Generative AI at SAP

Unit 1: Approaches to Artificial Intelligence

Generative AI at SAP

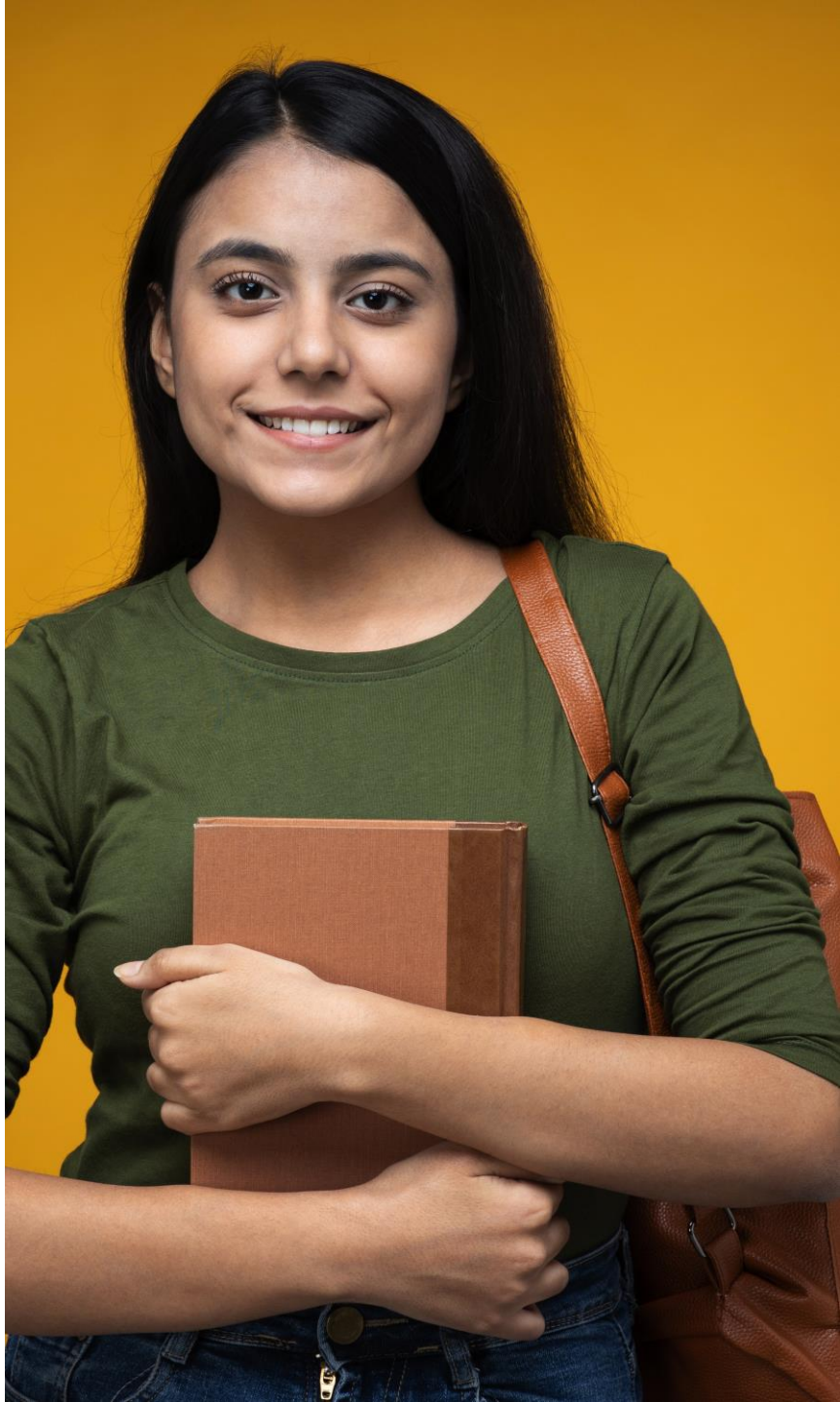
Course Overview and Learning Objectives

How it works:

- Course consists of 5 units
- Course assignment
- Discussion forum

What you will learn:

1. What the different approaches to artificial intelligence are, and why probabilistic models extend the reach of machines
2. What makes generative AI different and what its capabilities are
3. What the limitations of generative AI are, and what methods there are to adapt generative AI to business context
4. How to build and extend SAP applications with generative AI
5. What some of the generative AI business use cases are, and SAP’s product portfolio



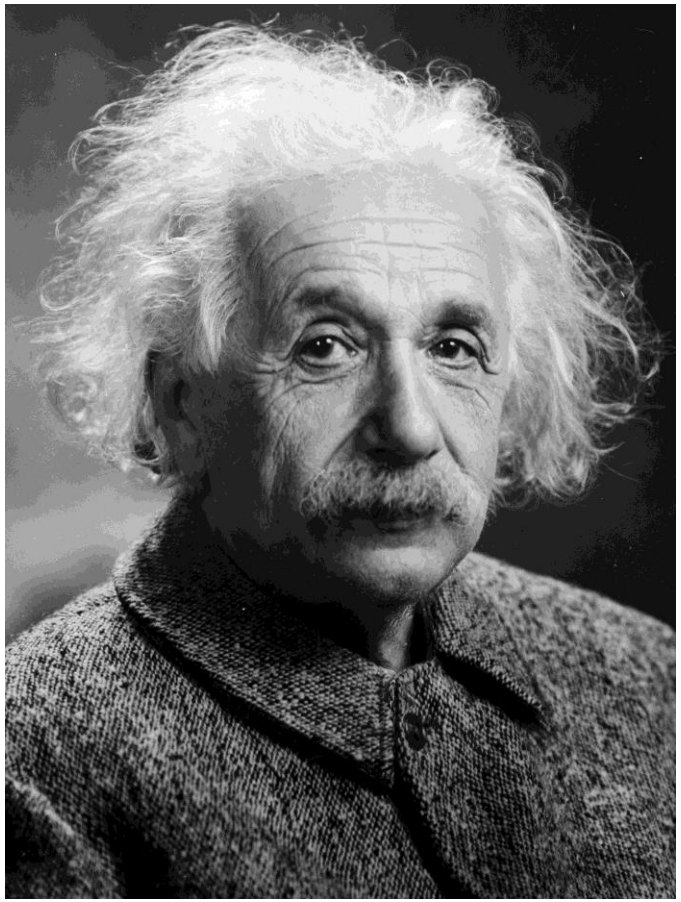
Objectives of Unit 1

In Unit 1, you will learn

- Definitions of “intelligence” and “artificial intelligence”
- Humanity’s approaches to artificial intelligence
  - Symbolic AI
  - Statistical AI
- The relation between AI, machine learning, deep learning, and generative AI

What is “intelligence”?

Intelligence: the ability to accomplish complex goals.



Source: Wikimedia Commons.

Max Tegmark, Life 3.0: Being Human in the Age of Artificial Intelligence

The ability to see patterns and predict outcomes based on previous experiences.

Dr. Jeff Hawkins, Neuroscientist

That quality that enables an entity to function appropriately and with foresight in its environment.

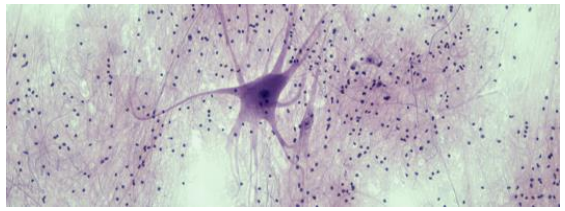
Intelligence allows humans to understand and generate language, perceive and respond to sensory outputs, play challenging games, synthesize and summarize information, and create (art, music. theorems…).

Dr. Nils J. Nilsson, Stanford, one of founders of AI research

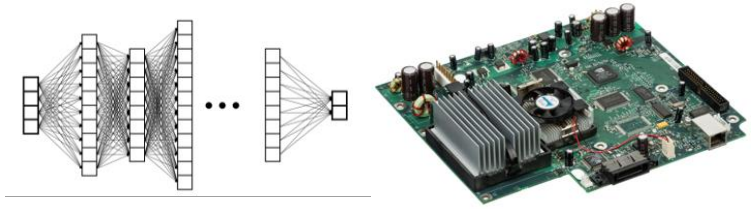
What is “artificial intelligence”?

Artificial intelligence (AI): intelligence exhibited by non-biological systems.

Source: Photo by David Hanson. Wikimedia Commons.



Neuron on substrate of biological tissue.



Digital neural network on substrate of silicon chips.

Narrow AI: ability to accomplish a narrow set of goals, aka “weak AI”. e.g. a model that excels at classifying cat pictures cannot play online chess, and vice-versa.

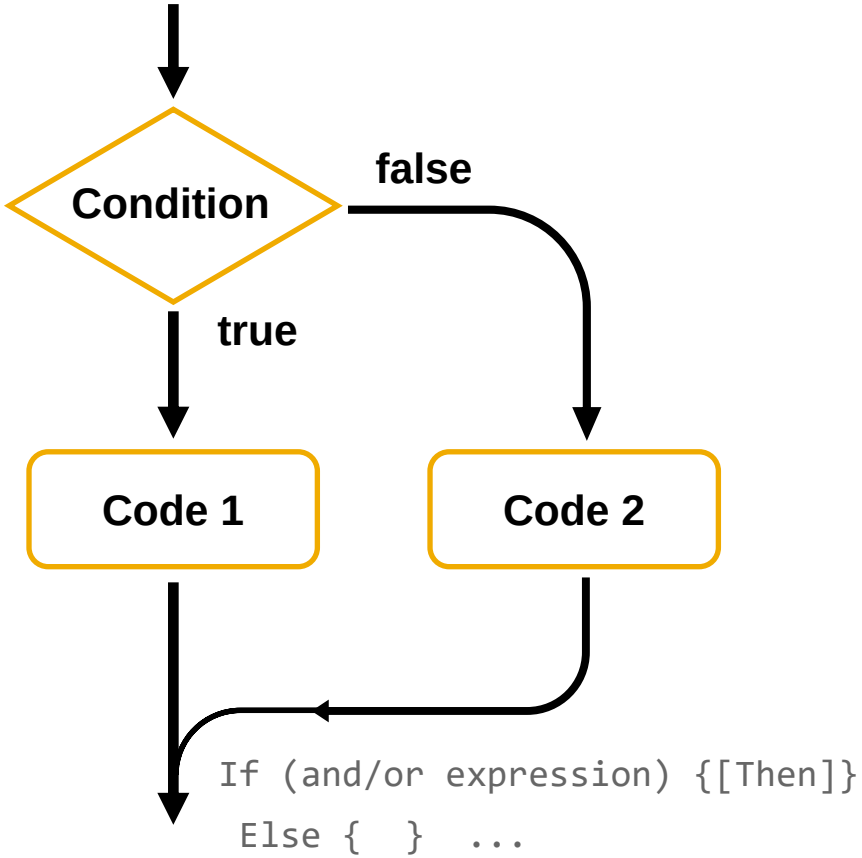
Artificial general intelligence (AGI): ability to understand and learn any intellectual task that a human being can, aka “strong AI”.*

* recent approaches show “sparks of AGI”* by generalizing across goals, but experts disagree when or even if AGI will ever be achieved.

* [2303.12712] Sparks of Artificial General Intelligence: Early experiments with GPT-4 (arxiv.org)

Approaches to AI

Symbolic AI: explicitly represent knowledge e.g. through rules, expert systems, and deterministic programming



Approaches to AI

Thought experiment: how many rules would you need to describe something as simple as identifying a picture of a cat vs. a picture of a dog in a computer?

Source: Wikimedia Commons.

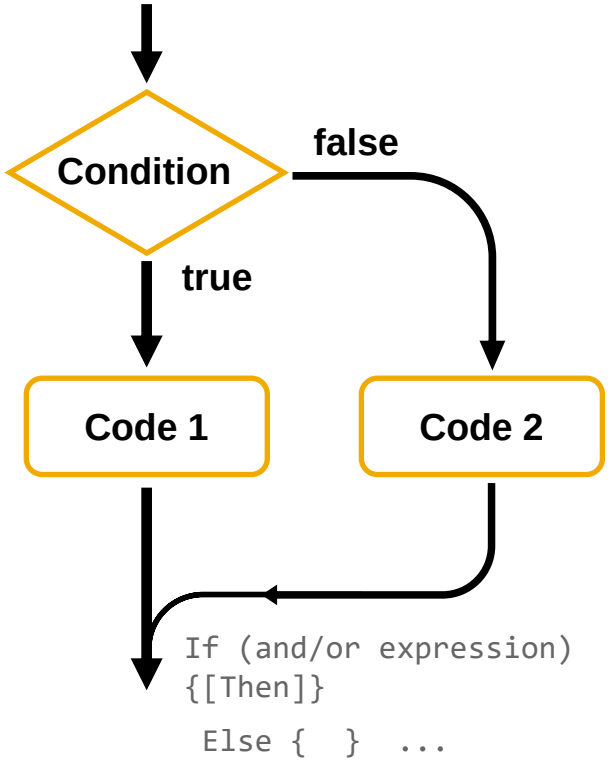
"I shall reconsider human knowledge by starting from the fact that ***we can know more than we can tell***."

Michael Polanyi, on the nature of explicit knowledge vs. tacit knowledge

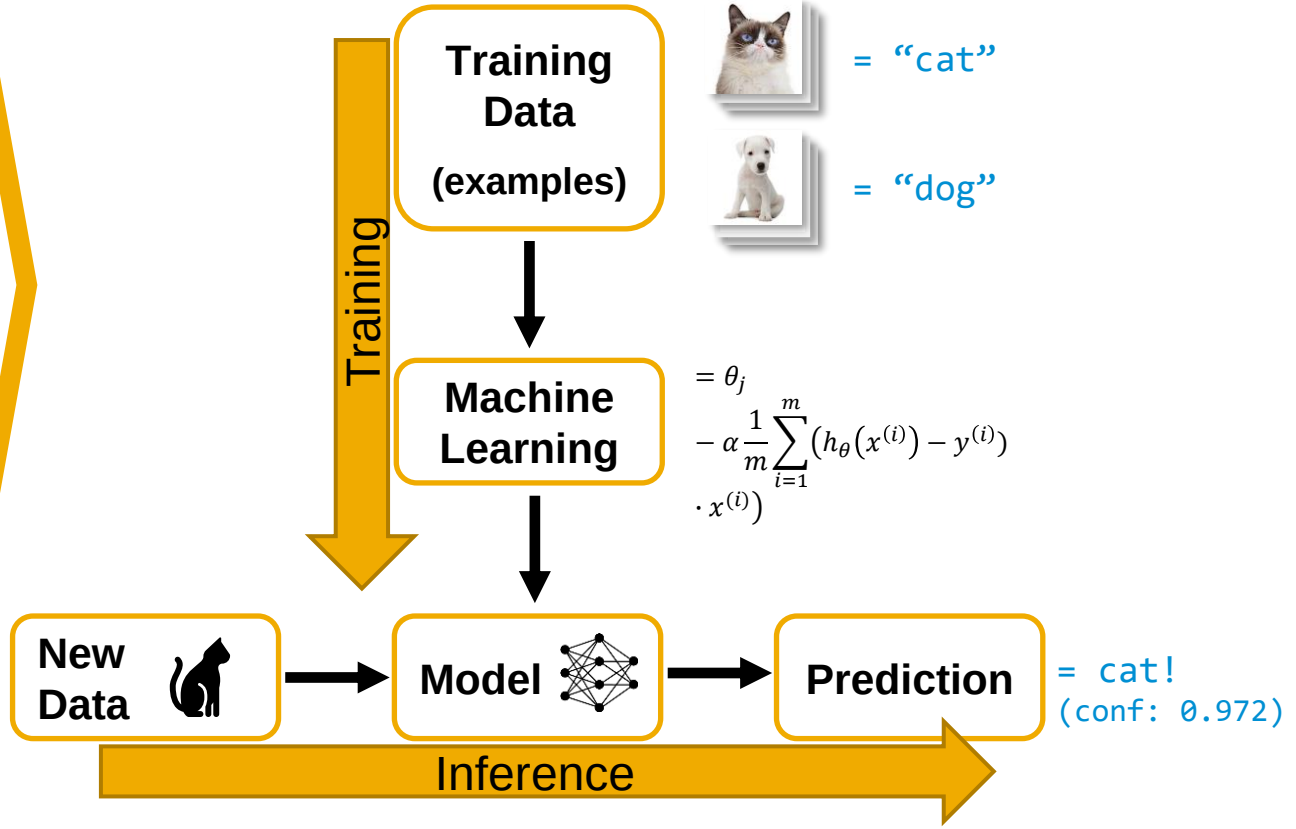
We quickly run into limits describing the complex rules and relationships between inputs and outcomes, i.e. trying to codify knowledge explicitly based on our tacit knowledge.

Approaches to AI

Symbolic AI: explicitly represent knowledge e.g. through rules, expert systems, and deterministic programming



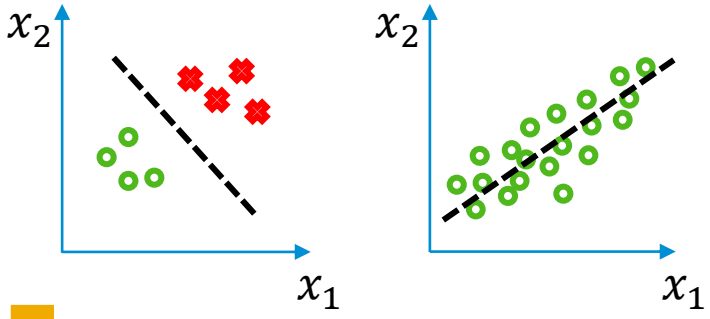
Probabilistic machine learning: learn from examples in the data without being explicitly programmed



Statistical approaches to AI

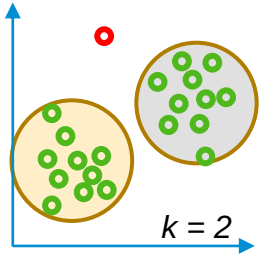
Supervised learning

- Train the model with labeled examples (input) and the solution (output)
- **Output**: regression, classification
- Example: ticket classification



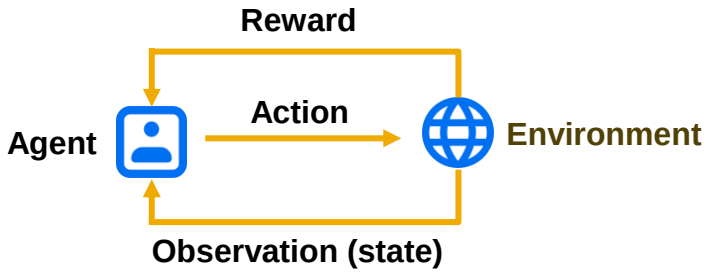
Unsupervised learning

- Data set is unlabeled – model finds patterns/structures
- **Output**: clustering, dimensionality reduction
- Example: fraud detection



Reinforcement learning

- Agents observe the environment, perform actions, and are rewarded or penalized
- Do not confuse this with updating a supervised learning model!
- **Output**: agent learns a **policy** (what actions to best take given a situation)
- Example: AlphaGo



Self-supervised learning

- Neural networks where the “label examples” are given in the structure of the data itself, e.g. large language models predict the next word
- **Basis of foundation models and generative AI**. We will explore more in Unit 2.

A note on statistical approaches to AI, probability, and uncertainty

Although all knowledge has some uncertainty, many business people are not comfortable with the probabilistic nature of AI.

What did you see? And how certain are you on a scale of 1-10?

Concert… or cotton harvest?

As amazing as human intelligence is, people are far from 100% accurate.

A computer can learn to execute tasks… often faster and more accurately than people, but usually not with 100% accuracy.

Humans + AI working together

Source: BBC. 9. November 2017. “This picture has gone viral, but it’s not what you think it is.”

Summary of approaches to AI

Intelligence: the ability to achieve complex goals

Artificial Intelligence (AI)

- Intelligence exhibited by machines
- Includes many approaches, like symbolic AI all the way to neuromorphic computing

Machine Learning (ML)

- Computers learn from examples in the data without being explicitly programmed
- Numerical and statistical approaches to train a model, including many kinds of algorithms
- Supervised learning (including self-supervised learning), unsupervised learning, reinforcement learning

Deep Learning

- A subfield of machine learning that uses specialized computational techniques, namely various multi-layer **artificial neural network** architectures (e.g. RNNs, CNNs, transformers…)

Foundation models and generative AI

- Neural networks, typically using the transformer architecture, trained via a self-supervised learning objective
- Exhibit emergent properties, generalize across tasks, and can generate new content

Focus of this course

Thank you.

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