GHENT UNIVERSITY

# Course Specifications

Valid as from the academic year 2025-2026

## Cognitive and Brain-Inspired Artificial Intelligence (E016360)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 3.0** **Study time 90 h**

**Course offerings in academic year 2026-2027**

| | | |
|---|---|---|
| A (semester 2) | English | Gent |

**Lecturers in academic year 2026-2027**

| | | |
|---|---|---|
| Belpaeme, Tony | TWO6 | lecturer-in-charge |
| Dambre, Joni | TWO6 | co-lecturer |

| Offered in the following programmes in 2026-2027 | crdts | offering |
|---|---|---|
| Bridging Programme Master of Science in Bioinformatics(main subject Engineering) | 3 | A |
| Master of Science in Bioinformatics(main subject Engineering) | 3 | A |
| Master of Science in Computer Science Engineering | 3 | A |

**Teaching languages**

English

**Keywords**

Artificial intelligence, machine learning, robotics, cognitive science, philosophy of AI

**Position of the course**

This course offers an interdisciplinary view of artificial intelligence. It is an in-depth course in addition to basic courses, such as Artificial Intelligence (AI) and Machine Learning (ML), and makes the connection between cognition, nervous systems and brains on the one hand, and new developments and major trends within AI and ML.

**Contents**

The course handles 6 themes, chosen from but not limited to the following topics.

- Cognitive sciences and the relationship to artificial intelligence.
- The similarities and differences between natural and artificial cognition.
- The interaction between evolution, environment and the individual and how this is relevant for AI.
- Computational creativity (definitions and metrics of creativity, generative AI).
- Embodied cognition (Central Pattern Generators, active compliance, mechanical optimization of sensors and morphology, vision systems).
- Arithmetic and learning in the brain (neurons and synapses, synaptic learning, self-organization, reward-based learning, back propagation).
- Consciousness (concepts related to consciousness, theories of consciousness, consciousness in natural and artificial systems).
- Emotion (concepts of emotion, quantifying emotion, the contribution of emotion to cognition, decision making and learning).
- Natural language (the contribution of language to cognition, semantics, the unique position of the human species).
- Imitation and learning from demonstration (situating imitation, the role of imitation in machine learning).

**Initial competences**

This course builds on certain final competencies of Artificial Intelligence and Machine Learning, and knowledge of general AI and ML techniques is required before taking this course.

**Final competences**

1 Consult interdisciplinary sources relevant to artificial intelligence, machine

learning and robotics.
2 Independently assess and interpret interdisciplinary sources relevant to artificial intelligence, machine learning and robotics.
3 Being able to identify similarities and differences between biological and artificial cognition and intelligence.
4 Mastering the interdisciplinary jargon specific to cognitive sciences, artificial intelligence, machine learning and robotics.
5 Display interdisciplinary insights relevant to artificial intelligence, machine learning and robotics.
6 Applying an interdisciplinary insight to a well-defined problem in artificial intelligence, machine learning or robotics.
7 Ability to communicate with colleagues about interdisciplinary work.

**Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

**Conditions for exam contract**

This course unit cannot be taken via an exam contract

**Teaching methods**

Group work, Lecture

**Extra information on the teaching methods**

Lectures, student presentations, followed by participatory discussion and working groups.

**Study material**

Type: Handouts

Name: Wetenschappelijke artikelen en hoofdstukken uit boeken. Materiaal zal in het Engels aangeboden worden, en zal beschikbaar gemaakt worden als digitale download op de website.
Indicative price: Free or paid by faculty
Optional: no

**References**

**Course content-related study coaching**

**Assessment moments**

continuous assessment

**Examination methods in case of periodic assessment during the first examination period**

**Examination methods in case of periodic assessment during the second examination period**

**Examination methods in case of permanent assessment**

Oral assessment, Participation

**Possibilities of retake in case of permanent assessment**

examination during the second examination period is possible in modified form

**Extra information on the examination methods**

100% non-periodical evaluation. This is based on attendance, participation, peer evaluation, short knowledge tests and a presentation. Each student is expected to participate in discussion moments and give at least one presentation on a topic.
Dates and further details will be communicated via the website.
A second examination opportunity is possible and is based on a paper.

**Calculation of the examination mark**

Students may miss one knowledge test when they have valid extenuating circumstances. If they more than one test, even with valid extenuating circumstances, then an alternative task will be set by the lecturer. Unjustified absence during a knowledge test will result in a zero mark for the test.