



Data
Schools

Module 2: Introduction to Machine Learning

Categories of Machine Learning

Modules for this topic

1. Overview: What is Machine learning
2. Categories of Machine Learning
3. Machine Learning Application Development Approach
4. *Building Classification Model*
5. Recommender Systems
6. *Building a Recommender Engine*

Module 2

Categories of Machine Learning

The Main Categories of Machine Learning

1

CLASSICAL ML

Simple data with
clear features

2

NEURAL NETWORKS & DEEP LEARNING

Complicated data
with unclear
features

3

REINFORCEMENT LEARNING

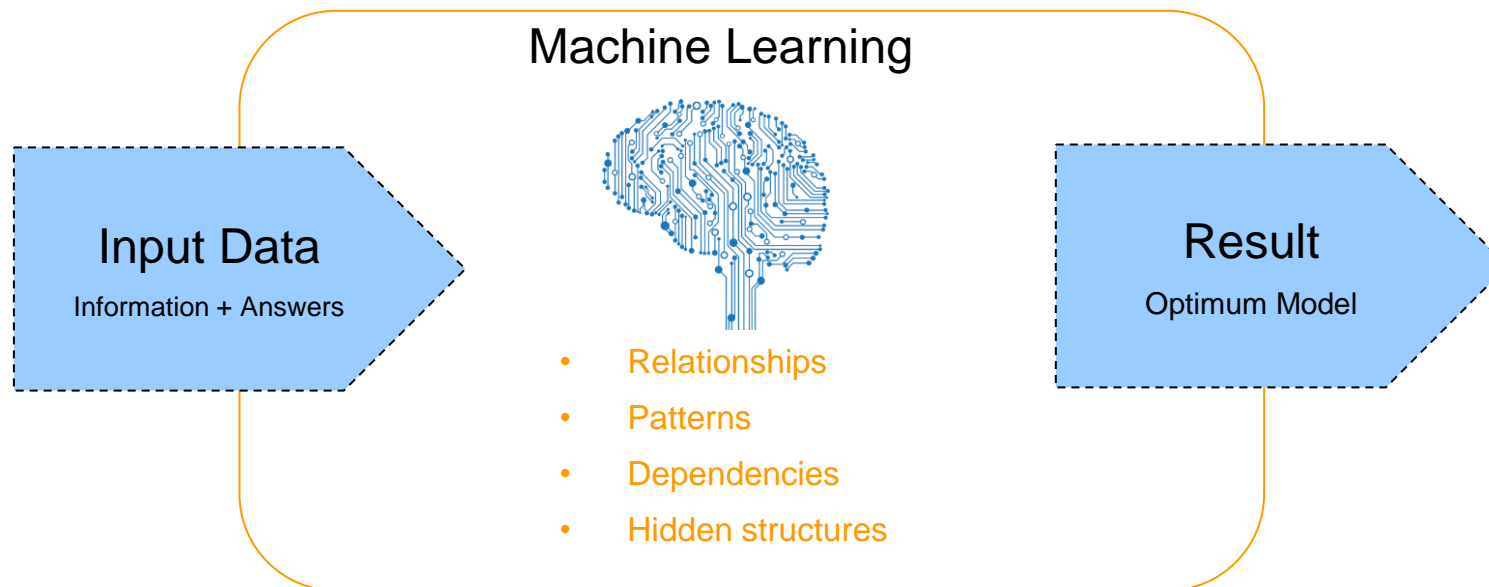
No data, but we
have an
environment to
interact with

Our focus today

Classical Machine Learning

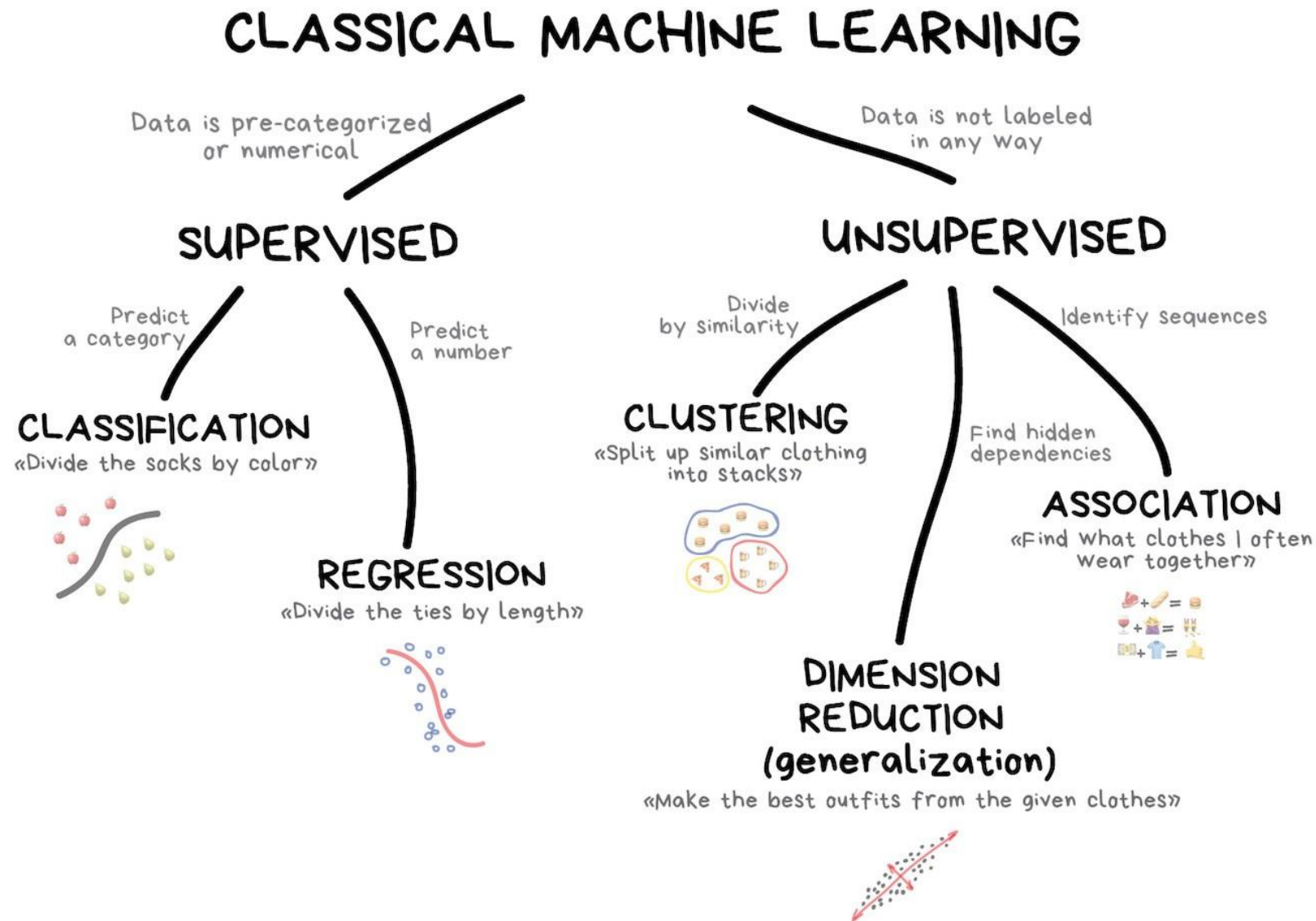
Supervised and Unsupervised Learning

1. **Supervised learning** - we already know the answers we want (found in past or completed data).



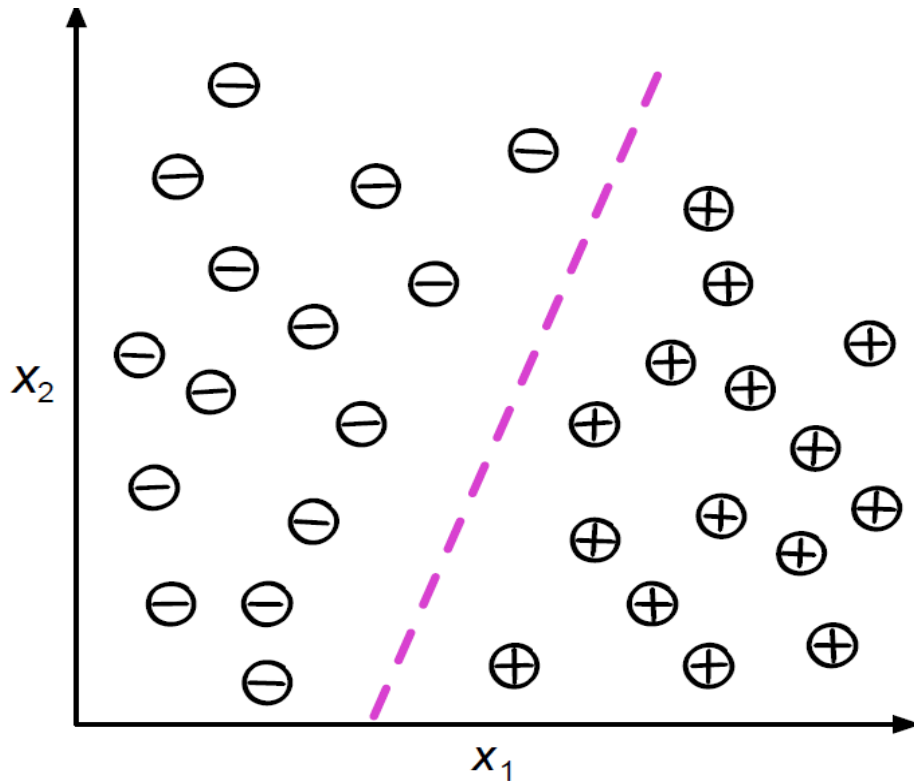
2. **Unsupervised learning** - we want to find unknown structures or trends.

Breaking It Down



Supervised Learning: Classification

Splits objects based at one of the attributes known beforehand.

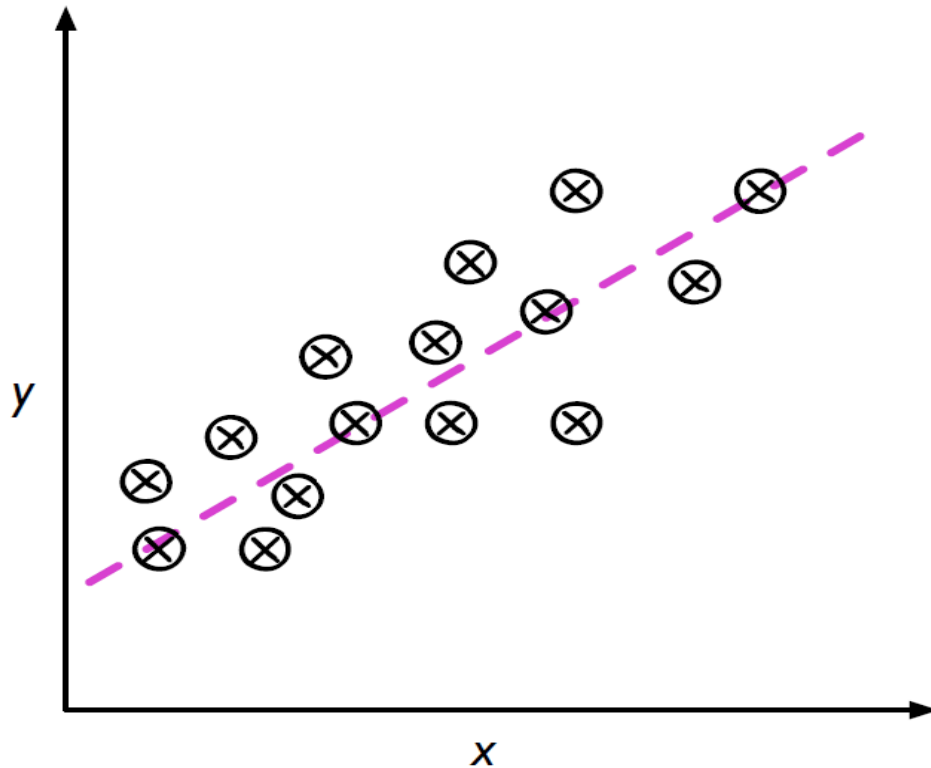


Today used for:

- Spam filtering
- Language detection
- A search of similar documents
- Sentiment analysis
- Recognition of handwritten characters and numbers
- Fraud detection

Supervised Learning: Regression

Regression is basically classification where we forecast a number instead of category. (Linear and Polynomial)

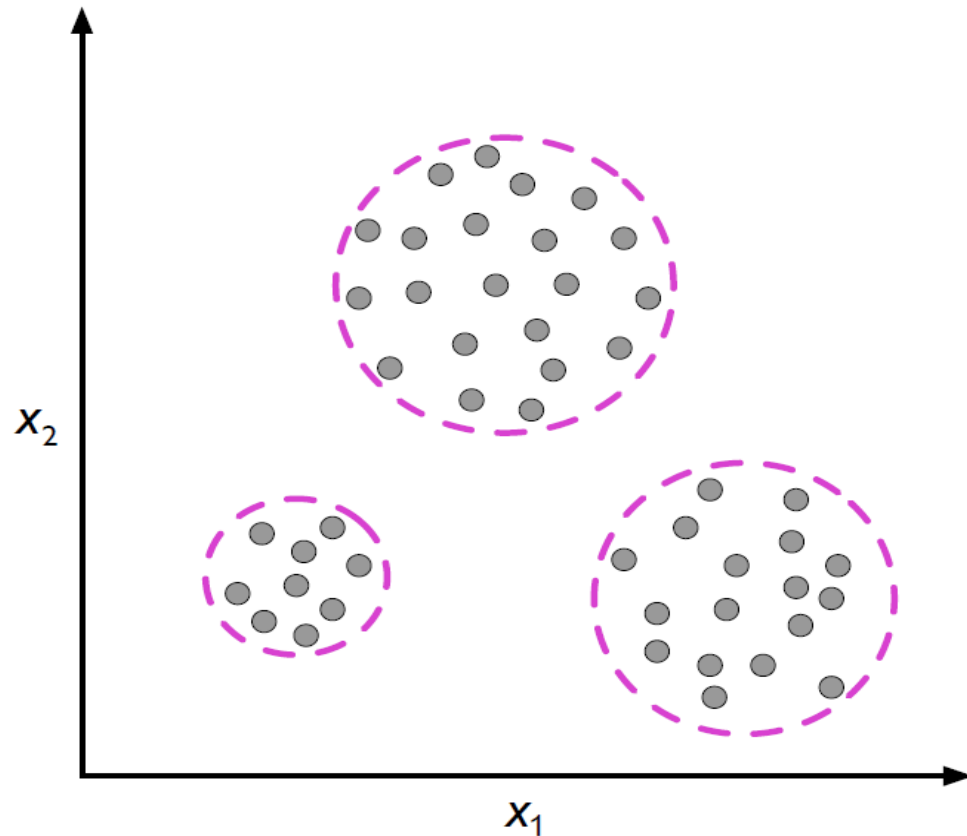


Today used for:

- Stock price forecasts
- Demand and sales volume analysis
- Medical diagnosis
- Any number-time correlations

Unsupervised Learning: Clustering

Divides objects based on unknown features. Machine chooses the best way.

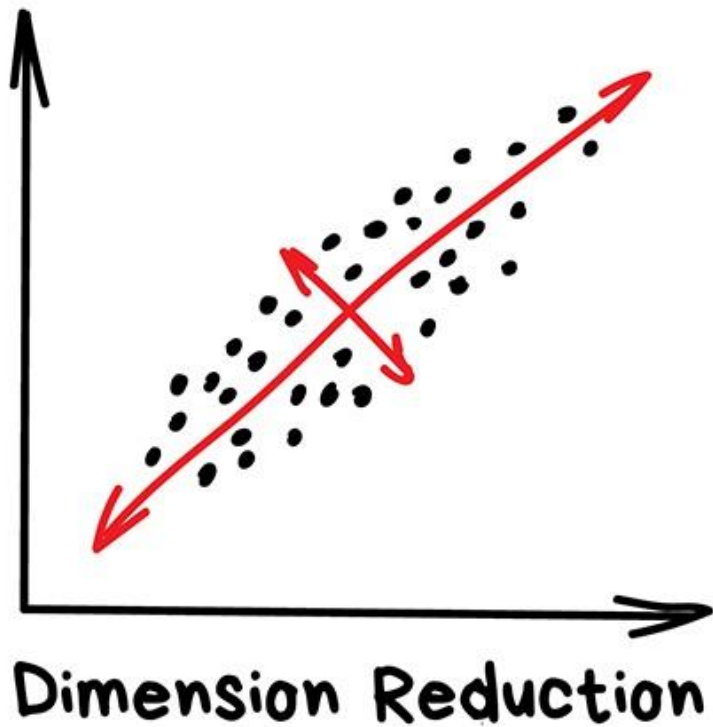


Today used for:

- For market segmentation (types of customers, loyalty)
- To merge close points on a map
- For image compression
- To analyze and label new data
- To detect abnormal behavior

Unsupervised Learning: Dimensionality Reduction

Divides objects based on unknown features. Machine chooses the best way.

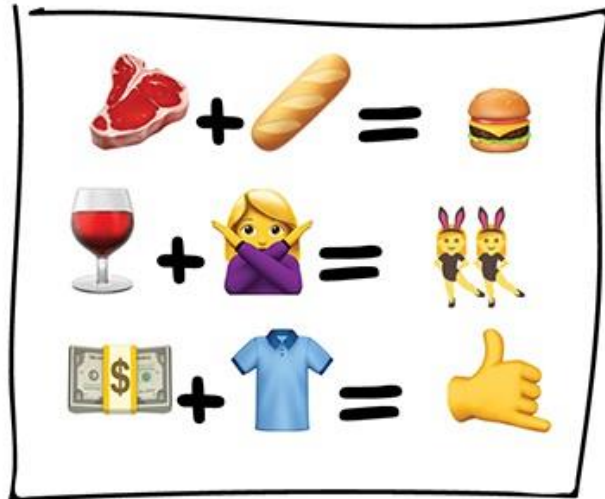


Today used for:

- Recommender systems (★)
- Beautiful visualizations
- Topic modeling and similar document search
- Fake image analysis
- Risk management

Unsupervised Learning: Association Rule Learning

Look for patterns in the orders' stream.



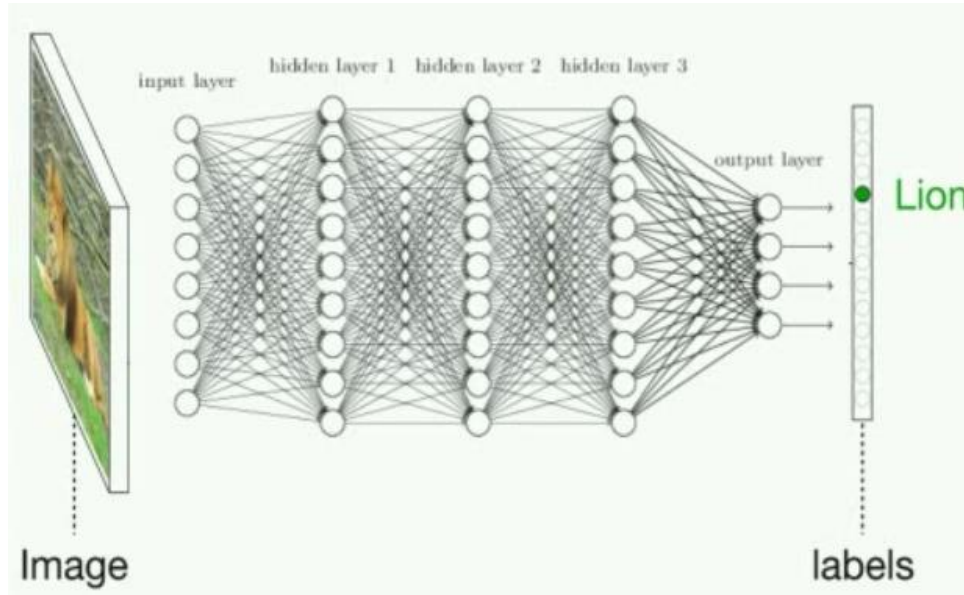
Association Rule Learning

Today used for:

- To forecast sales and discounts
- To analyze goods bought together
- To place the products on the shelves
- To analyze web surfing patterns

Neural Networks and Deep Learning

Mimic the way the brain works – collection of neurons and connections



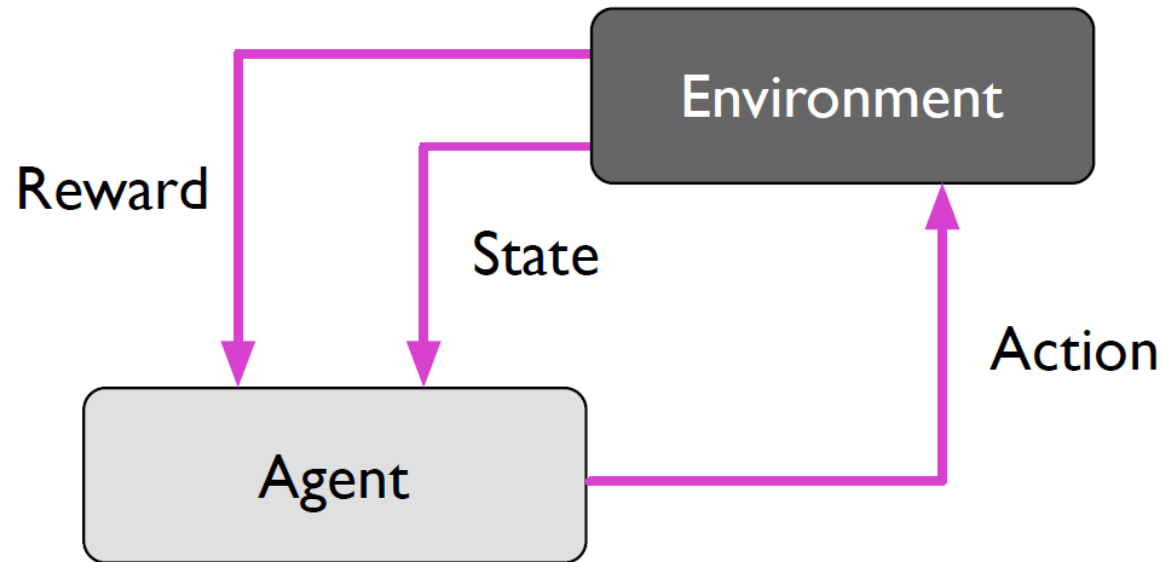
Neural Networks

Today used for:

- Replacement of all algorithms above
- Object identification on photos and videos
- Speech recognition and synthesis
- Image processing, style transfer
- Machine translation

Reinforcement Learning:

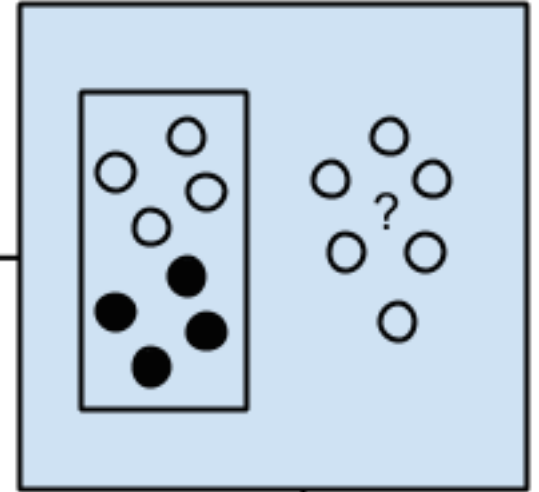
Throw a robot into a maze and let it find an exit.



Today used for:

- Self-driving cars
- Robot vacuums
- Games
- Automating trading
- Enterprise resource management

Supervised Learning – Simple Example



Math Quiz #1 - Teacher's Answer Key

$$1) \quad 2 \quad 4 \quad 5 \quad = \quad 3$$

$$2) \quad 5 \quad 2 \quad 8 \quad = \quad 2$$

$$3) \quad 2 \quad 2 \quad 1 \quad = \quad 3$$

$$4) \quad 4 \quad 2 \quad 2 \quad = \quad 6$$

$$5) \quad 6 \quad 2 \quad 2 \quad = \quad 10$$

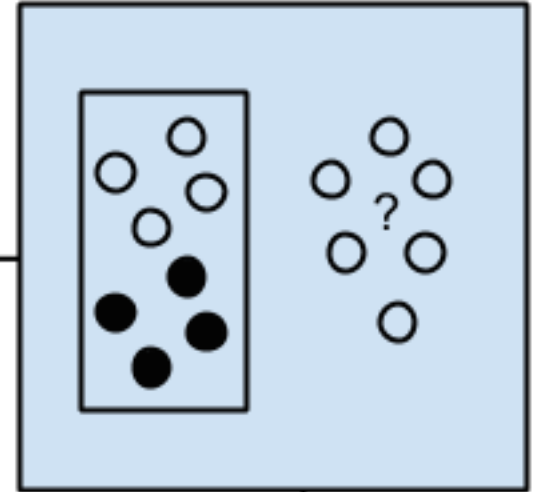
$$6) \quad 3 \quad 1 \quad 1 \quad = \quad 2$$

$$7) \quad 5 \quad 3 \quad 4 \quad = \quad 11$$

$$8) \quad 1 \quad 8 \quad 1 \quad = \quad 7$$

Supervised Learning
Algorithms

Supervised Learning – Simple Example



Math Quiz #1 - Teacher's Answer Key

$$1) \quad 2 \quad 4 \quad 5 \quad = \quad 3$$

$$2) \quad 5 \overset{\text{X}}{-} 2 \quad - \quad 8 \quad = \quad 2$$

$$3) \quad 2 \overset{\text{X}}{-} 2 \quad - \quad 1 \quad = \quad 3$$

$$4) \quad 4 \overset{\text{X}}{-} 2 \quad - \quad 2 \quad = \quad 6$$
$$\quad \quad \text{X} \quad -$$

$$5) \quad 6 \quad 2 \quad 2 \quad = \quad 10$$

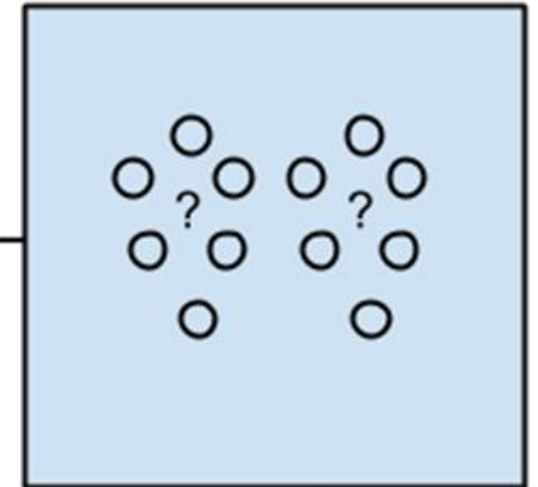
$$6) \quad 3 \overset{\text{X}}{-} 1 \quad - \quad 1 \quad = \quad 2$$

$$7) \quad 5 \overset{\text{X}}{-} 3 \quad - \quad 4 \quad = \quad 11$$

$$8) \quad 1 \overset{\text{X}}{-} 8 \quad - \quad 1 \quad = \quad 7$$
$$\quad \quad \text{X} \quad -$$

Supervised Learning
Algorithms

Unsupervised Learning – Simple Example



Unsupervised Learning
Algorithms

Math Quiz #1 - Teacher's Answer Key

1) 2 4 5 =

2) 5 2 8 =

3) 2 2 1 =

4) 4 2 2 =

5) 6 2 2 =

6) 3 1 1 =

7) 5 3 4 =

8) 1 8 1 =

Supervised & Unsupervised Learning

Supervised Learning:

Predicting values. **Known** targets.

User inputs correct answers to learn from. Machine uses the information to guess new answers.

CLASSIFICATION:

Identify a unique class
(Discrete values, Boolean, Categories)

REGRESSION:

Estimate continuous values
(Real-valued output)

Unsupervised Learning:

Search for structure in data. **Unknown** targets.

User inputs data with undefined answers. Machine finds useful information hidden in data

CLUSTER ANALYSIS:

Group into sets

DIMENSION REDUCTION:

Find hidden dependencies

ASSOCIATION:

Identify Sequences

Supervised & Unsupervised Learning

Supervised Learning:

Classification

- Decision Trees
- K-Nearest Neighbors
- Support Vector Machine
- Logistic Regression
- Naïve Bayes
- Random Forests

Regression

- Linear Regression
- Polynomial Regression

Unsupervised Learning:

Cluster Analysis

- K-Means Clustering
- Hierarchical Clustering

Dimension Reduction

- Principal Component Analysis (PCA)
- Linear Discriminant Analysis (LDA)

Association Rule

- Apriori
- Euclat
- FP-growth

Summary

- We now have a good understanding of the categories of machine learning
- We can differentiate between supervised, unsupervised and reinforcement learning
- We are now ready to do a simple exercise of supervised learning.