

1. Introduction

What is Machine Learning?

Input



Output

Cat	1
Dog	0
Bird	0
Horse	0

Cat	0
Dog	1
Bird	0
Horse	0

Cat	0
Dog	0
Bird	0
Horse	1

A Rule Based Approach

Concept

Input



Rules are pre-specified

Classification
Rule

Output

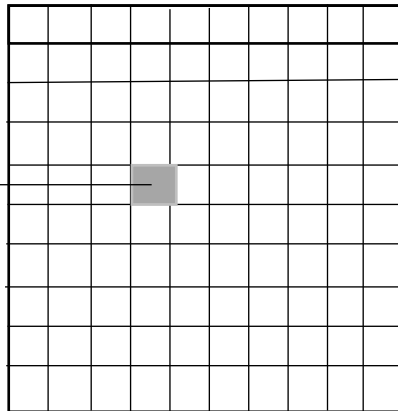
Cat	1
Dog	0
Bird	0
Horse	0



```

input data
if condition 1 satisfied
    ...
    if condition n satisfied
        output cat
    else
        output dog
    end

```

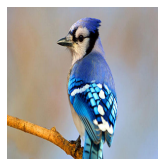
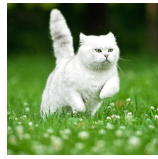
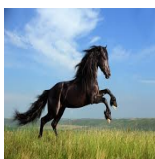


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The Learning Based Approach

Concept

Example 1 Example 2 Example 3 Example 4



Cat	0	Cat	0	Cat	1	Cat	0
Dog	1	Dog	0	Dog	0	Dog	0
Bird	0	Bird	0	Bird	0	Bird	1
Horse	0	Horse	1	Horse	0	Horse	0



Learning
Algorithm



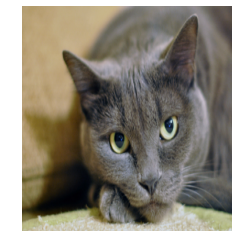
Classification
Rule Set



Classification
Rule



Cat	1
Dog	0
Bird	0
Horse	0



New Input

New Output

What is machine learning?



*Field of study that gives computers
the ability to learn without being
explicitly programmed.*

Arthur Samuel (1959)

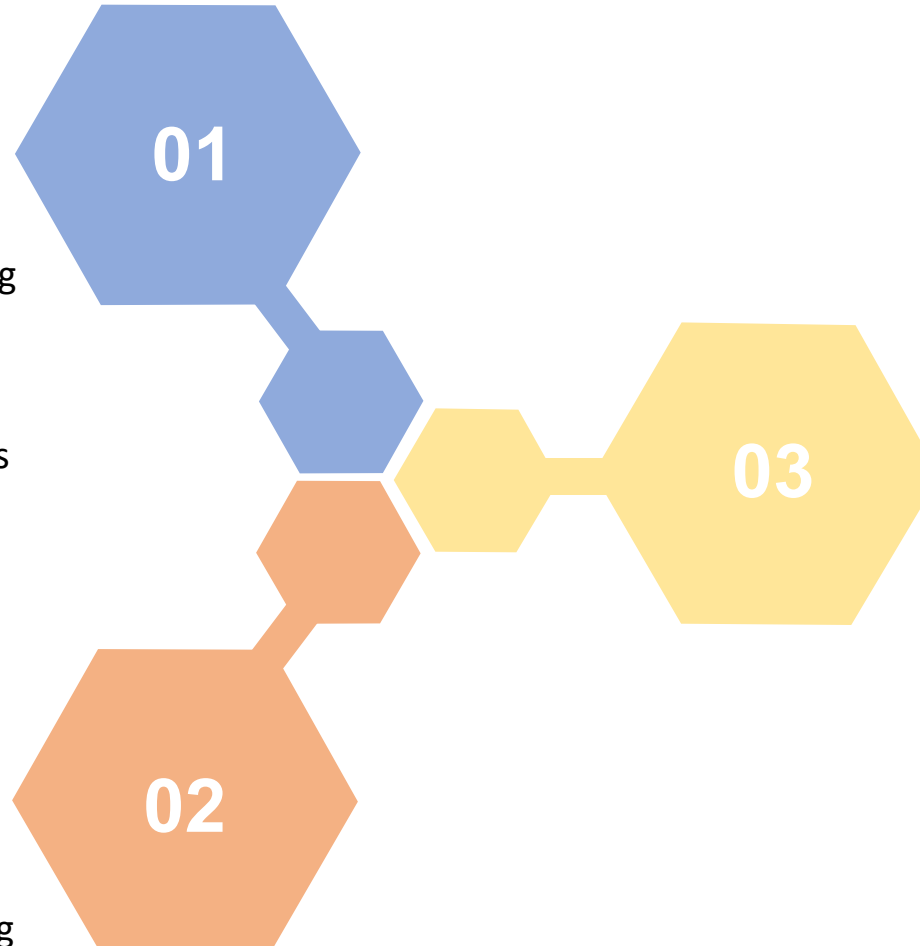
*Rules learnt automatically
based on data/experience*

Machine Learning Paradigms



Supervised Learning

Machine learning task of inferring a function describing the relationship between independent and dependent variables in a dataset. It relies on labelled examples

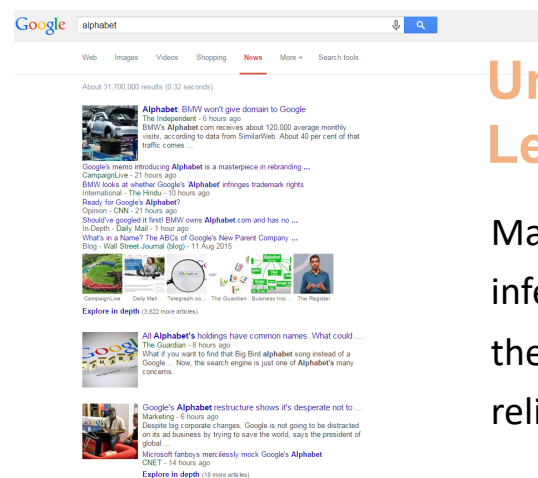


Unsupervised Learning

Machine learning task of inferring a function describing the structure of a dataset. It relies on unlabelled data.

Reinforcement Learning

It is concerned with how software agents ought to take actions in an environment so as to maximize some cumulative reward.



Supervised Learning

Example 1 Example 2 Example 3 Example 4 Example 5 Example 6



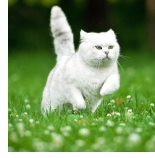
Cat **1**
Dog 0
Bird 0
Horse 0



Cat 0
Dog **1**
Bird 0
Horse 0



Cat 0
Dog 0
Bird 0
Horse **1**



Cat **1**
Dog 0
Bird 0
Horse 0



Cat 0
Dog 0
Bird **1**
Horse 0



Cat 0
Dog 0
Bird **1**
Horse 0



Learning
Algorithm



Prediction
Rule

Input



Output



Concept

The task of inferring a function describing the relationship between independent and dependent variables in a dataset (based on labelled examples)

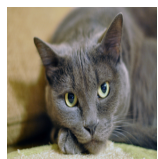
Applications

Supervised learning can be used to solve various tasks:

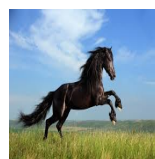
- Classification tasks
- Regression tasks
- Forecasting tasks
- Recommender systems
- Anomaly detection tasks

Variant: Semi-Supervised Learning

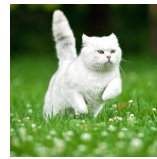
Example 1 Example 2 Example 3 Example 4 Example 5 Example 6



Cat 1
Dog 0
Bird 0
Horse 0



Cat 0
Dog 0
Bird 0
Horse 1



Cat 0
Dog 0
Bird 1
Horse 0



Learning
Algorithm



Input



Prediction
Rule

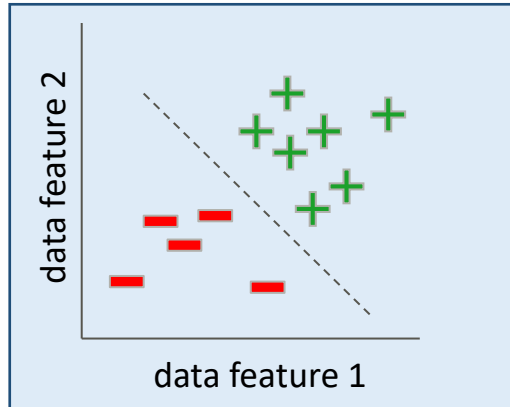


Output

Examples: Supervised Learning

Classification

Predict the class of an item given various examples



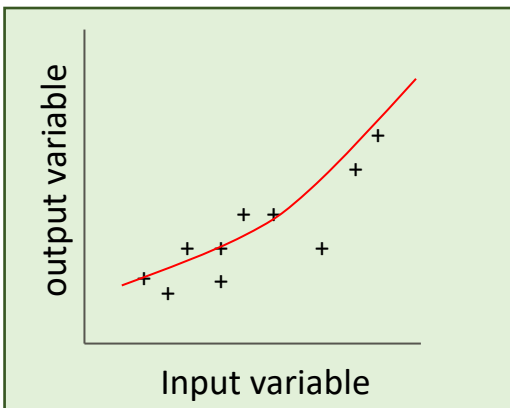
Example:

Classification of tumors as benign or malign based on:

- appearance (feature 1)
- tumor size (feature 2)

Regression

Predict the value of a variable given other variables.

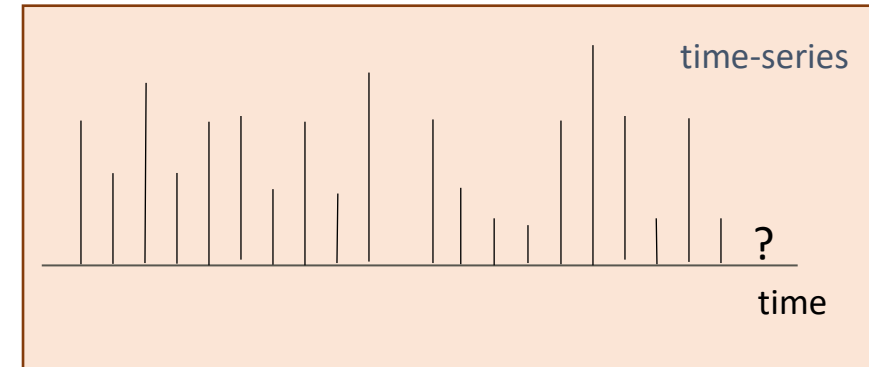


Example:

Prediction of a car's price (output variable) based on the car's mileage (input variable)

Forecasting

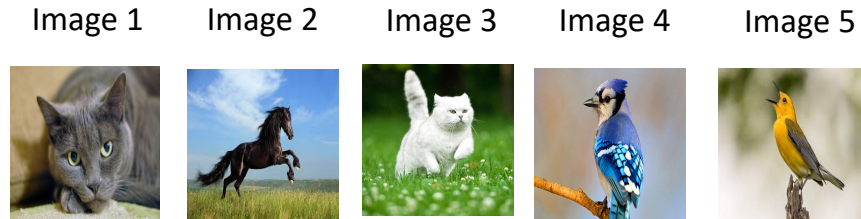
Predict future values given past ones



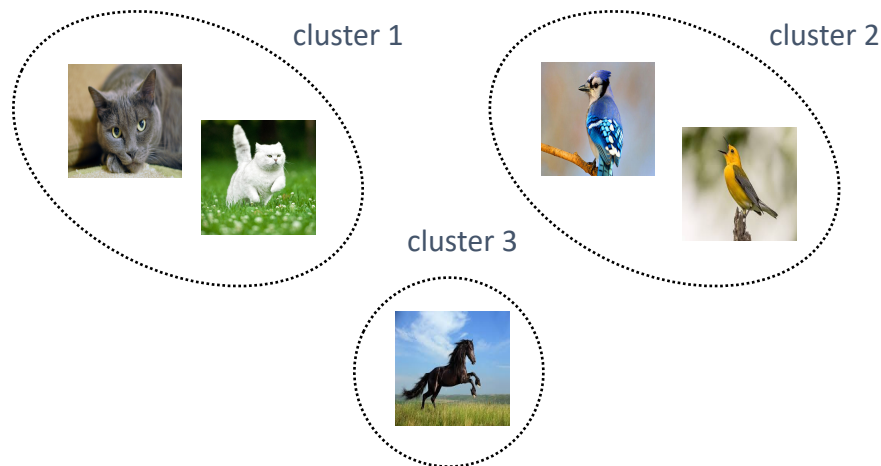
Example:

Prediction of tomorrow's stock value based on the previous stock values.

Unsupervised Learning



Learning
Algorithm



Concept

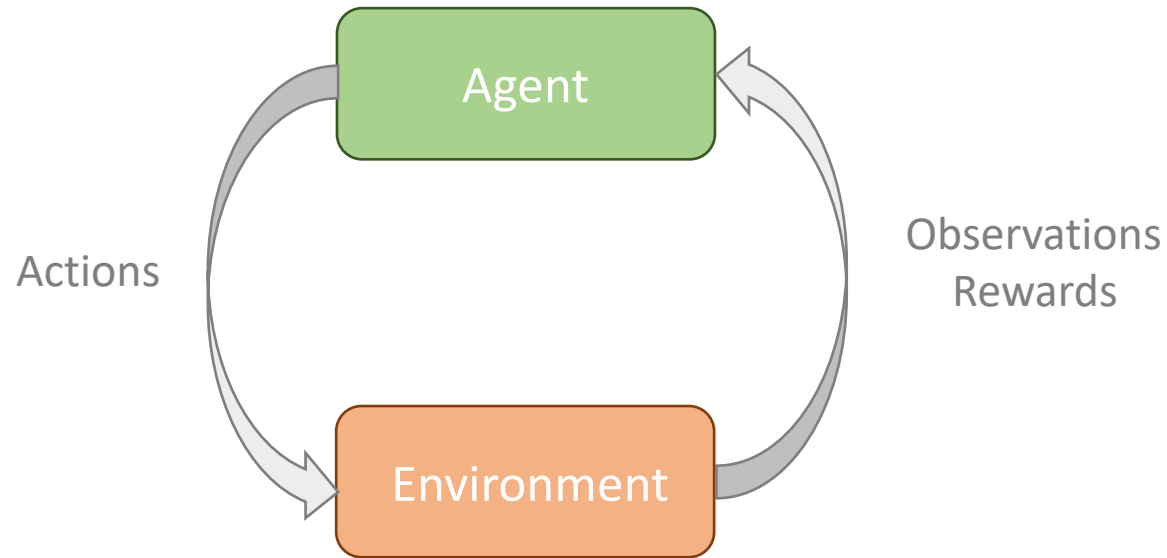
The task of inferring a function describing the structure of a dataset (based on unlabelled data).

Examples

Examples of unsupervised learning tasks include:

- Clustering tasks
- Dimensionality reduction tasks
- Recommender systems
- Anomaly detection tasks

Reinforcement Learning



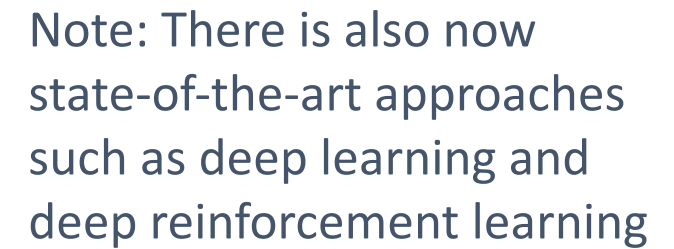
Concept

Reinforcement learning represents an agent's attempt to approximate the environment's function, in order to determine the agent's actions on the black-box environment that maximize the agent's rewards



Applications

Robotics, industrial automation, education and training, health and medicine, media and advertising, finance






Machine Learning: Real-World Examples

Google  







Web Images Videos Shopping **News** More ▾ Search tools

About 31,700,000 results (0.32 seconds)




Alphabet: BMW won't give domain to Google
The Independent - 6 hours ago
BMW's **Alphabet.com** receives about 120,000 average monthly visits, according to data from SimilarWeb. About 40 per cent of that traffic comes ...

Google's memo introducing **Alphabet** is a masterpiece in rebranding ...
CampaignLive - 21 hours ago
BMW looks at whether Google's '**Alphabet**' infringes trademark rights
International - The Hindu - 10 hours ago
Ready for Google's **Alphabet**?
Opinion - CNN - 21 hours ago
Should've googled it first! BMW owns **Alphabet.com** and has no ...
In-Depth - Daily Mail - 1 hour ago
What's in a Name? The ABCs of Google's New Parent Company ...
Blog - Wall Street Journal (blog) - 11 Aug 2015



CampaignLive Daily Mail Telegraph.co... The Guardian Business Insi... The Register

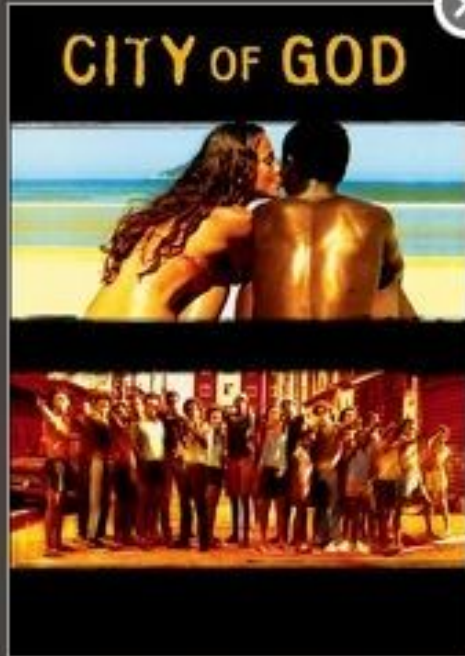
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All Alphabet's holdings have common names. What could ...
The Guardian - 8 hours ago
What if you want to find that Big Bird **alphabet** song instead of a Google ... Now, the search engine is just one of **Alphabet's** many concerns.

Related news are automatically clustered

Rate what you've seen to discover suggestions for you



Haven't Seen It



Haven't Seen It



Haven't Seen It

The Machine Learning Process

