Subject-specific regulations for the degree program

“Intellectics (MA)”

from 21 May 2025

On 10 June 2025, the Presidential Board of the University of Hamburg approved the subject-specific regulations for the degree program “Intellectics (MA)” adopted on 21 May 2025 by the Faculty Council of the Faculty of Humanities on the basis of Section 91 Paragraph 2 Number 1 of the Hamburg Higher Education Act (HmbHG) of 18 July 2001 (HmbGVBl . p. 171) in the version of 19 February 2025 (HmbGVBl . p. 241) .

preamble

These subject-specific regulations supplement the provisions of the examination regulations of the Faculty of Humanities at the University of Hamburg for study programs leading to the degree Master of Arts (MA) of 6 May 2015 in the currently valid version and describe the modules for the Intellectics MA study program.

I. Supplementary provisions

Regarding § 1
Study objectives, examination purpose, academic degree, Implementation of the study program

Regarding Section 1 Paragraph 1:

(1) Intellectics MA" program is to provide students with a deep understanding of the principles, approaches, methods, and results in the science of artificial intelligence (AI), based on the humanistic educational principle. It also promotes a broad scientific understanding of the interaction between humans and systems that can perform non-trivial tasks for humans from various perspectives. Approaches are pursued that arise, for example, from relevant questions in the humanities, including philosophy, and contribute to solving these questions.

(2) The science of AI is an interdisciplinary field of research that

It uses approaches and insights from various humanities and structural sciences (along with engineering and natural sciences) and implements and further develops them from an information technology perspective. Central to the communication of information technology abstraction and modeling

is the paradigm of a rational agent (also called an agentic system). This paradigm is an actor acting in a dynamic environment who, within limited time and memory resources and based on his observations and his internally formed model, independently develops a plan to achieve an internal goal. An agent can develop internal goals from context and task descriptions or proactively within the framework of an overall system. Intelligence in the sense of intellectics means that agents act rationally and complete non-trivial tasks to the satisfaction of humans without using a predefined algorithm. In systems with multiple agents and humans, additional challenges arise, as different local goals may be incompatible with a global goal. A system that successfully achieves a global goal is called an intelligent or AI system.

(3) In addition to a critical-analytical examination of intelligent agents, students also acquire the necessary theoretical and practical skills to develop new, safe, trustworthy, robust, transparent, and explainable agents themselves and to learn to evaluate diverse possibilities as well as potential dangers through reflection on social mechanisms and ethical issues.

(4) From a professional perspective, this not only opens up the option for students to pursue an academic career with a doctorate in the intersection of AI with, for example, computer science, philosophy, mathematics, sociology, economics, etc., but also the option of working in an advisory capacity on all AI-related topics in companies, committees, or non-profit organizations. The stated goal of the program, in the spirit of sustainable teaching, is not only to help students successfully apply for jobs in the aforementioned fields, but also to ensure quality and stability in their professional lives (job security) through the sustainable teaching of key ideas, concepts, methods, and approaches – as opposed to a focus on currently popular technologies, programming languages, etc.

Regarding Section 1 Paragraph 4:
The program is run by the Faculty of Humanities.

Regarding § 4
Study and examination structure, modules and credit points (CP)

Regarding Section 4 Paragraph 1: Curriculum and Study Plan

(1) Intellectics MA program comprises a total of 120 credit points (CP). These are distributed across the two sections of the program as follows:

1. Subject-specific modules (including final module) in the compulsory area (102 CP)

2. Elective area (18 credits)

(2) The compulsory part of the Master's program comprises nine compulsory modules, each worth 8 credits, and the final module, including the Master's thesis, worth 30 credits. Students earn 24 credits in each of the first three semesters for the compulsory part. This leaves 6 credits in each semester for the elective part, which students acquire through successful participation in selected Master's courses at the University of Hamburg to develop their individual profile (participation in the relevant modules must be confirmed). The final module, including the Master's thesis (30 credits), is scheduled for the second summer semester of the curriculum.

(3) The compulsory modules are divided into three pillars, each lasting three semesters (see the table of subject-specific compulsory modules below). Each pillar offers one module consisting of a lecture and a related seminar each semester. Details on the modules can be found in the respective module descriptions under II. The content of the pillars can be outlined as follows.

1. Pillar 1: The content of this pillar is focused on developing data and algorithmic competence. In addition to the fundamentals of probability theory and the approaches of classical machine learning algorithms, as well as their practical use and implementation, the basic ideas of modern (large) language and image processing models and their multimodal combination are taught. Various approaches are used to explain how complex functions can be broken down into smaller ones and how these can be systematically parameterized using training data to achieve the desired functionality. Approaches to ensuring the verifiably correct behavior of such systems for the benefit of humans are discussed. Knowledge from applied mathematics and linguistics also contributes to this.

2. Pillar 2: This pillar focuses on the intelligent agent as a system that plans actions and makes decisions. It is taught that communication can also be interpreted as action. In addition to well-known classical planning methods, more advanced probabilistic models are discussed that can be used to generate and execute (optimal) plans for complex goals, such as those required for implementation in generative AI systems. Insights from applied mathematics and philosophy (agency, decision theory, considerations of temporal logic) are incorporated here.

3. Pillar 3: The content of this pillar focuses on the multi-agent aspect of the Intellectics MA program. Relevant approaches to game theory, the design of social mechanisms, and formal ethics are taught from a logic-centered perspective, among others. This incorporates insights from applied mathematics, sociology (social mechanisms), philosophy (epistemology, approaches to causality, philosophy of mind), linguistics (conditional reasoning), psychology (human group behavior in a game), and ethics (normative principles and their implementation, e.g., in deontic logic).

Intellectic MA program **Subject-specific modules in the compulsory area**		
Module		
Int11 Understanding Data vs. Machine Training (8 credits / 4 credit hours) Lecture (3 credits, 2 SWS) Seminar (3 credits, 2 hours per week) Module examination in the seminar (2 credits)	**Int12 GenAI in Education, Science, and Society** (8 credits / 4 credit hours) Lecture (3 credits, 2 SWS) Seminar (3 credits, 2 hours per week) Module examination in the seminar (2 credits)	**Int13 Agents, Intellectics , and Logic** (8 credits / 4 credit hours) Lecture (3 credits, 2 SWS) Seminar (3 credits, 2 hours per week) Module examination in the seminar (2 credits)
Int21 Perception: Natural Language Processing and Computers Vision (8 LP / 4 SWS) Lecture (3 credits, 2 SWS) Seminar (3 credits, 2 hours per week) Module examination in the seminar (2 credits)	**Int22 Planning and Decision Processes** (8 credits / 4 credit hours) Lecture (3 credits, 2 SWS) Seminar (3 credits, 2 hours per week) Module examination in the seminar (2 credits)	**Int23 Uncertainty, Causality, and Conditions** (8 credits / 4 credit hours) Lecture (3 credits, 2 SWS) Seminar (3 credits, 2 hours per week) Module examination in the seminar (2 credits)
Int31 Human-Compatible AI (8 credits / 4 credit hours) Lecture (3 credits, 2 SWS) Seminar (3 credits, 2 hours per week) Module examination in the seminar (2 credits)	**Int32 Probabilistic Foundation Models** (8 credits / 4 credit hours) Lecture (3 credits, 2 SWS) Seminar (3 credits, 2 hours per week) Module examination in the seminar (2 credits)	**Int33 Social Mechanisms, Social Epistemology, and Formal Ethics** (8 credits / 4 credit hours) Lecture (3 credits, 2 SWS) Seminar (3 credits, 2 hours per week) Module examination in the seminar (2 credits)

Intellectic MA program **Interdisciplinary elective area**
Interdisciplinary elective area (18 credits) Events from the fields of philosophy, computer science or language, literature, media I/II.

Intellectic MA program **Final module**
Final module (30 credits) Master's thesis (25 credits)

Presentation with oral examination (5 credits)

Regarding Section 4 Paragraph 6: Final module
The final module consists of a graded master's thesis worth 25 ECTS credits, a student presentation on the results of the master's thesis, and a subsequent oral examination worth a total of 5 ECTS credits. The presentation and oral examination are graded together. The final grade is determined by 1/3 of the presentation and oral examination grades, and 2/3 of the graded master's thesis, which is based on the written assessments. Further details are provided in the module description of the final module.

Regarding § 5
Course types

Regarding Section 5 Paragraph 2: Course language
The language of instruction is English.

Regarding Section 5 Paragraph 3: Compulsory attendance
Attendance is mandatory in seminars. This course format encourages the discursive acquisition of relevant knowledge, including discussions, and the appropriate formulation and presentation of knowledge and work results. It therefore also practices argumentation and conveys this with the perspectives of others. The collaborative completion of tasks promotes and encourages shared discursive knowledge, especially when making individual contributions. Therefore, the qualification objectives of this course require student attendance. Attendance is fulfilled if students are present for at least 85% of the class time (hereinafter referred to as regular attendance). Attendance also applies to admission to the retake examination.

Regarding Section 14
Master's thesis

Regarding Section 14 Paragraph 2: Registration and admission to the Master's thesis
The application for admission to the Master's thesis requires completed study and examination achievements amounting to 56 ECTS credits in the compulsory area.

Regarding Section 14 Paragraph 6: Language of the Master's thesis
The master's thesis can be written in German or English.

Regarding Section 14 Paragraph 7: Processing time and scope of the Master's thesis
The processing time for the master's thesis is 5 months.
The master's thesis should generally be 80 to 100 pages of text.

Regarding Section 15
Assessment of examination results

Regarding Section 15 Paragraph 3: Calculation of overall and partial grades

(1) The overall grade of the Master's examination is determined from the Credit points weighted arithmetic mean of the module grades.

(2) Examination results or coursework from the elective area go not included in the overall grade.

II. Module descriptions

Module type	**Compulsory module in the Intellectics MA program**
title	**Understanding Data vs. Machine Training**
Module symbol	**Int11**
Qualification objectives	Students will possess skills in all topics listed in the outline under Content in the field of data analysis and machine learning. In particular, students will be able to (i) identify the central ideas, (ii) define the relevant terms, (iii) explain the functionality of the associated methods and approaches, (iv) critically reflect on and evaluate the possibilities, limitations, risks, and impacts of using these methods and approaches, and (v) apply the methods and approaches to solving typical problems in systems modeling and design. Students should acquire skills in using the Python programming language and be able to use them to gain an understanding of data processing processes, particularly for the machine training of functions, so that a professionally sound assessment of the performance of current techniques is possible. Skills in the field of analysis are acquired through direct application in the content area.

Contents	• Classification vs. regression, parametric and non-parametric supervised learning, regularization to avoid overfitting, minimum description length • Frequency analysis, shopping basket analysis, recommendations • Statistical fundamentals: samples, optimal estimators, distribution, density, cumulative distribution, scales: nominal, ordinal, interval and ratio scales, hypothesis tests, confidence intervals • Computational networks from differentiable parameterized elementary units, learning of network parameters with gradient descent , backpropagation, deep learning: embedding spaces and autoencoders, unsupervised learning • Stochastic or probabilistic fundamentals: probabilities, random variables, conditional probabilities, independence, distributions, Bayesian networks for specifying distributions by factorization, blackboard notation, queries, query answering algorithms, learning methods for complete data, regularization from a probabilistic perspective • Inductive learning: version space, entropy concept, decision trees, learning rules • Ensemble methods : Bagging (Random Forests), Boosting (XGBoost) • Clustering: K - Means , DBSCAN, Analysis of Variation • (ANOVA), t-test, linear discriminant analysis • Prediction by evaluating time series (ARIMA, Auto-Regressive Integrated Moving Average) **Practical part of the seminar** • Python programming language with associated libraries from the area of data science (NumPy , SciPy , Pandas, matplotlib , NLTK) as well as the basics of databases • Machine learning with Python (scikit-learn) • Deep learning with Python (PyTorch) • Tools for scientific work: Markup languages (LaTeX , Markdown), version management (git), development environments
Teaching methods	Lecture: 2 SWS Seminar: 2 SWS
Language of instruction	English

Requirements for participation	No
Module completion	**Prerequisite for registration for the module exam:** Regular attendance at the seminar in accordance with the regulations of Section 5, Paragraph 3. Required coursework (oral presentations, internships, reports, etc.) will be announced in detail at the beginning of the course. **Type of test:** Written assignment (12–15 pages, maximum completion time: 3 months) as part of the seminar. **Language of the module exam:** English
Workload in the individual module parts	Lecture: 3 credits Seminar: 3 credits Term paper: 2 credits
Total workload of the module	8 LP
Frequency of the offer	Annually in the winter semester
Length of time	1 semester
Recommended semester	1st semester

Module type	**Compulsory module in the Intellectics MA program**
title	**GenAI in Education, Science, and Society**
Module symbol	**Int12**
Qualification objectives	Students will possess skills in all topics listed in the outline under Content in the field of generative artificial intelligence and its impact on education, science, and society. In particular, students will be able to (i) identify the central ideas, (ii) define the relevant terms, (iii) explain the functionality of the associated methods and approaches, (iv) critically reflect on and evaluate the possibilities, limitations, risks, and impacts of using these methods and approaches, and (v) apply the methods and approaches to solving typical problems in systems modeling and design. Students will be able to discuss the impacts on education, science, and society in a well-founded, subject-specific manner. Skills in the field of linear algebra will be acquired through direct application to the content topics.
Contents	• Agents for information retrieval, algorithmic embedding and association techniques (e.g. TF-IDF) • Representation learning for sequential structures, automatic embedding: word2vec, CBOW, Skip- Gram with negative sampling • Natural language processing: large language models (LLMs): recurrent computation networks (with so-called LSTMs or GRUs as base units), transformation networks (e.g. BERT, GPT), basics of training generative pretrained language models (GPTs) • GPT generation parameters: temperature and top-P sampling, retrieval-assisted generation, embedding techniques for relational data (knowledge graphs), integration of knowledge graphs into language models, generation of knowledge graphs from texts, fine-tuning of pre-trained generative models for special tasks, distilling models • Prompt engineering: Verbalization of context and task descriptions (including context-related GPTs), context-related learning (zero-shot vs. few -shot prompt generation) • Software development with LLMs (code generation) • Image processing with convolutional networks and transformation networks: AlexNet , ResNet , transformation networks for visual data (ViT)

	• Vision and language: large multimodal models (ViLBERT), contrastive pre-training (CLIP) • Generation of images from textual descriptions (DALL-E) • Video analysis: Object detection with transformation network architectures (YOLO)
Teaching methods	Lecture: 2 SWS Seminar: 2 SWS
Language of instruction	English
Requirements for participation	No
Module completion	**Prerequisite for registration for the module exam:** Regular attendance at the seminar in accordance with the regulations of Section 5, Paragraph 3. Required coursework (oral presentations, internships, reports, etc.) will be announced in detail at the beginning of the course. **Type of test:** Written assignment (12–15 pages, maximum completion time: 3 months) as part of the seminar. **Language of the module exam:** English
Workload in the individual module parts	Lecture: 3 credits Seminar: 3 credits Term paper: 2 credits
Total workload of the module	8 LP
Frequency of the offer	Annually in the winter semester
Length of time	1 semester
Recommended semester	1st semester

Module type	**Compulsory module in the Intellectics MA program**
title	**Agents , Intellectics , and Logic**
Module symbol	**Int13**
Qualification objectives	Students will have acquired skills in all topics in the field of agentic systems related to the topic of intellectics , as listed in the

	outline sections under Content . In particular, students will be able to (i) identify the central ideas, (ii) define the relevant terms, (iii) explain how the associated methods and approaches work, (iv) critically reflect on and evaluate the possibilities, limitations, risks, and impacts of using these methods and approaches, and (v) apply the methods and approaches to solving typical problems in systems modeling and design. Students will be able to identify the key research topics in intellectics and differentiate them from AI research. Advanced skills in the field of logic will be acquired through direct application to the content-related topics.
Contents	• Agents, principle of bounded rationality: Artificial Intelligence, Turing test, Chinese room • Deterministic game theory and social choice functions, preference aggregation, agent mechanisms • Social mechanisms: goal-directed interaction of agents and people, design of social mechanisms, intellect as a science • Fundamentals of modeling in social mechanisms (propositional logic, first and second order predicate logic, modal logic, epistemic logic, knowledge and vision, knowledge and time, dynamic epistemic logic, doxastic logic, justification logic, knowledge-based programs)
Teaching methods	Lecture: 2 SWS Seminar: 2 SWS
Language of instruction	English
Requirements for participation	No
Module completion	**Prerequisite for registration for the module exam:** Regular attendance at the seminar in accordance with the regulations of Section 5, Paragraph 3. Required coursework (oral presentations, internships, reports, etc.) will be announced in detail at the beginning of the course. **Type of test:** Written assignment (12–15 pages, maximum completion time: 3 months) as part of the seminar. **Language of the module exam:** English
Workload in the individual module parts	Lecture: 3 credits Seminar: 3 credits Term paper: 2 credits

Total workload of the module	8 LP
Frequency of the offer	Annually in the winter semester
Length of time	1 semester
Recommended semester	1st semester

Module type	**Compulsory module in the Intellectics MA program**
title	**Perception: Natural Language Processing and Computer Vision**
Module symbol	**Int21**
Qualification objectives	Students will acquire skills in all topics in the field of perception listed in the outline sections under Content. This module expands the skills in model training and generative AI to include skills in developing new methods for (statistical) natural language processing and computer vision. Students will be able to (i) identify the central ideas, (ii) define the relevant terms, (iii) explain the functionality of the associated methods and approaches, (iv) critically reflect on and evaluate the possibilities, limitations, risks, and impacts of using these methods and approaches, and (v) apply and further develop the methods and approaches to solve typical problems in modeling and system design. Students will be able to understand, explain, and discuss research questions currently being discussed in the field of multimodal perception with a professional background, taking into account their impact on society and research.
Contents	• Stochastic fundamentals: Markov networks, Markov random fields, dynamic Bayesian networks, queries and query answering algorithms, sampling methods, learning methods for incomplete data (expectation maximization: EM, Baum-Welch method), PAC learning principle • Probabilistic language models, topic models, Latent Dirichlet Allocation (LDA), thematic developments over time represented with dynamic Bayesian networks • Transformation networks as probabilistic models, training methods for convolutional and transformation networks, application-specific training through fine-tuning (deep and shallow), integration of special (symbolic) problem solvers in GPTs, differential programming • Probabilistic computation networks (e.g. with applications in image processing), query answering and scalability, transformation of probabilistic models to probabilistic computation networks, control of large language models with probabilistic models • Generation of relevant new objects to simplify the finding of problem solutions (e.g. AlphaGeometry , FunSearch) • Generative modeling of data (e.g. images): Generation of images and videos: Variational autoencoder with vector

	quantization (DALL-E), denoising diffusion, outpainting and inpainting • Construction of complex probability distributions through a series of invertible transformations: Normalizing flows, combination with probabilistic computation networks, Generating Adversarial Networks (GANs)
Teaching methods	Lecture: 2 SWS Seminar: 2 SWS
Language of instruction	English
Requirements for participation	None, the prior acquisition of skills as described in the modules "Understanding Data vs. Machine Training" (Int11) and " GenAI in Education, Science, and Society" (Int12) is recommended.
Module completion	**Prerequisite for registration for the module exam:** Regular attendance at the seminar in accordance with the regulations of Section 5, Paragraph 3. Required coursework (oral presentations, internships, reports, etc.) will be announced in detail at the beginning of the course. **Type of test:** Written assignment (12–15 pages, maximum completion time: 3 months) as part of the seminar. **Language of the module exam:** English
Workload in the individual module parts	Lecture: 3 credits Seminar: 3 credits Term paper: 2 credits
Total workload of the module	8 LP
Frequency of the offer	Annually in the summer semester
Length of time	1 semester
Recommended semester	2nd semester

Module type	**Compulsory module in the Intellectics MA program**
title	**Planning and Decision Processes**
Module symbol	**Int22**

Qualification objectives	Compared to the skills acquired in the modules on model training and generative AI, students have expanded skills in all topics listed in the outline under Content in the areas of planning and decision-making processes for agentic systems. In particular, students are able to (i) identify the central ideas, (ii) define the relevant terms, (iii) explain the functionality of the associated methods and approaches, (iv) critically reflect on and evaluate the possibilities, limitations, risks, and impacts of using these methods and approaches, and (v) apply and further develop the methods and approaches to solve typical problems in system modeling and design. Students are able to understand and evaluate research questions currently being discussed in the field of planning with a professional background and discuss them with regard to their potential impact on society, the economy, and science.
Contents	**Topics** • Planning and acting with deterministic models, Contrarian planning for games: Minimax principle, Execution of sequential plans: Prediction • Planning and acting with temporal models • Planning and acting with probabilistic models • Decision theory, Markov decision processes, with (Markov decision processes , MDPs) and without information about the current state (Partially Observable MDPs, POMDPs), centralized and decentralized control (DEC-POMDPs) • Reinforcement learning • Exploration vs. exploitation, slot machine theory, Monte Carlo tree search (AlphaZero) • Factoring techniques for decision-making processes
Teaching methods	Lecture: 2 SWS Seminar: 2 SWS
Language of instruction	English
Requirements for participation	None, the prior acquisition of skills as described in the modules “Understanding Data vs. Machine Training” (Int11), “ GenAI in Education, Science, and Society” (Int12) and “ Agents , Intellectics , and Logic ” (Int13) is recommended.
Module completion	**Prerequisite for registration for the module exam:** Regular attendance at the seminar in accordance with the regulations of Section 5, Paragraph 3. Required coursework (oral

	presentations, internships, reports, etc.) will be announced in detail at the beginning of the course. **Type of test:** Written assignment (12–15 pages, maximum completion time: 3 months) as part of the seminar. **Language of the module exam:** English
Workload in the individual module parts	Lecture: 3 credits Seminar: 3 credits Term paper: 2 credits
Total workload of the module	8 LP
Frequency of the offer	Annually in the summer semester
Length of time	1 semester
Recommended semester	2nd semester

Module type	**Compulsory module in the Intellectics MA program**
title	**Uncertainty , Causality , and Conditionals**
Module symbol	**Int23**
Qualification objectives	As an extension of the skills in the area of logic in Intellectics , students possess skills in all topics listed in the outline under Content in the areas of uncertainty, causality, and conditional logic. In particular, students are able to (i) identify the central ideas, (ii) define the relevant terms, (iii) explain the functionality of the associated methods and approaches, (iv) critically reflect on and evaluate the possibilities, limitations, risks, and effects of using these methods and approaches, and (v) apply and further develop the methods and approaches to solve typical problems in the modeling and design of systems. Students are able to discuss central research questions in Intellectics with a sound professional background, with regard to their potential impact on society, business, and science.
Contents	• Bayesian epistemology • Causal models (Pearl), actual causality (Halpern) • D-Separation • Do-calculus • IC, PC algorithm for acquiring causal models • Intervention • Counterfactual conditionals in the Do-calculus • Multivalued logics for conditionals • Knowledge revision and (counterfactual) conditionals • Nonmonotonic logics and preference semantics • Probabilistic logics
Teaching methods	Lecture: 2 SWS Seminar: 2 SWS
Language of instruction	English
Requirements for participation	None, the prior acquisition of skills as described in the module " Agents , Intellectics , and Logic " (Int13) is recommended.
Module completion	**Prerequisite for registration for the module exam:** Regular attendance at the seminar in accordance with the regulations of Section 5, Paragraph 3. Required coursework (oral presentations, internships, reports, etc.) will be announced in detail at the beginning of the course. **Type of test:**

	Written assignment (12–15 pages, maximum completion time: 3 months) as part of the seminar. **Language of the module exam:** English
Workload in the individual module parts	Lecture: 3 credits Seminar: 3 credits Term paper: 2 credits
Total workload of the module	8 LP
Frequency of the offer	Annually in the winter semester
Length of time	1 semester
Recommended semester	2nd semester

Module type	**Compulsory module in the Intellectics MA program**
title	**Human- Compatible AI**
Module symbol	**Int31**
Qualification objectives	As an extension of their skills in agent perception and action planning, students will possess skills in all topics listed in the outline under "Content" in the area of human-compatible behavior of agentic systems. In particular, students will be able to (i) identify the central ideas, (ii) define the relevant terms, (iii) explain the functionality of the associated methods and approaches, (iv) critically reflect on and evaluate the possibilities, limitations, risks, and impacts of using these methods and approaches, and (v) apply and further develop the methods and approaches to solve typical problems in system modeling and design. Students will be able to discuss central research questions in intellectualism with a sound professional background, with regard to their potential impact on society, business, and science.
Contents	• Provably useful and well-founded AI, probabilistic security guarantees, elimination problem • Human-aware and human-centered AI: Mental models, interpretable behavior and explanation generation, agent-supported human collaboration, aligned AI, analogies and common sense • Adaptation of language models: Reinforcement learning with human feedback (PPO method) • Task-oriented perception: From task descriptions to internal goals, task representations • Basics of assistive games, perception of human preferences, inverse reinforcement learning • Simulation of the behavior of agents in mechanisms, Durkheim test, Weizenbaum test
Teaching methods	Lecture: 2 SWS Seminar: 2 SWS
Language of instruction	English
Requirements for participation	None, it is recommended to have acquired the skills described in the modules “ Perception : Natural Language Processing and Computer Vision” (Int21) and “ Planning and Decision Processes ” (Int22).
Module completion	**Prerequisite for registration for the module exam:**

	Regular attendance at the seminar in accordance with the regulations of Section 5, Paragraph 3. Required coursework (oral presentations, internships, reports, etc.) will be announced in detail at the beginning of the course. **Type of test:** Written assignment (12–15 pages, maximum completion time: 3 months) as part of the seminar. **Language of the module exam:** English
Workload in the individual module parts	Lecture: 3 credits Seminar: 3 credits Term paper: 2 credits
Total workload of the module	8 LP
Frequency of the offer	Annually in the winter semester
Length of time	1 semester
Recommended semester	3rd semester

Module type	**Compulsory module in the Intellectics MA program**
title	**Probabilistic Foundation Models**
Module symbol	**Int32**
Qualification objectives	Students will possess skills in all topics listed in the outline under "Content" in the area of fundamental probabilistic models, thereby expanding their skills in uncertainty, causality, and conditional logic. In particular, students will be able to (i) identify the central ideas, (ii) define the relevant terms, (iii) explain the functionality of the associated methods and approaches, (iv) critically reflect on and evaluate the possibilities, limitations, risks, and impacts of using these methods and approaches, and (v) apply and further develop the methods and approaches to solve typical problems in systems modeling and design. Students will be able to understand and further develop solutions to central research questions in intellectual theory with a sound professional background.
Contents	• Probabilistic relational models (PRMs), lifted inference: lifted variable elimination, lifted branching tree algorithm, model counting methods (first-order and algebraic type), relational probabilistic computation networks • Sequential (e.g., discrete-time) modeling and inference with PRMs, taming of PRMs over time (retrospective and progressive) • Machine Learning for PRMs • Decision making and planning with PRMs and causality considerations • Dynamic extensions of the state space: Generative dynamic causal probabilistic-relational models for stochastic games (genDC -SG-PRMs) • PRMs and LLMs
Teaching methods	Lecture: 2 SWS Seminar: 2 SWS
Language of instruction	English
Requirements for participation	None, it is recommended to have acquired the skills described in the modules " Perception : Natural Language Processing and Computer Vision" (Int21), " Planning and Decision Processes " (Int22) and " Uncertainty , Causality , and Conditions " (Int 23) are formulated
Module completion	**Prerequisite for registration for the module exam:**

	Regular attendance at the seminar in accordance with the regulations of Section 5, Paragraph 3. Required coursework (oral presentations, internships, reports, etc.) will be announced in detail at the beginning of the course. **Type of test:** Written assignment (12–15 pages, maximum completion time: 3 months) as part of the seminar. **Language of the module exam:** English
Workload in the individual module parts	Lecture: 3 credits Seminar: 3 credits Term paper: 2 credits
Total workload of the module	8 LP
Frequency of the offer	Annually in the winter semester
Length of time	1 semester
Recommended semester	3rd semester

Module type	**Compulsory module in the Intellectics MA program**
title	**Social Mechanisms, Social Epistemology, and Formal Ethics**
Module symbol	**Int33**
Qualification objectives	As an extension of their skills in the areas of uncertainty, causality, and conditional logic, students also possess skills in all topics listed in the outline sections under Content in the areas of design of social mechanisms, social epistemology, and the design of agents in social systems, allowing them to examine aspects of formal ethics. In particular, students are able to (i) identify the central ideas, (ii) define the relevant terms, (iii) explain the functionality of the associated methods and approaches, (iv) critically reflect on and judge the possibilities, limitations, risks, and effects of using these methods and approaches, and (v) apply and further develop the methods and approaches to solve typical problems in the modeling and design of systems. Students are able to discuss central research questions in intellectualism with a sound professional background, taking into account their potential impact on society, business, and science.
Contents	• Cooperation between agents, rules of cooperation • Social epistemology • Probabilistic game theory and social mechanisms from a logical perspective • Deontic logic • Normative systems and argumentation theory • Formal ethics
Teaching methods	Lecture: 2 SWS Seminar: 2 SWS
Language of instruction	English
Requirements for participation	None, the prior acquisition of competencies as formulated in the descriptions of the module " Uncertainty , Causality , and Conditionals " (Int23) is recommended.
Module completion	**Prerequisite for registration for the module exam:** Regular attendance at the seminar in accordance with the regulations of Section 5, Paragraph 3. Required coursework (oral presentations, internships, reports, etc.) will be announced in detail at the beginning of the course. **Type of test:**

	Written assignment (12–15 pages, maximum completion time: 3 months) as part of the seminar. **Language of the module exam:** English
Workload in the individual module parts	Lecture: 3 credits Seminar: 3 credits Term paper: 2 credits
Total workload of the module	8 LP
Frequency of the offer	Annually in the winter semester
Length of time	1 semester
Recommended semester	3rd semester

Module type	**Compulsory module in the Intellectics MA program**
title	**Final module**
Module symbol	-
Qualification objectives	Students have acquired the ability to independently explore scientific subject areas and problem areas in the field of artificial intelligence. They are capable of systematically and nuanced presentations in a written paper and in a technical discussion.
Contents	Preparation and writing of the master's thesis Preparing and giving the lecture
Teaching methods	Independent work of the students under supervision
Language of instruction	English
Requirements for participation	Successful completion of modules in the Intellectics MA program totaling 54 credits
Module completion	**Type of test:** Master's thesis with a total length of 80–100 pages. Oral examination as part of the presentation (60 minutes including presentation time). **Language of the module exam:** English
Workload in the individual module parts	Master's thesis: 25 credits Presentation and oral examination (including preparation time): 5 credits
Total workload of the module	30 LP
Frequency of the offer	In every semester
Length of time	5 months
Recommended semester	4th semester

Regarding Section 22
Come into effect

These subject-specific regulations will enter into force on the day following their publication as an official announcement by the University of Hamburg. They will apply for the first time to students beginning their studies in the winter semester of 2025/2026.

Hamburg, 24 June 2025
University of Hamburg