Appendices Bachelor's degree programme Artificial Intelligence 2024 – 2025

Appendix I Learning outcomes of the degree programme (Article 3.1.1)

The bachelor demonstrates knowledge, understanding, and the ability to evaluate, analyse and interpret relevant data in the field of

1. the symbolic approach to Artificial Intelligence and has the ability to apply this.

2. the numerical, non-symbolic approach to Artificial Intelligence and has the ability to apply this.

3. computational models of cognitive processes and has expertise in constructing and applying this.

4. autonomous systems and robotics and has the ability to apply this.

5. linguistics and language technology and has the ability to apply this.

6. knowledge and agent systems and has expertise in designing, implementing and applying these.
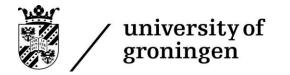
The bachelor has knowledge and understanding of

7. the most important philosophical theories developed in the areas of artificial intelligence and cognition.
8. relevant theories developed in the area of empirical sciences, psychology, biology and physics and has experience applying and analysing results thereof.

The bachelor has relevant knowledge and ability

9. to apply methods and techniques from mathematics and logic used in Artificial Intelligence.
10. to use algorithms, data structures and important programming languages used in Artificial Intelligence.

The bachelor has the ability

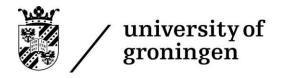11. on an academic level, to analyse problems, critically review scientific results and communicate about this both individually as well as in a group, both oral and in written form, also in a broader societal context.
12. to critically reflect on one's own working method and to recognize the need for continued learning on a high degree of autonomy, also in the context of a master or a specialist profession.

Appendix II Majors and Minors of the degree programme (Article 3.7.4)

The degree programme has one **Major**: Artificial Intelligence

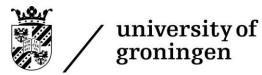The degree programme does not offer any **Minors**.

Appendix III Course units in the first year (List of course units; Article 4.1.1 / Compulsory order of examinations; Article 9.3)

The first year consists of twelve mandatory course units (60 ECTS), listed in the table below. Course details including modes of instruction, and modes of assessment are described in OCASYS.

Mandatory course units

Course code	Course unit name	ECTS
WBAI018-05	Algorithms and Data Structures	5
WBAI002-05	Autonomous Systems	5
WBAI010-05	Basic Scientific Skills	5
WBAI048-05	Calculus for Artificial Intelligence	5
WBAI021-05	Cognitive Psychology	5
WBAI063-05	Fundamental Artificial Intelligence	5
WBAI022-05	General Linguistics	5
WBAI003-05	Imperative Programming	5
WBAI004-05	Introduction to Artificial Intelligence	5
WBAI012-05	Introduction to Logic	5
WBAI026-05	Introduction to the Brain	5
WBAI050-05	Linear Algebra and Multivariable Calculus	5

There is no formal order of examinations for any of the course units in the first year.

Appendix IV Course units in the second and third years (List of course units; Article 7.1.1 / Compulsory order of examinations; Article 9.3)

The second and third years consist of mandatory course units (90 ECTS), including the Bachelor's Project and three Practical course units (15 ECTS), and elective course units (30 ECTS). Course details including entry requirements, modes of instruction, and modes of assessment are described in OCASYS.

Mandatory course units

Course code	Course unit name	ECTS
WBAI017-05	Advanced Logic	5
WBAI009-05	Architectures of Intelligence	5
WBAI901-15	Bachelor's Project	15
WBAI064-05	Data Science	5
WBAI040-05	Ethics in Artificial Intelligence	5
WBAI056-05	Introduction to Machine Learning	5
WBAI057-05	Knowledge and Agent Systems	5
WBAI065-05	Applied Machine Learning	5
WBAI059-05	Natural Language Processing	5
WBAI045-05	Object-Oriented Programming (for AI)	5
FI203AI	Philosophy of AI and Cognition	5
WBAI016-05	Signals and Systems	5
WBAI049-05	Statistics	5
	Practical course units	15

Students have to choose three Practical course units (15 ECTS) from the following list:

Practical course units

Course code	Course unit name	ECTS
WBAI046-05	Agent Technology Practical	5
WBAI025-05	Cognitive Ergonomics Practical	5
WBAI020-05	Cognitive Modelling Practical	5
WBAI014-05	Knowledge Technology Practical	5
WBAI027-05	Language Technology Practical	5
WBAI070-05	Machine Learning for Industry Practical	5
WBAI015-05	Reinforcement Learning Practical	5
WBAI066-05	Robotics Practical	5
WBAI062-05	Social Robotics Practical	5

Note: It is possible to take more than three practical course units, if students use their elective space for the additional courses.

In addition to the mandatory programme, the second and third year consist of elective course units (30 ECTS). 15 ECTS have to be chosen from a list of pre-approved electives. The other 15 ECTS can be either from the list of pre-approved electives, or free electives for which students need to request the formal approval of the Board of Examiners.

Students can choose from the following lists of course units without needing approval of the Board of Examiners:

Pre-approved elective course units from AI

Course code	Course unit name	ECTS
WBAI058-05	Domain Analysis	5
WBAI055-05	Human Factors	5
WBAI072-05	Human Language Learning	5
WBAI069-05	Hybrid Intelligence	5
WBAI067-05	Introduction to Robotics	5
WBAI068-05	Large Language Models	5
WBAI028-05	Neural Networks	5
WBAI071-05	Social Robotics	5
WBAI073-05	Speech Technology	5
WBAI052-05	Structural Analysis of Language for Cognitive Modelling	5
WBAI054-05	Uncertainty in Machine Learning	5
WBAI061-05	Reinforcement Learning	5

Pre-approved elective course units from other degree programmes

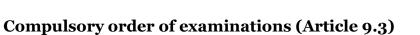| Course code	Course unit name	ECTS
WBCS052-05	Advanced Algorithms	5
WBCS053-05	Advanced Programming	5
WBCS035-05	Advanced Programming in C++	5
WBCS033-05	C++ Fundamentals	5
WBCS039-05	Compiler Construction	5
WBCS044-05	Computational Complexity	5
LIX025B05	Computational Grammar	5
WBCS019-05	Computer Graphics	5
LIX029B05	Conversational Interfaces	5
WBCS002-05	Functional Programming	5
PSB3E-M06	Human Error	5
WBCS040-05	Information Retrieval	5
WBCS004-05	Information Security	5
WBCS021-05	Introduction to Information Systems	5
WBEC002-05	Introduction to Science Education [a]	5
RGARI70210	IT Law for non-law Students [a]	10

[a] This course unit is taught in Dutch

WBCS027-05	Languages and Machines	5
PSB3E-CP09	Learning and memory	5
LIX003B05	Logic Programming	5
LIX032B05	Machine Translation	5
FI202LBG	Philosophy of Mind: Body, Brain, Mind [a]	7
FI153LH	Philosophy of the Natural Sciences: Physics and Metaphysics	5
WBCS034-05	Programming in C++	5
PSB3E-CP08	Thinking and deciding	5
WBCS008-05	Web Engineering	5
	Additional practical course units from the list of practical course units above	

As stated in Article 8.2.2, students are free to take any University Minor as a broadening module without explicit permission from the Board of Examiners. An exception to this rule is the Minor *Data Wise: Data Science in Society*, organized by the Faculty of Behavioural and Social Sciences, as the contents significantly overlap with the Artificial Intelligence BSc programme. It is also not possible to include a course from a University Minor if an equivalent or similar course is already taught in the Artificial Intelligence BSc programme.

Compulsory order of examinations (Article 9.3)

The examinations for the course units listed below may not be taken before the examinations for the associated course units have been passed:

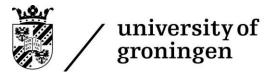| Course unit name and code	Entry requirements [b]
Advanced Logic [WBAI017-05]	Introduction to Logic [WBAI012-05]
Applied Machine Learning [WBAI065-05]	Introduction to Machine Learning [WBAI056-05]
Bachelor's Project [WBAI901-15]	Completion of all first-year course units Completion of at least 135 ECTS credit points from the AI bachelor's programme Submission of study programme in Progress Portal Data Science [WBAI064-05] Statistics [WBAI049-05]
Cognitive Ergonomics Practical [WBAI025-05]	Cognitive Psychology [WBAI021-05]
Cognitive Modelling Practical [WBAI020-05]	Architectures of Intelligence [WBAI009-05]
Data Science [WBAI064-05]	Statistics [WBAI049-05]
Human Language Learning [WBAI072-05]	General Linguistics [WBAI022-05]
Hybrid Intelligence [WBAI069-05]	Knowledge and Agent Systems [WBAI057-05]
Introduction to Machine Learning [WBAI056-05]	Calculus for AI [WBAI048-05] Linear Algebra and Multivariable Calculus [WBAI050-05]
Language Technology Practical [WBAI027-05]	Natural Language Processing [WBAI059-05] *or* Language and Speech Technology [WBAI007-05] *or* Participation in the course Large Language Models [WBAI068-05]
Large Language Models [WBAI068-05]	Natural Language Processing [WBAI059-05] [c]
Neural Networks [WBAI028-05]	Introduction to Machine Learning [WBAI056-05]
Reinforcement Learning Practical [WBAI015-05]	Autonomous Systems [WBAI002-05] Imperative Programming [WBAI003-05]
Robotics Practical [WBAI066-05]	Calculus for AI [WBAI048-05] Linear Algebra and Multivariable Calculus [WBAI050-05]
Signals and Systems [WBAI016-05]	Calculus for AI [WBAI048-05] Linear Algebra and Multivariable Calculus [WBAI050-05]
Speech Technology [WBAI073-05]	General Linguistics [WBAI022-05] Signals and Systems [WBAI016-05]

[b] In the event that a student has applied for a course to count as a course replacement, this replacement course also counts as a valid alternative for the course entry requirement in question.
[c] Advised entry requirement

Structural Analysis of Language for Cognitive Modelling [WBAI052-05]	General Linguistics [WBAI022-05]
Uncertainty in Machine Learning [WBAI054-05]	Introduction to Machine Learning [WBAI056-05] *or* Neural Networks [WBAI028-05]

Appendix V Contact hours first year and second and third year (Article 3.6)

Contact hours First year	
Type of contact hour	**Contact hours per year (approx. 682)**
Lectures	Approx. 270
Tutorial	Approx. 180
Practicals	Approx. 90
Tutoring / Mentor Hours	Approx. 10
Supervision during an internship	0
Final Examinations and Re-examinations	Approx. 60
Mid-term Examinations	Approx. 15
Career Support (FSE General)	Approx. 12
Miscellaneous Sessions (e.g. Q&A)	Approx. 30

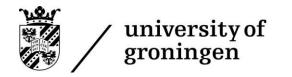| Contact hours Second and third year	
Type of contact hour	**Contact hours per year (approx. 1251.5)**
Lectures	Approx. 520
Tutorial	Approx. 100
Practicals	Approx. 460
Tutoring / Mentor Hours	0
Supervision during an internship or project	Approx. 7.5
Final Examinations and Re-examinations	Approx. 100
Mid-term Examinations	Approx. 0
Career Support (FSE General)	Approx. 24
Miscellaneous Sessions (e.g. Q&A)	Approx. 40

Appendix VI Additional requirements Open degree programmes (Article 7.3)

Students are permitted to obtain a diploma in the Artificial Intelligence BSc programme without fully fitting the curriculum set out in Appendix III and Appendix IV. This can only happen in consultation with and after approval of the Board of Examiners of the degree programme. Students are required to finish a BSc Project, to guarantee they are able to function as a BSc level researcher in line with the Dublin level descriptors / Framework for Qualifications of the European Higher Education Area, and are required to fit the Learning Outcomes of the programme (set out in Appendix I). These Learning Outcomes have been established in accordance with the AI BSc Framework of Reference of the Netherlands.

Appendix VII Transitional provisions (Article 12.1)

To prevent negative effects of curriculum changes on students who were already registered in the programme before these changes were made, the following transitional provisions apply.
The provisions are listed in reverse-chronological order. General provisions are described through text. Course units that are a direct replacement for discontinued course units are listed in table format.

Students who have already completed a discontinued course are excluded from taking the respective replacement course.

Any cases not listed in the Teaching and Examination Regulations, through either the current curriculum or the transitional provisions, are to be treated by the Board of Examiners of the degree programme.

Students who started in 2023-2024 or before:

Discontinued course unit			Replacement course unit		
Course Code	Course Name	ECTS	Course Code	Course Name	ECTS
WBAI023-05	Artificial Intelligence 1	5	WBAI063-05	Fundamental Artificial Intelligence	5
WBAI011-05	Data Analytics and Communication	5	WBAI064-05	Data Science	5
WBAI007-05	Language and Speech Technology	5	WBAI073-05	Speech Technology	5
WBAI060-05	Machine Learning Practical	5	WBAI065-05	Applied Machine Learning	5
WBAI029-05	Robotics Practical 1	5	WBAI066-05	Robotics Practical	5
WBAI008-05	Neurophysics	5	WBAI067-05	Introduction to Robotics	5

Students are allowed to count Language and Speech Technology [WBAI007-05] instead of Natural Language Processing [WBAI059-05] as part of their mandatory programme. If they choose to do so, Natural Language Processing [WBAI059-05] may be used as a pre-approved elective option instead.

Students who passed the course Language and Speech Technology [WBAI007-05] are not allowed to follow the course Speech Technology [WBAI073-05].

Students are allowed to take Neural Networks [WBAI028-05] instead of Applied Machine Learning [WBAI065-05] as part of their mandatory programme. If they choose to do so, Applied Machine Learning [WBAI065-05] may be used as a pre-approved elective option instead.

Students who passed the course Machine Learning Practical [WBAI060-05] can choose to either:
1. use the course as one of their three mandatory practicals. If they choose to do so, they are not allowed to follow Applied Machine Learning [WBAI065-05] and must take the previously mandatory course Neural Networks [WBAI028-05].
2. use the course as a replacement course for Applied Machine Learning [WBAI065-05] as part of their mandatory programme. If they choose to do so, they are not allowed to follow Applied Machine Learning [WBAI065-05] and must take and additional practical.

From 24-25 onwards, Robotics Practical 2 [WBAI030-05] is no longer offered. Students who started in 23-24 or before are still allowed to include this course as a valid practical.

Students who started in 2021-2022 or before:

Discontinued course unit			Replacement course unit		
Course Code	Course Name	ECTS	Course Code	Course Name	ECTS
WBAI006-05	Knowledge and Agent Technology	5	WBAI057-05	Knowledge and Agent Systems	5

Students who started in 2020−2021 or before:

Discontinued course unit			Replacement course unit		
Course Code	Course Name	ECTS	Course Code	Course Name	ECTS
WBAI047-05	Constraint-based Grammatical Analysis	5	WBAI052-05	Structural Analysis of Language for Cognitive Modelling	5
WBCS037-05	Linear Algebra and Multivariable Calculus	5	WBAI050-05	Linear Algebra and Multivariable Calculus	5
WBCS028-05	Object-Oriented Programming	5	WBAI045-05	Object-Oriented Programming	5
WBCS038-05	Statistics	5	WBAI049-05	Statistics	5

Students are allowed to take Neurophysics [WBAI008-05] instead of Ethics in Artificial Intelligence [WBAI040-05] as part of their mandatory programme. If they choose to do so, Ethics in Artificial Intelligence [WBAI040-05] may be used as a pre-approved elective option instead.

Robotics Practical 3 [WBAI051-05] is considered a valid practical course unit of the Artificial Intelligence BSc programme. Students who completed this course are not allowed to follow Robotics Practical 1 [WBAI029-05].

From 23-24 onwards, Artificial Intelligence 2 [WBAI001-05] is no longer offered and no longer a compulsory course, while Introduction to Machine Learning (for AI) [WBAI056-05] turns into a compulsory course. Students who started in 20-21 or before are allowed to include Artificial Intelligence 2 instead of Introduction to Machine Learning (for AI) as part of their mandatory programme. If they choose to do so, Introduction to Machine Learning (for AI) may be included as a pre-approved elective.