Course syllabus

Sustainable AI? Social and Environmental Impacts of Artificial Intelligence
Hållbar AI? Sociala och miljömässiga effekter av artificiell intelligens

TFRH21, 7.5 credits, G2 (First Cycle)

Valid for: 2025/26
Faculty: Faculty of Engineering LTH
Decided by: PLED L
Date of Decision: 2024-12-06
Effective: 2025-03-17

General Information

Depth of study relative to the degree requirements: First cycle, has at least 60 credits in first-cycle course/s as entry requirements
Language of instruction: The course will be given in English

Aim

Artificial intelligence (AI) has fast become synonymous with social and economic change. Seemingly overnight, it has spread into all corners of life, from the private to the professional to the public, and shows no sign of slowing down. But what does the rapid adoption of this technology mean for society? How do we make sure that its economic impact does not create more social problems than it solves? How might the change brought about by AI be made more sustainable, not only for us, but for the natural world?

This course explores the social, economic and environmental change brought on by developments in AI. It aims to provide critical and analytical tools to interrogate AI change processes and steer them in more sustainable directions. This is achieved with a focus on: (1) the conceptual and empirical origins of ‘sustainability’ and ‘artificial intelligence’, and theoretical frameworks for researching and understanding their intersection; (2) the social and material origins of AI systems, with particular attention to their invisible production processes and environmental costs; and (3) uses and impacts of AI in key areas of social, economic and environmental life.

Through a combination of online lectures and seminars on key readings, course participants will develop knowledge of the challenges and opportunities for AI to contribute to positive social, environmental and economic change. They will learn how to use sustainability frameworks in the area of AI, how to identify the reflexivity of AI systems (ie, their capacity to attend to the

unsustainable conditions on which they are built) but also the rebound effects that threaten to undermine their promise, and will develop critical and conceptual faculties to analyse the multiple and conflicting impacts of emerging technologies. In this way, the course aims to provide practical social scientific knowledge to lifelong learners (with private or public sector organisational experience) and engineering students (in complement to their technical learning).

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- explain the concepts of sustainability and artificial intelligence
- recognise and differentiate the dominant approaches to sustainable and ethical AI
- describe challenges and opportunities for AI to contribute to sustainable change
- describe tensions between social, economic and environmental aspects of AI

Competences and skills
For a passing grade the student must

- analyse and evaluate the sustainability claims of AI applications
- recognise and compare the reflexivity and rebound effects of AI systems
- compare and contrast disciplinary perspectives on sustainable AI
- demonstrate mastery of basic English terminology used in social science research on AI impacts and ethics

Judgement and approach
For a passing grade the student must

- identify, assess and credibly balance conflicting interests in AI development and regulation, with particular attention to ethical and sustainable consequences
- demonstrate a critical, independent and interdisciplinary research approach to case studies of the sustainability of AI and AI for sustainability

Contents

The course has been designed to facilitate distance learning (ie, online engagement) but will provide opportunities for onsite discussions. The first, introductory lecture will be held on campus with remote attendance possible (via Zoom). Each of the lectures will be recorded and uploaded to the LMS (ie, Canvas). Participants will be able to access the materials and complete the readings at their convenience during the week. Weekly seminar discussions of the course materials will also take place. These may be online or onsite (or hybrid), depending on student numbers, with preference for online attendance given to distance learners. Borrowing from the flipped classroom pedagogy, the seminars will be lightly structured, with questions and discussions being directed by the participants.

Three sets of three lectures give the course material its structure. In the first set, the students will gain theoretical purchase on the concepts of sustainability and AI, and how they interrelate. The second, on the sustainability of AI, will explore the production of AI from an interdisciplinary open-systems perspective. It will examine where the hardware and data that power AI originate, the labour involved in training AI models, and the environmental footprint of the AI supply chain. The third set will focus on AI for sustainability. It will address the use of AI in land use management, human resource management, and public administration, and think through what a fair, accountable and sustainable AI should involve.

Examination details

Grading scale: UG - (U, G) - (Fail, Pass)
Assessment:

The course will be 7.5 credits. Three written assignments of 1500 words will be set, one for each of the three lecture sets given on the course. To pass the course, students must receive a passing grade in each of the assignments.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Modules
Code: 0125. **Name:** Sustainable AI? Social and Environmental Impacts of Artificial Intelligence.
Credits: 7.5. **Grading scale:** UG - (U, G).

Admission

Admission requirements:

- 90 credits in finished courses.

Assumed prior knowledge: The course is intended to be suitable for participants with at least 5 years of work-life experience.
The number of participants is limited to: No

Reading list

- Andreassen, Rikke; Rikke, Kaun, Anne; Nikunen, Kaarina: Fostering the data welfare state: A Nordic perspective on datafication. Nordicom Review, 42(2), 207–223, 2021.
- Bender, Emily M., Gebru, Timnit, McMillan-Major, Angelina, & Shmitchell, Shmargaret: On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?. Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency (pp. 610–623), 2021.
- Crawford, Kate; Joler, Vladan: Anatomy of an AI System. anatomyof.ai, 2018.
  http://www.anatomyof.ai
- Dauvergne, Peter: Conserving and rewilding the earth (AI in the Wild: Sustainability in the age of artificial intelligence, pp. 53–69). The MIT Press (Cambridge, MA), 2020.
- Delfanti, Alessandro: Work hard (The Warehouse: Workers and Robots at Amazon, pp. 30–54). Pluto Press (London), 2021.
- Dignum, Virginia: What is Artificial Intelligence? (Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way, pp. 9–34). Springer International Publishing (Cham), 2019.
- Eubanks, Virginia: The Allegheny Algorithm (Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor, pp. 127–173). St. Martin's Press (New York), 2018.
- Gabrys, Jennifer: Media in the Dump: Salvage stories and spaces of remainder (Digital Rubbish: A natural history of electronics, pp. 127–146). The University of Michigan Press (Ann Arbor, MI), 2011.
- Kitchin, Rob: Big Data (The Data Revolution: A critical analysis of big data, open data & data infrastructures (2nd Ed.), pp. 61–74). Sage Publications (Los Angeles, CA), 2022.
- Liu, Zheng: Sociological perspectives on artificial intelligence: A typological reading. Sociology Compass, 15(3), e12851, 2021.
- Luccioni, Alexandra Sasha; Hernandez-Garcia, Alex: Counting Carbon: A Survey of Factors Influencing the Emissions of Machine Learning. arXiv.org, 2023.
  http://arxiv.org/abs/2302.08476
- Mantz, Jeffrey W: Improvisational economies: Coltan production in the eastern Congo. Social Anthropology, 16(1), 34–50, 2008.
- Mollen, Anne; Meyer, Andreas; Rohde, Friederike; Wagner, Josephin: Artificial Intelligence: How to Make it More Sustainable. Sustain: Sustainable AI in Practice, Issue #1, AlgorithmWatch (Berlin), 2022.
  https://algorithmwatch.org/en/wp-content/uploads/2022/06/SustAIn_Magazine_2022_EN.pdf
- Pasek, Anne: Getting Into Fights With Data Centers: Or, a Modest Proposal for Reframing the Climate Politics of ICT. Experimental Methods and Media Lab, Trent University, Peterborough, Ontario, 2023.
  https://emmlab.info/Resources_page/Data%20Center%20Fights_digital.pdf

- Raworth, Kate: Defining a Safe and Just Space for Humanity (Linda Starke (Ed.), pp. 28–38, State of the world 2013: Is sustainability still possible?). Island Press (Washington, DC), 2013.
- Scoones, Ian: Sustainability. Development in Practice, 17(4–5), 589–596, 2007.
- Tzachor, Asaf; Devare, Medha; King, Brian; Avin, Shahar; Ó hÉigeartaigh, Seán: Responsible artificial intelligence in agriculture requires systemic understanding of risks and externalities. Nature Machine Intelligence, 4(2), 104–109, 2022.
- Van Wynsberghe, Aimee: Sustainable AI: AI for sustainability and the sustainability of AI. AI and Ethics, 1(3), 213–218, 2021.
- Vinuesa, Ricardo, Azizpour, Hossein, Leite, Iolanda, Balaam, Madeline, Dignum, Virginia, Domisch, Sami, Felländer, Anna; Langhans, Simone Daniela; Tegmark, Max; Fuso-Nerini, Francesco: The role of artificial intelligence in achieving the Sustainable Development Goals. Nature Communications, 11(1), 233, 2020.
- Weiskopf, Richard; Hansen, Hans Kause: Algorithmic governmentality and the space of ethics: Examples from 'People Analytics'. Human Relations, 76(3), 483–506, 2023.
- Zukalova, Zaneta: Shepherd’s Office: The Politics of Digital Labor and Its Impact on the Amazon Mechanical Turk Workers. Media-N: Journal of the New Media Caucus, 16(1), 99–115, 2020.

Contact

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