

Introduction

Fundamentals of Artificial Intelligence

Main Areas of Artificial Intelligence (AI)

tabular data

Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	LotShape	LandContour	Utilities	... PoolArea	PoolQC	Fence	MiscFeature	MiscVal	MoSold	YrSold	SaleType	SaleCondition	SalePrice			
0	1	60	RL	65.0	8450	Pave	NaN	Reg	Lvl	AllPub	...	0	NaN	NaN	0	2	2008	WD	Normal	208500	
1	2	20	RL	80.0	9600	Pave	NaN	Reg	Lvl	AllPub	...	0	NaN	NaN	0	5	2007	WD	Normal	181500	
2	3	60	RL	68.0	11250	Pave	NaN	IR1	Lvl	AllPub	...	0	NaN	NaN	0	9	2008	WD	Normal	223500	
3	4	70	RL	60.0	9550	Pave	NaN	IR1	Lvl	AllPub	...	0	NaN	NaN	0	2	2006	WD	Abnorml	140000	
4	5	60	RL	84.0	14260	Pave	NaN	IR1	Lvl	AllPub	...	0	NaN	NaN	0	12	2008	WD	Normal	250000	
...		
1455	1455	60	RL	62.0	2017	Pave	NaN	Reg	Lvl	AllPub	...	0	NaN	NaN	0	8	2007	WD	Normal	170000	
1456	1457	20	RL	85.0	13175	Pave	NaN	Reg	Lvl	AllPub	...	0	NaN	MnPrv	NaN	0	2	2010	WD	Normal	210000
1457	1458	70	RL	66.0	9042	Pave	NaN	Reg	Lvl	AllPub	...	0	NaN	GdPrv	Shed	2500	5	2010	WD	Normal	266500
1458	1459	20	RL	68.0	9717	Pave	NaN	Reg	Lvl	AllPub	...	0	NaN	NaN	NaN	0	4	2010	WD	Normal	142125
1459	1460	20	RL	75.0	9937	Pave	NaN	Reg	Lvl	AllPub	...	0	NaN	NaN	NaN	0	6	2008	WD	Normal	147500

[1460 rows x 81 columns]

language models

The Lord of the Rings

Article Talk

From Wikipedia, the free encyclopedia

(Redirected from Lord of the rings)

This article is about the book. For other uses, see *The Lord of the Rings* (disambiguation).

"War of the Ring" redirects here. For other uses, see *War of the Ring* (disambiguation).

The Lord of the Rings is an epic high fantasy novel by the English author and scholar J. R. R.

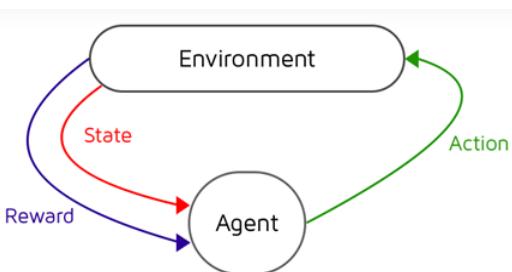
Tolkien. Set in Middle-earth, the story began as a sequel to Tolkien's 1937 children's book *The Hobbit*, but eventually developed into a much larger work. Written in stages between 1937 and

1949, *The Lord of the Rings* is one of the best-selling books ever written, with over 150 million copies sold.^[1]

The title refers to the story's main antagonist,^[2] Sauron, the Dark Lord who in an earlier age created the One Ring to rule the other Rings of Power given to Men, Dwarves, and Elves, in his campaign to conquer all of Middle-earth. From homely beginnings in the Shire, a hobbit land reminiscent of the English countryside, the story ranges across Middle-earth, following the quest to destroy the One Ring, seen mainly through the eyes of the hobbits Frodo, Sam, Merry, and Pippin. Aiding Frodo are the Wizard Gandalf, the Men Aragorn and Boromir, the Elf Legolas, and the Dwarf Gimli, who unite in order to rally the Free Peoples of Middle-earth against Sauron's armies and give Frodo a chance to destroy the One Ring in the fire of Mount Doom.

Although often mistakenly called a trilogy, the work was intended by Tolkien to be one volume in a two-volume set along with *The Silmarillion*.^{[3][4]} For economic reasons, *The Lord of the Rings* was first published over the course of a year from 29 July 1954 to 20 October 1955 in three volumes rather than one^{[5][6]} under the titles *The Fellowship of the Ring*, *The Two Towers*, and *The Return of the King*. *The Silmarillion* appeared only after the author's death. The work is divided internally into six books, two per volume, with several appendices of background material.^[3] These three volumes were later published as a boxed set, and even finally as a single volume, following the author's original intent.

control



computer vision

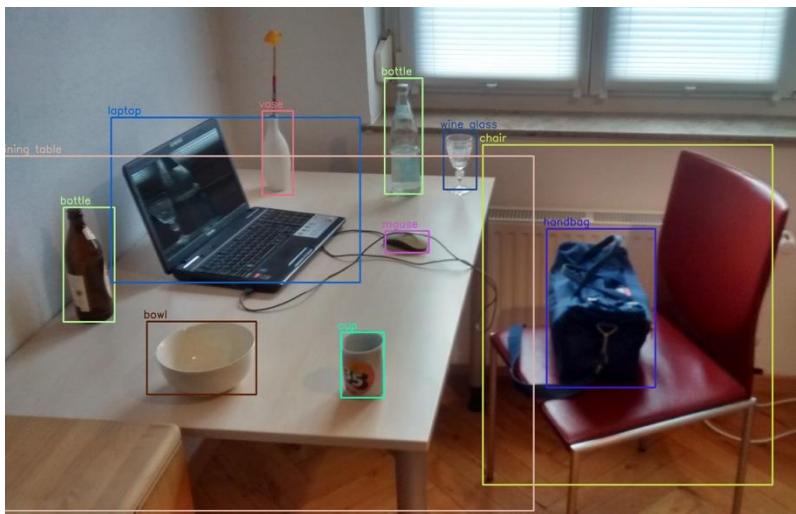


all empowered by one key component:
learning from data → Machine Learning (ML)

When to Use AI/ML

automation

too complex for rules



object recognition, chat bot, ...

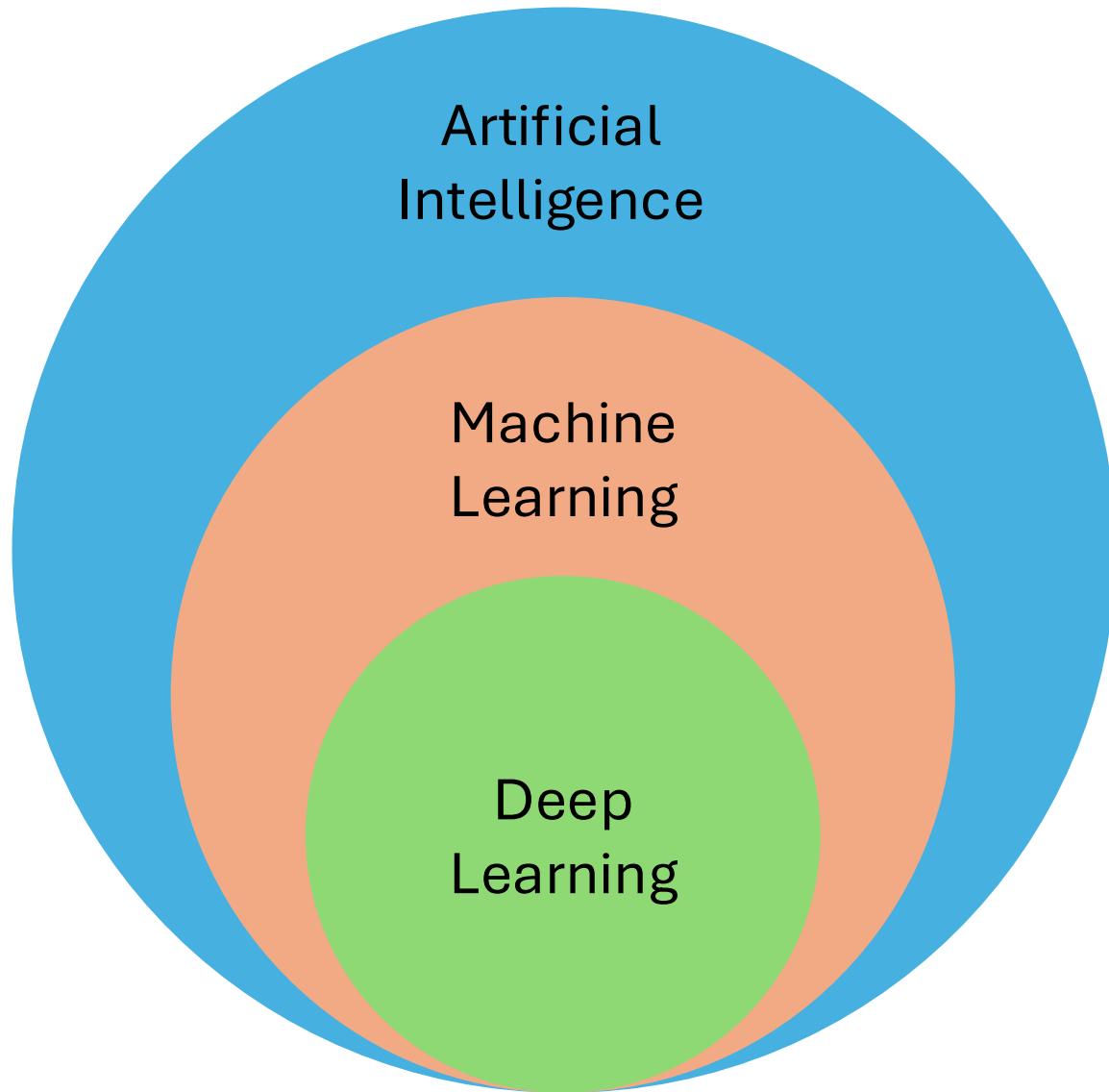
uncertainty

too complex for humans



AlphaFold

protein structure predictions, demand forecasting, ...



blend of diverse components from different domains (statistics, optimization, computer science, ...)

Deep Learning: special kind of ML methods using *deep* neural networks (e.g., CNNs, transformers)

What Is Machine Learning?

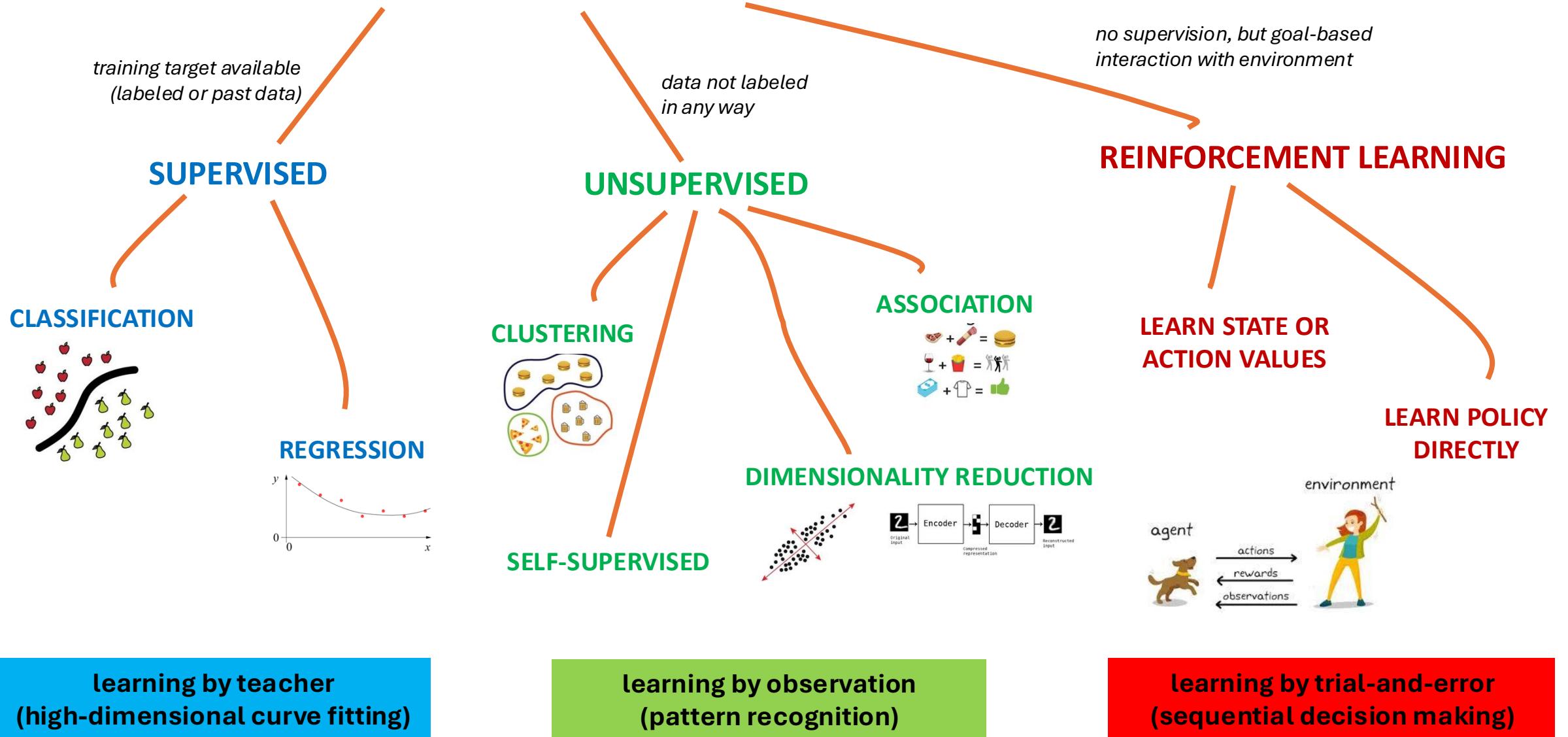
learning from experience/data: exploiting statistical dependencies with the aim of **generalization** to new data

training: **ML algorithm + data = explicit algorithm** (to be used later)

→ reduction of complexity and much better generalizability compared to handcrafted algorithms

analogy: Humans do not hit the ground running (storage capacity of DNA limited) but have learning capabilities.

MACHINE LEARNING



unsupervised and reinforcement learning can both be cast as supervised-learning setup

Supervised Learning

Target Quantity

- **known in training:** labeled samples or observations from past
- to be for unknown cases (e.g., future values)



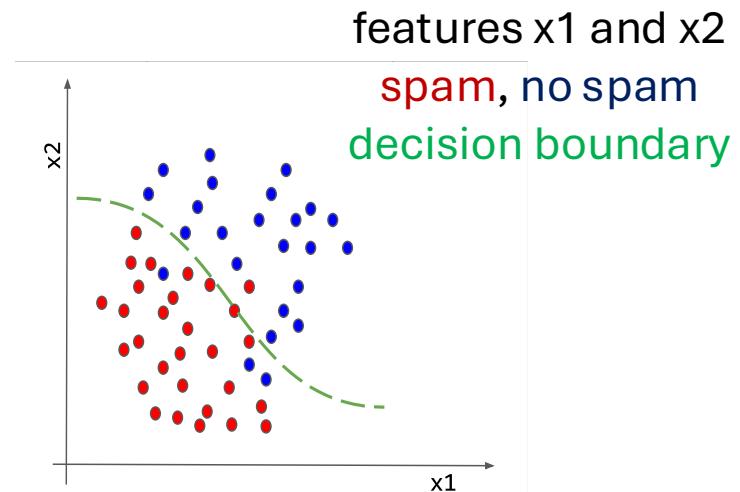
Features

- (prepared) input information that is
- correlated to target quantity
 - known at prediction time

Example: Spam Filtering
classify emails as spam or no spam

use accordingly **labeled emails as training set**

use information like occurrence of specific words or email length as **features**

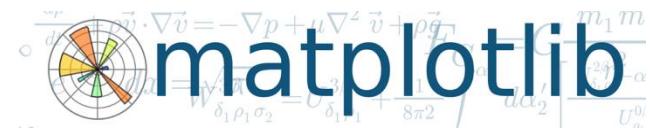


features x_1 and x_2
spam, no spam
decision boundary

Used Programming Language: Python



- good compromise between rapid prototyping and production
- vast ecosystem
- very popular for data processing and ML: scientific Python stack



Programming Environments

locally, best use

- a virtual environment to flexibly install packages (e.g., [venv](#))
- an IDE of your choice (e.g., [VS Code](#))
- both plain Python files or [Jupyter notebooks](#) are fine

but cloud-based environments also fine (e.g., [Google Colab](#))

Course Schedule

Part 1: Foundations (Theory + Classical ML)

1. AI/ML Overview
Search & Optimization, Supervised & Unsupervised Learning
2. Python & scikit-learn
3. Data and Preprocessing
4. Supervised Learning
Linear Models, K-Nearest Neighbors, Simple Neural Networks, Decision Trees
5. Model Evaluation & Selection

Part 2: Applications (Domains + Deep Learning)

1. Machine Learning for Tabular Data
Random Forest, Gradient Boosting
2. Deep Learning with PyTorch
3. Computer Vision
Convolutional Neural Networks, Image Classification, Object Detection, Segmentation, Image Synthesis
4. NLP & Large Language Models
Transformers, Text Analysis, Generative AI, Chatbots, Agent Systems
5. Control & Reinforcement Learning