CURRICULUM FOR THE
BACHELOR'S PROGRAM IN
ARTIFICIAL INTELLIGENCE.

(in English)

JYU

**JOHANNES KEPLER
UNIVERSITY LINZ**

Contents

§ 1 Qualification Profile

(1) Artificial Intelligence (AI) refers to the ability of machines to perform cognitive tasks commonly associated with human intelligence including perception, learning, reasoning, planning, speech and language, and taking actions. Conceived more than five decades ago with the vision of understanding and emulating human intelligence, AI has since evolved towards a broadly applicable engineering discipline in which algorithms and data are brought together in order to solve a variety of problems in pattern recognition, learning, and decision making. Currently, AI pervades commercial applications in an unprecedented manner and is fundamentally changing how businesses operate across virtually all sectors, including manufacturing, healthcare, education, information technology, finance, and transportation. Concerning the impact of AI on industry and economy, experts frequently state that "data is the new oil, while AI is the new electricity".

(2) The recent surge of AI can mainly be attributed to advances in machine learning, in particular deep learning, where algorithms learn from examples and experience rather than relying on predefined rules. Artificial deep neural networks trained by modern learning algorithms on massive datasets can achieve outstanding and sometimes super-human performance in various fields such as computer vision, speech recognition, and medical applications. Modern developments in AI have created the current vision of a general artificial intelligence, a machine that could successfully perform any cognitive task by virtue of its sensory perception, previous experience, learned skills, and world knowledge. Such a general AI would affect every application area since it could be deployed as an intelligent and highly skilled raw model for learning or deducing specialized solutions for any problem.

(3) AI is, by its nature, an interdisciplinary subject drawing upon computer science, mathematics, robotics, psychology, linguistics, philosophy, and many other fields. The Bachelor program in Artificial Intelligence at Johannes Kepler University (JKU) Linz offers a broad and balanced foundational education in mathematics and computer science on the one side and specialized training in core AI subjects such as machine learning, data science, knowledge representation, reasoning, natural language processing (text and speech), and computer vision on the other. In addition, the students will learn about the broader ethical implications of AI for society.

(4) This Bachelor program focuses primarily on the competency of systematic problem solving. Students should be capable to approach complex tasks in a structured and methodological manner in order to develop valid and useful solutions. In addition, the program promotes social competences by teaching the students to work out and present their concepts and results in teams. Practical training also allows the students to acquire the skills and tools relevant for approaching a wide set of problems they may encounter in their later careers.

(5) This Bachelor program prepares its graduates both for subsequent Master studies and for the immediate entry into the job market, where graduates will be able to develop AI solutions in many different sectors of industry and economy.

§ 2 Structure and Outline

(1) In accordance with § 54 para. 1 UG the Bachelor's program in Artificial Intelligence belongs to the category of engineering degrees and is taught in English.

(2) The Bachelor's program in Artificial Intelligence covers six semesters and consists of 180 ECTS points, which are distributed as follows:

Subjects	ECTS
Mandatory Subjects	162
Bachelor's Thesis	9
Free Electives	9
Total	180

(3) For Free Electives students have to pass examinations corresponding to 9 ECTS points, which can be chosen from any recognized national or international post-secondary educational institution. The Free Electives shall provide additional skills beyond the Bachelor's program in Artificial Intelligence and can be taken anytime during the Bachelor's study.

(4) This program is, with certain restrictions, suitable for students with professional duties or supervision obligations. Most lectures and combined courses are also offered in digital form (streaming). In general, there is no obligation to attend lectures, although attendance is recommended. In combined courses, exercises, seminars, and practical works, attendance is sometimes mandatory. For exams, it cannot be guaranteed that they will be offered in digital form or at the end of the day. Working students must expect an extended period of study.

(5) Courses are usually offered only once per year.

(6) The recommended course of study is shown in the annex 1.

§ 3 Studies Introductory and Orientation Phase

(1) According to § 66 para. 1 UG the introductory and orientation phase consists of courses which give an overview of the fundamental contents and structure of the corresponding curriculum of studies. The introductory and orientation phase of the Bachelor's program in Artificial Intelligence covers courses amounting to 9 ECTS points in total, which can be chosen out of the following list:

Code	Type of course	Name	ECTS winter term	ECTS summer term
536AIBAIAIV19	VL	Introduction to AI	3	
536AIBAHO1V2	VL	Hands-on AI I	1.5	
536AIBAHO1U2	UE	Hands-on AI I	1.5	
536COSCPP1V	VL	Programming in Python I	3	
536COSCPP1U	UE	Programming in Python I	3	
521THEOLOGV	VL	Logic	3	
536MATHAI1V1	VL	Mathematics for AI I	6	
536AIBAHO2V2	VL	Hands-on AI II		1.5
536AIBAHO2U2	UE	Hands-on AI II		3
536COSCAD1V	VL	Algorithms and Data Structures 1		3
536COSCPP2V	VL	Programming in Python II		1.5
536COSCPP2U	UE	Programming in Python II		1.5
536MATHAI2V1	VL	Mathematics for AI II		6

(2) Before completion of the introductory and orientation phase further courses to an extent of 21 ECTS points can be chosen out of the following list:

Code	Type of course	Name	ECTS winter term	ECTS summer term
536AISOLAIK2(	KV	Lecture Series Artificial Intelligence	1.5	
536AISORAIK1	KV	Responsible AI	3	
521THEOLOGL	UE	Logic	1.5	
536MATHAI1U1	UE	Mathematics for AI I	3	
536AISOTASK1	KV	Technology and Society		3
536COSCAD1L	UE	Algorithms and Data Structures 1		1.5
536DASCSTAV	VL	Statistics for AI		3
536DASCSTAU	UE	Statistics for AI		3
536MATHAI2U1	UE	Mathematics for AI II		3
INBIPVOAINT	VO	Artificial Intelligence	3	
INBIPUEAINT	UE	Artificial Intelligence	1.5	
INBIPVOALG2	VO	Algorithmen und Datenstrukturen 2	3	
INBIPUEALG2	UE	Algorithmen und Datenstrukturen 2	1.5	
536DASCBMD/	KV	Basic Methods of Data Analysis	3	
921DASIVIAV1	VL	Visual Analytics	3	
536DASCVIAU1	UE	Visual Analytics	1.5	
536MLPEMSTV	VL	Machine Learning: Supervised Techniques	3	
536MLPEMSTL	UE	Machine Learning: Supervised Techniques	1.5	
536MATHAI3V1	VL	Mathematics for AI III	6	
536MATHAI3U1	UE	Mathematics for AI III	3	

§ 4 Mandatory Subjects/Modules

(1) The following subjects have to be completed successfully:

Code	Name	ECTS
536AIBA21	AI Basics and Practical Training	25.5
536AISO19	AI and Society	10.5
536COSC19	Computer Science	18
536DASC21	Data Science	33
536KNRR19	Knowledge Representation and Reasoning	13.5
536MLPE19	Machine Learning and Perception	18

Code	Name	ECTS
536MATH19	Mathematics	31.5
536ARSP19	Area of Specialization	12

(2) Courses chosen within the subject Area of Specialization cannot be chosen again in the Master studies.

§ 5 Courses

(1) The names and the types of all courses of the mandatory subjects as well as their ECTS points, their duration in hours per week, their codes, their registration requirements, and their admission procedures (in case of limited availability of places) are described in the study handbook of JKU (studienhandbuch.jku.at).

(2) The possible types of courses as well as the examination regulations are described in §§ 13 and 14 of the JKU statute (Section "Studienrecht").

§ 6 Bachelor's Thesis

(1) Students of the Bachelor's program Artificial Intelligence must complete a Bachelor's Thesis according to § 80 UG in the course SE "Bachelor's Thesis Seminar in AI" (536BAARBTSS19).

(2) The Bachelor's Thesis will be graded in combination with the "Bachelor's Thesis Seminar in AI" by the teacher of this course.

(3) The Curricular Committee for Artificial Intelligence may specify guidelines for the formal structure of a Bachelor's Thesis.

(4) The topic of the Bachelor's Thesis has to be expressed in the certificate.

§ 7 Examination Regulations

(1) The regulations for subject examinations and course examinations are described in the study handbook of JKU (studienhandbuch.jku.at).

(2) The Bachelor's program in Artificial Intelligence is concluded by a Bachelor's Examination. The Bachelor's Examination consists of the successful completion of mandatory subjects according to § 4. In order to graduate, students must also receive a passing grade for their Bachelor's thesis as well as for the free electives examinations.

§ 8 Academic Degree

(1) Graduates of the Bachelor's program in Artificial Intelligence are awarded the academic degree „Bachelor of Science", abbreviated „BSc" or „BSc (JKU)".

(2) The certificate about the academic degree is issued in English and in German.

§ 9 Legal Validity

(1) This curriculum comes into effect on October 1st, 2019.

(2) § 3, § 10 and annex 1 as published in the official newsletter of the Johannes Kepler University Linz on June 30th, 2020, 30th piece, item 350 will take effect on October 1st, 2020.

(3) § 2 para. 4, 5 and 6, § 3 para. 1, § 4 para. 1, § 10 and annex 1 as published in the official newsletter of the Johannes Kepler University Linz on May 18th, 2021, 23rd piece, item 294 will take effect on October 1st, 2021.

§ 10 Transitional Arrangements

(1) For students who have passed examinations within the curriculum of the Bachelor's program in Artificial Intelligence in a previous version, the equivalences listed in the study handbook of JKU apply.

(2) In addition to the equivalences given in the study handbook of JKU, following equivalences are effective:

Table A: Equivalence of subject packages

Package of subjects in the Bachelor's program in Artificial Intelligence version of 2019	equivalent package of subjects in the Bachelor's program in Artificial Intelligence version of 2021
536AIBA19: AI Basics and Practical Training (26 ECTS) + 536DASC19: Data Science (32.5 ECTS)	536AIBA21: AI Basics and Practical Training (25.5 ECTS) + 536DASC21: Data Science (33 ECTS)

Annex 1: Global map of study subjects – Bachelor's Program "Artificial Intelligence" (2021)

1st Semester (WS)	ECTS	2nd Semester (SS)	ECTS	3rd Semester (WS)	ECTS	4th Semester (SS)	ECTS	5th Semester (WS)	ECTS	6th Semester (SS)	ECTS	
Subject/Course	ECTS	Subject/Course	ECTS	Subject/Course	ECTS	Subject/Course	ECTS	Subject/Course	ECTS	Subject/Course	ECTS	
AI Basics and Practical Work Hands-on AI I (1.5 VL) Hands-on AI I (1.5 UE) Introduction to AI (3 VL)	6.0	**AI Basics and Practical Work** Hands-on AI II (1.5 VL) Hands-on AI II (3 UE)	4.5	**AI Basics and Practical Work** Artificial Intelligence (3 VO) Artificial Intelligence (1.5 UE)	4.5	**AI Basics and Practical Work** Seminar in AI (3 SE)	3.0	**AI Basics and Practical Work** Practical Work in AI (7.5 PR)	7.5			25.5
AI and Society Lecture Series Artificial Intelligence (1.5 KV) Responsible AI (3 KV)	4.5	**AI and Society** Technology and Society (3 KV)	3.0							**AI and Society** Gender Studies	3.0	10.5
Computer Science Programming in Python I (3 VL) Programming in Python I (3 UE)	6.0	**Computer Science** Algorithms and Data Structures 1 (3 VL) Algorithms and Data Structures 1 (1.5 UE) Programming in Python II (1.5 VL) Programming in Python II (1.5 UE)	7.5	**Computer Science** Algorithms and Data Structures 2 (3 VL) Algorithms and Data Structures 2 (1.5 UE)	4.5							18.0
		Data Science Statistics for AI (3 VL) Statistics for AI (3 UE)	6.0	**Data Science** Basic Methods of Data Analysis (3 KV) Visual Analytics (3 VL) Visual Analytics (1.5 UE)	7.5	**Data Science** Computational Data Analytics (3 KV) Learning from User-generated Data (3 VL) Learning from User-generated Data (1.5 UE)	7.5	**Data Science** Introduction to Computational Statistics (3 VL) Introduction to Computational Statistics (1.5 UE) Natural Language Processing (1.5 VL) Natural Language Processing (1.5 UE)	7.5	**Data Science** Digital Signal Processing (3 VL) Digital Signal Processing (1.5 UE)	4.5	33.0
Knowledge Representation and Reasoning Logic (3 VL) Logic (1.5 UE)	4.5					**Knowledge Representation and Reasoning** Formal Models (3 VL) Formal Models (1.5 UE)	4.5	**Knowledge Representation and Reasoning** Computational Logics for AI (3 VL) Computational Logics for AI (1.5 UE)	4.5			13.5
				Machine Learning and Perception Machine Learning: Supervised Techniques (3 VL) Machine Learning: Supervised Techniques (1.5 UE)	4.5	**Machine Learning and Perception** Machine Learning: Unsupervised Techniques (3 VL) Machine Learning: Unsupervised Techniques (1.5 UE) Machine Learning and Pattern Classification (3 VL) Machine Learning and Pattern Classification (1.5 UE)	9.0	**Machine Learning and Perception** Reinforcement Learning (3 VL) Reinforcement Learning (1.5 UE)	4.5			18.0
Mathematics Mathematics for AI I (6 VL) Mathematics for AI I (3 UE)	9.0	**Mathematics** Mathematics for AI II (6 VL) Mathematics for AI II (3 UE)	9.0	**Mathematics** Mathematics for AI III (6 VL) Mathematics for AI III (3 UE)	9.0	**Mathematics** Numerical Optimization (3 VL) Numerical Optimization (1.5 UE)	4.5					31.5
						Area of Specialization	1.5	**Area of Specialization**	3.0	**Area of Specialization**	7.5	12.0
								Free Electives	3.0	**Free Electives**	6.0	9.0
										Bachelor's Thesis Bachelor's Thesis Seminar in AI (9 SE)	9.0	9.0
	30.0		30.0		30.0		30.0		30.0		30.0	

Total ECTS: 180.0