

## INTENSIVE POSTGRADUATE PROGRAMME AI IN LEGAL PRACTICE AND ITS REGULATION

### Curricular unit

Basics of AI

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

Il Memming Park, Gonzalo Polavieja, Daniel McNamee, Helena Sofia Andrade Nunes Pereira Pinto, Ricardo Daniel Santos Faro Marques Ribeiro

### Syllabus

#### Lecture I (Memming Park):

Artificial intelligence is constantly advancing. I will provide a broad overview of artificial intelligence and machine learning with some historical perspectives. We will discuss the current social impacts of AI/ML systems and efforts to mitigate machine bias in the context of judicial decision support, social inequalities. We will also discuss the philosophical questions regarding AI and their agency.

#### Lecture II (Gonzalo Polavieja):

I will start with a technical definition of what learning (and generalization) is. I will define and give examples of three types of learning problems: regression, classification and reinforcement learning.

After these basic concepts, I will discuss how to learn from data using optimization. I will discuss in some concrete detail the Perceptron as a very simple model that learns using optimization. This model is also the basic unit of deep learning models. We then discuss what the Perceptron cannot do as a motivation to add layers of perceptrons in what is called the Multilayer Perceptron (MLP). Some modifications of MLP like the Convolution Neural Networks will also be discussed.

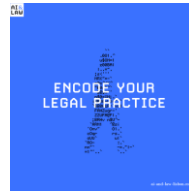
Some of the concepts will be illustrated with concrete calculations using a Python notebook, for which I would advise to bring a laptop if you have one.

Lecture III (Daniel McNamee): Sequential decision-making has long been recognized as a core paradigm for artificial intelligence. One approach to solving sequential decision-making problems is reinforcement learning which has underpinned many recent state-of-the-art advances in developing systems with human and superhuman-level performance. In this lecture, we will provide an introduction to Reinforcement Learning spanning its roots in classical psychology to its role in modern AI systems. Specific topics will include Classical Conditioning, Temporal-Difference Learning, Q-learning, and Function Approximation.

Lecture IV (Ricardo Ribeiro) Natural Language Processing: Introduction to Natural Language Processing, Words, Parsing, Semantics, Tools.

Lecture V (Ricardo Ribeiro) Applications in Law with focus on existing Law and Jurisprudence projects; Limitations of LLM's.

Lecture VI (Sofia Pinto) Other areas of AI: Knowledge Representation and Reasoning, Difficulties and Limitations.



### 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

An Introduction to Reinforcement Learning, Sutton & Barto (2018).  
Artificial Intelligence, A Modern Approach, Norvig & Russell (2020).  
Causality: Models, Reasoning and Inference, Judea Pearl (2009).  
Pattern Recognition and Machine Learning, Chris Bishop (2006).  
Speech and Language Processing (3rd ed. draft), Dan Jurafsky and James H. Martin (2022, <https://web.stanford.edu/~jurafsky/slp3/>).  
Multidisciplinary Perspectives on Artificial Intelligence and the Law, Henrique Sousa Antunes, Pedro Miguel Freitas, Arlindo L. Oliveira, Clara Martins Pereira, Elsa Vaz de Sequeira, Luís Barreto Xavier, Law, Governance and Technology Series (LGTS, volume 58), Springer, 2023.  
Speech and Language Processing (3rd ed. draft), Dan Jurafsky and James H. Martin (2022, <https://web.stanford.edu/~jurafsky/slp3/>).  
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<https://law-arizona.libguides.com/lawlibrary/chatGPTandbingchatlegalresearchguide>  
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