



MACHINE LEARNING

PARADIGMS OF MACHINE LEARNING

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LEARNING FOCUS

- Reminder of Machine Learning
- The three main machine learning paradigms
- How supervised, unsupervised, and reinforcement learning differ



REMINDER: WHAT IS MACHINE LEARNING?



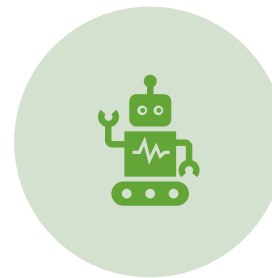
Machine learning is a subset of artificial intelligence.



It allows computer systems to learn from data rather than being explicitly programmed.

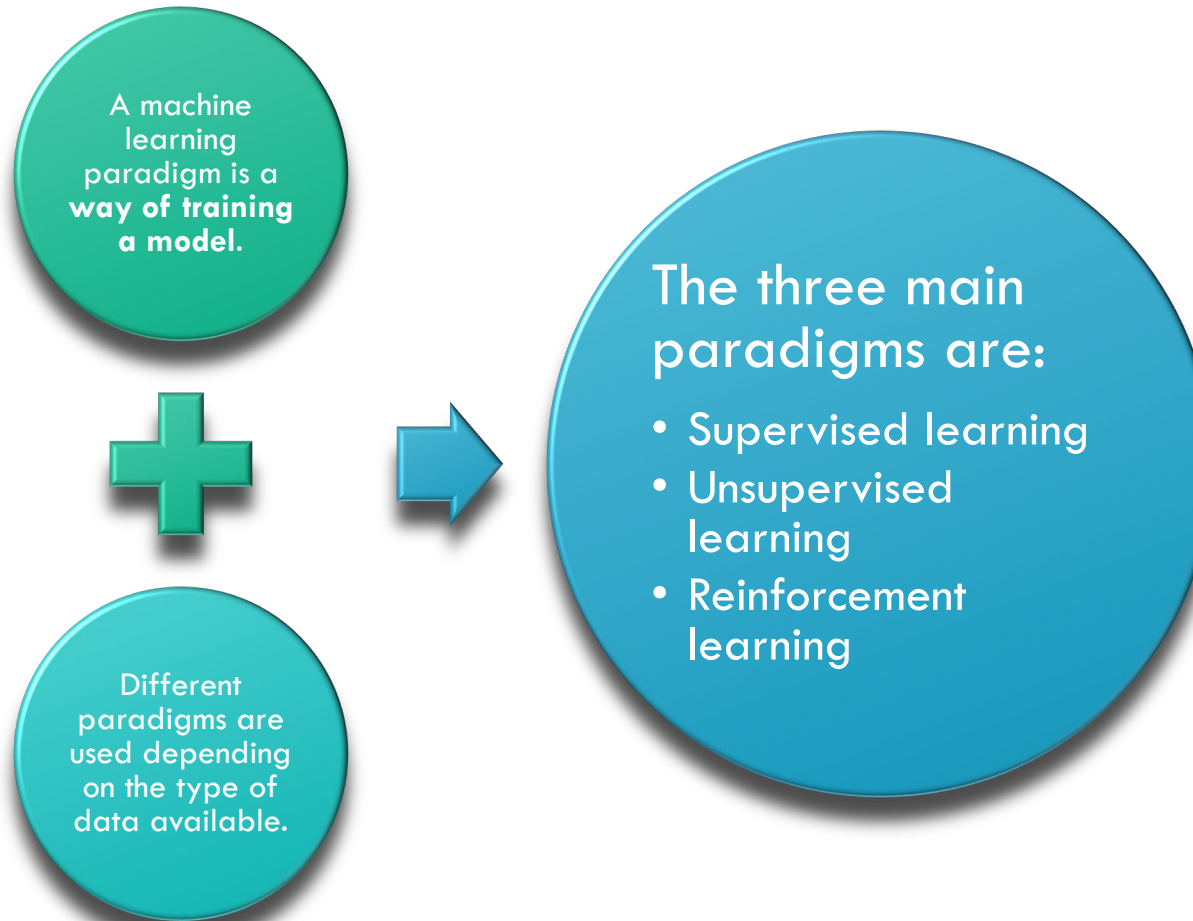


The system improves its performance by identifying patterns in data.



Machine learning is widely used in both traditional AI and generative AI systems.

WHAT ARE MACHINE LEARNING PARADIGMS?



SUPERVISED LEARNING: OVERVIEW

- Supervised learning uses **labelled data**.
- Each input comes with a correct output.
- The model learns by comparing its predictions to the correct answers.
- Errors are used to improve future predictions.

SUPERVISED LEARNING: EXAMPLES

- Email spam detection (spam or not spam)
- Image recognition (cat, dog, or bird)
- Predicting house prices from past data

Key point:

- Supervised learning is used when the correct answers are already known.



UNSUPERVISED LEARNING: OVERVIEW

- Unsupervised learning uses **unlabelled data**.
- The system is not given correct answers.
- It finds patterns, similarities, or groups on its own.
- Often used to explore data rather than make predictions.

UNSUPERVISED LEARNING: EXAMPLES

- Grouping customers by buying behaviour
- Detecting unusual activity in data
- Organising large collections of images

Key point:

- Unsupervised learning discovers hidden structures in data.



REINFORCEMENT LEARNING: OVERVIEW

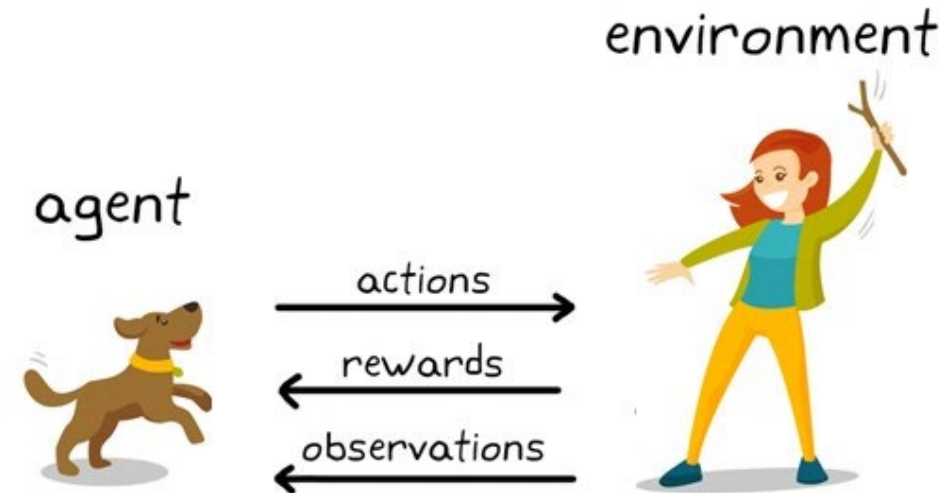
- Reinforcement learning is based on **trial and error**.
- An agent learns by interacting with an environment.
- Actions are rewarded or punished.
- The goal is to maximise rewards over time.

REINFORCEMENT LEARNING: EXAMPLES

- AI learning to play games
- Robots learning to walk
- Traffic light systems adapting to traffic flow

Key point:

- Reinforcement learning learns from feedback, not labelled data.



COMPARING THE THREE PARADIGMS

EACH PARADIGM IS SUITED TO DIFFERENT PROBLEMS / ENVIRONMENTS

○ **Supervised**

- Supervised learning uses labelled data and known answers.

○ **Unsupervised**

- Unsupervised learning uses unlabelled data to find patterns.

○ **Reinforcement**

- Reinforcement learning learns through rewards and penalties.

WHY MACHINE LEARNING PARADIGMS MATTER



Why?

- Choosing the correct paradigm affects accuracy and usefulness.
- Real-world AI systems often combine more than one paradigm.
- Understanding paradigms helps explain how AI systems learn.

SUMMARY



Machine learning allows systems to learn from data.



Supervised learning learns from labelled examples.



Unsupervised learning finds patterns without answers.



Reinforcement learning learns through rewards and penalties.