



Machine Learning

AI4202
Lecture 1



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Course General Description

- This course provides an extensive overview of **modern machine learning**, covering supervised learning methods such as linear regression • logistic regression • unsupervised learning (such as clustering), and reinforcement learning



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Pre-requirements for this course

- AI4101 - Artificial Intelligence Principles



Course Content

- Introduction to Machine Learning and Learning Models (Supervised, Unsupervised, Reinforcement Learning) — **3 hours**
- Statistical Learning Theory — **6 hours**
- Linear Regression Model — **6 hours**
- Logistic Regression — **6 hours**
- Naïve Bayes Classifier and its Applications — **6 hours**
- Generalization and Regularization — **6 hours**
- Unsupervised Learning (K-means Clustering) — **6 hours**
- Introduction to Reinforcement Learning — **6 hours**



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Course Expected Learning Outcomes

- Understand the **key challenges** in machine learning (data, model choice, model complexity).
- Learn different **machine learning algorithms**, their strengths, and limitations.
- **Use** methods to identify and fix learning problems.
- **Build** a machine learning algorithm from scratch and test it on real-world data.
- **Compare and evaluate** different algorithms for quality and reliability.
- **Apply** reinforcement learning to a real-world task.
- Work well in **teams** and demonstrate **leadership** skills.



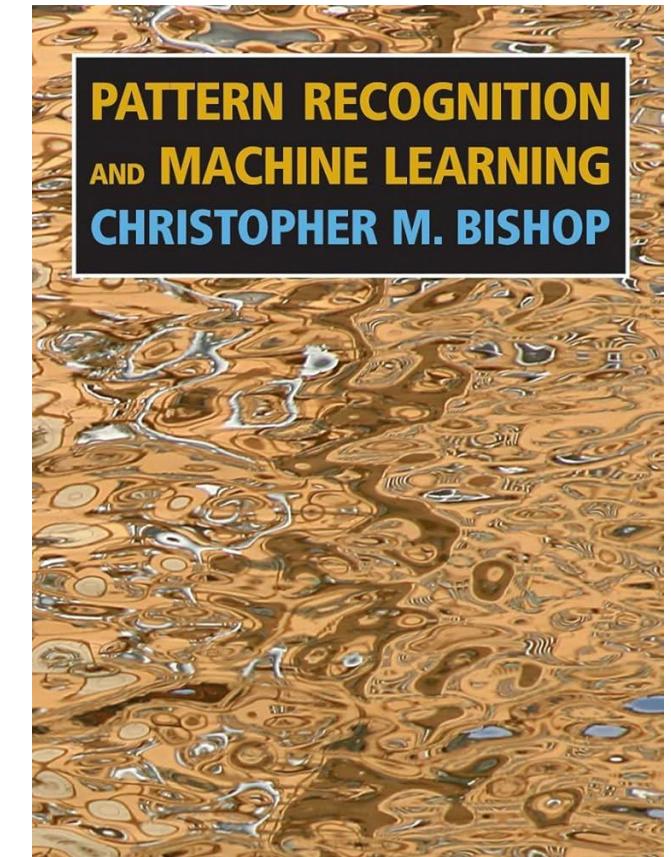
Assessment

Assessment Activities *	Assessment timing	Percentage of Total Assessment Score
Assignments	Throughout the semester	10%
Quizzes	Throughout the semester	10%
Mid-term exam	7-8	20%
Group project	Throughout the semester	20%
Final Exam	17-18	40%

**Our course Midterm will be in the 8th week
on Sunday 10/12th/2025**

References and Learning Resources

- **Essential References:** Pattern Recognition and Machine Learning, by Bishop
- **Supportive References:**
 - Machine Learning with PyTorch and Scikit-Learn, by Sebastian Raschka
 - Yuxi (Hayden) Liu Vahid Mirjalili (2022)
- **Electronic Materials:** Ng, A., & Ma, T. (2023). CS229 Lecture Notes*.





Policies

- **Timeliness**

Please be at the class on time. Attendance will be taken at the beginning of the class, and latecomers will be considered absent.

- **Mobile Phone Usage**

Please turn off your mobiles while you are in the class. You will be forced to leave the class if your mobile rings.

- **Assessment Attendance**

Any absence from any assessment (i.e., quizzes, tutorial assignments, exams) will result in losing marks unless you provide an official excuse.

- **Class Attendance**

If you miss a class, you must present a valid/official excuse. Otherwise, your absence will be counted. Your valid excuse must be presented no later than 48 hours from your missed class.

- **Attendance Requirement**

According to university policies, each student is expected to attend at least 85% of the contact hours. Otherwise, the student will be considered denied (DN- محروم).

- **Academic Integrity**

Cheating and plagiarism are considered felonies. Any form of cheating during exams will result in an F grade for the exam. If plagiarism is discovered in submitted coursework, all contributors will receive a zero mark for that specific coursework.



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Office Hours

- My office hours this semester will be every **Tuesday from 11:30 AM to 1:30 PM.**
- If needed, we can also schedule additional meetings at other times based on the requirements of the course.



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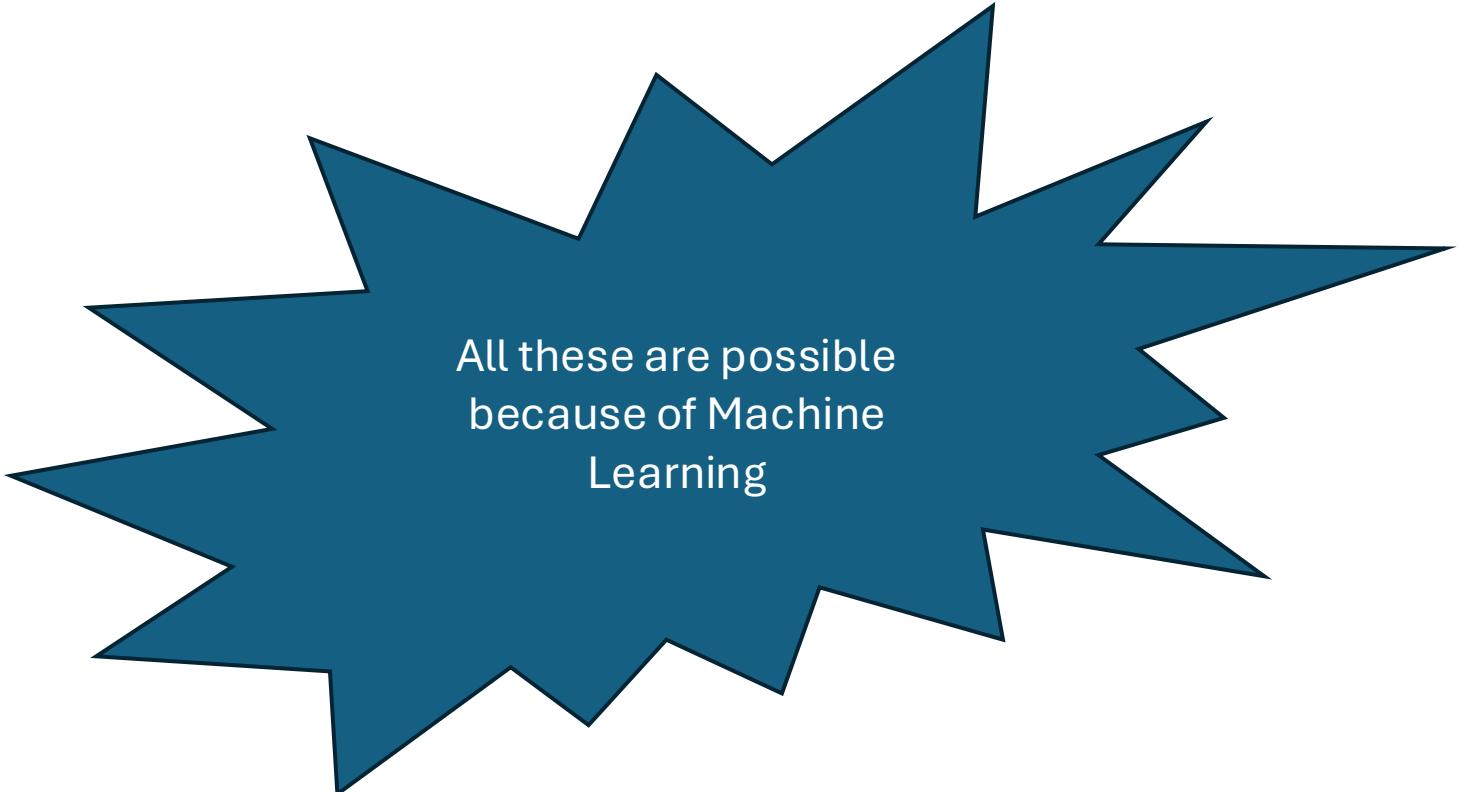
Outline

- ML Example
- What is Machine Learning?
- Why ML Matters?
- Overview of Learning Models
 - Supervised Learning
 - Unsupervised Learning
 - Reinforcement Learning



Real-life ML applications:

- Netflix recommendations
- Voice assistants
- Self-driving cars
- Medical diagnosis



All these are possible
because of Machine
Learning

Example (Netflix Recommendation System – How It Works)

- **User Data** → Netflix collects your viewing history, ratings, and clicks.
- **Content Data** → It also looks at information about shows/movies (genres, actors, etc.).
- **ML Models** → Machine learning combines both types of data using collaborative filtering, deep learning, and ranking algorithms.
- **Recommendations** → Netflix shows you a personalized list (including dynamic posters and previews).





What is Machine Learning?

- Machine learning (ML) is a branch of artificial intelligence (AI) focused on enabling computers and machines to **imitate the way that humans learn**, to perform tasks **autonomously**, and to improve their performance and accuracy through **experience** and **exposure to more data.***
- In plain English “Machine Learning is teaching computers to learn patterns from data instead of programming every step.”

* <https://www.ibm.com/think/topics/machine-learning>



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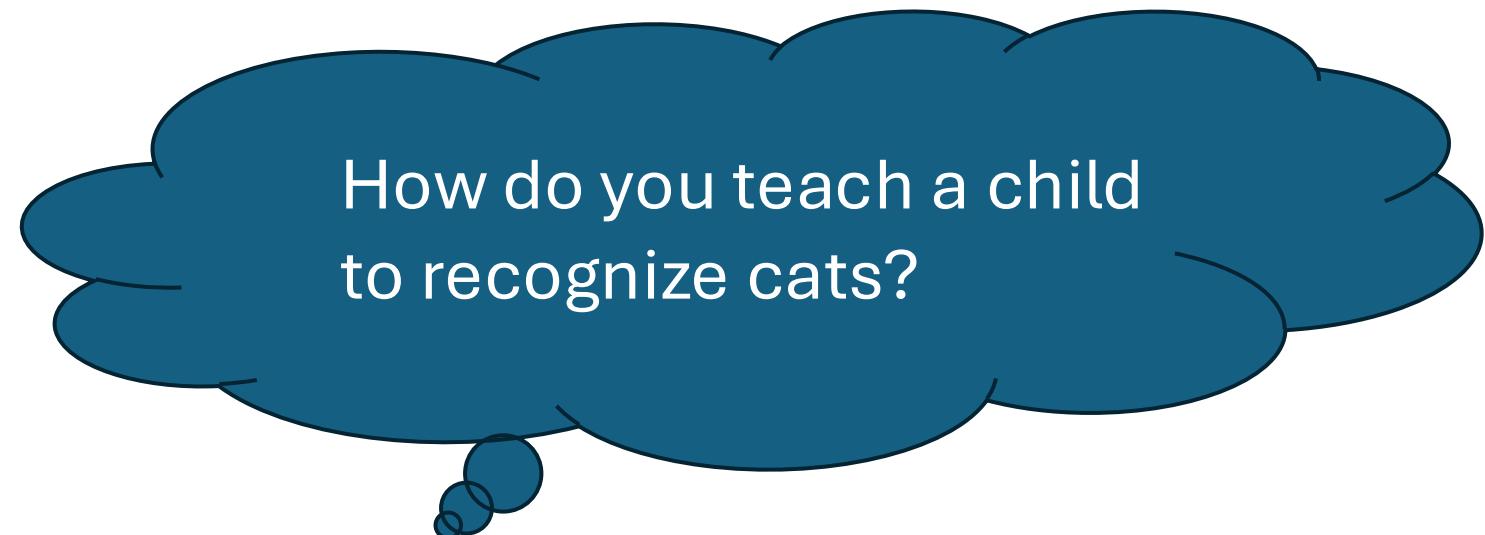
What is Machine Learning?

- Compare with **traditional programming**:
 - Traditional: Data + Rules (program) → Answer
 - ML: Data + Answer → Rules (program)



What is Machine Learning?

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What is Machine Learning?



How would you write rules to
recognize cats?



Why ML Matters?

- **Key strengths:**
 - Can handle massive data.
 - Improves with experience.
 - Enables automation + prediction.
- **Impact areas:**
 - Healthcare, finance, transportation, education.



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Overview of Learning Models

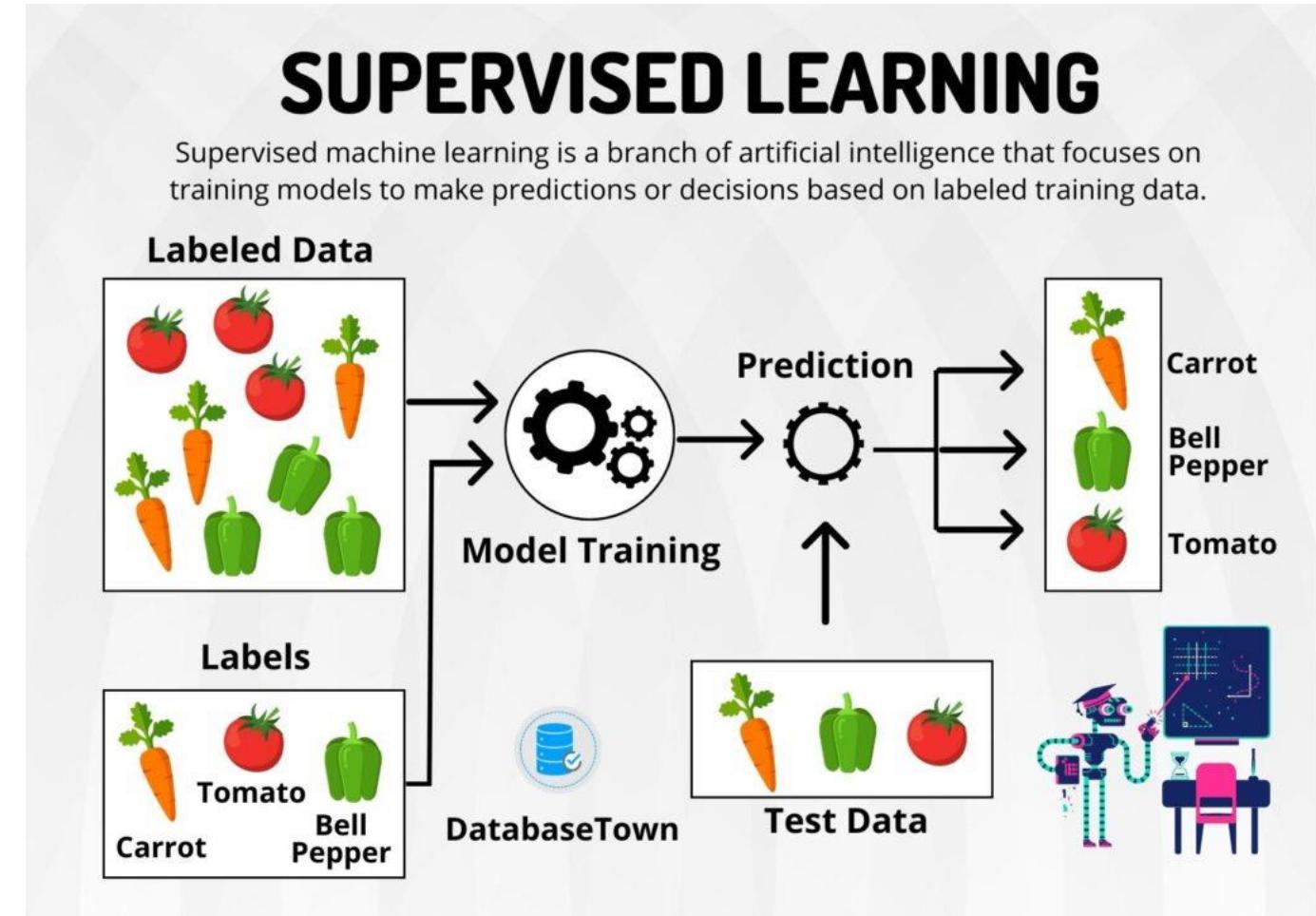
- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

Supervised Learning



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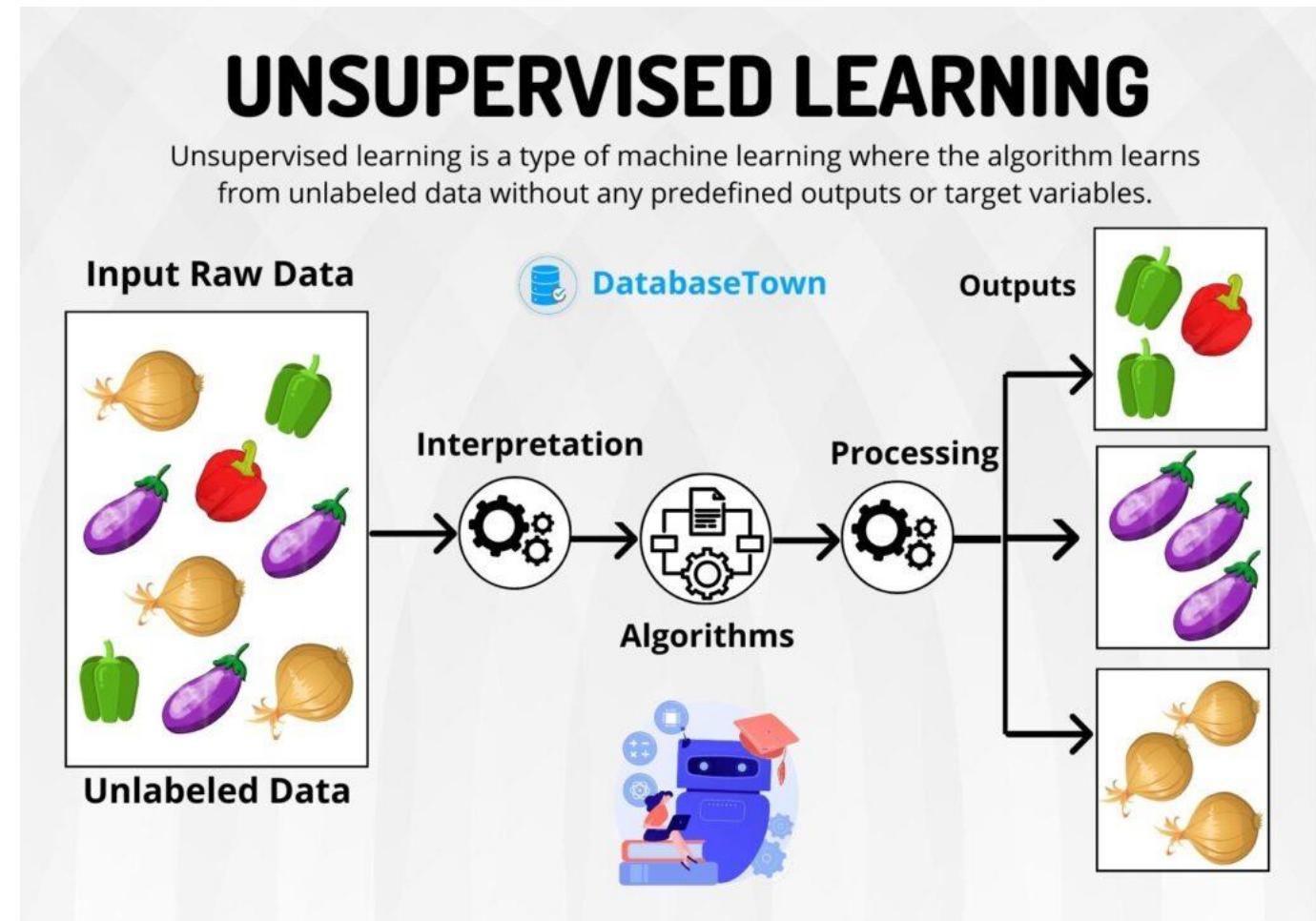
- **Idea:** Learn from labeled data (input → correct output).
- Examples:
 - Spam vs. not spam (classification).
 - House price prediction (regression).





Unsupervised Learning

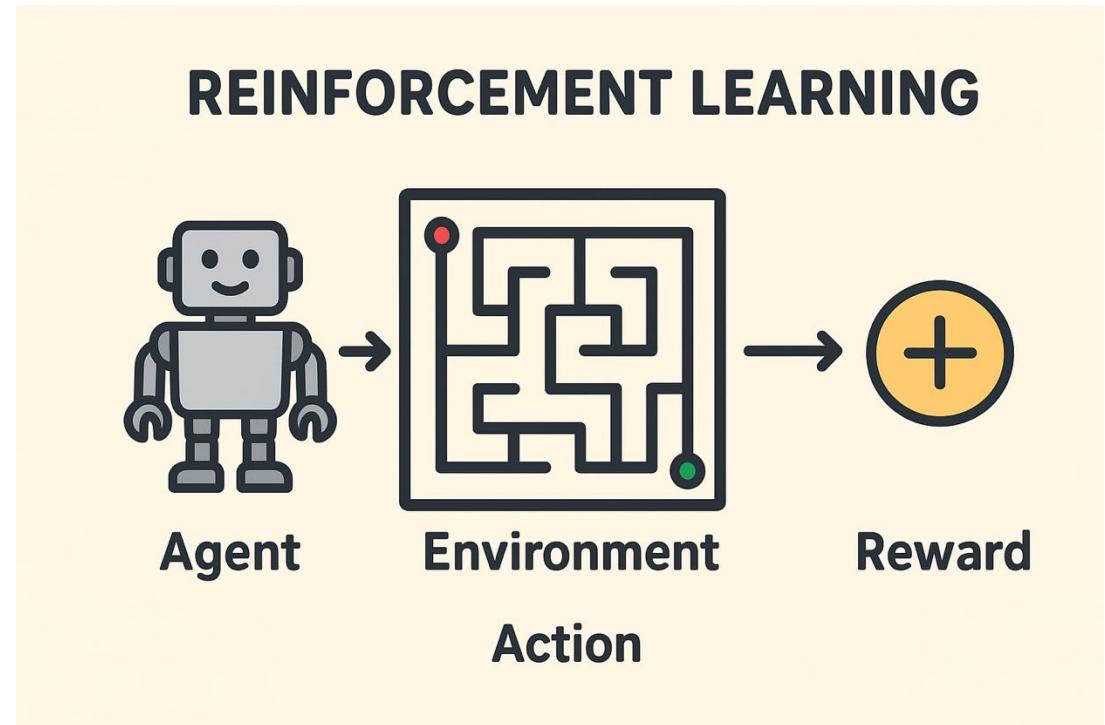
- Idea: Find hidden patterns in **unlabeled data**.
- Examples:
- Grouping customers by shopping behavior.
- Spotify grouping songs into genres.





Reinforcement Learning

- **Idea:** Learn by **trial and error**, maximizing reward.
- **Key terms:**
 - Agent
 - Environment
 - Reward.
- **Examples:**
 - Teaching a robot to walk.
 - Maze Game





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Questions!