**DO NOT POLLUTE!** AVOID PRINTING, OR PRINT 2-SIDED MULTIPAGE.

## 1.1 What is Artificial Intelligence?

In a nutshell, *artificial intelligence* (AI) is a broad field of study concerned with building computer systems that can perform tasks which, when done by humans, are typically associated with intelligence. These tasks include recognizing patterns, understanding language, making decisions, learning from experience, and generating creative artifacts such as images, music, or text.

At this point nobody knows if AI systems think or understand in a human sense. All we know is that they operate by identifying regularities in data and using those regularities to produce outputs that appear intelligent. AI is therefore best understood as a collection of methods for automating decision-making and pattern recognition using data and computation.

## 1.2 The Main Ingredients of AI

Although AI systems can look very different on the surface, most of them are built from a small number of core ingredients. Understanding these ingredients helps demystify how AI works.

**Data.** Data are recorded observations about the world. They can take many forms, including numbers, text, images, audio recordings, or video. In AI, data serve as examples from which systems learn patterns.

**Model.** A model is a mathematical function that maps inputs (such as an image or a sentence) to outputs (such as a label, a decision, or a generated response). These functions have parameters that can be adjusted so that the model delivers the desired output for a given input.

**Learning.** Learning is the process by which a model adjusts its parameters using examples (data). Rather than being explicitly programmed with rules, AI systems generally *learn* by being shown examples until the model achieves the desired behavior. Like observing the colors obtained by combining different proportions of red, green, and blue until the model is capable of telling us the exact quantities required to obtain a desired shade of pink.

**Computation.** Computation refers to the algorithmic procedures and hardware used to carry out learning and prediction. Modern AI relies heavily on fast computers and specialized hardware to process large amounts of data efficiently.

## 1.3 Everyday Examples of AI

AI systems are now embedded in many aspects of daily life. The following examples illustrate how the core ingredients above come together in practice.

### Recommendation Systems

Recommendation systems suggest items such as movies, music, books, or products. They work by analyzing past behavior (for example, what users watched or purchased) and identifying patterns across many users. The system then predicts what a particular user is likely to enjoy next.

### Chatbots and Language Models

Chatbots are AI systems designed to produce text in response to user input. They are trained on large collections of written language and learn patterns in how words and sentences are typically arranged. When generating a response, a chatbot predicts plausible continuations of text based on these patterns. In other words, they generate language by pattern completion.

### Medical Diagnostics

In medical settings, AI systems can assist in tasks such as analyzing medical images or predicting health risks. These systems learn from large datasets of past cases, where outcomes are known, to recognize patterns associated with certain conditions. AI can thus highlight information relevant to medical conditions, and aid diagnosing.

### Art and Image Generation

AI can also generate images, music, and other artistic artifacts. These systems are trained on large collections of existing artworks and learn stylistic patterns. When generating new content, the AI recombines learned patterns in novel ways.

## 1.4 AI for Sciences and Humanities

This course will explore the core ingredients of AI and how they interact to accomplish the goals of different applications. The material will be presented with conceptual precision, but without requiring advanced mathematics or programming skills. Rather than treating AI systems as mysterious or autonomous agents, the course dissects their inner workings, underlying structures, and design choices, equipping students to engage with AI technologies in a more informed, critical, ethical, and creative manner.