- Artificial Intelligence (AI)

People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

Moujahid Abdelhafid Boualsouf University of Mila

Faculty of Legal Sciences and Law

Course Title

Artificial Intelligence

Law enforcement officers augmented by artificial intelligence will replace those who are not, as they are the only ones capable of tackling a new generation of crimes and delivering justice in the digital age.

Prepared by:

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Target Students:

- Master's 1 - Real Estate Law;
- Master's 1 - Administrative Law;
- Master's 1 - Criminal Law and Criminal Sciences;
- Master's 1 - Business Law.

Academic Year 2025–2026

Course Objectives:

This course aims to equip students with both theoretical knowledge and practical skills in artificial intelligence and its applications in legal contexts. The specific objectives are:

1. To familiarize students with artificial intelligence algorithms and enable them to apply these techniques in text processing, legal data analysis, and judicial decision support (judges, lawyers, notaries, court clerks, etc.), including behavioral and textual analysis for prediction and trend identification.
2. To enable students to understand fundamental programming concepts using Python, including problem-solving, algorithm design, basic data structures, control flow, and an introduction to object-oriented programming.
3. To provide an understanding of major artificial intelligence approaches and their application in problem-solving.
4. To develop the ability to process and analyze legal texts using appropriate computational tools.

Course Topics

- Topic 1: Introduction to Artificial Intelligence (AI)
- Topic 2: Programming Languages
- Topic 3: Types and Approaches in Artificial Intelligence (AI)
- 4 : Mini-project

- Topic 1: Introduction to Artificial Intelligence (AI)

First: The Chronological Development of Artificial Intelligence

The goal of examining historical events is not to list them, but to select key milestones and significant events that changed ways of thinking or technology and that constituted qualitative shifts in the development of artificial intelligence based on two scientific criteria: cognitive impact and practical/technological impact.

1 - Intellectual Roots (Pre-1950)

Charles Babbage designed the Analytical Engine, and Ada Lovelace developed algorithms for this machine.

This phase represents the theoretical foundation of the concept of the “artificial mind.”

2. Theoretical Foundations

In 1950, Alan Turing proposed the Turing Test as a criterion for evaluating machine intelligence. and in 1956: the Dartmouth Conference was held, which is considered the official birth of artificial intelligence as an independent scientific field

3 - Early Models

1943: Warren McCulloch and Walter Pitts presented the first mathematical model of artificial neural networks.

1957–1959: Herbert Simon and Allen Newell developed a program as the first attempt to simulate human thinking.

4 - Major shifts and events that define the essence of artificial intelligence and its cycles of progress and decline

1974–1980 : The first stagnation phase in artificial intelligence research,

1980–1987: The boom phase of expert systems

1987–1993: The second stagnation phase

1993–2011: The modern AI phase

2012: The AlexNet model achieves a quantum leap in image recognition, sparking the deep learning revolution.

2017 Google introduced the Transformer architecture, which became the foundation for modern models.

2022 The emergence of ChatGPT contributed to the widespread adoption of artificial intelligence.

Second: The Concept of Artificial Intelligence:

Artificial Intelligence (AI) is an extremely broad field, and as such, it is difficult to provide a single, unified definition. There are numerous definitions, including the following:

1. Classical Definitions

1 – 1 John McCarthy's Definition

John McCarthy is considered the originator of the term "artificial intelligence," often abbreviated as "AI." He defined it as the ability to design computer programs capable of performing tasks that require human intelligence, which humans currently perform better (McCarthy, Minsky, Rochester, & Shannon, 1955).

1 -2 Marvin Lee Minsky's Definition

Artificial intelligence is the creation of computer programs that perform tasks requiring high-level mental processes such as sensory learning, memory organization, and critical reasoning (Minsky, 1968).

2 - Modern Academic Definition

2 1 – Definition by Council of Europe, Ad Hoc Committee on Artificial Intelligence

According to the Council of Europe, artificial intelligence is a multidisciplinary field that seeks to understand and simulate perception, reasoning, and learning processes using computational systems to assist or replace human activities.

2 – 2 Definition by the Organisation for Economic Co-operation and Development (OECD)

"An artificial intelligence system is a machine-based system that—for explicitly or implicitly defined objectives—can infer from the inputs it receives how to generate outputs such as predictions, content, recommendations, or decisions that may affect physical or virtual environments. AI systems vary in their levels of autonomy and their ability to adapt after deployment."

3. Synthetic Definition

Artificial Intelligence (Artificial Intelligence - AI) is a multidisciplinary field in computer science that aims to design and develop computer systems and programs capable of simulating human cognitive abilities such as learning, reasoning, decision-making, language comprehension, and vision, with the goal of improving performance in complex tasks or performing tasks that humans cannot handle with high accuracy or speed.

Third : Classification of Definitions of Artificial Intelligence

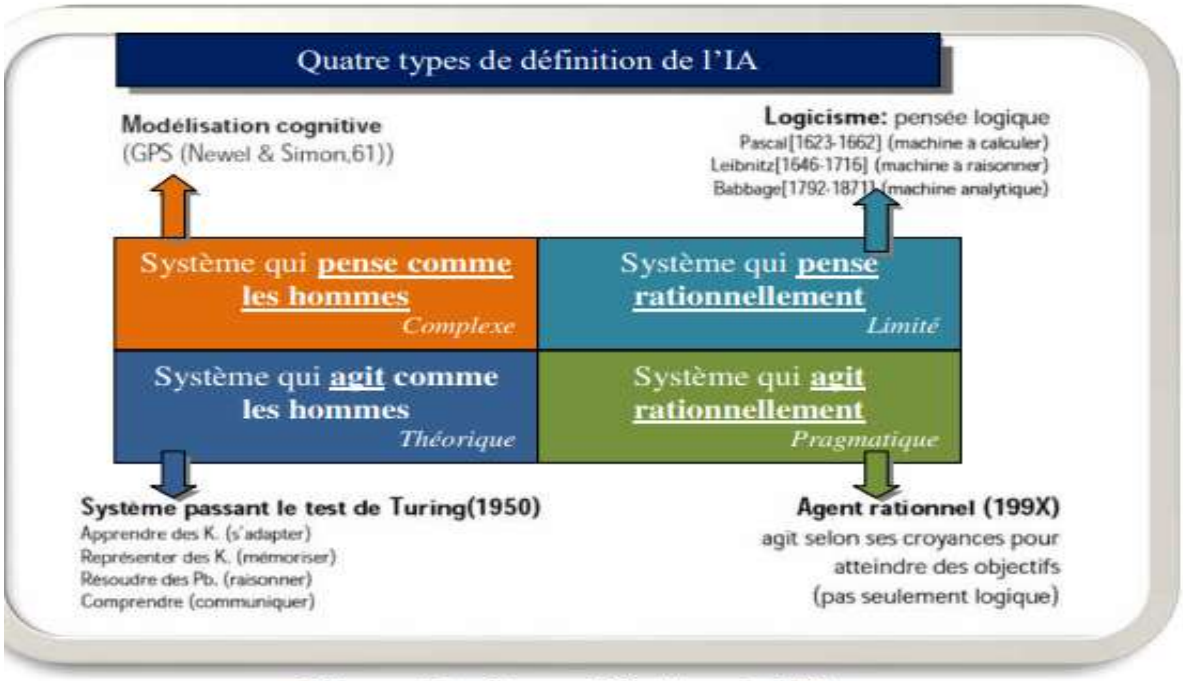


***Figure 1.1** : Quatre définitions de l'IA.*

The figure presents four types of definitions of artificial intelligence (AI) based on different methodologies, categorized along two main axes: thinking versus action, and human simulation versus rational behavior. These can be explained academically as follows:

Definitions of artificial intelligence are based on two fundamental dimensions:

- Thinking versus action (Does the system focus on thinking or on acting/performance?)

- Human simulation versus rationality (Does the system seek to simulate human behavior or to achieve rational performance?)

This framework illustrates how definitions of artificial intelligence vary depending on whether the focus is on humans or on rationality, and whether the goal is an internal understanding of mental processes or the achievement of rational practical performance.

Based on these two dimensions, artificial intelligence can be classified into four types:

- **a system that thinks like humans,**
- **a system that behaves like humans,**
- **a system that thinks rationally,**
- **and a system that behaves rationally.**

Topic 2: Programming Languages

First : Introduction to Programming

- **Programming in Python**
- **Getting Started with the Development Environment, Installing Python, and Writing Your First**
- **Variables and Processes**
- **Working with Files and Databases**
- **Command Structures and Their Applications in Programming**

Python's official website: www.python.org

1 - Introduction

in recent decades, the world has witnessed a rapid digital transformation that has reshaped every field, and the legal profession has not been immune to this radical shift. With the growing volume of legal data and the accumulation of judicial rulings and legislative texts, modern technological tools have become a necessity rather than an academic luxury. (1)

In this context, the Python programming language stands out as the most suitable tool for both law students and legal researchers, given its simple syntax, its similarity to natural language, and the abundance of libraries specialized in data analysis, text processing, and artificial intelligence.

2 - Definition of Programming:

Programming is the process of writing instructions and commands and storing them in memory so that the processor can retrieve them to direct the computer on how to handle data, following specific rules defined by the language the programmer has chosen to implement the program and solve the problem; each language has its own distinctive characteristics. (4.)

3 - Programming Languages

Programming languages are a set of rules and symbols used to write instructions that a computer can understand for the purpose of creating a computer program (5).

4 - Programming in Python:

Python is currently one of the most in-demand programming languages and one of the most important languages relied upon by those interested in the fields of artificial intelligence and information security, as it has become the bridge connecting the legal world and the world of artificial intelligence**.(7)**

5 - The Origins and Historical Development of Python

Python is a high-level, interpreted, dynamically typed programming language created by Dutch programmer Guido van Rossum while working at the Center for Mathematics and Computer Science (CWI) – CWI) in the Netherlands between 1985 and 1989, and it was officially announced in 1991. .(8) It can be used to build desktop programs, web applications, games, etc.

6 - Characteristics and Features of Python

Python has many features:

- It is a high-level programming language, meaning it is designed to be relatively clear to both humans and computers;

- It is easy to learn and efficient, with simple syntax and code that is easy to read;

- It has a large community and a vast number of libraries;

- It is an object-oriented, free, and open-source language with automatic memory management;

7 - Applications of Programming in Legal Practice

Case and File Management Automatic Document Reading and Organization Python + pandas

Contract Drafting Automated Contract Template Generation Python + docx

Legal Research Case Law Retrieval Python + NLP

E-litigation Filing lawsuits and service of process digitally Online platforms + API

8 -- The Importance of Python in the Legal Field

The Python programming language is an extremely important tool in the legal field, serving as a bridge between law and technology, which enables legal professionals to provide more efficient services and keep pace with modern developments.

It is used in several areas, including:

- **Legal Automation:** It helps automate contract drafting, document review, and the management of routine obligations, saving time and effort.

- **Legal Data Analytics:** It enables the rapid and accurate analysis of large volumes of contracts and documents to extract key clauses, identify patterns, and assess risks faster and more accurately than traditional methods.

- **Legal Research:** Used to search massive legal databases to effectively retrieve relevant case law and legislation,

- **Predictive Analytics:**

Getting Familiar with the Development Environment, Installing Python, and Writing Your First Python Program

9 - Integrated Development Environment (IDE)

An Integrated Development Environment (IDE) is a program used by programmers to develop software. It combines a set of essential tools within a single graphical user interface (GUI), which simplifies the programming process and increases productivity

Examples of Development Environments

- **Spyder**

is an open-source integrated development environment (IDE) primarily designed for data science and analysis using Python. It provides an interactive interface and is often used as part of the Anaconda package.

- **Jupyter Notebook**

is an open-source web application that allows users to create and share documents; it is widely used in data cleaning, data analysis, and machine learning.

10 - Downloading and Installing Python:

Python can be easily installed from the official website, where versions compatible with various operating systems are available.

- Install Python and launch the editor (See Activity #01 on the e-learning platform)

`https://elearning.univ-mila.dz/a2026/mod/resource/view.php?id=68479`

This can be done via the official website**: : www.python.org**

Python can be run after installation using:

-Graphical User Interfaces (GUI) via Integrated Development Environments (IDE)

- Command Line Interface (CLI) to execute commands directly

To verify the installation via the command line, type python –version

Online Python

You can also write and run programs without installing Python, using online programming platforms such as**:** **https://www.online-python.com/**

11 - My First Simple Python Program

https://www.online-python.com/

12 – Variables

A variable is a space in computer memory that has a name, a value, and a data type. A variable can be likened to a file in a lawyer's office: it has a name (file number), content (case details), and type (criminal, civil, commercial)

```
====== #أنواع المتغيرات بأمثلة قانونية======

#عدد صحيح – (int) للأرقام والتواريخ
عدد_القضايا47 =
سنة_الحكم2023 =
مدة_العقوبة #     5 =    بالسنوات

#عدد عشري – (float) للمبالغ المالية
مبلغ_التعويض # 150000.75 =  دينار جزائري
نسبة_الغرامة25% # 0.25 =

#نص – (str) للأسماء والعناوين
اسم_المتهم' =     محمد بن عمر'
نوع_الجريمة' =    احتيال مالي'
رقم_الملف' =      ج'2023/0472/

#منطقي – (bool) للحالات الثنائية
القضية_مفتوحةTrue =
تم_الاستئنافFalse =

#عرض المعلومات
print('الملف رقم ',رقم_الملف:')
print('المتهم ',اسم_المتهم:' | ',الجريمة ,نوع_الجريمة:')
print('التعويض المطلوب ',مبلغ_التعويض:' ,دج')
```

13 - Handling Legal Files and Databases

13 - 1 Files in Python —(Digital Legal Documents)

In programming, a file is a storage unit containing data saved on a hard drive.

A file path consists of: folder name + file name + extension

(e.g., Acts/Act_001.txt).

Text files support UTF-8 encoding, which supports the Arabic language.(12)

The file extension indicates the file type and helps determine the appropriate program to open the file

```
# ====== قانونية وثيقة وقراءة إنشاء ======

# عقد ملف وكتابة إنشاء
with open('إيجار_عقد_001.txt', 'w', encoding='utf-8') as ملف:
    ملف.write('إيجار عقد\n')
    ملف.write('المؤجر: السيد أحمد بن علي\n')
    ملف.write('المستأجر: السيدة فاطمة علي بو\n')
    ملف.write('العقد مدة: 12 شهراً\n')
    ملف.write('الشهري الإيجار: 25000 دج\n')

print('بنجاح الوثيقة إنشاء تم')

# الملف قراءة
with open('إيجار_عقد_001.txt', 'r', encoding='utf-8') as ملف:
    محتوى = ملف.read()
    print('العقد محتوى:')
    print(محتوى)
```

13 -2 Working with Databases (Legal Databases)

Databases are classified by structure into:

- **Structured Databases**

Data is stored in organized tables consisting of rows and columns, and these databases rely on SQL for querying and managing data. They are used when the data is simple and homogeneous, such as survey results or student records.

Examples: MySQL, PostgreSQL, SQL Server, Microsoft Access, SQLite.

Advantages: query speed, accuracy, and data integrity.

- **Unstructured / NoSQL Databases**

Used to store unstructured or diverse data types, such as images, videos, long texts, and open-ended responses in qualitative surveys.

Examples: MongoDB, Elasticsearch, Firebase, Cassandra.

Advantages: High flexibility, scalability, suitable for big data.

- **Semi-structured databases**

An intermediate type that combines both types, such as JSON and XML files, and is widely used for data exchange between applications and statistical software.

14 - Prompt engineering

Prompt engineering is a relatively new field within

artificial intelligence, aimed at systematically designing and formulating instructions for AI models to obtain accurate and reliable results.

It is an advanced skill that helps you write smart prompts to get the best answers and analyses from AI models such as ChatGPT, Google Bard, Claude AI, and others.

Databases, each of which has a specific use in legal work:

Applications of Natural Language Processing in Legal Research

- ◄ Extracting key provisions from lengthy contracts
- ◄ Summarizing court rulings and legal precedents
- ◄ Comparing multiple legislative texts
- ◄ Drafting preliminary legal memoranda
- ◄ Translating legal documents to and from Arabic

- Topic 3: Types and Approaches in Artificial Intelligence (AI)

First: Classifications of Artificial Intelligence:

In mainstream academic literature, artificial intelligence (AI) is an umbrella term. AI is classified according to three basic criteria: classification by capability level, classification by method of operation or functions, and classification by scope of application.

1 - Classification Based on the Level of Cognitive Capabilities

According to this criterion, artificial intelligence is classified into three main categories, representing increasing levels of ability to understand, learn, and generalize. This classification is the most common in the literature (Russell & Norvig, 2020).

1 - 1 Narrow Artificial Intelligence (ANI)

Also known as Weak AI, this refers to a system designed to perform a specific task or a limited set of tasks with high efficiency, sometimes surpassing human performance within that scope, without possessing a true ability to generalize beyond the domain for which it was trained.

According to the Stanford Artificial Intelligence Index (AI I, A Index, 2024), this type accounts for over 98% of currently deployed AI applications; however, this category has weaknesses, as it remains confined to its original domain. A system specialized in "language translation" is incapable of driving a car or making a medical diagnosis because it lacks awareness or the ability to transfer skills.

Characteristics of Narrow Artificial Intelligence: The most important characteristics that distinguish it are:

- Precise functional specialization;
- Inability to generalize or limited generalization within the same domain (Narrow Generalization);
- Absence of consciousness and perception;
- Reliance on machine learning algorithms and deep learning algorithms.

Legal Applications:

This type is most prevalent in the legal field, particularly in:

- Automated legal research; Contract analysis; Classification of judicial rulings;
- Assistance with administrative and judicial decision-making.

Reference: Russell & Norvig, Artificial Intelligence: A Modern Approach, 2021.*

1 – 2 Artificial General Intelligence (AGI)

General artificial intelligence is defined as a system capable of learning, thinking, and solving problems across diverse fields at a level comparable to or exceeding human intelligence. It has the ability to transfer knowledge flexibly from one field to another, much as humans do instinctively.

Currently, it is considered entirely theoretical and has not been realized in practice, but it constitutes the strategic goal of a number of advanced research laboratories and companies. Nick Bostrom (2014) notes in his book *Superintelligence* (Bostrom, 2014) that achieving this level could constitute a profound civilizational shift, while Stuart Russell emphasizes the need to focus on aligning goals rather than merely developing capabilities. Major research organizations, such as the Future of Life Institute and Anthropic, agree that this level may be achieved within the coming decades, although estimates of the timeline vary widely.

Thus, the "next level" that scientists are striving to reach is known as "human-level intelligence."

Characteristics of General Artificial Intelligence:

Its most important distinguishing features:

- It possesses the ability to learn autonomously across multiple domains.
- The ability to "broadly generalize"; that is, to transfer its experience from one domain to another (just as a child learns to catch a ball and then applies the same principle to catching an apple).
- The ability to think abstractly, plan independently, and solve problems in diverse domains for which it was not previously programmed;

Hypothetical examples

- An intelligent legal system capable of analyzing a real estate dispute, then automatically transitioning to analyze a criminal or commercial case with the same efficiency
- A robot capable of self-learning in changing environments and Self-driving

Legal Implications:

If this level is achieved, it will raise issues related to:

- The distribution of responsibility for independent decisions
- The extent of its impact on judicial discretion;
- The authority of automated reasoning;

Reference: Goertzel, B. (2014). Artificial General Intelligence

1 - 3 Superintelligent AI (Super AI)

Artificial Superintelligence (ASI) is defined as a hypothetical system and level of artificial intelligence characterized by the ability to surpass human cognitive performance in all domains, including analytical thinking, creativity, and complex decision-making.

This level represents an advanced extension of general artificial intelligence (AGI), as it is not limited to simulating human capabilities but comprehensively and qualitatively surpasses them; however, it remains within the realm of theoretical models and speculative studies.

Nevertheless, it occupies a central position in academic discussions regarding the ethics and governance of artificial intelligence, given the profound transformations it may bring about in the relationship between humans and technology.

Characteristics of Superintelligence: Key distinguishing features:

- Comprehensive cognitive superiority;
- Self-improvement capability;
- Superior learning speed and very high autonomy;
- Potential for the emergence of unexpected goals.

Legal and Ethical Implications:

This level raises profound issues, including:

- The possibility of recognizing legal personality;
- The challenge of reconciling human values; risks of control and governance;
- The legitimacy of independent judicial decision-making;
- Its impact on the principle of legal certainty;

Based on the classification according to the level of cognitive capabilities, we conclude that artificial intelligence is a comprehensive scientific field; narrow artificial intelligence (ANI) represents the current practical manifestation of this field, while both general artificial intelligence (AGI) and super-artificial intelligence (ASI) represent forward-looking concepts, meaning that we are facing an entity that surpasses human minds; if realized, which could result in numerous expected and unexpected consequences, presenting opportunities, challenges, and technical, legal, and ethical risks, such as the issue of legal liability, the possibility of automated judicial decisions, and potential impacts on the principle of judicial independence

Second: Classification by Mode of Operation (Functionality-Based)

According to this criterion, artificial intelligence is classified into four types of increasing complexity, starting with interactive machines, followed by limited memory, then theory of mind, and finally self-awareness. We break them down as follows:

1 - Reactive Machines (Reactive Machines)

Reactive machines are the simplest forms of artificial intelligence and the oldest historically. Their operation is limited to responding to inputs without any ability to store experiences or recall past knowledge; they process real-time data and produce predetermined responses through fixed algorithms. [1]

Russell and Huber describe this type as a "Simple Reflex Agent," as it operates according to strict conditional rules such as: "If condition C is met, execute action A," without any interpretation of context or reference to historical context.[2]

2 - Limited Memory

Limited memory systems go beyond the capabilities of the previous category, as they have the ability to use past data and experiences to make decisions that are more accurate and relevant to the current context. However, this memory is temporary and constrained by a limited time and data frame, and does not accumulate sustainably like human memory.

Technically, these systems rely on deep learning models and Long Short-Term Memory (LSTM) networks, enabling them to recognize patterns and learn statistically from massive amounts of historical data.[6]

3 - Theory of Mind

The term "theory of mind" is borrowed from developmental psychology and refers to the ability to attribute mental states—such as emotions, intentions, and beliefs—to others and to predict their behavior based on those attributions. This concept was developed by Primack and Woodruff in 1978 in the context of a study of primate behavior. [8]

The term "Theory of Mind in Artificial Intelligence" describes the next generation of systems that will be capable of understanding human social and emotional contexts and adapting their responses accordingly, moving beyond mere information processing to grasping what the user "wants" and "feels."[9] 3 - Theory of Mind

4 - Self-Aware AI

In the context of artificial intelligence, self-awareness refers to a system's ability to recognize its own existence, its internal states, and its place in the surrounding world. The philosophical roots of this concept trace back to Descartes's "Cogito" ("I think, therefore I am"), and it is closely linked to "The Hard Problem of Consciousness,"

Third : Approaches to Artificial Intelligence (Technical Foundations)

Artificial intelligence, as a multidisciplinary scientific field, is based on a set of fundamental theoretical and technical approaches that explain how intelligent systems are constructed and how they function. These approaches form the methodological foundation upon which various types of artificial intelligence and its applications are based. The most important of these approaches are:

Symbolic AI

1 – 1 Rule-based systems

1 – 2 Expert Systems

Machine Learning

2 – 1 Supervised Learning

2 - 2 Unsupervised Learning

2 - 3 Semi-supervised Learning

2 – 4 Reinforcement Learning

2 – 5 Online/Incremental Learning:

Deep Learning

3 – 1 Convolutional Neural Networks (CNN)

3 - 2 Recurrent Neural Networks (RNN)

3 – 3 Transformers

Generative Artificial Intelligence

4 – 1 Large Language Models (LLMs)

4 – 2 Diffusion Models

4 – 3 Multimodal AI

Understanding these approaches is particularly important for law students in grasping the technical foundations of smart decisions, enabling them to analyze their legal implications and the limits of their accountability.

1 - The Symbolic Approach to Artificial Intelligence (Symbolic AI)

The symbolic approach is one of the oldest approaches in the history of artificial intelligence; it is also known as classical AI or knowledge-based AI.

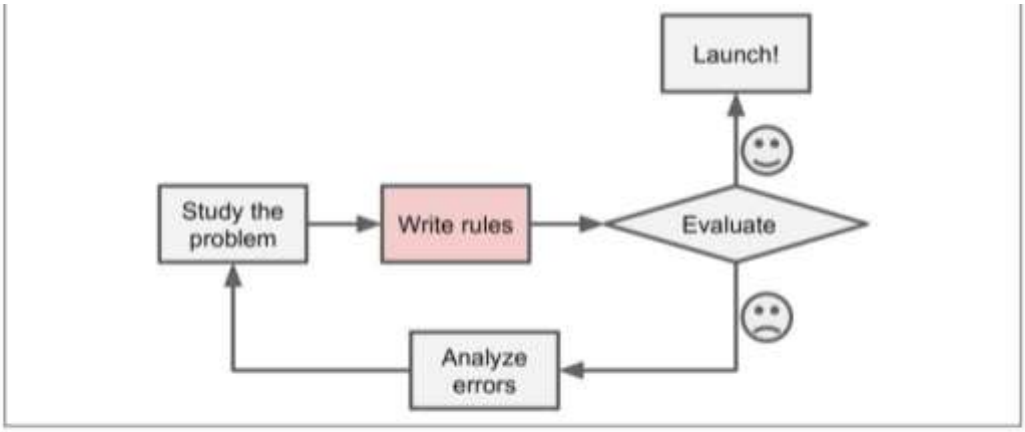
This approach is based on the fundamental premise that intelligence can be simulated by representing human knowledge in the form of explicit symbols and logical rules, and then enabling the machine to reason based on them.

This approach differs from machine learning in that the system does not learn from data automatically, but rather relies on knowledge that a human expert has previously encoded in the form of rules such as:

- If the condition is met (IF), then the result is (THEN) IF condition THEN action

With regard to legal reasoning, this approach is closest to the traditional legal method, because legal reasoning itself is based on: facts; legal conditions; a legal rule; and a result or judgment

Legal reasoning = fact + rule = judgment.



The traditional approach. If the problem is not trivial, your program wil likely become a long list of complex rules pretty hard to maintain.

Exemple :

IF property_registration = false -
THEN contract = null
IF party_capacity = false
THEN contract = voidable
IF consent = valid AND object = lawful AND registration = true
THEN contract = valid

1- 1 Rule-Based Systems

Rule-based systems are the most straightforward form of the symbolic approach, in which knowledge is represented in the form of production rules.

A. **Advantages of the symbolic approach**: Among its most important advantages are:

- Transparency and interpretability
- Ease of tracing the reason behind a decision
- Suitability for legal and regulatory systems
- Suitability for domains with explicit rules
- No need for large amounts of data.

1 - 2 Expert Systems

Expert systems are considered the most important practical application of the symbolic approach.

They are programs designed to simulate the expertise of a specialist in a specific field, such as law, medicine, or accounting, by storing their knowledge in a knowledge base and using an inference engine to reach the appropriate decision.

In the judiciary, these are programs that simulate the expertise of a judge or lawyer through an "inference engine" and an "interpretation unit" that justifies the reasoning behind the ruling, in accordance with the principle of reasoning in judicial decisions.

Components of an Expert System:

An expert system typically consists of four elements:

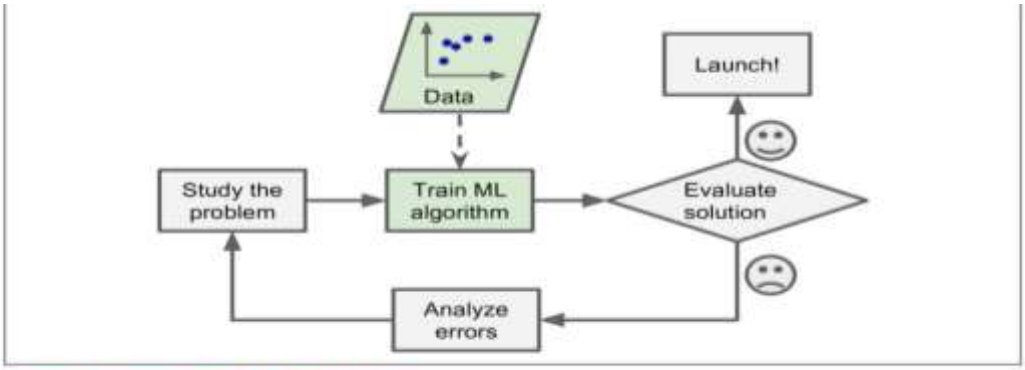
- **Knowledge Base**: Contains legal rules; facts; precedents and exceptions;
- **Inference Engine**: The component responsible for applying rules; testing conditions and deriving solutions;
- **User Interface**: Enables the judge, lawyer, or student to enter data and information;
- **Explanation module**: explains to the user why the system reached this conclusion;

the explanation module is of paramount importance in the legal field, as it aligns with the principle of reasoning in judgments and judicial transparency

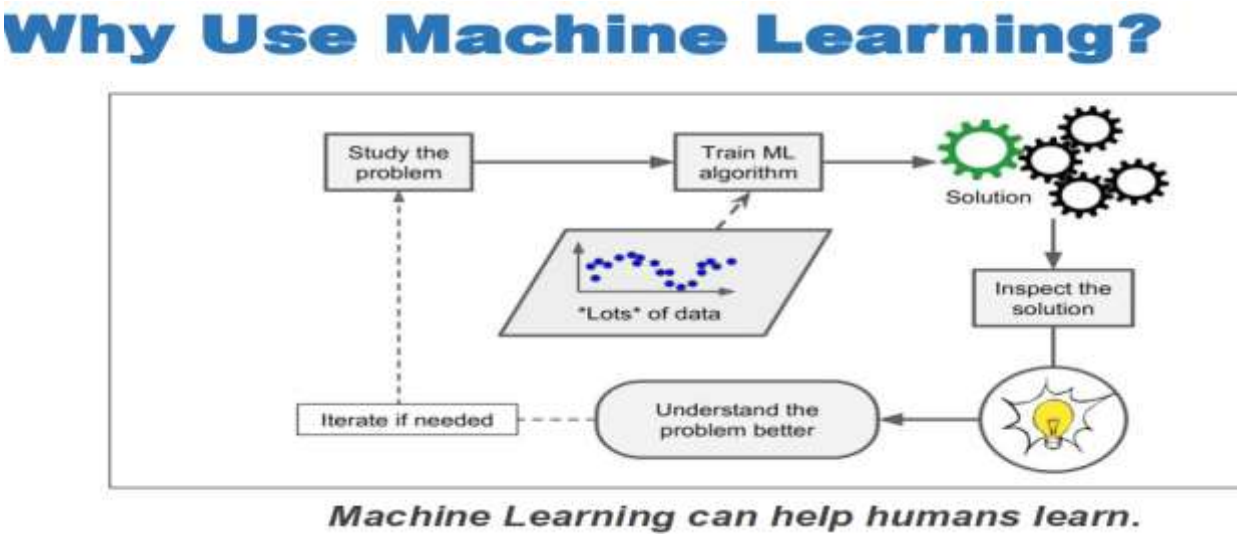
2 - Machine Learning Approach

When a machine is enabled to learn from data and past experiences to improve its future decisions without explicit programming for each scenario, we are dealing with one of the most important branches of artificial intelligence: machine learning.

Machine learning is a branch of artificial intelligence that focuses on developing algorithms that allow systems to learn from data and make decisions based on patterns discovered in that data or on predictions, without being explicitly programmed. It is fed a massive amount of data so that it can learn from it and predict the future.



Machine Learning approach. The program is much shorter, easier to maintain, and most likely more accurate.



Machine Learning can help humans learn.

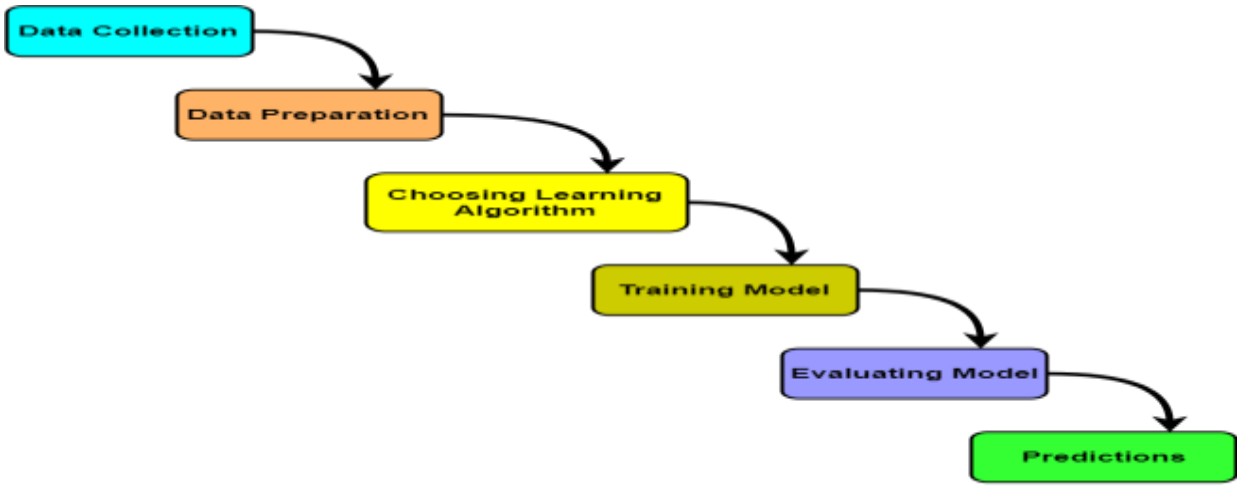
Machine learning components: There are three main components:

- data,
- features,
- and algorithms

Machine Learning Workflow:

A sequential set of steps that form the basis for successfully building machine learning systems

- Artificial Intelligence (AI)



Machine Learning Workflow

sources : https://www.gatevidyalay.com/machine-learning-workflow-process-steps/#google_vignette

2 - 1 Types and Methods of Machine Learning:

Machine learning is divided into three main categories: supervised learning, unsupervised learning, and reinforcement learning, in addition to two subcategories: semi-supervised learning and online learning,

The types of machine learning

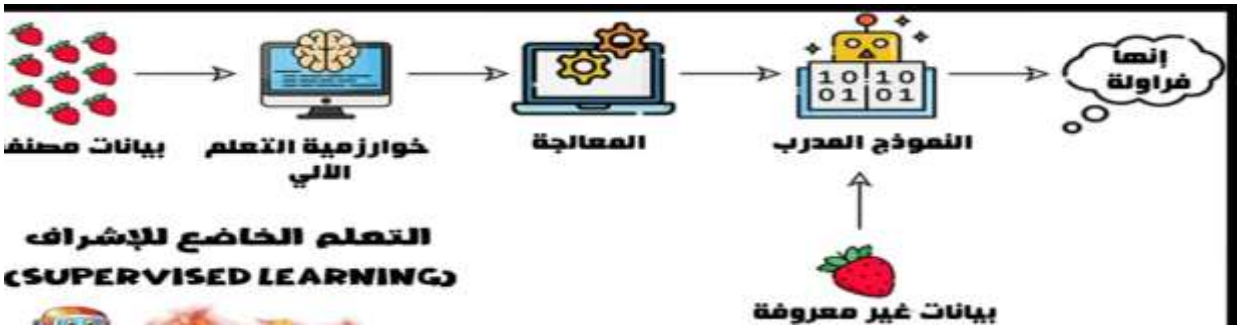
2.1.1 Supervised Learning

One of the models of machine learning, in which models are built based on labeled data

and require prior knowledge—that is, learning from existing, classified (labeled) accompanied by correct answers or specific labels. Here, the system learns and the model is trained using solved examples containing inputs and correct outputs (labels), so that it can learn from them and apply this knowledge to new, unknown cases.

The importance of supervised learning in the judiciary and administration is evident in its ability to:

- **Automated classification**: of cases (civil, commercial, criminal) to facilitate their distribution among judicial chambers.
- **Predicting outcomes**: based on similar judicial precedents (known as predictive justice).



Types of supervised learning: The most important are classification and regression:

 Classification: Used when the desired outcome is a predefined category or a binary choice (yes/no, true/false, civil/criminal, sales contract/lease agreement), where the goal is to assign each item to a category.

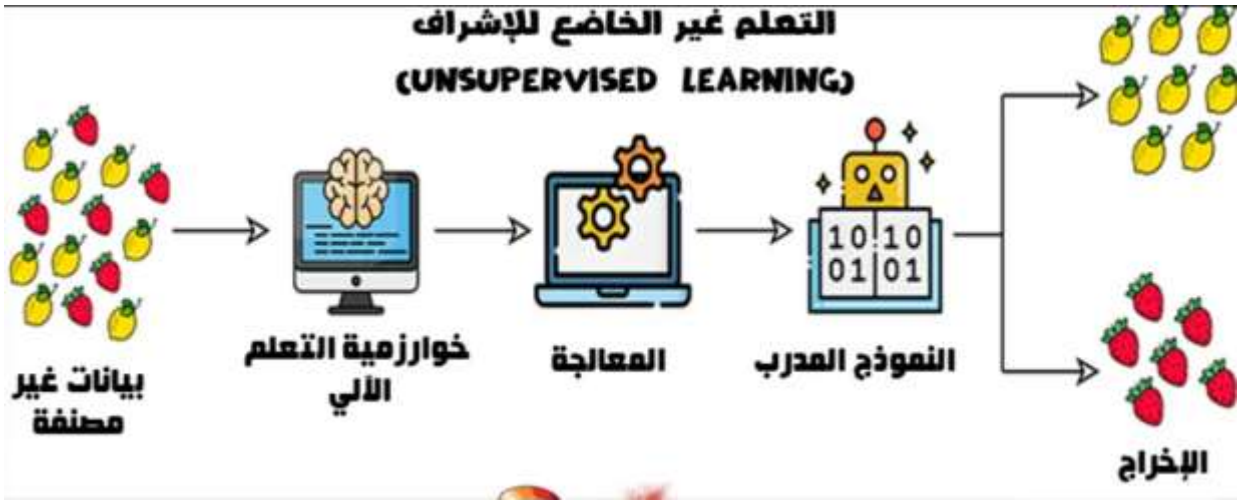
Legal Application: Using classification algorithms to determine whether a crime constitutes a “misdemeanor” or a “felony” based on the elements of the case file and the factual circumstances, or

 Regression (Regression)

Regression is one of the most important supervised learning techniques in machine learning. It is used to predict an outcome consisting of continuous numerical values (amount of a fine, length of a sentence, etc.) . These values to be predicted are numerical, and there is an approximate relationship between the variables.

2.1.2 Unsupervised Learning

This type of machine learning is considered the most capable of handling big data, as the model is trained using unlabeled data—that is, data that does not contain predefined answers. Here, the goal is not to classify based on prior knowledge, but rather to discover hidden structures and patterns in unlabeled data and the complex relationships within the data that the human mind might not notice on its own. In other words, we do not tell the model M the correct category; instead, we let it discover the patterns and relationships on its own.



Types of unsupervised learning: The two main ones are clustering, association, and anomaly detection.

Clustering: Clustering is one of the unsupervised learning techniques, and it aims to assign data samples to a specific number of clusters so that the elements within each cluster share similar characteristics and differ from the elements in other clusters.

Example: If we have data on court clerks containing the number of reported cases and the number of unreported cases, the clustering algorithm can categorize them into diligent court clerks and non-diligent court clerks, without the system being informed of these categories in advance.

- **Association***:*

An association rule is a rule-based method for finding relationships between variables in a given dataset. These methods are frequently used to analyze cases, allowing for a better understanding of the relationships between them.

- **Anomaly Detection**

is an unsupervised machine learning technique aimed at detecting abnormal elements, data, or behaviors that differ significantly from the rest of the elements or data. It is considered an unsupervised learning application because the data is not typically classified as normal or abnormal; Here, the system learns the general pattern of normal data, and any data point that deviates significantly from this pattern is considered an anomaly.

Example: If the average number of cases handled by the Mila Judicial Council per month is 23, and 444 cases were handled in June, this would be considered an anomaly.

Anomaly detection algorithms are used to detect fraud and identify cyberattacks.

2.1.3 Reinforcement Learning

A type of machine learning in which an intelligent system learns by mimicking human behavior through a process of trial and error.

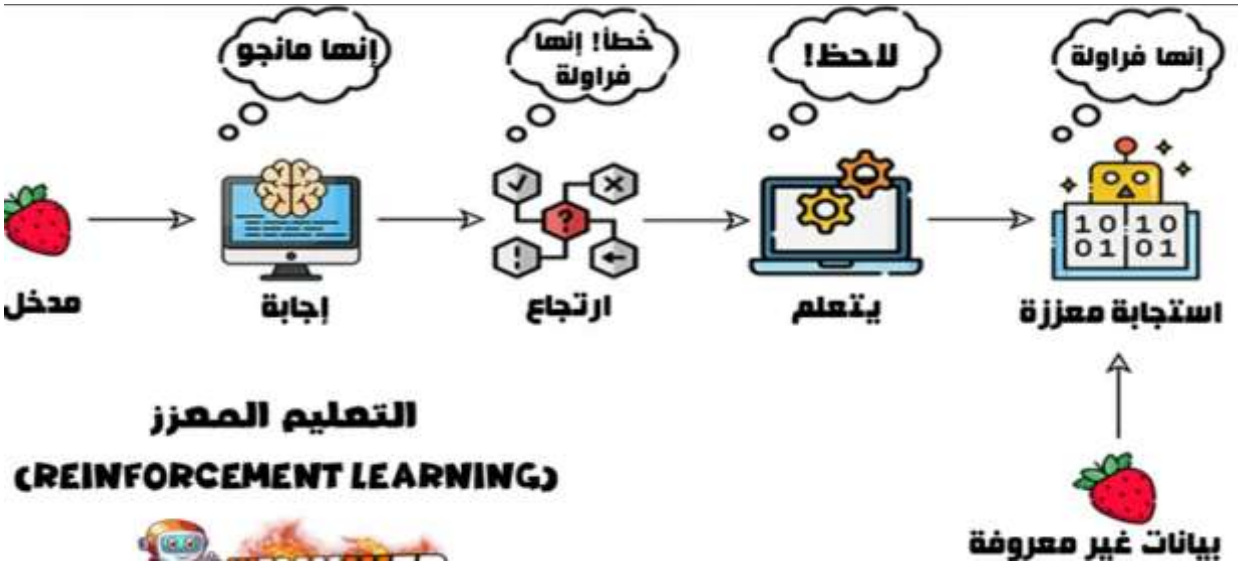
In this model, the system is not provided with pre-labeled data; rather, it makes decisions by interacting with factors in the surrounding environment to achieve a specific goal.

The mechanism works as follows: the system makes a decision;

if the decision leads to a positive and correct outcome, it is rewarded;

if the decision leads to a negative or incorrect outcome, it is penalized;

Based on this reward, it knows it has done something correct, which drives it to continuously improve its behavior on its own to achieve optimal policy and optimal behavior



Exemple in law M

Automated Mediation and Negotiation Systems:

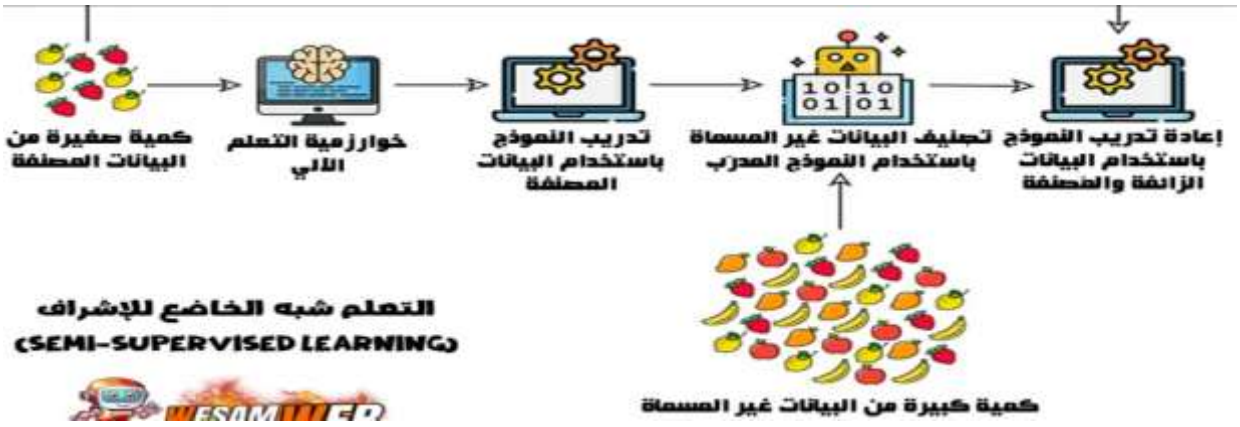
Reinforcement learning algorithms can be used to develop software that negotiates automatically to reach an amicable “settlement” satisfactory to both parties, with the system learning from each round of negotiations how to make concessions that achieve the best possible legal and amicable outcome.

- Compliance systems to train companies on avoiding legal violations based on the history of imposed penalties.

2 – 1 – 4 Semi-Supervised Learning:

One of the machine learning models, it combines data and is considered a hybrid model that integrates a small amount of labeled data (such as manually classified contracts) with a massive amount of unlabeled data (raw court archives).

Legal Benefit: Reduced cost and human effort; the machine uses the small amount of data labeled by experts (judges/lawyers) as a guide to understand and classify millions of other unlabeled documents.



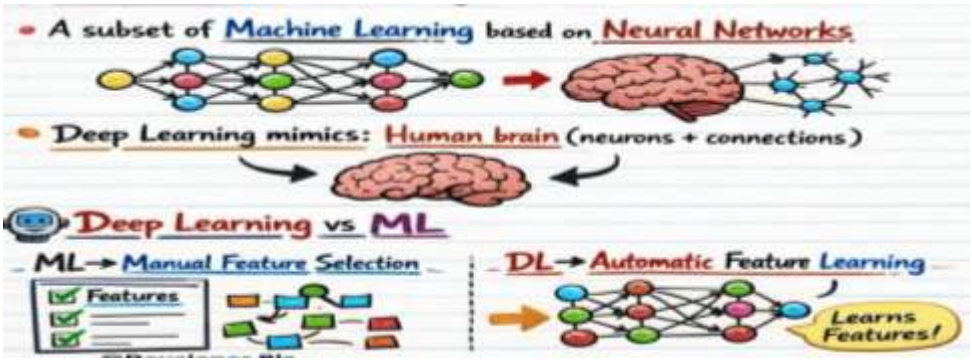
2.1.5 Online/Incremental Learning

This is a system capable of learning and evolving incrementally as new data flows .in, without the need to retrain on all the old data or reset the system from scratch

Legal Benefit: Ideal for legal systems facing constant legislative changes, as the system is fed new laws and updated immediately upon their publication in the Official Gazette without losing its knowledge of previous laws

3 - Deep Learning

A type of machine learning based on a network of interconnected cells and relying on artificial neural networks that mimic the human brain



A neural network

A neural network is a machine learning model that stacks simple "neurons" in layers and learns pattern recognition weights and biases from data to map inputs to outputs.

Neural networks are among the most influential algorithms in modern machine learning and artificial intelligence

Despite the high accuracy of deep learning systems, these systems raise the "black box" problem; it is difficult to explain how the machine arrives at a decision, which may conflict with the right to explanation enshrined in global privacy laws (such as the GDPR).

5 - Legal Challenges

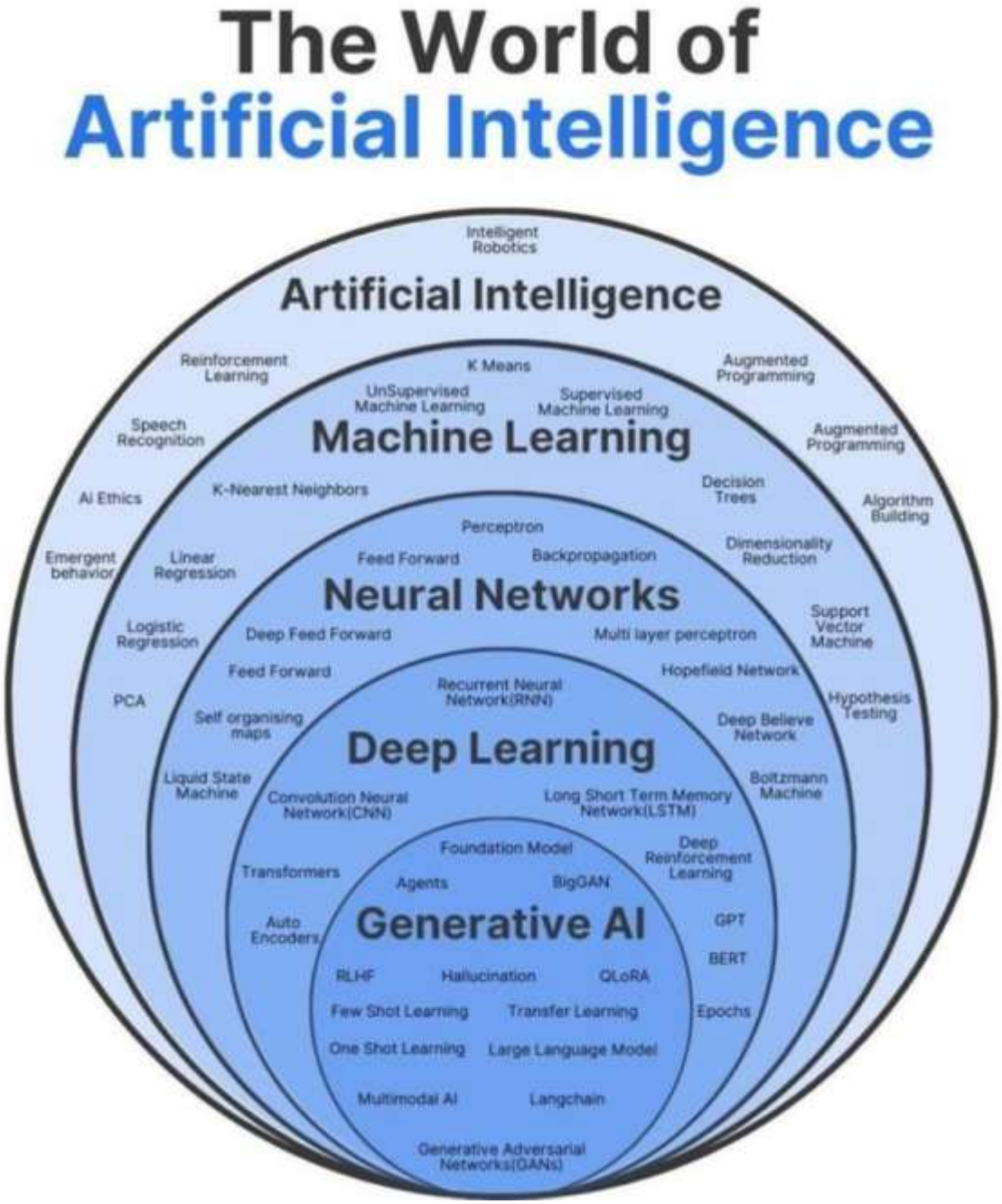
- The Liability Issue: Who is liable when an algorithm violates the GDPR? The developer? The company that deployed it? The user who triggered it? Current law has not definitively resolved this issue.

- The Jurisdiction Issue: European data is processed on U.S. servers using Chinese models—which law applies?

- The Consent Issue: Consent to data processing is given for a specific purpose—but AI produces conclusions that were not in the person's mind when they consented. Does the consent remain valid?

- The problem of indirect discrimination: An algorithm may not use sensitive data (such as race or gender) directly, but may infer it from proxy data (such as ZIP code or purchasing patterns), which is known as indirect algorithmic discrimination.

- Artificial Intelligence (AI)



Practical Exercises

1 What is the difference between supervised learning and unsupervised learning, in terms of principle and objective?

2 Provide examples of machine learning in the legal field.

3 Study the concepts and literature of artificial intelligence to determine whether current computers are capable of performing the following tasks:
- Playing ping-pong correctly
- Driving a car in the city center
- Writing a fairy tale or myth
- Express your opinion on a legal issue
- Research the implementation of a complex process using artificial intelligence

4 -Can an artificial intelligence system be held accountable for a judicial error?

5 The first version of the National Artificial Intelligence Strategy was launched in December 2024 during the African Startup Conference. How is Algeria implementing this national strategy in key sectors?

6 How does Law 18-07 address automated AI decisions?

1 What is the role of the National Council for Artificial Intelligence in Algeria?

7 In your opinion, can a rule-based expert system (Symbolic AI) replace a judge's discretion in criminal cases that rely on "personal conviction"?

8 "Criminal justice relies on the 'judge's inner conviction' (Intime Conviction). In contrast, Symbolic AI relies on pure formal logic.

9 Do you believe that 'automating judicial rulings' achieves absolute justice by eliminating human emotions, or does it violate the spirit of the law, which requires consideration of the individual nature of punishment and human circumstances?"

10 Identify, based on Law 22-01, examples of newly emerging crimes that can be committed using "deepfake" technologies.

11 Under Law 18-07, discuss the "right to explanation": Does an Algerian citizen have the right to know the "logic" used by artificial intelligence to reject their administrative or banking request?

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