

Cognitive Science and Artificial Intelligence elective package



Cognitive Science and Artificial Intelligence elective package

Offered by	Department Tilburg University
Language	English
Primarily interesting for	All students, but most relevant for students with background in Major Data Science.
Prerequisites	Required courses: NA Recommended courses: NA
Contact person	jbds@tilburguniversity.edu

Content and composition

In this elective package from the bachelor Cognitive Science and Artificial Intelligence, you learn about artificial intelligence (the study of computers and software that can perform intelligent behavior). Particularly, you focus on artificial intelligence, human cognition and technological innovation and ask questions like: "Can computers interpret human emotions in a reliable way? How does our brain process all the impulses which it receives and how does it respond to virtual and augmented reality? How does communication between humans and robots work? And what forms of artificial intelligence can we expect in the (near) future?".

Course code	Course name	Level classification
822047	Introduction to Machine Learning	2.
810031	Autonomous systems	2.
800882	Multi agent systems	2.
800829	Advanced Programming	3.
800883	Introduction to Deep Learning	3.
822188	Data Structures and Algorithms	3.
822208	AI for Nature and Environment	3.
822210	Methods for Responsible AI	3.
822196	Software Engineering for CSAI	3.

Course description

Note 1: Please note that these electives take place in Tilburg.

If you are a bachelor Data Science student you need to register for this course by sending an email to jbds@tilburguniversity.edu.

For non-Data Science students: to participate in these courses you need to register as an individual 'bijvak' student at Tilburg University via this link: www.tilburguniversity.edu/students/administration/registration/first-minors

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Note 2: these courses take place in Tilburg and do not follow the time schedule of the TU/e. They are mainly organized in semesters. Keep this in mind when selecting these courses.

Please contact jbds@tilburguniversity.edu in case you experience difficulties with your schedule.

Note 3: Data Science students are also allowed to take other courses from the bachelor Cognitive Science and Artificial Intelligence in Tilburg. If you would like to take one of the other courses from this bachelor program, you can ask permission via jbds@tilburguniversity.edu. You can also receive more information about the level of the other courses in this bachelor's program.

Since courses from Cognitive Science and AI are, in general, not open to Tilburg students from other programs, we need to manually register you for these courses. This also holds for those courses that are stated in this elective package.

Note 4: Registration for the courses Introduction to Deep Learning and Software Engineering for CSAI can only be requested after finalizing the course Introduction to Machine Learning.

You can find more information about the bachelor's program Cognitive Science and AI on the Tilburg website or via the study guide:

https://catalogus.tilburguniversity.edu/osiris_student_tiuprd/SetTaal.do?taal=en&bronUrl=/osiris_student_tiuprd/OnderwijsCatalogusZoekExamenprogramma.do&event=setTaal&requestToken=b0e2ba2f906c23b95657a6811f6c2af00e18bf1c (select study program).

Finally, note that also the other courses of the Cognitive Science & AI bachelor are semester courses and that scheduling information is only available about three weeks before the start of the courses. They do not follow the TU/e schedule of four quarters.

Introduction to Machine Learning

This course provides an introduction to machine learning – extracting knowledge from data - using Python and accompanying libraries. Machine learning is applied in all domains of everyday life, from music and film recommendations to financial decisions, security, personalized health care, and practical research.

Autonomous systems

This course offers a review of standard cognitive robotics and provides insights into the mechanisms behind natural and cognitive phenomena, with a focus on how to model these in simulations and robots. In the theoretical part of the course, you will learn the main theory behind autonomous systems and social robotics. In the practical part, you will put these theories into practice through the creation of your own social autonomous agent.

Multi-agent Systems

Multi-agent systems are everywhere in our society. For example, air traffic controllers maintaining aircraft separation and landing planes, utility companies distributing energy, travel agents booking trips, and epidemiological models of disease spread. In each case, there are various 'agents' that are coordinating, negotiating, and competing with each other to deliver the required services and perform their tasks. The promise of the future is that more of the agents in these systems will be artificial and may even need to interact with humans. Moreover, many models for understanding complex systems in our society involve simulating the spread of viruses, how economic trade works, and the evolution of language and other cultural traits often use multi-agent systems.

Advanced Programming

This course teaches advanced programming skills for Python, an accessible and versatile programming language – although the concepts are relevant to any programming language. The goal is to ensure that after this course you can continue to develop independently as a programmer, and that you can confidently analyze and solve the

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programming challenges related to your future professional activities, using a variety of techniques that will allow you to implement the most efficient and maintainable solution to a problem.

Introduction to Deep Learning

This course can only be followed after finalizing the course Introduction to Machine Learning.

In this course students will acquire theoretical knowledge of Neural Network models, develop practical skills for performing experiments with deep learning, and apply procedures for optimizing Deep Neural Networks.

Data Structures and Algorithms

The importance of computational techniques in professional lives is growing rapidly. Such techniques are also at the basis of many of the courses taught in the CSAI and Data Science programs. The course "Data Structures and Algorithms" builds on the computational knowledge from the course "Basic Programming" ("Introduction to Programming") in two ways: (1) it continues teaching the students the general programming language Python, and (2) it provides with the skills to use advanced data structures and design and assess algorithms.

AI for Nature and Environment

This course will provide the skills and knowledge to apply AI and data science in multiple ways to help nature and the environment. The biodiversity crisis and climate crisis are complex and interconnected: luckily there are many ways that technology can help to monitor the natural world, and to help society have a more positive impact.

This course focusses on a diverse set of applications of tech for nature, in each case studying how data science and AI methodologies can be used. We also encourage a critical and comparative approach, by looking at the impacts as well as the benefits of tech for nature, and considering machine learning good practices. The course assumes some familiarity with programming (Python) and with AI concepts, and explores the topics through computer-based data/AI practical work.

Methods for Responsible AI

Nowadays, artificial intelligence (AI) has become a hot topic around the world, offering massive potential for innovation in a variety of science disciplines. However, applications of AI come with risks for both individuals and society, for example, by disseminating biases in critical decision-making, undermining political deliberation, or developing autonomous weaponry. These issues urge studying different aspects involved in responsible AI applications. This course is designed to help students acquire the basic knowledge about the most pressing philosophical, ethical, legal, and societal challenges posed by AI and what is the state-of-the-art solution to these challenges. The students also learn how to robustly implement and evaluate fair and non-discriminative AI models. In addition, this course encourages students to develop a critical character when it comes to scientific and societal applications of AI in real-world scenarios. This course is designed to promote one of the central objectives of the bachelor's program in cognitive science and artificial intelligence in delineating the social and ethical aspects of the sustainable use of intelligent systems in human daily lives.

Software Engineering for CSAI

This course will teach software engineering to students with a background in AI and ML. It aims to equip students with fundamental knowledge on designing, developing, testing, deploying and maintaining software solutions that depend on AI or ML components.