



# Machine Learning

**AI4202**  
**Lecture 1**

# 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

# 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**

# 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.

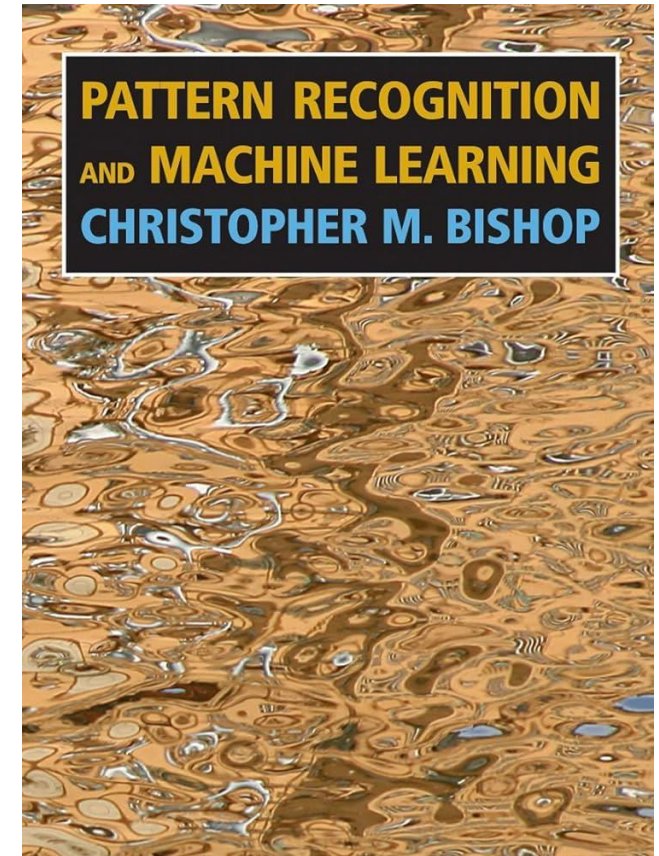
# Assessment

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 8<sup>th</sup> week  
on **Sunday 10/12<sup>th</sup>/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, Bahman Ghahramani (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 (محروم - DN).*

- **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.*



# Office Hours

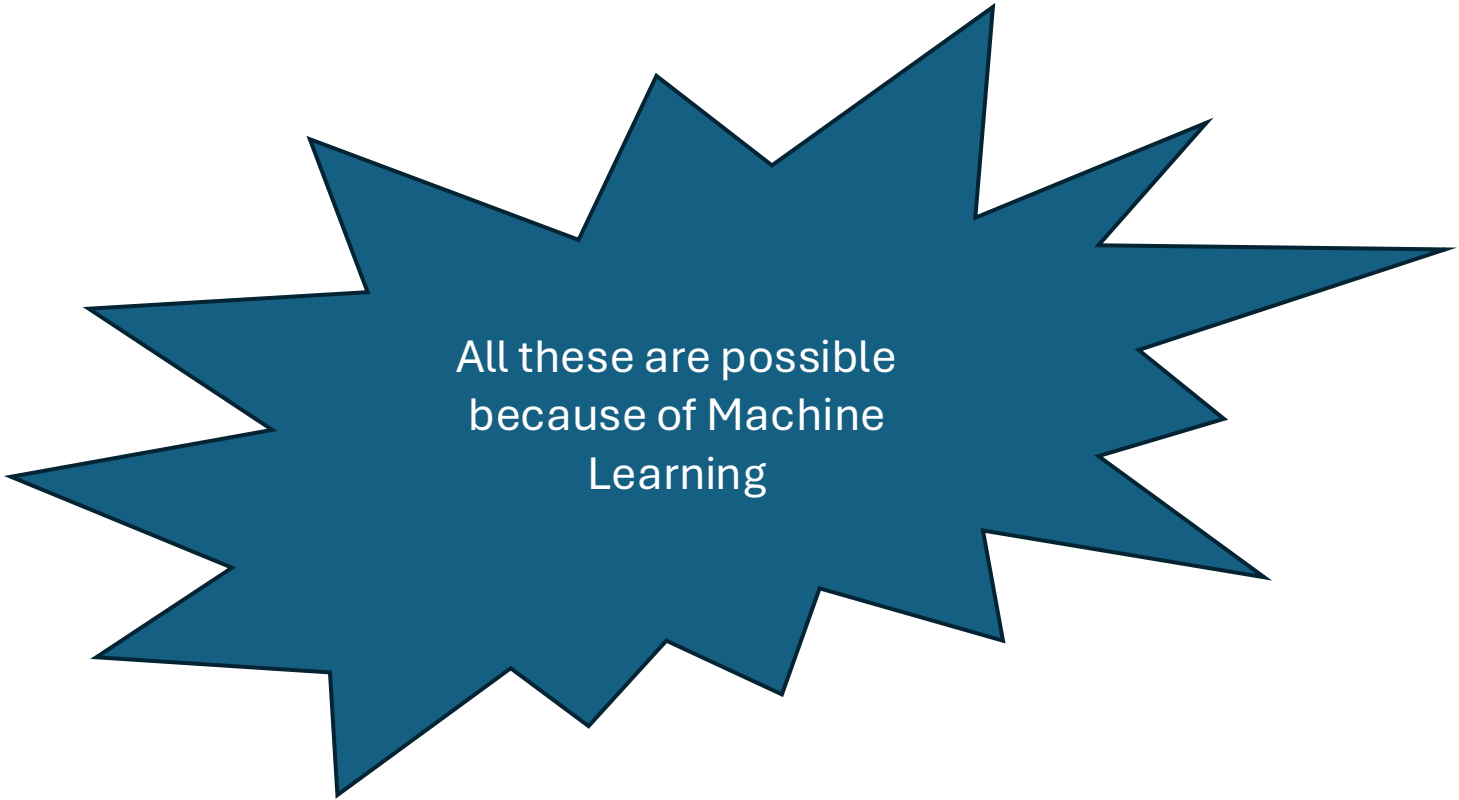
- My office hours this semester will be every **Tuesday from 11:30 AM to 1:30 PM.**
- If needed, we can also schedule additional meetings at other times based on the requirements of the course.

# 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.”

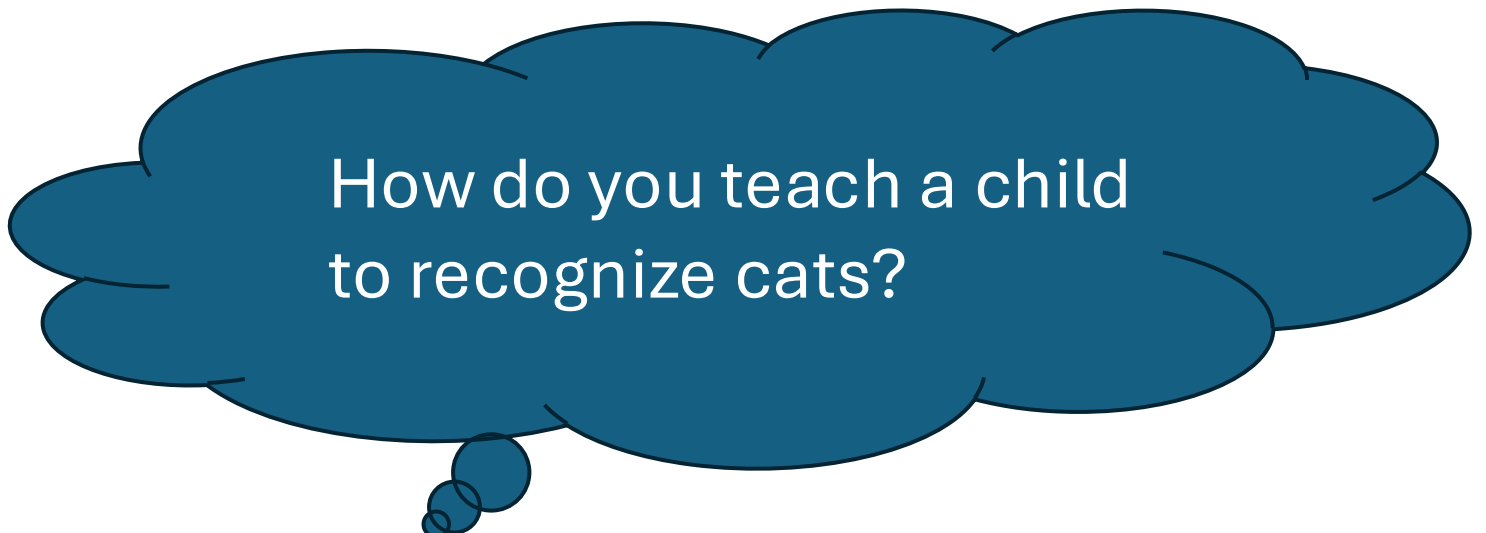
\* <https://www.ibm.com/think/topics/machine-learning>

# What is Machine Learning?

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

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How do you teach a child  
to recognize cats?

# 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:**

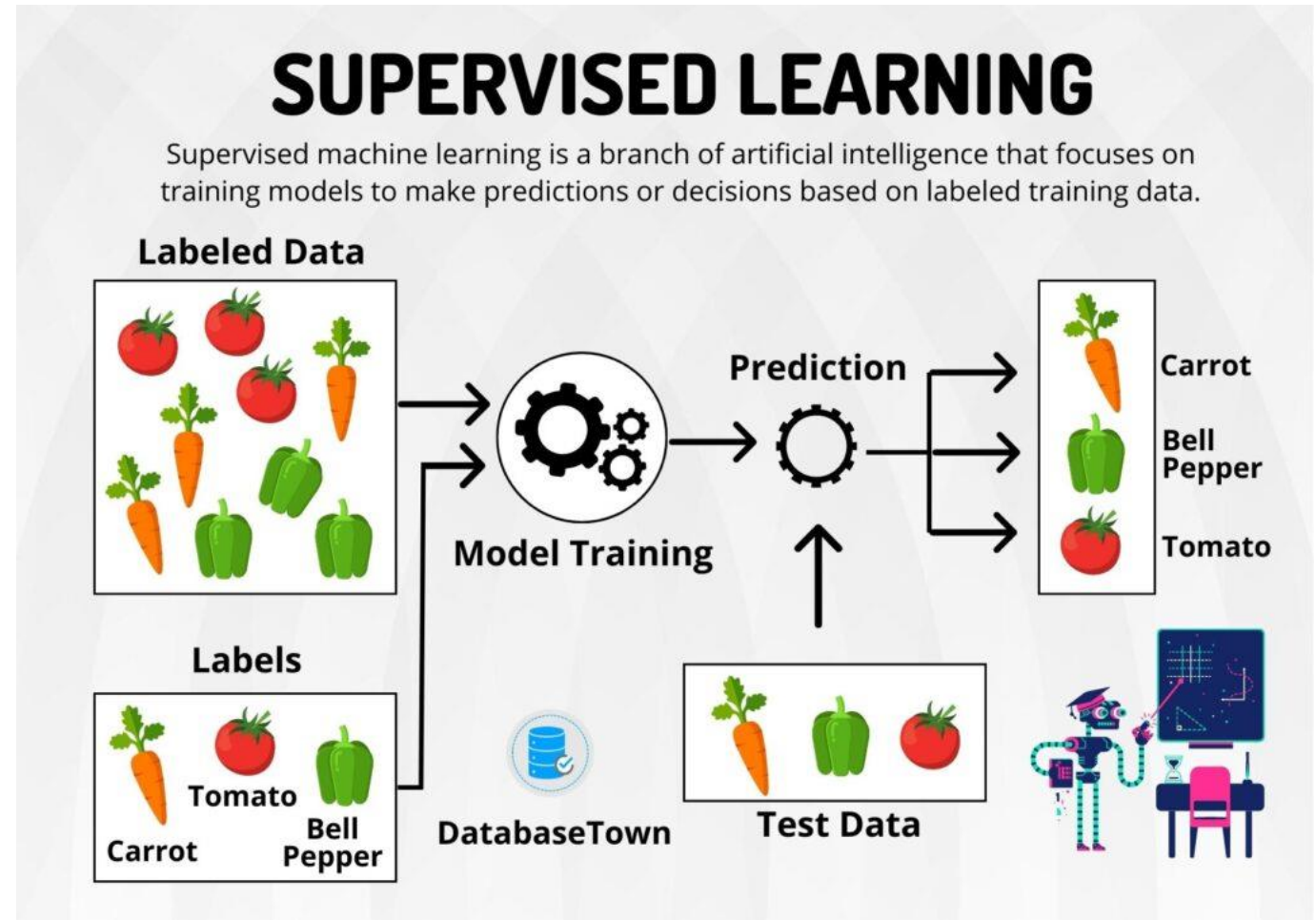
- Healthcare, finance, transportation, education.

# Overview of Learning Models

- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

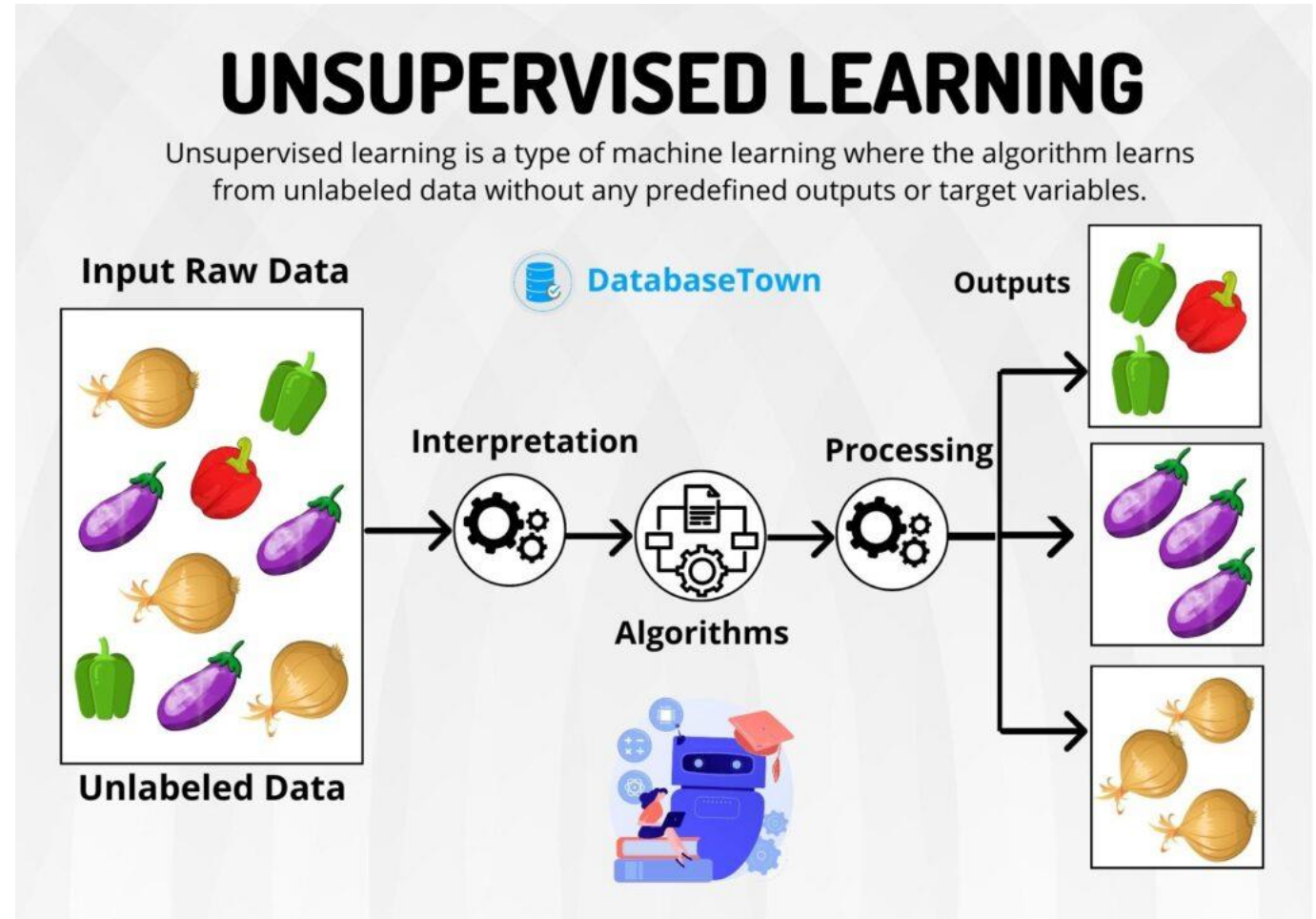
# Supervised Learning

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



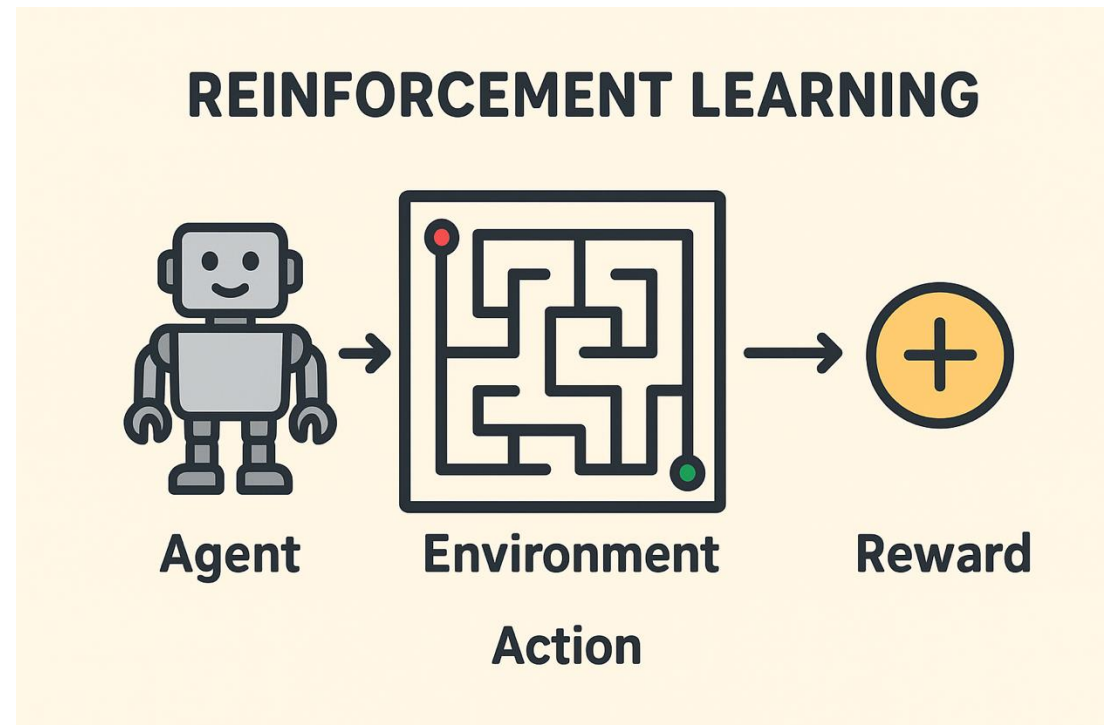
# Unsupervised Learning

- 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



# Questions!