



## LLM AI in Legal Practice and Its Regulation

2026/2027

### Curricular unit

Basics of AI (1<sup>st</sup> Week)

### Responsible Academic staff and respective workload in the curricular unit

Daniel McNamee, Francesco Trapani, Mariana Duarte

### Syllabus

#### **Lecture I (Francesco Trapani): Introduction to AI**

We introduce the idea of intelligence, both natural and artificial, and discuss how the field of AI has evolved throughout history. We start with historical AI systems and move through biologically-inspired connectionist models, until today's data-driven deep learning systems. The goal is to understand how AI systems work in principle, how they evolved, and which technical properties—opacity, unpredictability, etc.— can create challenges for law and regulation.

#### **Lecture II (Francesco Trapani): Neural Networks**

We discuss the basic blocks of AI systems: artificial neurons. We start from the simplest learning system (1 neuron) and understand how it can learn using a feedback error signal. From there, we build up to small networks, and understand what it means to approximate a function. The goal is to understand the basics of the learning process, also keeping in mind which are the intrinsic limitations, constraints and biases.

#### **Lecture III (Francesco Trapani) Reinforcement Learning**

We explore AI systems that interact with the world through actions. In particular, we discuss Reinforcement Learning (RL), the core paradigm for such systems. We discuss its basic components, the classical learning approaches, and the distinction between model-free and model-based learning.

#### **Lecture IV (Daniel McNamee): Language Models and Agentic AI**

Language serves as a fundamental cognitive tool, transforming the complex "messy" continuous external world into the "neat" discrete internal world of symbolic cognition. Language generation also serves as the foundation for a class of modern artificial intelligence systems known as "Large Language Models". We will introduce the core computational themes of these models and discuss how they may be integrated into agentic architectures.

#### **Mandatory Tutorial (Mariana Duarte): Language Model Interpretability**

We will explore how Large Language Models work and how to use them effectively. Starts with text embeddings, building intuition for how meaning can be represented as vectors. It then explores how LLMs work, with demonstrations of tokenization, next-token prediction (top-k examples) and how sampling parameters shape outputs. From there, it moves to practical use, covering prompting techniques such as in-context learning and a brief view of how LLMs trained to predict



tokens can be turned into agentic systems. Closes with a practical look at where these systems may fail, including hallucinations, sycophancy, and jailbreaking.

### **Facultative Tutorials (Mariana Duarte): Agent Architectures**

We will demonstrate agentic systems and how they can be useful in Law, including agent architectures, RAG and tool use and structured outputs.

### **Teaching methodologies (including evaluation)**

The teaching methodology will be composed of a mixture of lectures and interactive tutorials. The course will be evaluated based on the results of the tutorials, sets of exercises or multiple choice questions.

### **Main Bibliography**

- Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press, <https://www.deeplearningbook.org/>
- An Introduction to Reinforcement Learning, Sutton & Barto (2018)
- Speech and Language Processing (3rd ed. draft), Dan Jurafsky and James H. Martin (2022, <https://web.stanford.edu/~jurafsky/slp3/>)
- What are large language models (LLMs)? <https://www.ibm.com/think/topics/large-language-models>
- Sumers, et al., 2024 Cognitive Architectures for Language Agents <https://arxiv.org/abs/2309.02427>