Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

OFFICIAL TRANSLATION OF
Fachspezifische Bestimmungen für den Studiengang „Intellectics (M.A.)“

(Amtliche Bekanntmachung Nr. 50 vom 24. Juni 2025)

THIS TRANSLATION IS FOR INFORMATION ONLY – ONLY THE GERMAN VERSION SHALL BE LEGALLY VALID AND ENFORCEABLE!

Subject-Specific Provisions for the Master of Arts in Intellectics at the Faculty of Humanities

dated 21 May 2025

On 10 June 2025, the Executive University Board of the University of Hamburg ratified the Subject-Specific Provisions for the Master of Arts in Intellectics adopted by the Faculty of Humanities on 21 May 2012 pursuant to Section 91 subsection 2 number 1 of the Hamburg higher education act (Hamburgisches Hochschulgesetz, HmbHG) dated 18 July 2001 (HmbGVBl. p. 171) as amended on 19 February 2025 (HmbGVBl. p. 241).

Preamble

These Subject-Specific Provisions supplement the Examination Regulations by the Faculty of Humanities for Master of Arts Degree Programs at the University Hamburg dated 6 May 2015 as amended and provide a description of the modules for the Master of Arts in Intellectics.

I. Supplemental provisions

Section 1
Program and examination objectives, academic degree, and implementation of the degree program

Section 1 subsection 1:

(1) The research-oriented Master of Arts in program in Intellectics is taught entirely in English. It is not only aimed at providing students with an in-depth understanding of problems, methods, and results in subject areas from the research fields of Artificial Intelligence but also at promoting a broad and multiperspective scientific understanding of human interaction with systems that can perform nontrivial tasks for them. The pursued approaches are based on relevant humanities questions—including from philosophy, among others—and geared towards contributing solutions.

(2) The science of AI is an interdisciplinary research area that applies approaches and findings from various humanities and structural sciences disciplines (alongside engineering and natural sciences) and further develops them from an information technology perspective. The paradigm of rational agency (also known as agentic system) is central to the teaching of information technology abstraction and modeling, meaning the paradigm of an actor in a dynamic environment who, with limited time and memory resources, independently develops a plan to achieve an internal goal based on his observations and his intrinsic model. An agent can develop internal goals from context and task descriptions or proactively as part of an overall system. Intelligence in the sense of intellectics means that agents act rationally and fulfill nontrivial tasks to the satisfaction of humans without using a predefined algorithm. Multiagent systems bear additional challenges as varying local goals can be incompatible with a global goal. A system that successfully achieves a global goal is a so-called 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 novel transparent and explainable agents that are safe, trustworthy, robust, transparent, and explainable. They also learn to evaluate a range of options as well as potential dangers by reflecting on social and ethical issues.

(4) Professionally, this enables students to pursue academic careers with a doctorate at the intersection of AI and, for example, informatics, philosophy, mathematics, sociology, economics, among others, or build AI consultant careers at private companies, commissions, or nonprofit organizations. The declared aim of the degree program in the sense of sustainable teaching is to help students build successful careers in the abovementioned fields, while also promoting job quality and stability (job security) through the sustainable teaching of key ideas, concepts, methods, and approaches as opposed to a focus on trending technologies, programming languages, or similar.

Section 1 subsection 4:

The Faculty of Humanities is responsible for administering the degree program.

Section 4
Program and examination organization, modules, and ECTS credits

Section 4 subsection 1: Curriculum and timetable

(1) The Master of Arts in Intellectics comprises 120 ECTS credits.
These are distributed between the two (2) degree components as follows:
1. Subject-specific modules (including final module) in the required area (102 ECTS credits)
2. Elective area (18 ECTS credits)

(2) The required area of the master's degree program comprises nine (9) compulsory modules with eight (8) ECTS credits each and a final module, including the master's thesis, worth 30 ECTS credits. In the first three (3) semesters, students acquire 24 ECTS credits in each of the required areas. Thus, in the first three (3) semesters six (6) ECTS credits remain for the elective area in each semester, enabling students to hone their individual profile through successful participation in selected master's degree program courses at the University of Hamburg (participation in the relevant modules must be confirmed). The final module, including the master's thesis (30 ECTS credits) is scheduled for the second summer semester of the curriculum.

(3) The compulsory modules are divided into three (3) pillars over three (3) semesters each (see the table of subject-specific compulsory modules below). In each pillar, a module consisting of a lecture and an attendant seminar is offered each semester. Find details on the modules in the respective module descriptions under II. The contents of the pillars can be outlined as follows.

1. Pillar 1: The content of this pillar is geared towards developing data structure and algorithmic skills. In addition to the basics of probability theory and the classical approaches of machine learning algorithms and their practical application and implementation, students are taught the basic ideas of modern (large) language and image processing models and their multimodal combination. Various approaches are used to explain how complex functions can be broken down into smaller ones which, based on training data, can be systematically parameterized to achieve the desired functionality. Approaches to the demonstrably correct behavior of such systems for the benefit of humans are discussed. Knowledge from applied mathematics and linguistics is also incorporated.

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

3. Pillar 3: The content of this pillar focuses on the multiagent aspect of the Master of Arts in Intellectics. Relevant approaches to game theory, social mechanism design, and formal ethics are taught from a logic-centered perspective; findings from applied mathematics, sociology (social mechanisms), philosophy (epistemology, approaches to causality, philosophy of mind), linguistics (conditionals), psychology (behavior of people in a group in the context of a game) and ethics (normative principles and their implementation, for example, in deontic logic) are incorporated.

Master of Arts in Intellectics Subject-specific modules in the required area		
Modules		
Int11 Understanding Data vs. Machine Training	**Int12 GenAI in Education, Science, and Society**	**Int13 Agents, Intellectics, and Logic**
(8 ECTS credits / 4 credit hours per week)	(8 ECTS credits / 4 credit hours per week)	(8 ECTS credits / 4 credit hours per week)
Lecture (3 ECTS credits, 2 credit hours per week)	Lecture (3 ECTS credits, 2 credit hours per week)	Lecture (3 ECTS credits, 2 credit hours per week)
Seminar on (3 ECTS credits, 2 credit hours per week)	Seminar on (3 ECTS credits, 2 credit hours per week)	Seminar on (3 ECTS credits, 2 credit hours per week)
Module examination for the seminar (2 ECTS credits)	Module examination for the seminar (2 ECTS credits)	Module examination for the seminar (2 ECTS credits)
Int21 Perception: Natural Language Processing and Computer	**Int22 Planning and Decision Processes**	**Int23 Uncertainty, Causality, and Conditionals**
Vision (8 ECTS credits / 4 credit hours per week)	(8 ECTS credits / 4 credit hours per week)	(8 ECTS credits / 4 credit hours per week)
Lecture (3 ECTS credits, 2 credit hours per week)	Lecture (3 ECTS credits, 2 credit hours per week)	Lecture (3 ECTS credits, 2 credit hours per week)
Seminar on (3 ECTS credits, 2 credit hours per week)	Seminar on (3 ECTS credits, 2 credit hours per week)	Seminar on (3 ECTS credits, 2 credit hours per week)
Module examination for the seminar (2 ECTS credits)	Module examination for the seminar (2 ECTS credits)	Module examination for the seminar (2 ECTS credits)
Int31 Human-Compatible AI	**Int32 Probabilistic Foundation Models**	**Int33 Social Mechanisms, Social Epistemology, and Formal Ethics**
(8 ECTS credits / 4 credit hours per week)	(8 ECTS credits / 4 credit hours per week)	(8 ECTS credits / 4 credit hours per week)
Lecture (3 ECTS credits, 2 credit hours per week)	Lecture (3 ECTS credits, 2 credit hours per week)	Lecture (3 ECTS credits, 2 credit hours per week)
Seminar on (3 ECTS credits, credit hours per week)	Seminar on (3 ECTS credits, 2 credit hours per week)	Seminar on (3 ECTS credits, 2 credit hours per week)
Module examination for the seminar (2 ECTS credits)	Module examination for the seminar (2 ECTS credits)	Module examination for the seminar (2 ECTS credits)

Master of Arts in Intellectics Interdisciplinary elective area
Interdisciplinary elective area (18 ECTS credits)
Classes from the Departments of Philosophy, Informatics or Language, Literature, Media I/II.

Master of Arts in Intellectics Final module
Final Module (30 ECTS credits)
Master's thesis (25 ECTS credits)
Master's thesis and oral examination (5 ECTS credits)

Section 4 subsection 6: final module
The final module encompasses a graded master's thesis worth 25 ECTS credits as well as the students' presentation on the findings 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 overall grade is made up of 1/3 of the grade from the presentation and the oral examination and 2/3 from the graded master's thesis, which is based on the written reports. Further details can be found in the module description of the final module.

Section 5
Course types

Section 5 subsection 2: course language
The language of instruction is English.

Section 5 subsection 3: compulsory attendance
Attendance is compulsory for seminars. This type of course aims at the discursive acquisition of relevant knowledge, including discussions, the appropriate formulation and presentation of knowledge and work results. Correspondingly, students are taught arguments from the perspectives of others. The joint accomplishment of tasks fosters and requires shared discourse knowledge, particularly as regards individual contributions. Therefore, the qualification objectives of this course require student attendance. Compulsory attendance is met if students are present for at least 85% of the attendance time (hereinafter referred to as regular attendance). Compulsory attendance also applies to admission to repeat examinations.

Section 14
Master's thesis

Section 14 subsection 2: Registration for and admission to the master's thesis
The admission application for the master's thesis requires completed coursework and examinations amounting to 56 ECTS credits in the required area.

Section 14 subsection 6: Master's thesis language
The master's thesis may be written in either German or English.

Section 14 subsection 7: Processing time and scope of the master's thesis
Students have six months to write their master's thesis. The master's thesis should generally be approximately 80–100 pages.

Section 15
Evaluation of examinations

Section 15 subsection 3: Calculation of overall and partial grades
(1) The overall final grade for the master's degree is calculated from the average of the grades from the modules weighted according to the ECTS credits assigned to each module.
(2) Elective area examination grades are not used to calculate the overall final grade.

II. Module descriptions

Module type	Compulsory module in the Master of Arts in Intellectics
Title	Understanding Data vs. Machine Training
Modulesigle	Int11
Learning outcomes	Students acquire skills in all the topics listed in the bullet points under content in the area of data analysis and machine learning. In particular, students are able to (i) name the central ideas, (ii) define the relevant terms, (iii) explain how the relevant methods and approaches work, (iv) critically reflect on and assess the possibilities, limitations, risks, and effects of using these methods and approaches and (v) apply the methods and approaches to solve typical problems in modeling and designing systems. Students acquire Python programming skills and use these to gain an understanding of data processing, in particular of machine learning functions, which enable them to conduct academically sound evaluations of the performance of current techniques. They learn data analysis skills by directly applying their knowledge to related topics.
Module content	• Classification vs. regression, parametric and nonparametric supervised learning, regularization to avoid overfitting, minimum description length • Accumulation analysis, market basket analysis, recommendations • Statistical bases: Samples, optimal estimators, distribution, density, cumulative distribution, scales: Nominal, ordinal, interval and ratio scales, hypothesis testing, confidence intervals • Computational meshing based on differentiable parameterized elementary units, learning gradient mesh parameters, backpropagation, deep learning: Embedding rooms and autoencoders, unsupervised learning • Stochastic or probabilistic principles: Probabilities, random variables, conditional probabilities, independence, distributions, Bayesian networks for the specification of distributions through 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) • Cluster formation: K-Means, DBSCAN, analysis of variance • (ANOVA), t-test, linear discriminant analysis • Prediction by evaluating time series (ARIMA, Autoregressive Integrated Moving Average) **Practical part of the seminar** • Programming language Python with belonging libraries from the field of data science (NumPy, SciPy, Pandas, matplotlib, NLTK) as well as basics of databases • Machine learning with Python (scikit-learn) • Deep Learning with Python (PyTorch) • Tools for academic papers: Markup languages (LaTeX, Markdown), version management (Git), development environments

Teaching format(s)	Lecture: 2 credit hours per week Seminar: 2 credit hours per week
Language of instruction	English
Prerequisites	None
Module completion	**Prerequisites for registration to take the module examination:** Regular participation pursuant to Section 5 subsection 3. The exact required coursework (oral presentations, internships, reports, etc.) is announced before the course begins. **Type of examination:** Written term paper (12–15 pages, maximum processing time: 3 months) as part of the seminar. **Examination language:** English
Workload in the respective module components	Lecture: 3 ECTS credits Seminar: 3 ECTS credits Term paper: 2 ECTS credits
Total module workload	8 ECTS credits
Module frequency	Once a year, in the winter semester
Module duration	One semester
Recommended semester	First semester

Module type	Compulsory module in the Master of Arts in Intellectics
Title	**GenAI in Education, Science, and Society**
Modulesigle	**Int12**
Learning outcomes	Students have skills in all the topics listed in the bullet points under content in the field of generative artificial intelligence and their impacts on education, research, and society. In particular, students are able to (i) name the central ideas, (ii) define the relevant terms, (iii) explain how the relevant methods and approaches work, (iv) critically reflect on and assess the possibilities, limitations, risks, and effects of using these methods and approaches and (v) apply the methods and approaches to solve typical problems in modeling and designing systems. Students are able to discuss the effects on the educational system as well as on research and society in an academically sound manner. They acquire linear algebra skills by directly applying their knowledge to related topics.
Module content	• Agents for information research, 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 computational networks (with so-called LSTMs or GRUs base units), transformation networks (e.g., BERT, GPT), basics of training generative pretrained transformers (GPTs) • GPT generation parameters: Temperature and top-p sampling, retrieval-augmented generation, relational data embedding techniques (knowledge graphs), integration of knowledge graphs into large language models, knowledge graph generation from text, fine-tuning pretrained generative models for specific tasks, model distillation • 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 pretraining (CLIP) • Generation of images from textual descriptions (DALL-E) • Video analysis: Object detection with transformation network architectures (YOLO)
Teaching format(s)	Lecture: 2 credit hours per week Seminar: 2 credit hours per week
Language of instruction	English
Prerequisites	None

Module completion	**Prerequisites for registration to take the module examination:** Regular participation pursuant to Section 5 subsection 3. The exact required coursework (oral presentations, internships, reports, etc.) is announced before the course begins. **Type of examination:** Written term paper (12–15 pages, maximum processing time: 3 months) as part of the seminar. **Examination language:** English
Workload in the respective module components	Lecture: 3 ECTS credits Seminar: 3 ECTS credits Term paper: 2 ECTS credits
Total module workload	8 ECTS credits
Module frequency	Once a year, in the winter semester
Module duration	One semester
Recommended semester	First semester

Module type	Compulsory module in the Master of Arts in Intellectics
Title	**Agents, Intellectics, and Logic**
Modulesigle	**Int13**
Learning outcomes	Students have skills in all the topics listed in the bullet points under content in the area of agentic systems related to intellectics. In particular, students are able to (i) name the central ideas, (ii) define the relevant terms, (iii) explain how the relevant methods and approaches work, (iv) critically reflect on and assess the possibilities, limitations, risks, and effects of using these methods and approaches and (v) apply the methods and approaches to solve typical problems in modeling and designing systems. Students are able to name the key intellectics research topics and distinguish them from AI research. They acquire advanced logic skills by directly applying their knowledge to related topics.
Module content	• Agents, bounded rationality principle: Artificial intelligence, Turing Test, Chinese Room Argument • Deterministic game theory and social choice functions, preference aggregation, agent mechanisms • Social mechanisms: goal-oriented interaction of agents and humans, social mechanism design, the science of intellectics • Fundamentals of model building 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 format(s)	Lecture: 2 credit hours per week Seminar: 2 credit hours per week
Language of instruction	English
Prerequisites	None
Module completion	**Prerequisites for registration to take the module examination:** Regular participation pursuant to Section 5 subsection 3. The exact required coursework (oral presentations, internships, reports, etc.) is announced before the course begins. **Type of examination:** Written term paper (12–15 pages, maximum processing time: 3 months) as part of the seminar. **Examination language:** English
Workload in the respective module components	Lecture: 3 ECTS credits Seminar: 3 ECTS credits Term paper: 2 ECTS credits
Total module workload	8 ECTS credits
Module frequency	Once a year, in the winter semester
Module duration	One semester
Recommended semester	First semester

Module type	Compulsory module in the Master of Arts in Intellectics
Title	**Perception: Natural Language Processing and Computer Vision**
Modulesigle	**Int21**
Learning outcomes	Students acquire skills in all the topics listed in the bullet points under content in the area of perception. The module extends the skills for training models and generative AI with skills for developing new methods for (statistical) processing of natural language and computer vision. Students are able to (i) name the central ideas, (ii) define the relevant terms, (iii) explain how the associated methods and approaches work, (iv) critically reflect on and assess the possibilities, limits, risks, and effects of using these methods and approaches and (v) apply and further develop the methods and approaches to solve typical system design and modeling problems. Students are able to understand and explain research questions that are currently discussed in the field of multimodal perception around the world and discuss their impacts on society and research in an academic manner.
Module content	• Fundamentals of stochastics: 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 by 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, differentiable programming • Probabilistic computational networks (e.g., with applications in image processing), query answering and scalability, transformation of probabilistic models to probabilistic computational networks, control of large language models with probabilistic models • Generation of relevant new objects to simplify finding solutions to problems (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 calculation networks, Generating Adversarial Networks (GANs)
Teaching format(s)	Lecture: 2 credit hours per week Seminar: 2 credit hours per week
Language of instruction	English
Prerequisites	None. We recommend, however, that students acquire the skills described for the modules “Understanding Data vs. Machine Training” (Int11) and “GenAI in Education, Science, and Society” (Int12) prior to the course.

Module completion	**Prerequisites for registration to take the module examination:** Regular participation pursuant to Section 5 subsection 3. The exact required coursework (oral presentations, internships, reports, etc.) is announced before the course begins. **Type of examination:** Written term paper (12–15 pages, maximum processing time: 3 months) as part of the seminar. **Examination language:** English
Workload in the respective module components	Lecture: 3 ECTS credits Seminar: 3 ECTS credits Term paper: 2 ECTS credits
Total module workload	8 ECTS credits
Module frequency	Every summer semester
Module duration	One semester
Recommended semester	Second semester

Module type	Compulsory module in the Master of Arts in Intellectics
Title	**Planning and Decision Processes**
Modulesigle	**Int22**
Learning outcomes	Compared to the skills acquired in the modules on training models and generative AI, students have advanced skills in all the topics listed in the bullet points under content in the areas of planning and decision-making processes for agentic systems. In particular, students are able to (i) name the central ideas, (ii) define the relevant terms, (iii) explain how the belonging methods and approaches work, (iv) critically reflect on and assess the possibilities, limits, risks, and effects of using these methods and approaches and (v) apply and further develop the methods and approaches to solve typical system design and modeling problems. Students are able to understand research questions on planning that are currently raised around the world and to evaluate and to discuss them and their potential impacts on society, the economy, and science in an academic manner.
Module content	• 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, theory of multiarmed bandits, Monte Carlo tree search (AlphaZero) • Factorization techniques for decision-making processes
Teaching format(s)	Lecture: 2 credit hours per week Seminar: 2 credit hours per week
Language of instruction	English
Prerequisites	None. We recommend, however, that students acquire the skills described for the modules “Understanding Data vs. Machine Training” (Int11), “GenAI in Education, Science, and Society” (Int12), and “Agents, Intellectics, and Logic” (Int13) prior to the course.
Module completion	**Prerequisites for registration to take the module examination:** Regular participation pursuant to Section 5 subsection 3. The exact required coursework (oral presentations, internships, reports, etc.) is announced before the course begins. **Type of examination:** Written term paper (12–15 pages, maximum processing time: 3 months) as part of the seminar. **Examination language:** English
Workload in the respective module components	Lecture: 3 ECTS credits Seminar: 3 ECTS credits Term paper: 2 ECTS credits
Total module workload	8 ECTS credits
Module frequency	Every summer semester
Module duration	One semester
Recommended semester	Second semester

Module type	Compulsory module in the Master of Arts in Intellectics
Title	**Uncertainty, Causality, and Conditionals**
Modulesigle	**Int23**
Learning outcomes	Students acquire skills in all topics listed in the bullet points under content in the areas of uncertainty, causality, and conditional logic to broaden their intellectics logic skills. In particular, students are able to (i) name the central ideas, (ii) define the relevant terms, (iii) explain how the belonging methods and approaches work, (iv) critically reflect on and assess the possibilities, limits, risks, and effects of using these methods and approaches and (v) apply and further develop the methods and approaches to solve typical system design and modeling problems. Students are able to discuss key intellectics research questions and their possible impacts on society, the economy, and science in an academically sound manner.
Module content	• 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 logic for conditionals • Knowledge revision and (counterfactual) conditionals • Nonmonotonic logic and preference semantics • Probabilistic logic
Teaching format(s)	Lecture: 2 credit hours per week Seminar: 2 credit hours per week
Language of instruction	English
Prerequisites	None. We recommend, however, that students acquire the skills described for the module "Agents, Intellectics, and Logic" (Int13) prior to the course.
Module completion	**Prerequisites for registration to take the module examination:** Regular participation pursuant to Section 5 subsection 3. The exact required coursework (oral presentations, internships, reports, etc.) is announced before the course begins. **Type of examination:** Written term paper (12–15 pages, maximum processing time: 3 months) as part of the seminar. **Examination language:** English
Workload in the respective module components	Lecture: 3 ECTS credits Seminar: 3 ECTS credits Term paper: 2 ECTS credits
Total module workload	8 ECTS credits
Module frequency	Once a year, in the winter semester
Module duration	One semester
Recommended semester	Second semester

Module type	Compulsory module in the Master of Arts in Intellectics
Title	**Human-Compatible AI**
Modulesigle	**Int31**
Learning outcomes	Students acquire skills in all topics listed in the bullet points under content in the areas of uncertainty, causality, and conditional logic to broaden their skills in the area of human-compatible agentic system behavior. In particular, students are able to (i) name the central ideas, (ii) define the relevant terms, (iii) explain how the belonging methods and approaches work, (iv) critically reflect on and assess the possibilities, limits, risks, and effects of using these methods and approaches and (v) apply and further develop the methods and approaches to solve typical system design and modeling problems. Students are able to discuss key intellectics research questions and their possible impacts on society, the economy, and science in an academically sound manner.
Module content	• Demonstrably useful and well-founded AI, probabilistic safety guarantees, switch-off problem • Human-aware and human-centered AI: Mental models, interpretable behavior, and generation of explanations, agent-assisted human collaboration, aligned AI, analogies, and common sense • Adaptation of large language models: Reinforcement learning from human feedback (PPO method) • Task-oriented perception: From task descriptions to internal goals, task representations • Assistance games basics, perception of human preferences, Inverse Reinforcement Learning • Simulating agent behavior mechanisms, Durkheim Test, Weizenbaum Test
Teaching format(s)	Lecture: 2 credit hours per week Seminar: 2 credit hours per week
Language of instruction	English
Prerequisites	None. We recommend, however, that students acquire the skills described for the modules “Perception: Natural Language Processing and Computer Vision” (Int21) and “Planning and Decision Processes” (Int22) prior to the course.
Module completion	**Prerequisites for registration to take the module examination:** Regular participation pursuant to Section 5 subsection 3. The exact required coursework (oral presentations, internships, reports, etc.) is announced before the course begins. **Type of examination:** Written term paper (12–15 pages, maximum processing time: 3 months) as part of the seminar. **Examination language:** English
Workload in the respective module components	Lecture: 3 ECTS credits Seminar: 3 ECTS credits Term paper: 2 ECTS credits
Total module workload	8 ECTS credits
Module frequency	Once a year, in the winter semester
Module duration	One semester
Recommended semester	Third semester

Module type	Compulsory module in the Master of Arts in Intellectics
Title	**Probabilistic Foundation Models**
Modulesigle	**Int32**
Learning outcomes	The students acquire skills in all the topics listed in the bullet points under content in the area of fundamental probabilistic models, thereby broadening their uncertainty, causality, and conditional logic skills. In particular, students are able to (i) name the central ideas, (ii) define the relevant terms, (iii) explain how the belonging methods and approaches work, (iv) critically reflect on and assess the possibilities, limits, risks, and effects of using these methods and approaches and (v) apply and further develop the methods and approaches to solve typical system design and modeling problems. Students are able to understand and further develop solutions for key intellectics research questions in an academically sound manner.
Module content	• Probabilistic Relational Models (PRMs), Lifted Inference: Lifted variable elimination, lifted junction tree algorithm, model counting methods (first order and algebraic data types), relational probabilistic computing 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 under causality considerations • Dynamic extensions of the state space: Generative dynamic causal probabilistic-relational models for stochastic games (genDC-SG-PRMs) • PRMs and LLMs
Teaching format(s)	Lecture: 2 credit hours per week Seminar: 2 credit hours per week
Language of instruction	English
Prerequisites	None. We recommend, however, that students acquire the skills described for the modules “Perception: Natural Language Processing and Computer Vision” (Int21) and “Planning and Decision Processes” (Int22) prior to the course.
Module completion	**Prerequisites for registration to take the module examination:** Regular participation pursuant to Section 5 subsection 3. The exact required coursework (oral presentations, internships, reports, etc.) is announced before the course begins. **Type of examination:** Written term paper (12–15 pages, maximum processing time: 3 months) as part of the seminar. **Examination language:** English
Workload in the respective module components	Lecture: 3 ECTS credits Seminar: 3 ECTS credits Term paper: 2 ECTS credits
Total module workload	8 ECTS credits
Module frequency	Once a year, in the winter semester
Module duration	One semester
Recommended semester	Third semester

Module type	Compulsory module in the Master of Arts in Intellectics
Title	**Social Mechanisms, Social Epistemology, and Formal Ethics**
Modulesigle	**Int33**
Learning outcomes	Students also have skills in all the topics listed in the bullet points under content in the areas of social mechanism design, social epistemology, and design of social agents to broaden their uncertainty, causality, and conditional logic knowledge, so that aspects of formal ethics can be examined. In particular, students are able to (i) name the central ideas, (ii) define the relevant terms, (iii) explain how the belonging methods and approaches work, (iv) critically reflect on and assess the possibilities, limits, risks, and effects of using these methods and approaches and (v) apply and further develop the methods and approaches to solve typical system design and modeling problems. Students are able to discuss key intellectics research questions and their possible impacts on society, the economy, and science in an academically sound manner.
Module content	• 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 format(s)	Lecture: 2 credit hours per week Seminar: 2 credit hours per week
Language of instruction	English
Prerequisites	None. We recommend, however, that students acquire the skills described for the module "Uncertainty, Causality, and Conditionals" (Int23) prior to the course.
Module completion	**Prerequisites for registration to take the module examination:** Regular participation pursuant to Section 5 subsection 3. The exact required coursework (oral presentations, internships, reports, etc.) is announced before the course begins. **Type of examination:** Written term paper (12–15 pages, maximum processing time: 3 months) as part of the seminar. **Examination language:** English
Workload in the respective module components	Lecture: 3 ECTS credits Seminar: 3 ECTS credits Term paper: 2 ECTS credits
Total module workload	8 ECTS credits
Module frequency	Once a year, in the winter semester
Module duration	One semester
Recommended semester	Third semester

Module type	Compulsory module in the Master of Arts in Intellectics
Title	**Final module**
Modulesigle	**-**
Learning outcomes	Students are able to independently develop academic and scholarly work within the area of artificial intelligence and related problematic issues using academic and scholarly methods. They are able to present this work systematically and with nuanced argument in a written paper and in oral discourse.
Module content	Preparation and writing the master's thesis Preparing and giving the presentation
Teaching format(s)	Students own work under supervision
Language of instruction	English
Prerequisites	Successful completion of modules in the Master of Arts in Intellectics amounting to 54 ECTS credits
Module completion	**Type of examination:** Master's thesis with a total length of 80–100 pages and oral examination as part of the presentation (60 min incl. presentation time) **Examination language:** English
Workload in the respective module components	Master's thesis: 25 ECTS credits
Total module workload	30 ECTS credits
Module frequency	Each semester
Module duration	5 month
Recommended semester	Fourth semester

Section 22
Effective date

These Subject-Specific Provisions become effective on the day following official publication by the University of Hamburg. They first apply to students commencing their studies in Winter Semester 2025/2026.

Hamburg, 24 June 2025
University of Hamburg