

An Overview of Machine Learning & Data Mining

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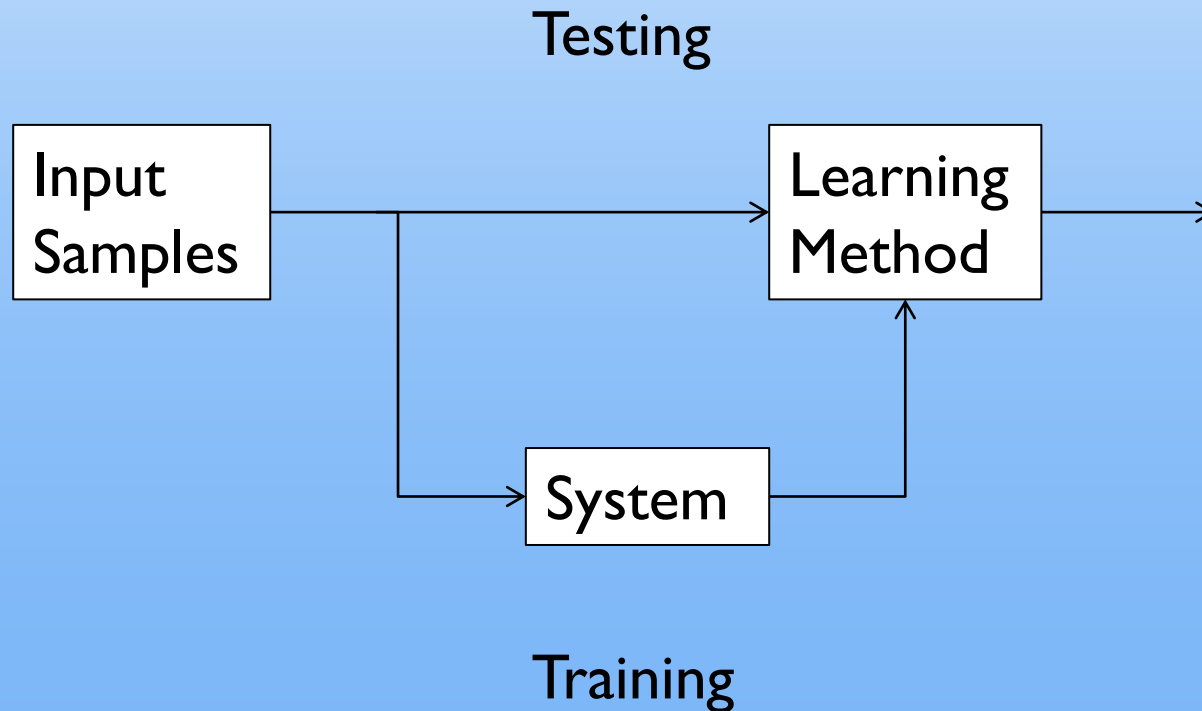
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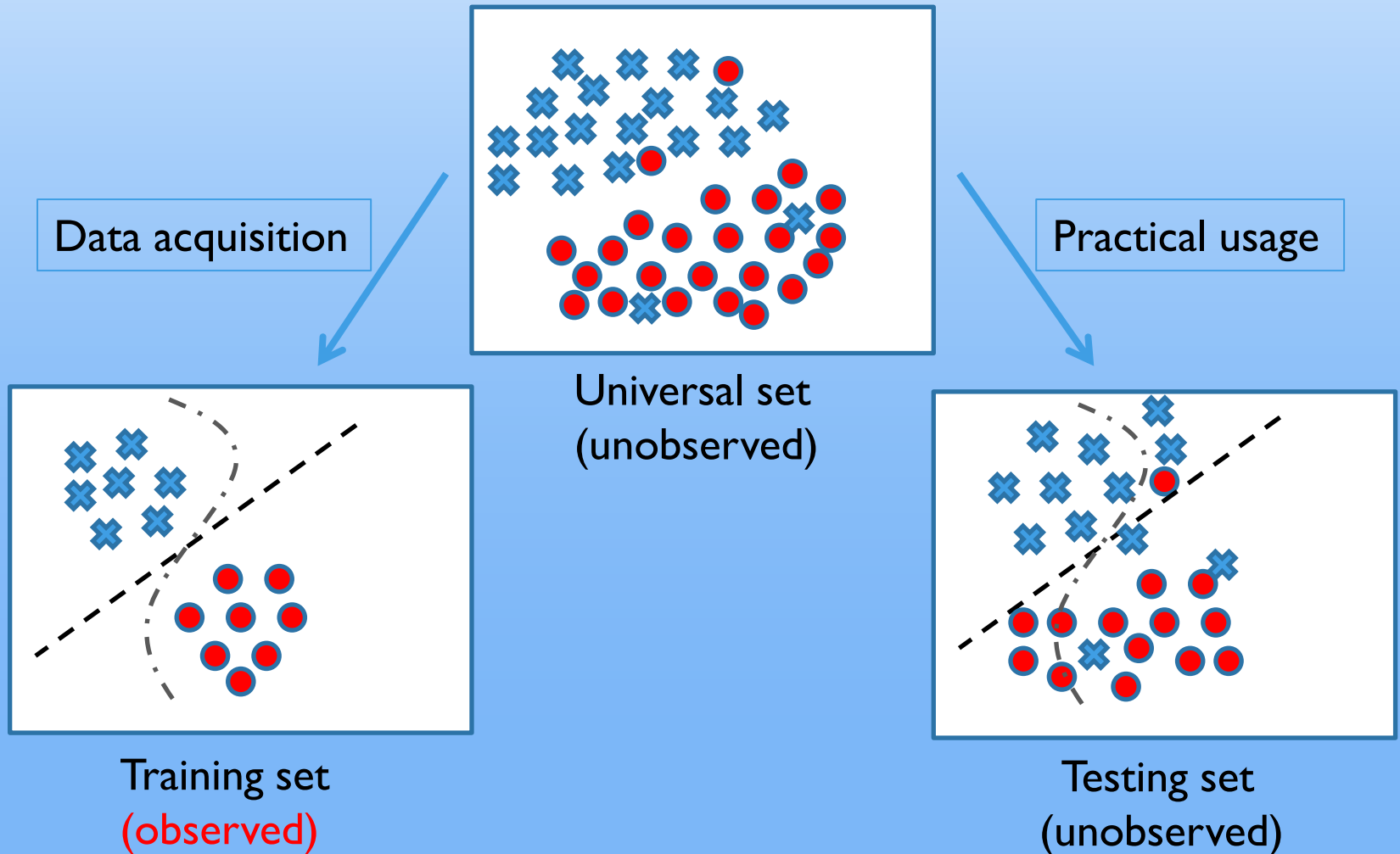
What is machine learning?

- A branch of **artificial intelligence**, concerned with the design and development of algorithms that allow computers to evolve behaviors based on empirical data.
- As intelligence requires knowledge, it is necessary for the computers to acquire knowledge.

Learning system model

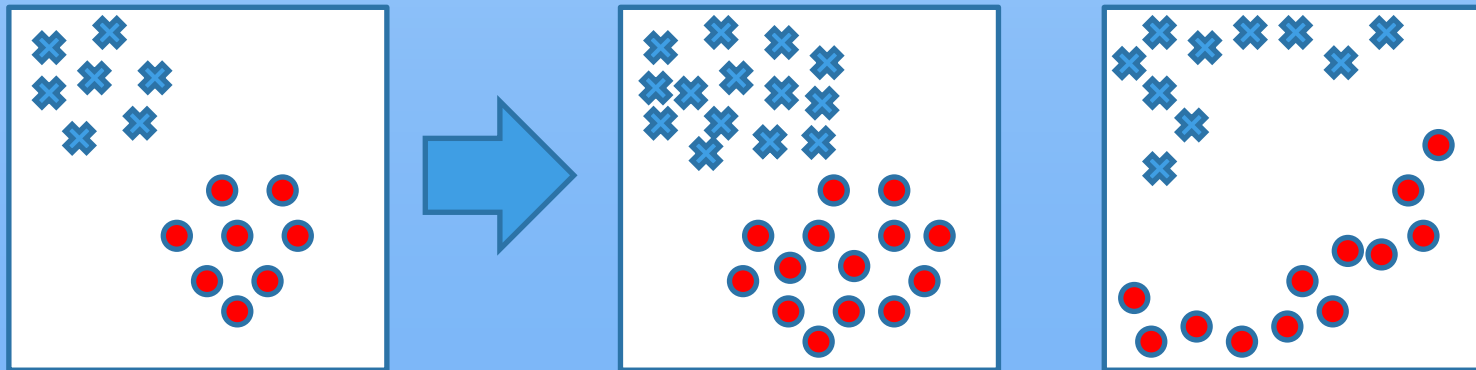


Training and testing



Training and testing

- Training is the process of making the system able to learn.
- No free lunch rule:
 - Training set and testing set come from the same distribution
 - Need to make some assumptions or bias



Performance

- There are several factors affecting the performance:
 - **Types of training** provided
 - The form and extent of any initial **background knowledge**
 - The **type of feedback** provided
 - The **learning algorithms** used
- Two important factors:
 - Modeling
 - Optimization

Algorithms

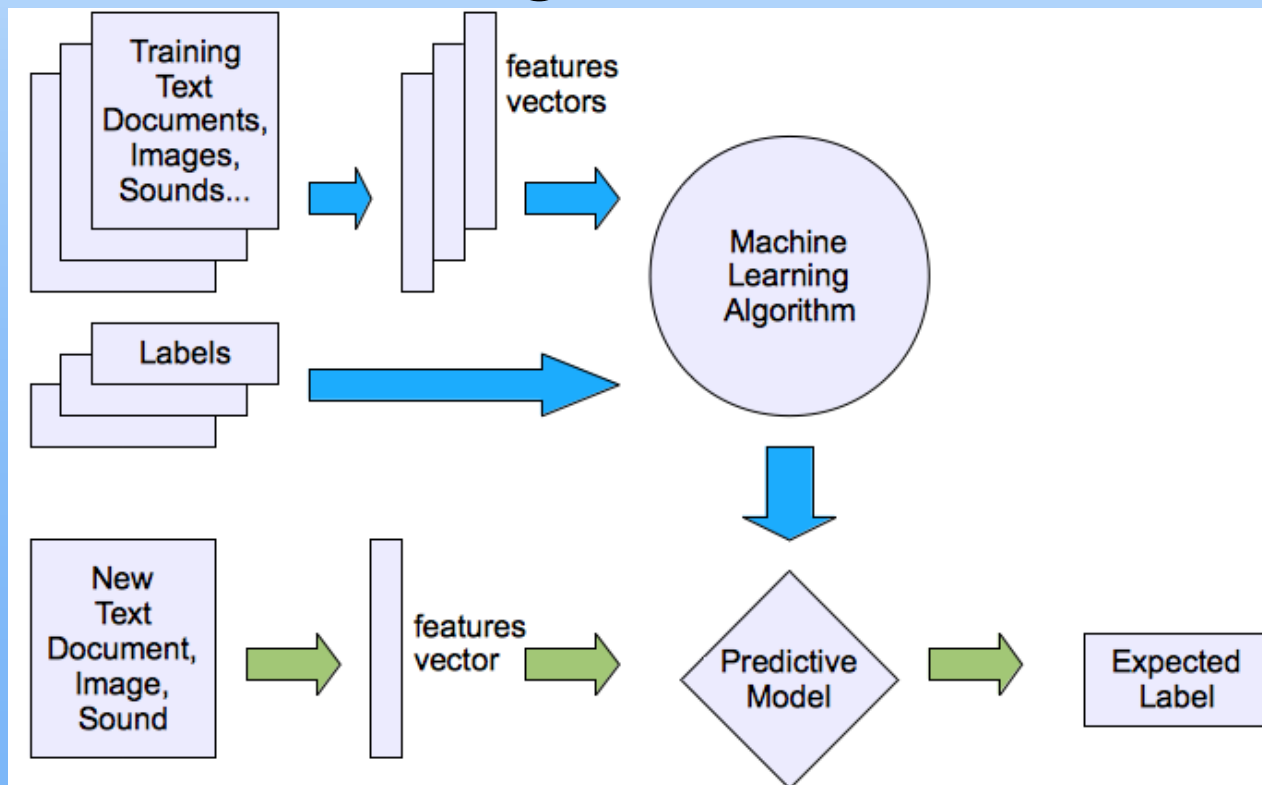
- The success of machine learning system also depends on the algorithms.
- The algorithms control the search to find and build the knowledge structures.
- The learning algorithms should extract useful information from training examples.

Algorithms

- **Supervised learning** ($\{x_n \in R^d, y_n \in R\}_{n=1}^N$)
 - Prediction
 - Classification (discrete labels), Regression (real values)
- **Unsupervised learning** ($\{x_n \in R^d\}_{n=1}^N$)
 - Clustering
 - Probability distribution estimation
 - Finding association (in features)
 - Dimension reduction
- **Semi-supervised learning**
- **Reinforcement learning**
 - Decision making (robot, chess machine)

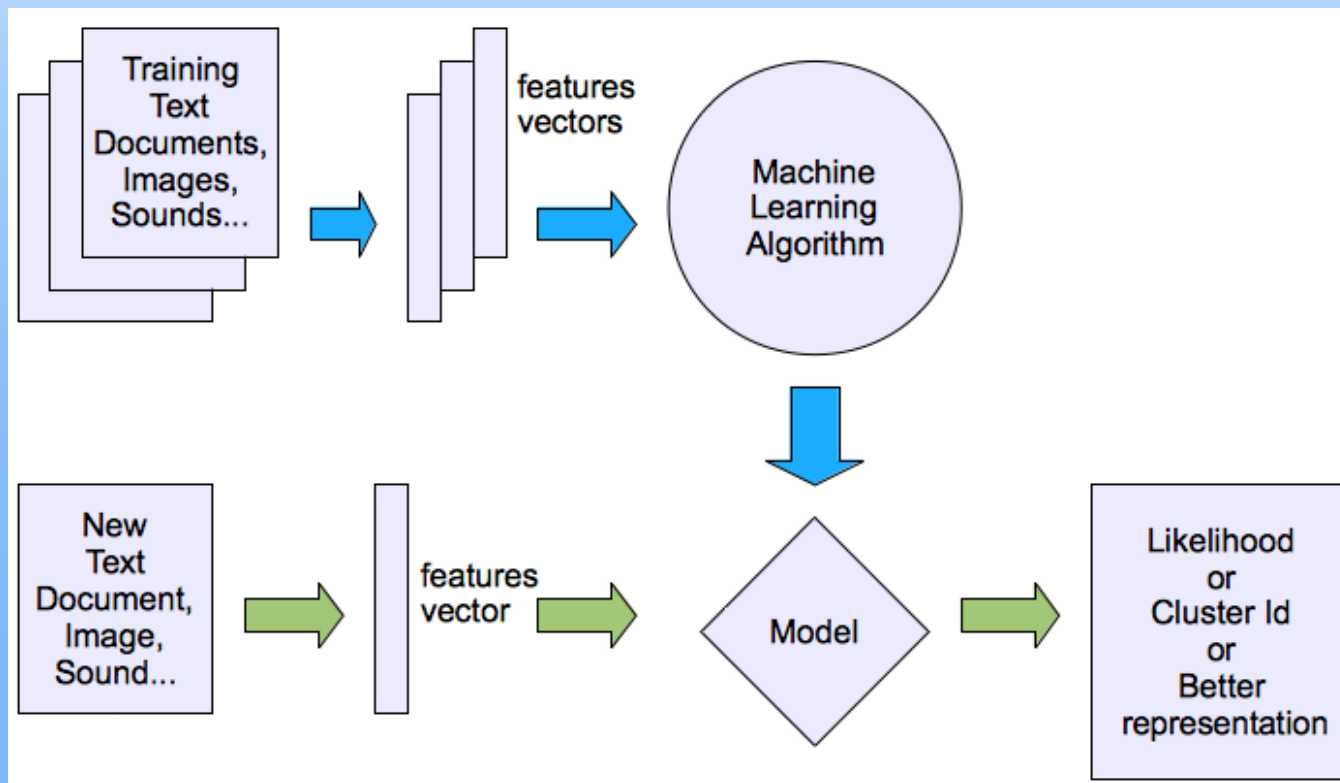
Machine learning structure

■ Supervised learning



Machine learning structure

■ Unsupervised learning



Applications

- ▣ Face detection
- ▣ Object detection and recognition
- ▣ Image segmentation
- ▣ Multimedia event detection
- ▣ Economical and commercial usage

Supportive Documents

Python:

<https://www.w3schools.com/python/>

Numpy:

https://www.youtube.com/watch?v=mOZ0UCeuRX4&ab_channel=APMonitor.com

Vector:

https://www.youtube.com/watch?v=ml4NSzCQobk&ab_channel=TED-Ed

Matrices:

https://www.youtube.com/watch?v=bDoqKswdp6c&ab_channel=MyWhyU

Linear Algebra:

https://www.youtube.com/watch?v=celUu5aY6_Q&ab_channel=MATLABProgrammingforNumericalComputation

Calculus:

https://www.youtube.com/watch?v=WsQQvHm4ISw&ab_channel=TheOrganicChemistryTutor

Statistics:

https://www.youtube.com/watch?v=kyjlxslWlls&ab_channel=zedstatistics

Course Structure

- ▣ Learn Algorithm
- ▣ Learn Preprocessing
- ▣ Learn Paper Writing
- ▣ Given Work

Next Class Work

- Euclidean Distance

https://www.youtube.com/watch?v=iXBR2AdESnA&ab_channel=DataCamp