

LLM PROGRAMME

AI IN LEGAL PRACTICE AND ITS REGULATION

Curricular unit

Basics of AI

Responsible Academic staff and respective workload in the curricular unit

Daniel McNamee/Gonzalo de Polavieja/Il Memming Park

Syllabus

Part 1: Introduction to AI and Machine Learning (Il Memming Park)

We will discuss how the research of artificial intelligence has evolved throughout the history. In particular, we will zoom into the interaction with the fields of neuroscience and statistics that started artificial neural networks and machine learning. In the tutorial, we will explore the fundamental concepts of probabilistic reasoning and making the “best” decisions.

- History of AI, Neuroscience, and Machine Learning (2hr, lecture)
- Bayesian inference & basic math refresher (3hr, tutorial)
- References:
 - NeuroMatchAcademy refresher on differentiation:
https://compneuro.neuromatch.io/tutorials/WOD4_Calculus/student/WOD4_Tutorial1.html
 - Tutorial on Bayesian modeling by Wei Ji Ma: https://www.youtube.com/watch?v=f7RH_E8yG6g
 - Sayed, A. H. (2023). *Inference and learning from data: Volume 1-3*. Cambridge University Press.

Part 2: Artificial Neural Networks, including language models (Gonzalo de Polavieja)

We will explain what Artificial Neural Networks do, and discuss their different architectures. In tutorials, we will train neural networks and discuss how to make them work best.

- Multilayer Perceptron, Convolutional Neural Networks and Transformers (2hr lecture)
- Notebooks on Multilayer Perceptron, Convolutional Neural Networks and large language models (3hr tutorial)
- Large Language Model (LLM) agents (3hr + 3hr tutorial)
- **Assignment:** train a network from data or design an LLM agent
- References:
 - Prince, S. (2023). *Understanding deep learning*. MIT Press.
https://github.com/udlbook/udlbook/releases/download/v4.0.2/UnderstandingDeepLearning_07_02_24_C.pdf
 - Open AI API, <https://platform.openai.com/docs/api-reference/introduction>

Part 3: Reinforcement Learning (RL) (Daniel McNamee)

- RL part 1 (2hr lecture)
 - Classical conditioning, temporal difference learning, explore-exploit trade-off
- RL part 2 (3hr lecture)
 - Model-free vs model-based reinforcement learning
 - Deep reinforcement learning

- RL (3hr tutorial) Model-based reinforcement learning (MBRL) and RL+LLMs
- Reference:
 - Sutton, R. S., & Barto, A. G. (2018). *Reinforcement Learning: An Introduction* (2nd ed.). MIT Press.

Teaching methodologies (including evaluation)

Main Bibliography