, fallback processes, auditability. **F. Prioritization & decision logic (go/no-go)** - Scoring approach: value × feasibility × risk × time-to-value. - MVP design: success metrics, experiment design, acceptance criteria, pilot roadmap. - Decision brief: clear recommendation including risks, dependencies, and next steps.

Use-Case Discovery & Problem Framing (Process & Stakeholders) Prof. Dr. C. Ungerer / Prof. Dr.-Ing. M. Bühler	V, Ü	2	3	The course introduces the structured identification and framing of AI use cases. Working from the process, stakeholder and data perspectives, students learn how an ill-defined domain problem is turned into a specified, feasible and measurable task. The course thus provides the input for the economic and technical assessment carried out in Modul 3.2. **A. Problem understanding vs. "solution jumping"** - Typical failure modes of AI initiatives: wrong problem, wrong stakeholders, unrealistic data assumptions. - Problem space vs. solution space; "jobs-to-be-done"; common AI problem types (decision support, prediction, classification, optimization, assistance). - Differentiation: AI use case vs. "classic" digitization/automation. **B. Process discovery & value stream perspective** - Process discovery methods: SIPOC, swimlanes, event-/case-based views, interfaces and media breaks. - Bottlenecks, variability, rework loops, quality cost as quantifiable "pain points". - Identifying automation and decision points and where data is created in the process. **C. Stakeholder analysis & change perspective** - Stakeholder mapping (influence vs. impact), user roles, decision roles, and "shadow stakeholders" (compliance, IT, works council). - Interests, incentives, resistance patterns; adoption as a design requirement. - Communication and engagement logic for discovery workshops. **D. Problem framing & use-case specification** - Problem statement (SMART / OKR-aligned), scope and non-goals, assumptions and risks. - Use-case canvas: target state, users, triggers, inputs/outputs, decisions, constraints, success criteria. - Operationalizing success: KPIs, baseline definition, measurement approach, "value hypothesis". **E. Early feasibility & data readiness check** - Data readiness quick check: availability, quality, granularity, labeling effort, bias risks, data ownership. - System context: sources, interfaces, process/data governance, privacy and information security constraints. - Rough effort–benefit estimation: value vs. feasibility, dependencies, defining a "thin slice" MVP. **F. Output artefacts & handover to delivery** - Deliverables: problem brief, stakeholder map, process/value stream sketch, use-case canvas, KPI/baseline plan, data readiness checklist. - Prioritization of multiple use cases (scoring) and recommendation for pilot/MVP. - Reflection: trade-offs, risks, ethical and organizational implications (human-in-the-loop).

Literature	- Davenport, T. H., & Ronanki, R. (2018). "Artificial Intelligence for the Real World." *Harvard Business Review*. - Iansiti, M., & Lakhani, K. R. (2020). *Competing in the Age of AI*. Harvard Business Review Press. - Fountaine, T., McCarthy, B., & Saleh, T. (2020). *Building the AI-Powered Organization*. Harvard Business Review Press. - Provost, F., & Fawcett, T. (2013). *Data Science for Business*. O'Reilly. - Grover, V., Chiang, R. H. L., Liang, T.-P., & Zhang, D. (2018). "Creating Strategic Business Value from Big Data Analytics." *Journal of Management Information Systems*. - Parmenter, D. (2015). *Key Performance Indicators: Developing, Implementing, and Using Winning KPIs* (3rd ed.). Wiley. - Hubbard, D. W. (2014). *How to Measure Anything* (3rd ed.). Wiley. - Shapiro, J. F. (2007). *Modeling the Supply Chain* (2nd ed.). Cengage. *(für Value/Feasibility & trade-offs – optional)* - ISACA (versch. Ausgaben). *COBIT* (Governance/Control – optional als Brücke zu CORE02).		
Language	English	**Last update**	18.01.2026

Module 4	**Technical AI Foundations: Applied ML, Data Pipelines & Decision Systems**			
Module coordination	**Start**	**Module code/no.**	**ECTS-points**	**Workload**
Prof. Dr. C. Knievel	SS, WS	Modul 4	6	180 h
	Duration	**SWS**	**Contact hours**	**Self-Study hours**
	1 Semester	4	60 h	120 h

Usability in programs	**Intended degree**	**Type of module (compulsory PM/elective WPM)**	**Semester of study**	**SPO-version / year**
MAI	M.Eng.	PM	1	SPO 1 / 2027

Competence-based requirements for participation	Grundlegende Programmier- und Statistikkenntnisse sind hilfreich, aber nicht zwingend.
Usability in above-mentioned program	Prerequisite for: None. Basic programming and statistics knowledge is recommended. Recommended in combination with: Modul 3 (Use-Case Discovery & Value Realization) und Modul 5 (Execution & Scaling / MLOps).

Method of evaluation		**Graded exam**	**Ungraded exam**	**Ungraded performance record**
	Module exam (MP)			
	Submodule exam (MTP)	K60, K60		
Calculation of the final grade	☐ Grade of the graded module (part) examination ☒ ECTS-weighted arithmetic mean of the graded module part examinations ☐ Others:			

Learning objectives	Students name the major model classes of applied machine learning, including linear models, tree-based methods and neural networks, together with methods of data preparation and feature engineering and the structure of robust data pipelines. They explain the end-to-end machine learning lifecycle from data acquisition and feature engineering through training, evaluation and deployment to monitoring and model maintenance, and they explain risks such as overfitting, bias, data leakage and model drift. They apply exploratory data analysis, feature derivation, model training and model evaluation using suitable metrics. They examine data quality issues and error patterns and test the assumptions and limitations of model classes. They select the components of an end-to-end pipeline (data ingestion, cleaning, validation, training, inference, logging and monitoring) for a given problem and justify these design choices with respect to objectives, data constraints and operational decision logic. Students differentiate between model classes with respect to a given problem, its data constraints and its operational requirements. They compute baselines, document experiments reproducibly and justify results transparently. They select appropriate models, metrics and thresholds and assess the quality-assurance and robustness measures required for a productive setting. Students communicate and defend technical decisions on machine learning and data engineering in an audience-appropriate manner and within interdisciplinary teams. They critique the responsibilities and limitations of data-driven systems, identify common risks such as bias, data quality issues and automation bias, and derive pragmatic mitigation measures. They organise their own work through iterative planning, prioritisation and review, and maintain rigorous documentation and versioning.

Teaching and learning methods	☒ Lecture ☒ Practice ☐ Workshop/Seminar ☐ Project ☐ Laboratory ☐ Excursion ☐ Thesis ☒ Others: Blended Learning mit interaktiver Vorlesung, Live-Coding und betreuten Übungsphasen; Hands-on Labs (Jupyter/Notebook-basiert) zur Implementierung zentraler ML-Verfahren sowie zum Aufbau von Datenpipelines; Mini-Projekte in Kleingruppen (Use-Case-orient.)

Submodule Lecturer	**Type**	**SWS**	**ECTS**	**Teaching content**

Applied ML, Data Pipelines & Decision Systems Prof. Dr. C. Knievel	V, Ü	2	3	The course covers the technical foundations of applied machine learning and their embedding in operational decision systems. Alongside model families, evaluation and data pipelines, the systematic assurance of AI systems is a central concern. It provides the technical basis for the application and operations modules of the second semester. **A. Machine Learning Foundations & Algorithms** - Core principles and hyperparameters of key model families (linear models, ensemble methods, neural networks). - Evaluation beyond accuracy: precision, recall, F1, ROC/AUC in an applied/industrial context. - Feature engineering and preprocessing for technical/engineering data. **B. Data Pipelines & Engineering** - Pipeline architectures: from data sources to inference (batch vs. streaming, ETL/ELT, orchestration basics). - Data management and governance: data and model versioning, data lineage, and reproducibility. - Technical reproducibility of training results (experiments, configurations, seeds, artefacts). **C. Engineering Assurance & Safety for AI** - Systematic assurance: transferring established engineering principles (e.g., V-model / W-model) to ML development. - Learning assurance: methods to ensure data quality, coverage of the operational design domain (ODD), and bias mitigation. - Implementation assurance: model robustness in real-world use, monitoring input data (data drift), and handling unknown scenarios (out-of-distribution detection). - Explainability (XAI): technical methods (e.g., feature importance, local surrogates) to validate and interpret model behaviour.

Data Engineering & Quality for AI (Pipelines, Testing, Governance) Prof. Dr. R. Seepold / Prof. Dr. C. Knievel	V, Ü	2	3	The course addresses the data-side prerequisite of productive AI: architecture, pipelines, data quality and governance. Students learn to design, test and monitor data flows so that models remain reproducible, auditable and operable. It complements the model perspective of Modul 4.1 with the data and operations perspective. **A. Data Engineering for AI (Foundations & Architectures)** - Roles and interfaces: data engineering vs data science vs MLOps. - Data lifecycle: ingestion, storage, processing, and serving for ML use. - Architectures: data lake/lakehouse/warehouse; batch vs streaming; ETL vs ELT. - ML-ready data models: feature stores, semantic layers, data products. **B. Pipelines, Orchestration & Automation** - Pipeline building blocks: ingestion, transformation, quality gates, versioning, deployment. - Orchestration concepts (DAGs), monitoring, alerting, and automation patterns. - Reproducibility: configurations, artifacts, lineage, experiment tracking (data/model). - Cost and performance optimization (compute, storage, SLAs/SLOs, scaling). **C. Data Quality, Testing & Observability** - Data quality dimensions: accuracy, completeness, timeliness, consistency, validity, uniqueness. - Testing strategies: unit/integration tests for pipelines, schema tests, contract testing. - Data observability: drift, anomalies, freshness, null rates, distribution shifts. - Root-cause analysis & incident response (runbooks, postmortems). **D. Governance, Security & Compliance (AI-ready Data)** - Governance operating model: roles (owner/steward), policies, cataloging, metadata management. - Access control, privacy, data classification, auditability (RBAC/ABAC, least privilege). - Responsible data: bias risks, documentation (datasheets), operational domain coverage. - Release and approval processes for production-grade AI data.

Literature	- Géron, A.: *Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow*. O'Reilly. - Hastie, T.; Tibshirani, R.; Friedman, J.: *The Elements of Statistical Learning*. Springer. - Kleppmann, M.: *Designing Data-Intensive Applications*. O'Reilly. - Sculley, D. et al.: "Hidden Technical Debt in Machine Learning Systems." *NIPS* (Workshop), 2015. - Molnar, C.: *Interpretable Machine Learning*. (Open-access book). - Kuhn, M.; Johnson, K.: *Applied Predictive Modeling* bzw. *Feature Engineering and Selection*. Springer. - Breck, E. et al.: "The ML Test Score: A Rubric for ML Production Readiness and Technical Debt Reduction." *IEEE Big Data*, 2017.		
Language	English	**Last update**	18.01.2026

Module 5	AI Transformation Execution & Scaling Lab			
Module coordination	**Start**	**Module code/no.**	**ECTS-points**	**Workload**
J. Wang	SS, WS	Modul 5	6	180 h
	Duration	**SWS**	**Contact hours**	**Self-Study hours**
	1 Semester	4	60 h	120 h

Usability in programs	**Intended degree**	**Type of module (compulsory PM/elective WPM)**	**Semester of study**	**SPO-version / year**
MAI	M.Eng.	PM	2	SPO 1 / 2027

Competence-based requirements for participation	Keine formalen Teilnahmevoraussetzungen. Bereitschaft zur aktiven Mitarbeit in Teamsettings (Workshops, Reviews) sowie grundlegende Vertrautheit mit Use-Case-, Daten- und ML-Grundlagen.
Usability in above-mentioned program	Prerequisite for: Empfohlen: Inhalte aus CORE03 (Use-Case Discovery & Value Realization) sowie CORE04 (Technical AI Foundations); hilfreich: CORE02 (Governance/Compliance/Ethics). Recommended in combination with: Modul 3, Modul 4, Modul 2 (und praktisch auch Modul 1, wenn parallel geplant).

Method of evaluation		**Graded exam**	**Ungraded exam**	**Ungraded performance record**
	Module exam (MP)			
	Submodule exam (MTP)	B, PR, K60		
Calculation of the final grade	☐ Grade of the graded module (part) examination ☒ ECTS-weighted arithmetic mean of the graded module part examinations ☐ Others:			

Learning objectives	Students name operating models and architectures for the sustainable operation of AI systems, including DevOps and MLOps practices, continuous delivery, model and data versioning, monitoring and service-level logics. They explain the scaling logic of AI initiatives across organisation, technology, data, processes and skills. They analyse operational risks such as model drift, data quality issues, performance and latency constraints and compliance requirements, and assess their impact on operations and value. They develop a realistic scaling strategy including metrics for adoption, value contribution, quality and risk. Students apply transformation and delivery methods such as agile product development, portfolio and roadmap management, indicator-based steering and risk-based approaches to AI initiatives. They assess delivery and prioritisation decisions under resource and schedule constraints, judge trade-offs between time, cost, quality and risk, and select appropriate technical and organisational mitigation measures. They produce the governing artefacts of a scaling initiative (roadmap, release and rollout plan, runbooks, monitoring and retraining concept) and design a measurable control framework with baseline, targets and review cycles. Students collaborate in interdisciplinary teams, make trade-offs transparent and communicate decision rationales to different audiences. They practise stakeholder management, facilitation, constructive feedback and conflict resolution in realistic transformation settings. They critique the responsibilities and limitations of operating AI systems and articulate their contribution to sustainable and trustworthy AI adoption.

Teaching and learning methods	☐ Lecture ☐ Practice ☒ Workshop/Seminar ☐ Project ☐ Laboratory ☐ Excursion ☐ Thesis ☒ Others: Seminaristischer Unterricht, interaktive Workshops, Fallstudien, Labor-/Übungsanteile (Tool- und Methodenpraxis), Projektarbeit in Teams, Coaching/Sprechstunden, Peer-Reviews, Gastvorträge aus der Praxis.

Submodule Lecturer	**Type**	**SWS**	**ECTS**	**Teaching content**

Scaling, Adoption & AI Operations (MLOps/Monitoring) Prof. Dr.-Ing. M. Bühler / J. Wang	V, Ü	2	3	This course covers concepts, methods, and tools for operating, scaling, and sustainably embedding AI systems in organizations. Topics include DevOps/MLOps target operating models, roles and responsibilities (RACI, SRE/Operations), ML CI/CD, deployment and retraining automation, model/data versioning, monitoring (model/data drift, performance, bias, robustness), logging/tracing, incident & problem management, service levels (SLA/SLO), runbooks, and security/privacy in operations. A strong focus is placed on adoption and scaling: change and enablement measures, operational governance, KPI setups for usage and impact (adoption, value realization), operational cost management/FinOps, and the transition from pilots to scalable production systems. **Topics** - Target operating models for productive AI systems (DevOps/MLOps) - Operating models and responsibilities: roles, RACI, SRE/operations - CI/CD for ML, automation of deployment and retraining - Model and data versioning - Monitoring: model and data drift, performance, bias, robustness; logging and tracing - Incident and problem management, service levels (SLA/SLO), runbooks - Security and privacy in operations - Adoption and scaling: change and enablement measures, operational governance - Indicators for usage and impact, operational cost management and FinOps - Transition from pilots to scalable production systems

Execution & Delivery Management for AI Transformation J. Wang / Prof. Dr.-Ing. M. Bühler	V, Ü	2	3	The course addresses the management of AI transformation initiatives from pilot to product. It focuses on delivery and operating models, planning and prioritization, quality and risk management, and the anchoring of benefits through indicators. It prepares the operations and scaling perspective of Modul 5.2. **A. Delivery & Operating Models for AI Transformation** - From pilot to product: product vs project logic, product teams, platform teams, CoE vs federated model. - Roles and responsibilities: product owner, delivery lead, data/ML engineers, domain experts, risk/compliance. - Governance: steering, architecture board, model/data governance, change enablement. **B. Planning, Control & Portfolio Management** - Use-case prioritization: value vs feasibility, dependencies, maturity, capacity constraints. - Roadmapping: MVP/release planning, data/platform roadmap, iteration and milestone logic. - Budget and capacity: team capacity planning, build vs buy, vendor management. **C. Delivery Methods: Agile, Hybrid, Stage-Gates** - Agile delivery for AI: discovery–delivery–operations, backlog, data/model user stories. - Hybrid models: combining agile delivery with decision and approval gates. - Documentation and traceability: requirements, data/model documentation, audit-ready traceability. **D. Quality, Risk & Compliance in Delivery** - Quality criteria: data quality, model performance, robustness, monitoring, drift. - Risk management: model risk, bias/fairness, security, privacy, human-in-the-loop. - Acceptance and release: testing strategy, validation, go-live readiness, rollback plans. **E. Change Enablement & Adoption** - Stakeholder communication, training, role changes, HR/works council interfaces. - Adoption metrics: usage, process penetration, productivity/quality indicators. - Scaling patterns: rollout waves, pilots, champion networks, lessons learned. **F. KPIs & Value Tracking** - Value realization: hypotheses, baselines, KPIs, leading/lagging indicators. - Benefit tracking in operations: outcome measurement, process KPIs, cost of quality, time-to-value. - Continuous improvement: PIRs, incident learnings, continuous improvement loops.

Literature	- Forsgren, N.; Humble, J.; Kim, G.: *Accelerate*. IT Revolution. - Humble, J.; O'Reilly, J.; Molesky, J.: *Lean Enterprise*. O'Reilly. - Skelton, M.; Pais, M.: *Team Topologies*. IT Revolution. - Huyen, C.: *Designing Machine Learning Systems*. O'Reilly. - Treveil, M. et al.: *Introducing MLOps*. O'Reilly. - Cohn, M.: *Agile Estimating and Planning*. Pearson. - (Optional) Google: *MLOps: Continuous delivery and automation pipelines in machine learning* (Whitepaper/Guide).		
Language	English	**Last update**	18.01.2026

Module 6	**AI Transformation Sprint Project**			
Module coordination	**Start**	**Module code/no.**	**ECTS-points**	**Workload**
Prof. Dr. C. Päßler	SS, WS	Modul 6	6	180 h
	Duration	**SWS**	**Contact hours**	**Self-Study hours**
	1 Semester	1	60 h	120 h

Usability in programs	**Intended degree**	**Type of module (compulsory PM/elective WPM)**	**Semester of study**	**SPO-version / year**
MAI	M.Eng.	PM	2	SPO 1 / 2027

Competence-based requirements for participation	Erfolgreiche Teilnahme an den grundlegenden Core-Modulen des Studiengangs, insbesondere in den Bereichen AI Transformation, Governance sowie Technical AI Foundations.
Usability in above-mentioned program	Prerequisite for: Grundlegende Kenntnisse zu KI-Systemen, Daten- und Entscheidungsunterstützung sowie zu Organisations- und Transformationsprozessen. Recommended in combination with: Scaling, Systems Thinking & Integration Lab (Modul 5), AI Use-Case Discovery & Value Realization (Modul 3)

Method of evaluation		**Graded exam**	**Ungraded exam**	**Ungraded performance record**
	Module exam (MP)	AB, PR		
	Submodule exam (MTP)	AB		
Calculation of the final grade	☐ Grade of the graded module (part) examination ☒ ECTS-weighted arithmetic mean of the graded module part examinations ☐ Others:			

Learning objectives	Students name approaches and tools for the sprint-based delivery of AI transformation initiatives in real industrial contexts. They explain the interdependencies between technology, organisation, governance and economic impact. They assess the effect of solution options on the scalability, operation and benefit of an AI system. They design, implement and evaluate an AI-supported transformation initiative under given organisational, technical, legal and time constraints. Students analyse complex problem situations, prioritise them and transfer them into workable increments. They examine risks, dependencies and goal conflicts systematically and derive well-founded decision and action recommendations. They operationalise concrete AI use cases, integrate solutions into existing value-creation and IT systems and measure progress and impact against suitable indicators. Students take responsibility for decisions under uncertainty and collaborate in interdisciplinary project teams, integrating differing disciplinary perspectives from technology, organisation, management and governance. They communicate complex matters appropriately to technical and non-technical stakeholders and defend their own professional positions in a reasoned manner. They critique their own conduct with regard to impact, limits and ethical implications and develop a professional role understanding in the context of AI transformation.

Teaching and learning methods	☐ Lecture ☐ Practice ☒ Workshop/Seminar ☒ Project ☒ Laboratory ☐ Excursion ☐ Thesis ☒ Others: Industry-embedded sprint-based project work with coaching, milestone reviews and final management presentation.

Submodule Lecturer	**Type**	**SWS**	**ECTS**	**Teaching content**

AI Transformation Sprint Lab (Project-Based Learning) Prof. Dr.-Ing. M. Bühler / Prof. Dr. C. Päßler	PJ	1	6	The course is designed as a project-based sprint lab supporting students in the execution of a real-world AI transformation project in collaboration with industry partners. The focus lies on the structured planning, implementation and validation of AI use cases under realistic organizational, technical, legal and time constraints. Students work in interdisciplinary teams and take responsibility for analysis, solution design, implementation, evaluation and presentation of results. The course includes an initial project kick-off, regular review and coaching sessions, and a final results presentation. Rather than teaching isolated technologies, the emphasis is placed on integrated AI solutions considering data, organization, governance and business impact. **Topics** - Project kick-off with the industry partner: target state, scope, constraints - Structured planning, implementation and validation of an AI use case - Work in interdisciplinary teams: responsibility from analysis to presentation of results - Regular review and coaching sessions - Integration of AI system, data, organisation, governance and business impact - Final presentation of results to the university and the practice partner

Literature	Die im Modul behandelten Inhalte basieren primär auf projektbezogenen Materialien, Fallstudien und Dokumentationen der jeweiligen Industriepartner. Ergänzend werden ausgewählte wissenschaftliche und praxisorientierte Publikationen zu KI-Transformation, Organisationsentwicklung, Projekt- und Implementierungsmanagement sowie Governance und Ethik herangezogen. Die konkrete Literaturliste wird projektabhängig zu Beginn des Moduls bekannt gegeben.		
Language	German/English	**Last update**	13.01.2026

Module 7	**Electives**			
Module coordination	**Start**	**Module code/no.**	**ECTS-points**	**Workload**
Prof. Dr.-Ing. M. Bühler	SS, WS	Modul 7	24	720 h
	Duration	**SWS**	**Contact hours**	**Self-Study hours**
	2 Semester	0	240 h	480 h

Usability in programs	**Intended degree**	**Type of module (compulsory PM/elective WPM)**	**Semester of study**	**SPO-version / year**
MAI	M.Eng.	WPM	2	SPO 1 / 2027

Competence-based requirements for participation	Erfolgreich abgeschlossene Pflichtmodule des 1. Semesters (CORE01–CORE04) empfohlen. Modulabhängige Vorkenntnisse werden in der jeweiligen Lehrveranstaltungsbeschreibung des MAI-Wahlpflichtfach-Katalogs ausgewiesen.
Usability in above-mentioned program	Prerequisite for: Recommended in combination with: Die wählbaren Lehrveranstaltungen sind im Wahlpflichtkatalog WPK-27-28 des Studiengangs ausgewiesen.

Method of evaluation		**Graded exam**	**Ungraded exam**	**Ungraded performance record**
	Module exam (MP)			
	Submodule exam (MTP)			
Calculation of the final grade	☐ Grade of the graded module (part) examination ☒ ECTS-weighted arithmetic mean of the graded module part examinations ☐ Others:			

Learning objectives	Students acquire in-depth knowledge in specialised fields relevant to AI-supported transformation, selected in accordance with their individual profile and professional goals. The subject-specific learning outcomes follow the module description of the course chosen from the elective catalogue. Each admitted course reaches at least level 4 in one subject-specific and one methodological competency. The courses available for selection are listed in the programme's elective catalogue (INdigit, catalogue code WPK-27-28). The catalogue is updated each semester and approved by the programme management; it is not part of this module handbook. Students familiarise themselves independently with new subject areas, research relevant information, organise it and evaluate it critically. They transfer methods and approaches from other disciplines to their own field of application and contextualise them. Students engage constructively with ways of thinking and working outside their own discipline and integrate different academic perspectives. They present and discuss results across disciplinary boundaries. They reflect on their own learning progress and develop their capacity for independent study.

Teaching and learning methods	☒ Lecture ☒ Practice ☒ Workshop/Seminar ☒ Project ☐ Laboratory ☒ Excursion ☒ Thesis ☒ Others: Selbststudium, strukturierte Lektüre, Industriebesuche, Case-based Learning. Konkrete Lehr- und Lernformen werden je nach gewählter Lehrveranstaltung im aktuellen MAI-Wahlpflichtfach-Katalog ausgewiesen.

Submodule Lecturer	**Type**	**SWS**	**ECTS**	**Teaching content**

Literature	Modulabhängig: Die Literaturlisten der einzelnen Wahlpflicht-Lehrveranstaltungen werden zu Beginn des jeweiligen Semesters bekanntgegeben und richten sich nach den im aktuellen MAI-Wahlpflichtfach-Katalog ausgewiesenen Lehrveranstaltungen.		
Language	German/English	**Last update**	10.05.2026

Module 8	**Master Thesis**			
Module coordination	**Start**	**Module code/no.**	**ECTS-points**	**Workload**
Prof. Dr.-Ing. M. Bühler	SS, WS	Modul 8	30	900 h
	Duration	**SWS**	**Contact hours**	**Self-Study hours**
	1 Semester	0	0 h	900 h

Usability in programs	**Intended degree**	**Type of module (compulsory PM/elective WPM)**	**Semester of study**	**SPO-version / year**
MAI	M.Eng.	PM	3	SPO 1 / 2027

Competence-based requirements for participation	Zulassung zur Master-Thesis nach den Regelungen der SPO. Erfolgreicher Abschluss der Module 1 bis 6 wird empfohlen.
Usability in above-mentioned program	Prerequisite for: Keine. Recommended in combination with:

Method of evaluation		**Graded exam**	**Ungraded exam**	**Ungraded performance record**
	Module exam (MP)			
	Submodule exam (MTP)			
Calculation of the final grade	☐ Grade of the graded module (part) examination ☐ ECTS-weighted arithmetic mean of the graded module part examinations ☐ Others:			

Learning objectives	Students apply the subject-specific competencies of the programme to an open research question in the field of AI-supported transformation. Depending on the topic, the relevant subject-specific competency reaches the level of evaluating or creating; across all seven subject-specific competencies, analysing is the guaranteed lower bound. Students devise a research question, select a methodological approach and justify this selection. They analyse and model an open, complex problem independently. They transfer existing knowledge to an unfamiliar application context and develop their own solution approach from this transfer. They assess the value contribution and impact of their solution and plan their work over several months autonomously. Students document their approach and results transparently and present them in a manner appropriate to an academic audience, in English. They critique their own procedure, its assumptions and its limitations. They work independently and responsibly over an extended period and organise their own resources. They assess the ethical and societal implications of their work. They collaborate with supervisors and, where applicable, with a practice partner.

Teaching and learning methods	☐ Lecture ☐ Practice ☐ Workshop/Seminar ☐ Project ☐ Laboratory ☐ Excursion ☐ Thesis ☒ Others: Eigenständige wissenschaftliche Arbeit mit individueller Betreuung; Zwischenbesprechungen nach Vereinbarung.

Submodule Lecturer	**Type**	**SWS**	**ECTS**	**Teaching content**

Literature			
Language	English	**Last update**	