Introduction to AI for Biologists

Structure : EUR LIFE	Code de l'UE : SMUSVPJ	Lieu d'enseignement : Campus Valrose
Niveau du cours : M1, M2, Doctorat	Semestre : Impair	Langue : Anglais

Professor: Océane Fiant (oceane.fiant@univ-cotedazur.fr)

Description:

Modern Artificial Intelligence (AI) represents a series of advancements in computer science, applied mathematics, and statistics. It introduces innovative methods and tools that are increasingly shaping professional practices and influencing society.

This introductory course aims to familiarize students with the fundamental concepts and practical applications of AI, particularly in the fields of chemistry and geoscience. It provides students with the opportunity to understand and engage with these technologies, already embedded in current practices, such as analyzing data from physics experiments, exploring chemical spaces, or predicting earthquakes. The course will place a strong emphasis on machine learning methods, while also addressing the limitations of current techniques and the scientific, societal, and environmental challenges associated with these technologies, to enable students to identify the opportunities that AI brings to their respective disciplines.

Upon successful completion of this course, you will be awarded 3 ECTS.

This course was co-developed by the EUR LIFE and the EFELIA Côte d'Azur (École Française de l'Intelligence Artificielle) team.

Public:

Students in the first or second year of a Master's program in Life Sciences (GD, CRT, NCI and P3 courses), as well as PhD students.

Prerequisites:

There are no prerequisites for this course.

Learning outcomes:

By the end of this course, students will be able to:

- Explain the key concepts and methods of AI,
- Understand the capabilities, limitations and challenges of emerging AI systems,
- Start integrating AI advances into the exploration of research questions related to life sciences.

Teaching methods:

- Theoretical lectures
- Case studies
- Reading of scientific articles
- Moodle platfom
- Wooclap (polls, brainstorming, etc.)

Organisation:
- In-person:
  - 12h hours of lectures (CMs)
  - 12h of labs (TDs)

Planning :

Session	Date	Duration	Professor	Topics
1		4h	Océane Fiant	History and Concepts of AI (1/2): • Origins • Symbolic approaches
2		4h	Océane Fiant	History and Concepts of AI (2/2): • Connectionist approaches Challenges in AI: • Bias • Opacity

				• Generalizability
3		4h	Océane Fiant	Generative AI: • Overview • Use cases in biology • Key issues (bias, « hallucinations », etc.)
4		4h	Océane Fiant	Ethical and Social Issues in AI: • Cognitive capitalism • Digital labor • Moral machines
5		4h	Océane Fiant	AI in Biology (1/2): • Big Data and biology • Precision medicine • Case study: histological image segmentation
6		4h	Océane Fiant	AI in Biology (2/2): • Case study: protein structure prediction • Case study: AI for phenotyping cancer stem cells • Case study: tumor typing via mass spectrometry

Assessment: Continuous assessment.

- Oral presentation
- Written summary of the presentation
- Multiple-choice question test

Equipment:

Bringing a personal computer to class is recommended.

Bibliography:

References:
- Casilli, A. (2019), *En attendant les robots. Enquête sur le travail du clic*, Paris, Seuil.
- Crevier, D. (1999*), À la recherche de l'intelligence artificielle*, Paris, Flammarion.
- Floridi, L. (2023), *The Ethics of Artificial Intelligence: Principles, Challenges, and Opportunities*, Oxford, Oxford University Press.

- Leonelli, S. (2016), *Data-Centric Biology: A Philosophical Study*, Chicago, University of Chicago Press.

<u>Other ressources:</u>
- University of Helsinki & MinnaLearn (2018). *A free online introduction to artificial intelligence for non-experts.* https://course.elementsofai.com/
- Andrew Ng (s.d.). *AI for Everyone*. https://www.deeplearning.ai/courses/ai-for-everyone/
- Daniel Leufer & Alexa Steinbrück (2020), *AI Myths*. https://www.aimyths.org

Resources for success:

- TUT'TOP : peer tutoring on methodological, social, administrative or logistical issues.
- écri+ : to improve your written French.
- Centre de ressources en langues : to improve your foreign language skills (French or other).
- METODA : to improve your documentary research skills.
- S'orienter / Se réorienter : to be advised by the university's career counsellors.
- Centre de santé et aide sociale : to look after your physical and mental health, and to seek support in the event of social hardship.
- Cellule Handicap : support for students with disabilities.
- Plateforme de signalement : to report acts of violence, harassment or discrimination (sexual and gender-based violence, LGBTphobia, racism, xenophobia, etc.) you have witnessed or experienced at the university, and to get support.

Important: This syllabus has no binding value. Its content may change during the course of the year.