An Introduction to

ARTIFICIAL INTELLIGENCE

Artificial Intelligence

Artificial intelligence (AI) is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans and other animals. Colloquially, the term AI is applied when a machine mimics cognitive function that humans associate with other human minds, such as learning and problem solving.

By :Wikipedia

Artificial Intelligence

➢ Intelligence : the ability to acquire and apply knowledge

➢ Is created to stimulates human intelligence processes by machine, especially computer systems.

➢ These processes include learning, decision-making and self-correction. Particular application of AI include expert system, speech recognition and machine vision

Cross Term

Big Data is the capability to manage a huge volume of disparate data, at the right speed, and within the right time frame to allow real-time analysis and reaction. Big data has three shared characteristics: large volumes, high velocity and wide variety of data

Data Mining is the process of discovering interesting patterns and knowledge from large amounts of data. The data sources can include databases, data warehouses, Website, other information repositories, or data that are streamed into the system dynamically.

Cross Term

Data science encompasses a set of principles, problem definitions, algorithms, and processes for extracting nonobvious and useful patterns from large data sets. Many of the elements of data science have been developed in related fields such as machine learning and data mining. In fact, the terms *data science*, *machine learning*, and *data mining* are often used interchangeably.

Data Engineer

Data Engineers are the data professionals who prepare data to be analyzed by Data Scientists. They are software engineers who design, build, integrate data from various resources, and manage data. Then, they write complex queries on that, make sure it is easily accessible, works smoothly, and their goal is optimizing the performance of their company's big data ecosystem.
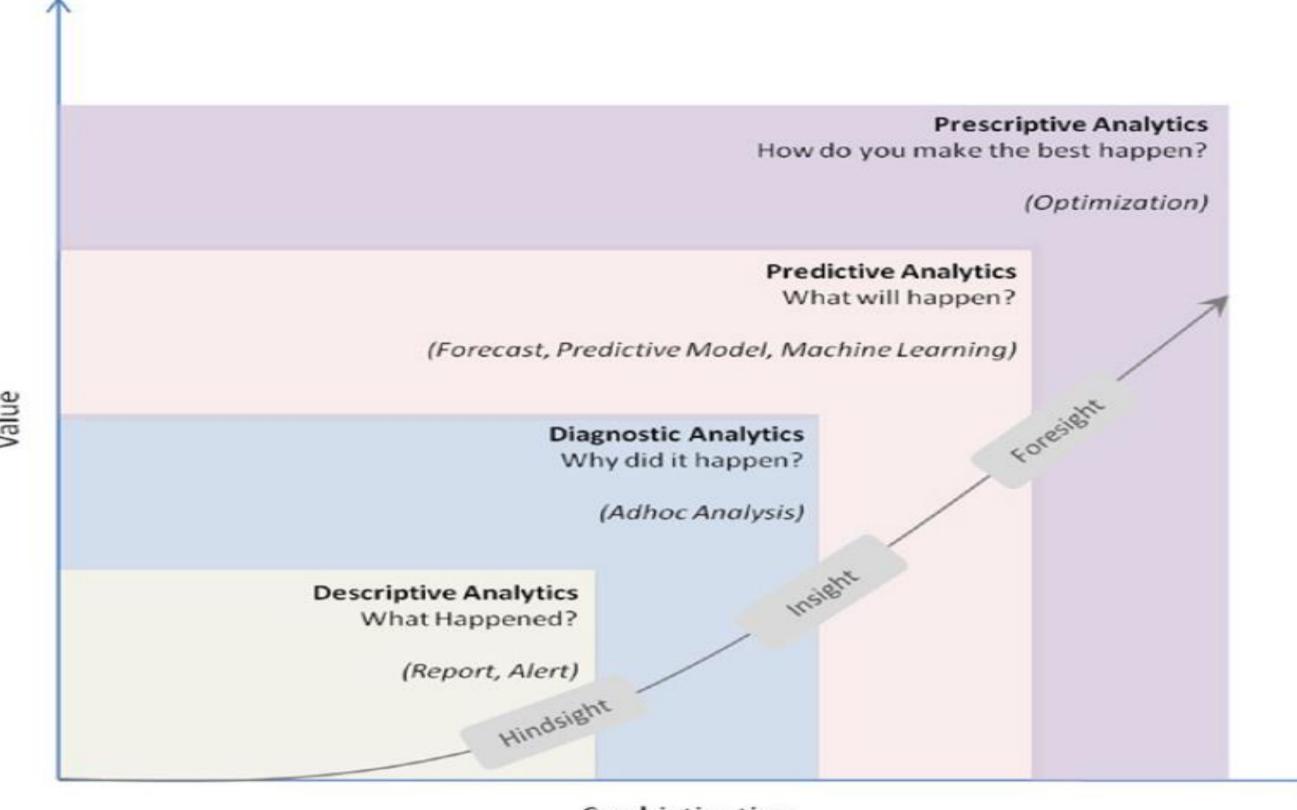
Data Analyst

Data Analysts are experienced data professionals in their organization who can query and process data, provide reports, summarize and visualize data. They have a strong understanding of how to leverage existing tools and methods to solve a problem, and help people from across the company understand specific queries with ad-hoc reports and charts. However, they are not expected to deal with analyzing big data, nor are they typically expected to have the mathematical or research background to develop new algorithms for specific problems.
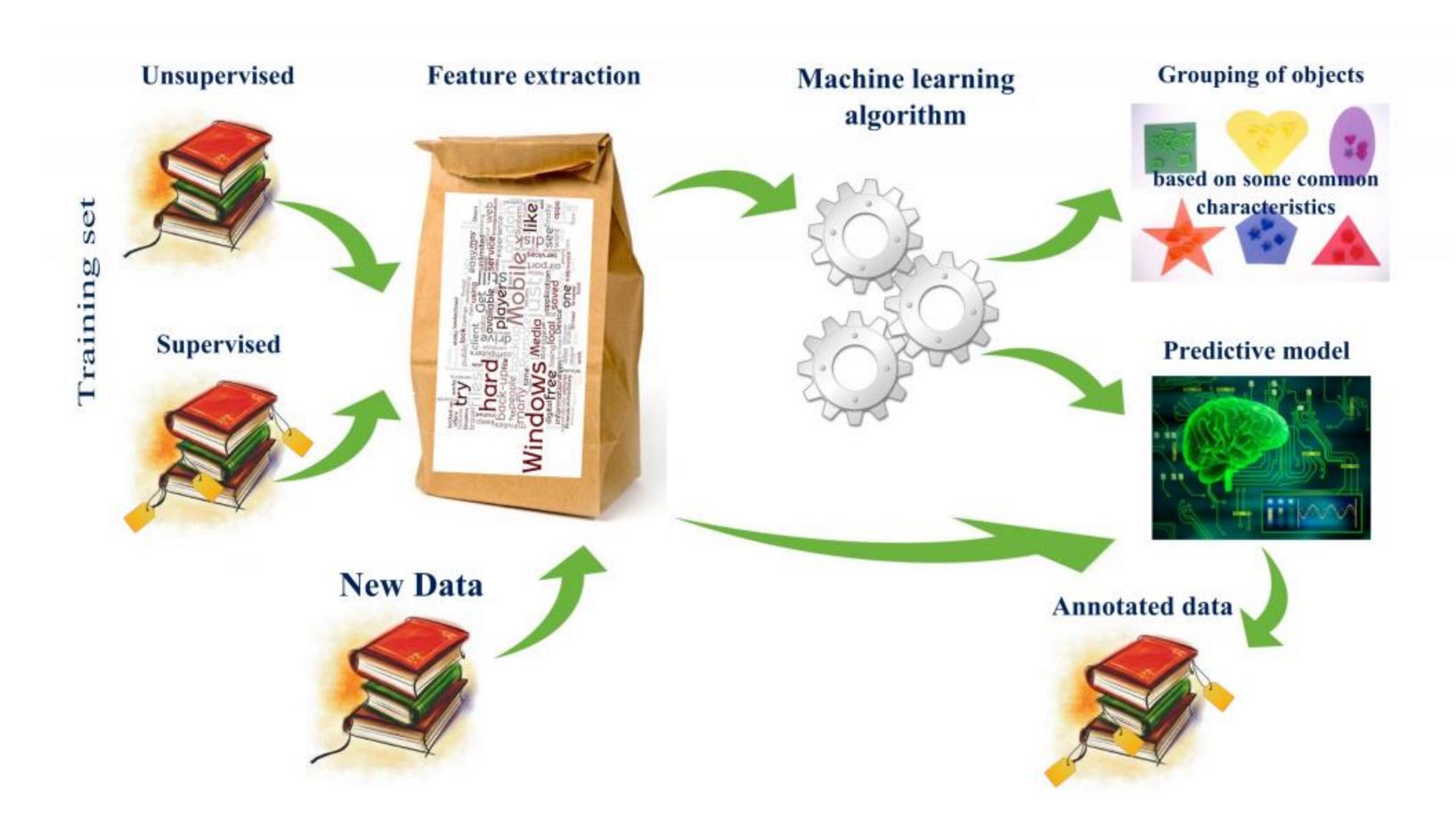
Data Scientist

Data Scientist is someone who can turn raw data into purified insights. Data scientists apply statistics, machine learning and analytic approaches to solve critical business problems. Their primary function is to help organizations turn their volumes of big data into valuable and actionable insights.

Data science can be considered as an advanced level of data analysis that is driven and automated by machine learning and computer science. In another word, in comparison with 'data analysts', in addition to data analytical skills, Data Scientists are expected to have strong programming skills, an ability to design new algorithms, handle big data, with some expertise in the domain knowledge.

4 Type of Data Analytics

How AI Works?

Perkembangan AI

Alan Turing

MIND

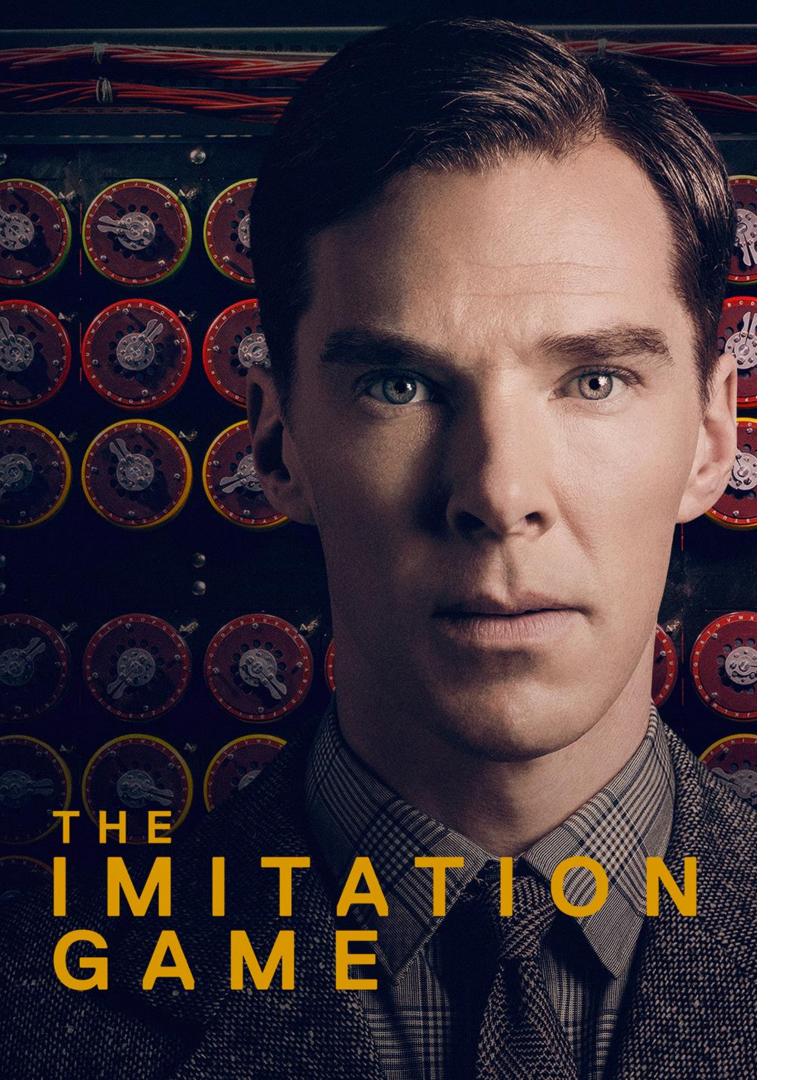## A QUARTERLY REVIEW

OF
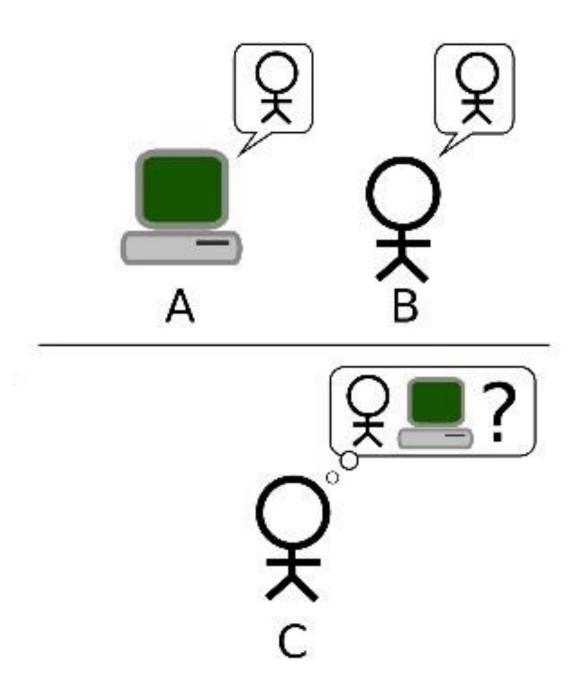
PSYCHOLOGY AND PHILOSOPHY

I.—COMPUTING MACHINERY AND INTELLIGENCE

By A. M. TURING

1. *The Imitation Game.*

I PROPOSE to consider the question, 'Can machines think?' This should begin with definitions of the meaning of the terms 'machine' and 'think'. The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words 'machine' and 'think' are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, 'Can machines think?' is to be sought in a statistical survey such as a Gallup poll. But this is absurd. Instead of attempting such a definition I shall replace the question by another, which is closely related to it and is expressed in relatively unambiguous words.

The Turing test is a test of a machine's ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human. - Wikipedia

Deep Blue beat Gary Kasparov

calculation to determine how many different games of chess were possible

$$10^{120}$$

Alphago Beat Lee Sedol

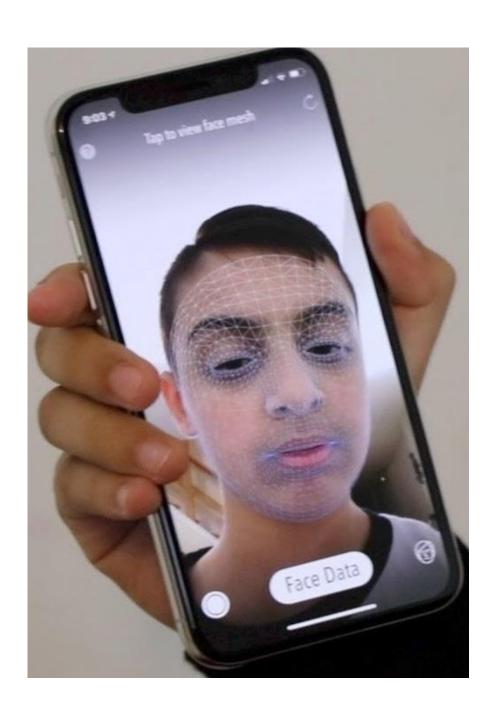calculation to determine how many different games of alpha go were possible

$$10^{170}$$

AI Today

Smart App

E-commerce

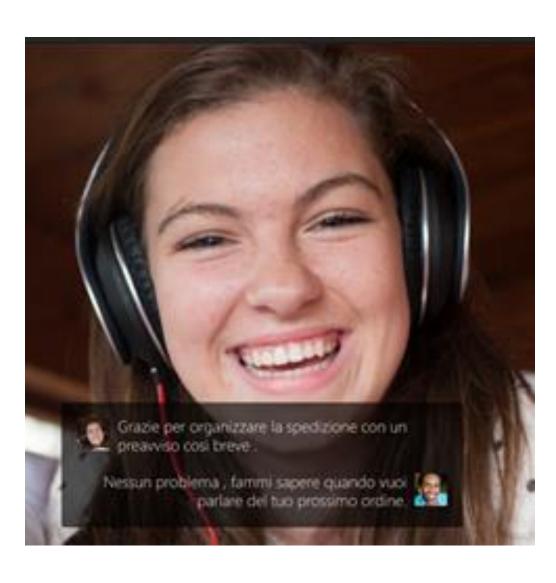tokopedia

Bukalapak.com

Shopee

Smart Office
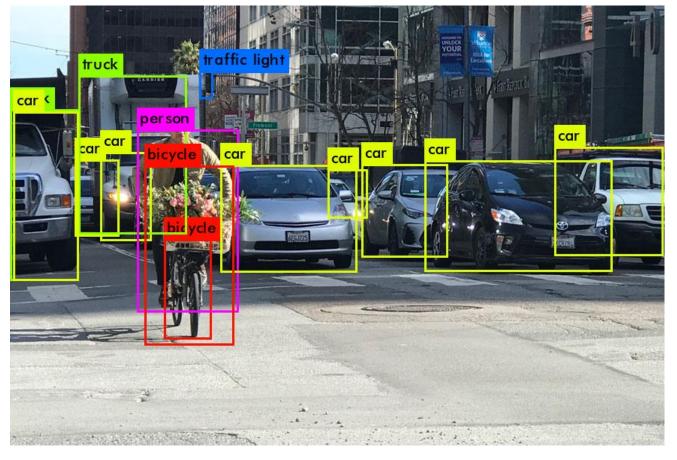
Smart Home

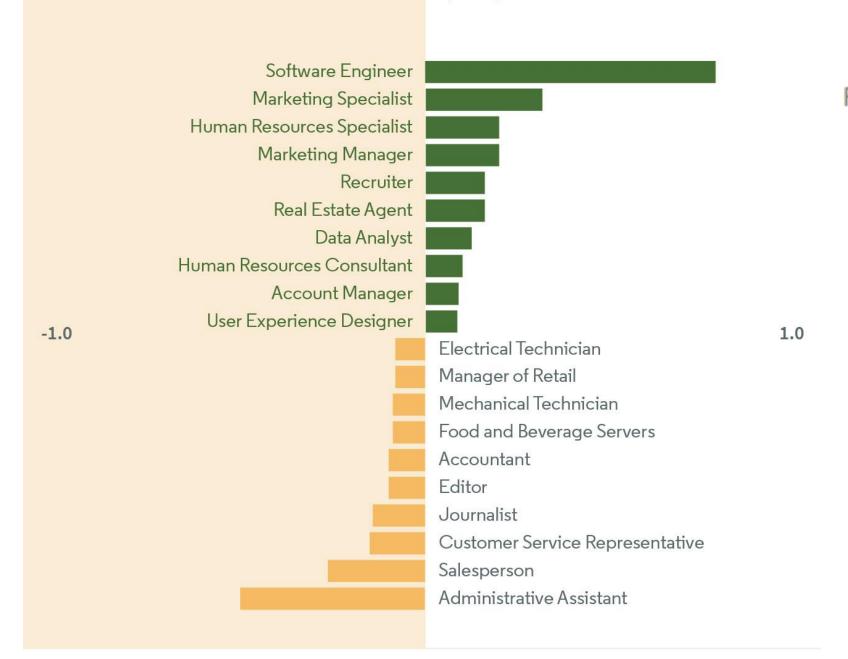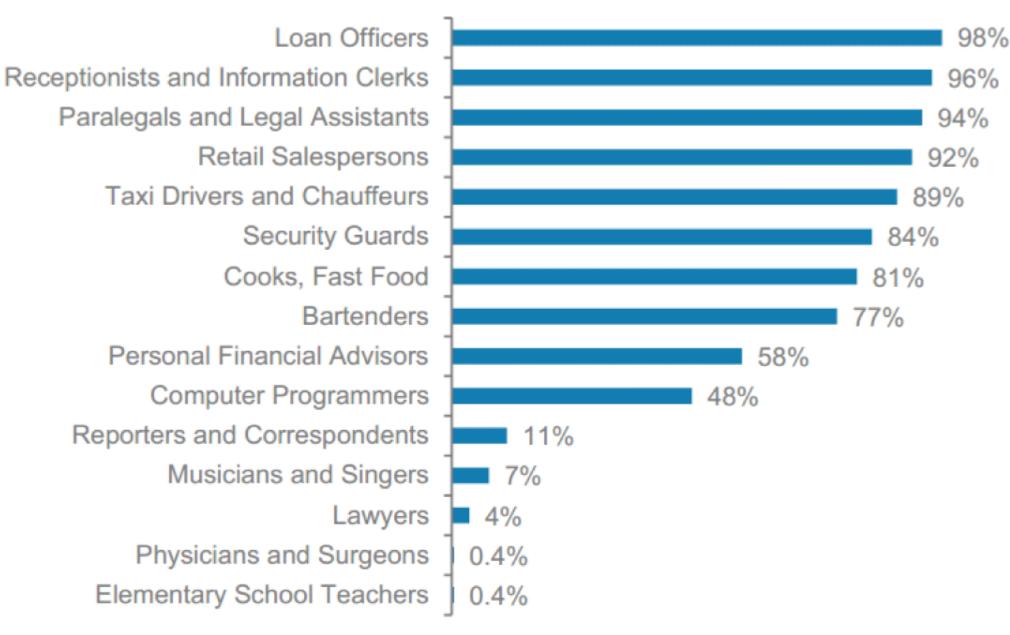# Natural Language Processing

Computer Vision

How AI is Shaking Up The Job Market

Growing and declining occupations, globally

These are the jobs that have grown or declined the most over the past 5 years.

Software Engineer
Marketing Specialist
Human Resources Specialist
Marketing Manager
Recruiter
Real Estate Agent
Data Analyst
Human Resources Consultant
Account Manager
User Experience Designer

-1.0   1.0

Electrical Technician
Manager of Retail
Mechanical Technician
Food and Beverage Servers
Accountant
Editor
Journalist
Customer Service Representative
Salesperson
Administrative Assistant

Probability of a job becoming automatable

Occupation	Probability
Loan Officers	98%
Receptionists and Information Clerks	96%
Paralegals and Legal Assistants	94%
Retail Salespersons	92%
Taxi Drivers and Chauffeurs	89%
Security Guards	84%
Cooks, Fast Food	81%
Bartenders	77%
Personal Financial Advisors	58%
Computer Programmers	48%
Reporters and Correspondents	11%
Musicians and Singers	7%
Lawyers	4%
Physicians and Surgeons	0.4%
Elementary School Teachers	0.4%

Note: This list of emerging and declining jobs, and their associated occupational change indices, were identified by tracking how each occupation's share of hiring has changed over the last 5 years as a proportion of total hiring on LinkedIn's platform. Hiring information is gleaned based on when a member states they started a position on their profile. A positive change index indicates that the occupation's share of total hiring is growing, while a negative index means that the occupation is shrinking, on a monthly basis.

Source: University of Oxford, C.B. Frey and M. Osborne, Morgan Stanley Research
Note: Select occupations ranked according to their probability of becoming automatable.

Digging Deeper!

Machine Learning

Machine Learning

Machine learning is programming computers to optimize a performance criterion using example data or past experience. We have a model defined up to some parameters, and learning is the execution of a computer program to optimize the parameters of the model using the training data or past experience. The model may be predictive to make predictions in the future, or descriptive to gain knowledge from data, or both.

ARTIFICIAL INTELLIGENCE
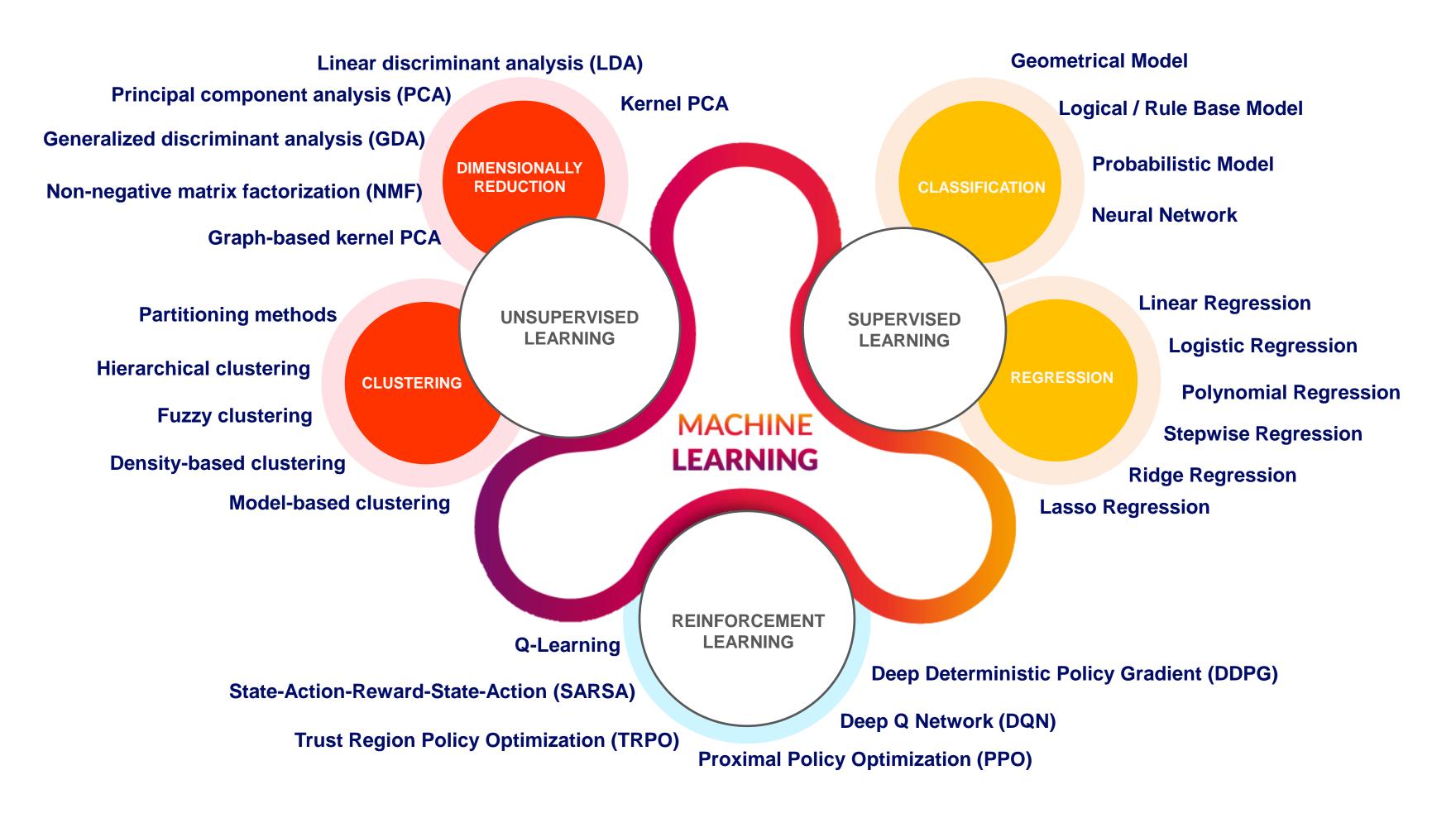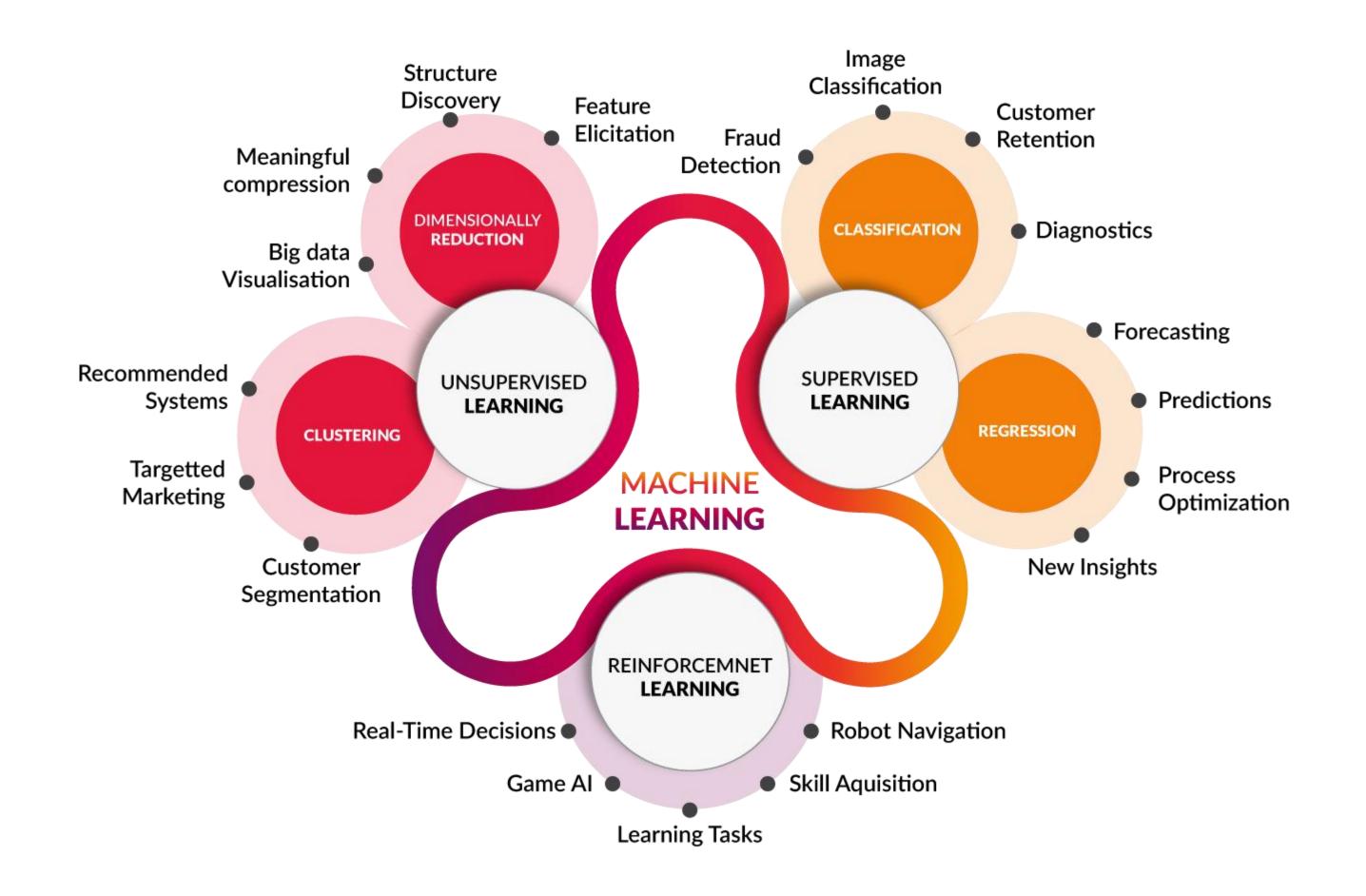A program that can sense, reason, act, and adapt

MACHINE LEARNING
Algorithms whose performance improve as they are exposed to more data over time

DEEP LEARNING
Subset of machine learning in which multilayered neural networks learn from vast amounts of data
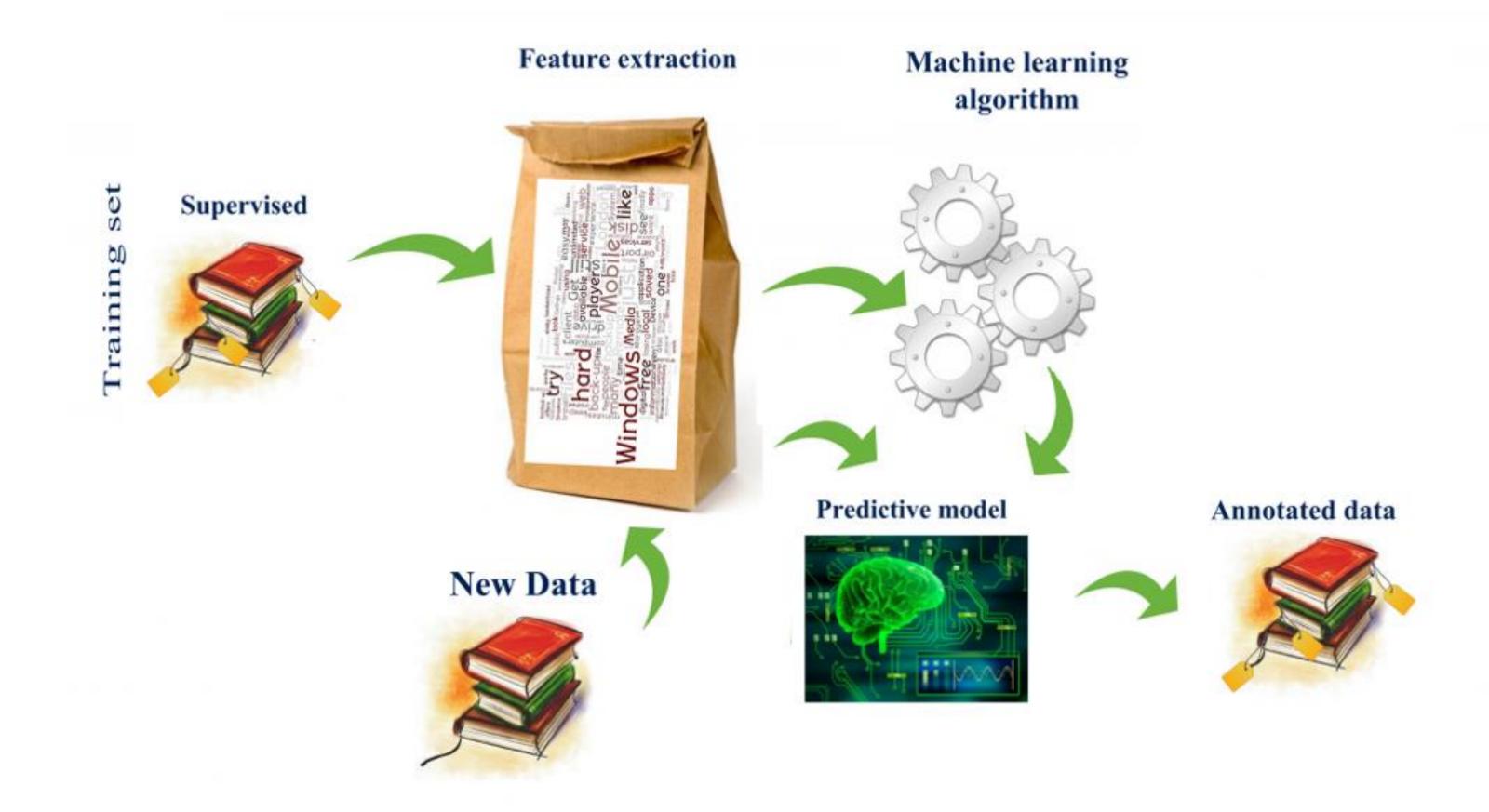
Type of Machine Learning

Linear discriminant analysis (LDA)

Principal component analysis (PCA)

Generalized discriminant analysis (GDA)

Non-negative matrix factorization (NMF)

Graph-based kernel PCA

Kernel PCA

DIMENSIONALLY REDUCTION

Geometrical Model

Logical / Rule Base Model

Probabilistic Model

Neural Network

CLASSIFICATION

UNSUPERVISED LEARNING

SUPERVISED LEARNING

Partitioning methods

Hierarchical clustering

Fuzzy clustering

Density-based clustering

Model-based clustering

CLUSTERING

Linear Regression

Logistic Regression

Polynomial Regression

Stepwise Regression

Ridge Regression

Lasso Regression

REGRESSION

MACHINE LEARNING

REINFORCEMENT LEARNING

Q-Learning

State-Action-Reward-State-Action (SARSA)

Trust Region Policy Optimization (TRPO)

Proximal Policy Optimization (PPO)

Deep Q Network (DQN)

Deep Deterministic Policy Gradient (DDPG)

MACHINE LEARNING

UNSUPERVISED LEARNING

DIMENSIONALLY REDUCTION
- Structure Discovery
- Feature Elicitation
- Meaningful compression
- Big data Visualisation

CLUSTERING
- Recommended Systems
- Targetted Marketing
- Customer Segmentation

SUPERVISED LEARNING

CLASSIFICATION
- Image Classification
- Customer Retention
- Fraud Detection
- Diagnostics

REGRESSION
- Forecasting
- Predictions
- Process Optimization
- New Insights

REINFORCEMNET LEARNING
- Real-Time Decisions
- Robot Navigation
- Game AI
- Skill Aquisition
- Learning Tasks

Supervised Learning

Supervised

In supervised learning, we want to build a model on the training data and then be able to make accurate predictions on new, unseen data that has the same characteristics as the training set that we used. If a model is able to make accurate predictions on unseen data, we say it is able to *generalize* from the training set to the test set.

Machine Learning
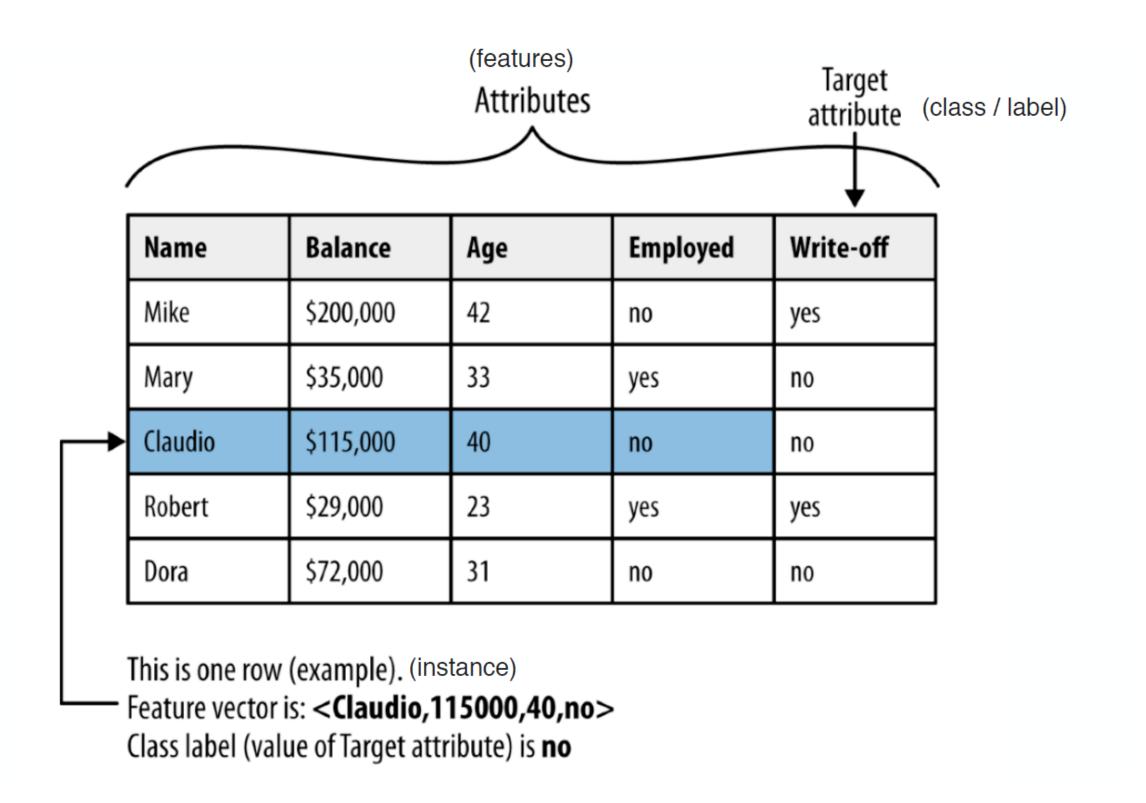
Important Term

- ✓ **Training Data,** is a set of data to discover potentially predictive relationships.

- ✓ **Test data,** is a set of data which has been specifically identified for use in tests.

- ✓ **Features / attributes,** The number of features or distinct traits that can be used to describe each item in a quantitative manner

- ✓ **Feature vector,** is an n-dimensional vector of numerical features that represent some object.

Important Term
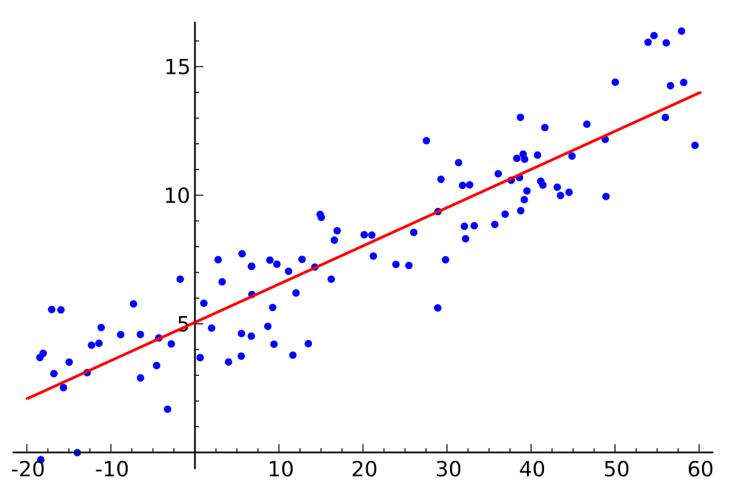
✓ **Label / class,** is the discrete attribute whose value you want to predict based on the values of other attributes.

✓ **Feature extraction,** is a dimensionality reduction process, where an initial set of raw variables is reduced to more manageable groups (features) for processing, while still accurately and completely describing the original data set
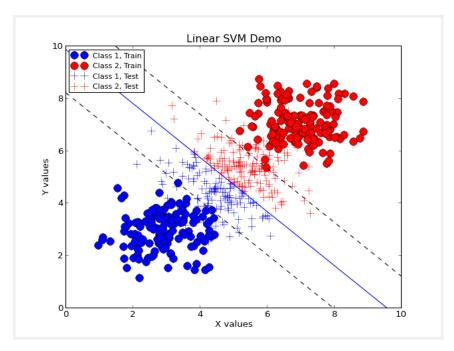
Important Term

(features)

Attributes

Target attribute (class / label)

Name	Balance	Age	Employed	Write-off
Mike	$200,000	42	no	yes
Mary	$35,000	33	yes	no
Claudio	$115,000	40	no	no
Robert	$29,000	23	yes	yes
Dora	$72,000	31	no	no

This is one row (example). (instance)
Feature vector is: **<Claudio,115000,40,no>**
Class label (value of Target attribute) is **no**

Type of Supervised Learning : Regression

✓ Regression is the process of estimating the relationship between input and output variables.

✓ This technique is used for forecasting, time series modelling and finding the causal effect relationship between the variables.

✓ For example, relationship between rash driving and number of road accidents by a driver is best studied through regression.

Type of Supervised Learning : Classification

✓ Classification is a process of classify data into a given number of classes.

✓ In classification, the goal is to predict a *class label*, which is a choice from a predefined.
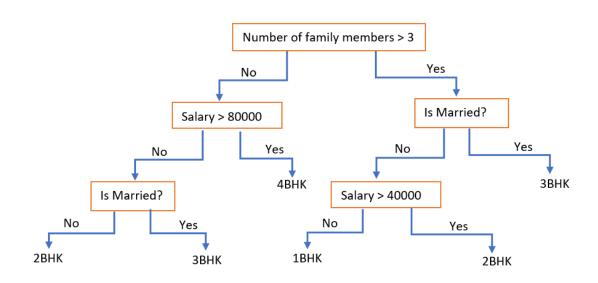
Four Types of Classification
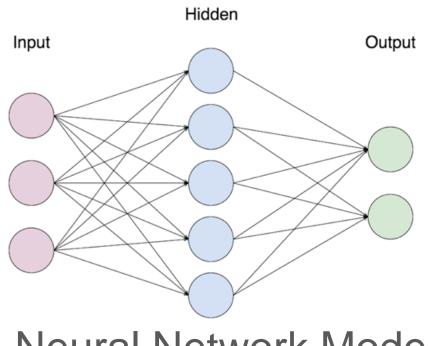
Geometric Model

Logical Model / Rule-Based Model

Probabilistic Model

Neural Network Model

Classification (1) Logical / Rule-Based Model

A **rule-based classifier** uses a set of IF-THEN rules for classification.
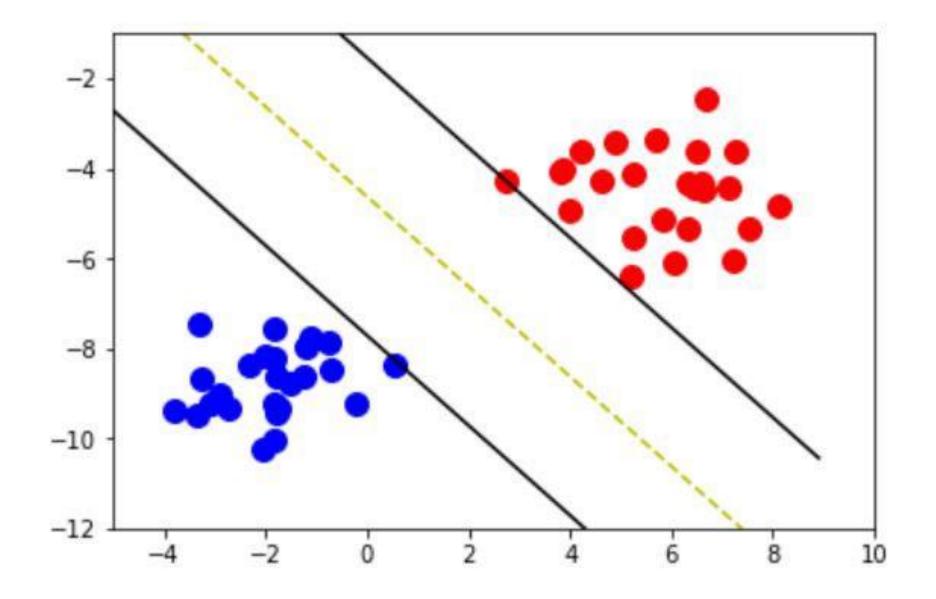
Rule-based classification schemes typically consist of :

1. Rule Induction Algorithm

2. Rule Ranking Measures

3. *Class Prediction Algorithm*

Case Based Reasoning, Rule Based Reasoning, Decision tree

Classification (2) Geometric Model

SVM, KNN, linear discriminant analysis

Classification (3) Probabilistic Model

✓ Information can be incomplete, inconsistent, uncertain, or all three. In other words, information is often unsuitable for solving a problem / making inference.

✓ The concept of probability has a long history that goes back thousands of years when words like "probably", "likely", "maybe", "perhaps" and "possibly" were introduced into spoken languages.

✓ Probability can also be defined as a **scientific measure of chance**.

Classification (3) Probabilistic Model

Use Bayesian Reasoning :

$$P(A \mid B) = \frac{P(B \mid A)P(A)}{P(B)}$$
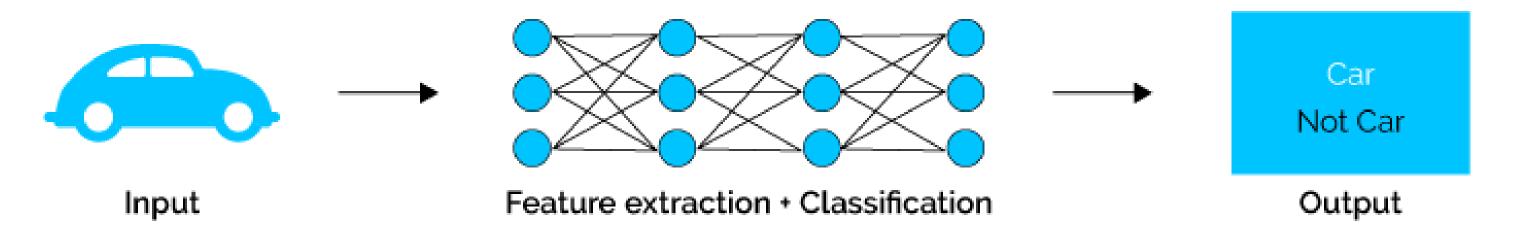
- ✓ P(A | B) is the **posterior** probability, or the probability of A given evidence B
- ✓ P(B | A) is the **likelihood**, or the probability of B given A
- ✓ P(A) is the **prior** probability, or the probability of A without taking any evidence into account
- ✓ P(B) is a normalization constant to obtain a probability density function with a sum of 1

Classification (4) Neural Network Model

A neural network is a massively parallel distributed processor made up of simple processing units that has a natural propensity for storing experiential knowledge and making it available for use. It resembles the brain in two respects:
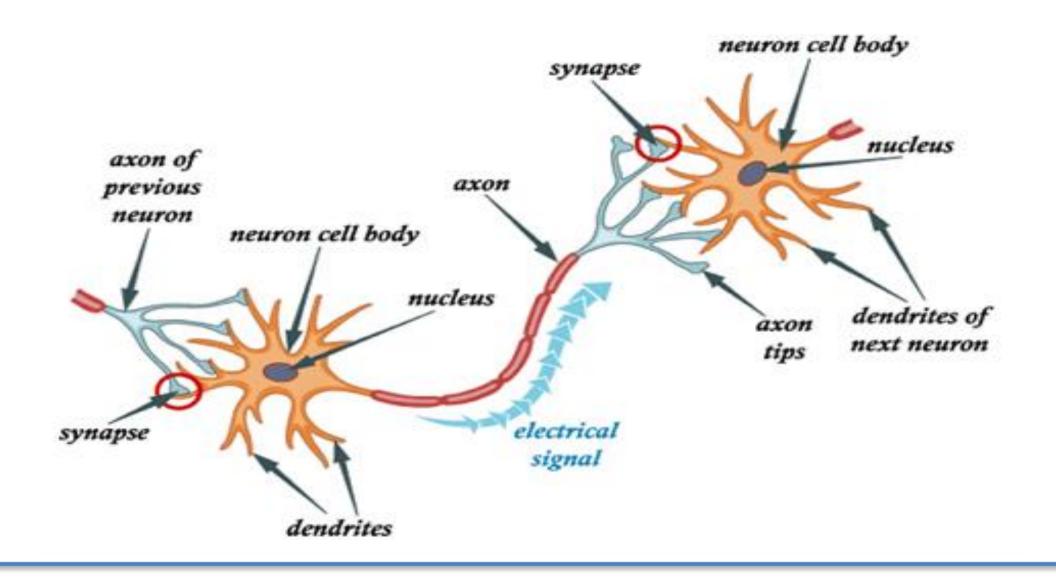
1. Knowledge is acquired by the network from its environment through a learning process.

2. Interneuron connection strengths, known as synaptic weights, are used to store the acquired knowledge

Classification (4) Neural Network Model

Classification (4) Neural Network Model

1. Ability to learn and model non-linear and complex relationships, which is really important because in real-life, many of the relationships between inputs and outputs are non-linear as well as complex.

2. *Input–Output Mapping.*

3. Generalize After learning from the initial inputs and their relationships, it can infer unseen relationships on unseen data as well, thus making the model generalize and predict on unseen data.
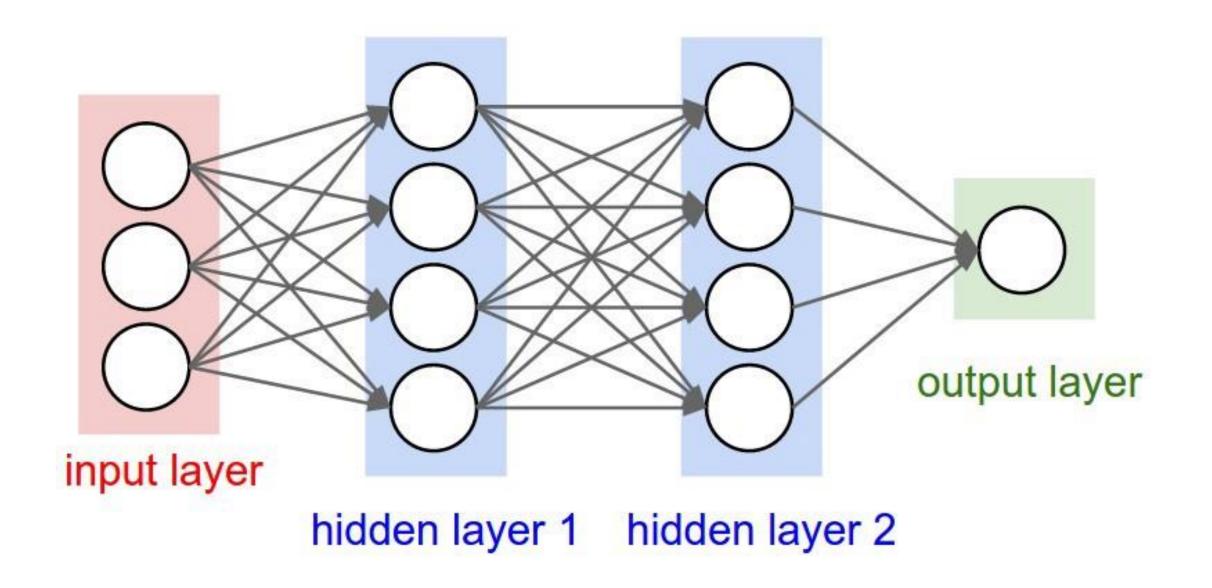
Classification (4) Neural Network Model
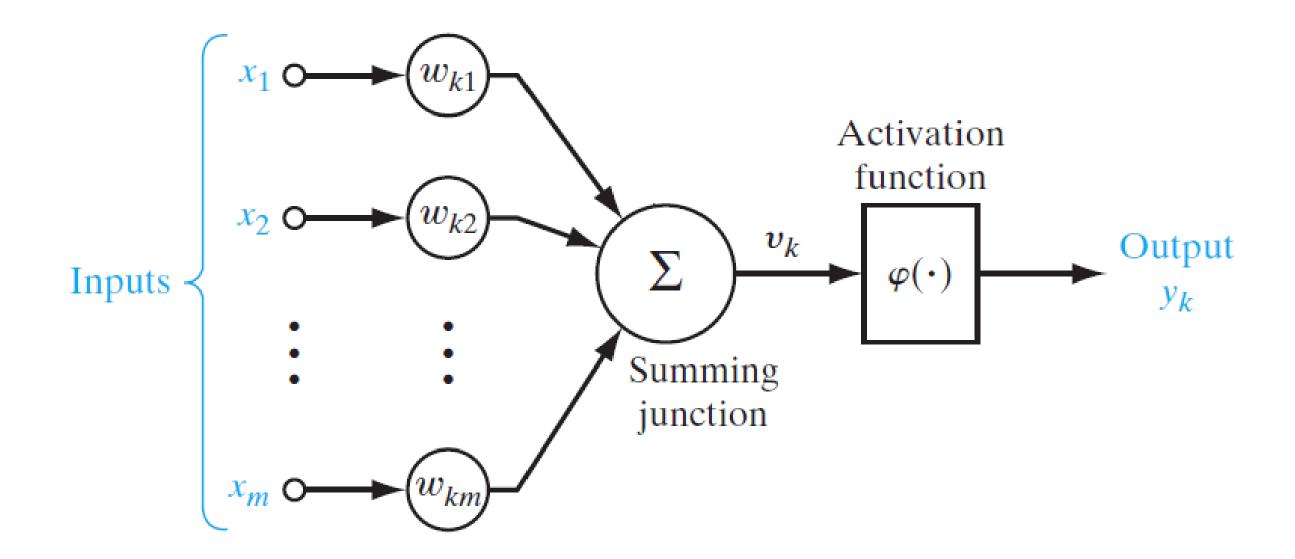
Step 1: External signal received by dendrites

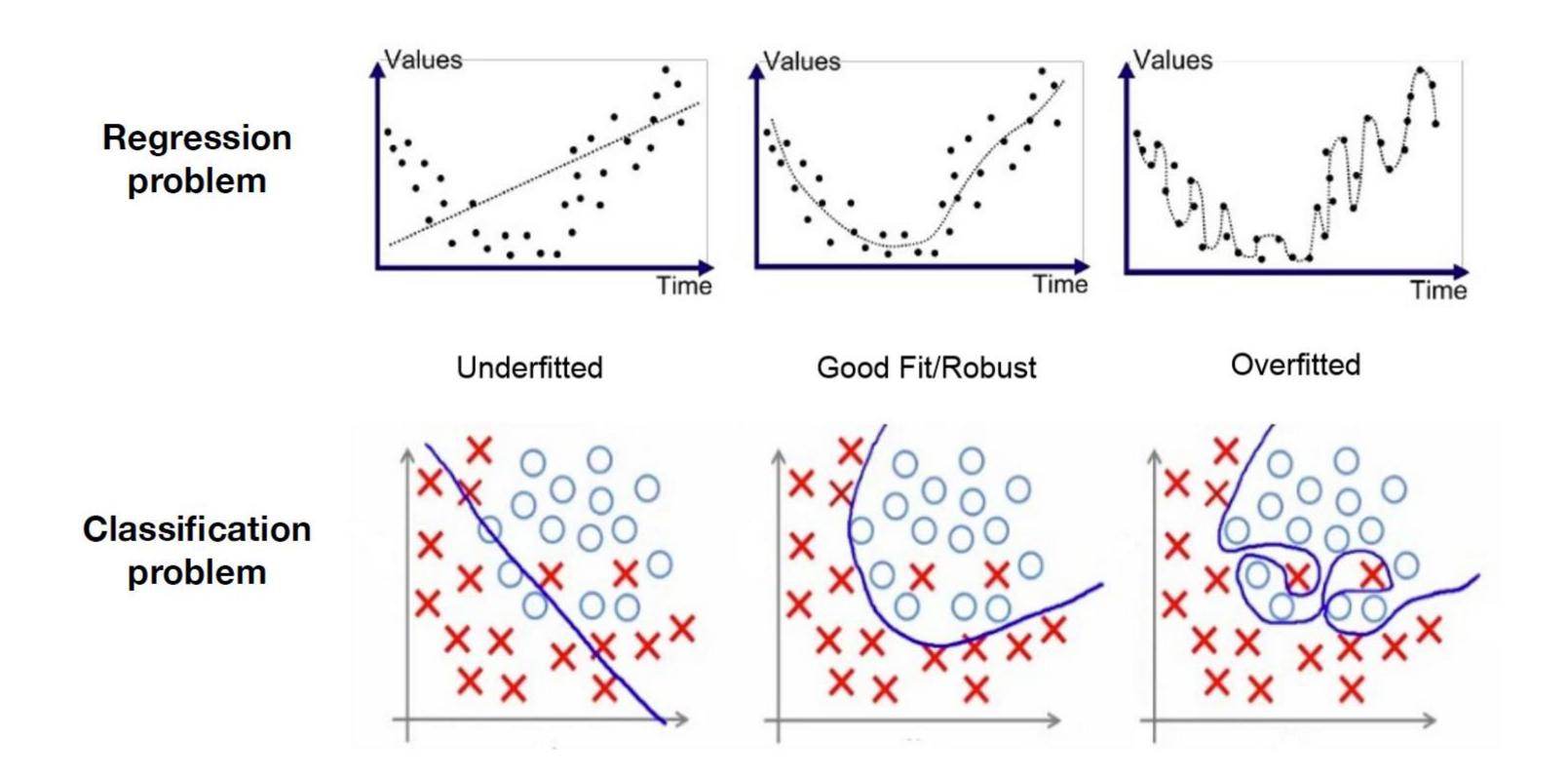**Step 2**: External signal processed in the neuron cell body

Step 3: Processed signal converted to an output signal and transmitted through the Axon

Step 4: Output signal received by the dendrites of the next neuron through the synapse

Classification (4) Neural Network Model

Classification (4) Neural Network Model

Overfiting and Underfiting

Regression problem

Underfitted — Good Fit/Robust — Overfitted

Classification problem

Next Unsupervised Learning

Sumber

- ✓ **Wikipedia Artificial intelligence,** en.wikipedia.org/wiki/Artificial_intelligence

- ✓ **What is Artificial Intelligence Exactly?,** www.youtube.com/watch?v=kWmX3pd1f10&t=27s

- ✓ **Data Mining Concepts and Techniques,** Jiawei Han, Micheline Kamber and Jian Pei

- ✓ **Big Data for Dummies,** Judith Hurwitz, Alan Nugent, Dr. Fern Halper and Marcia Kaufman

- ✓ **Data Scientist vs Data Engineer, What's the difference?,** cognitiveclass.ai/blog/data-scientist-vs-data-engineer/

- ✓ **Artificial Intelligence with Python,** Prateek Joshi

- ✓ **Machine Learning For Beginners,** https://towardsdatascience.com/machine-learning-for-beginners-d247a9420dab

- ✓ **The Ultimate Guide to 12 Dimensionality Reduction Techniques (with Python codes),** https://www.analyticsvidhya.com/blog/2018/08/dimensionality-reduction-techniques-python/

Sumber

- ✓ **Types of Clustering Methods: Overview and Quick Start R Code**, https://www.datanovia.com/en/blog/types-of-clustering-methods-overview-and-quick-start-r-code/

- ✓ **Introduction to Various Reinforcement Learning Algorithms. Part I (Q-Learning, SARSA, DQN, DDPG),** https://towardsdatascience.com/introduction-to-various-reinforcement-learning-algorithms-i-q-learning-sarsa-dqn-ddpg-72a5e0cb6287
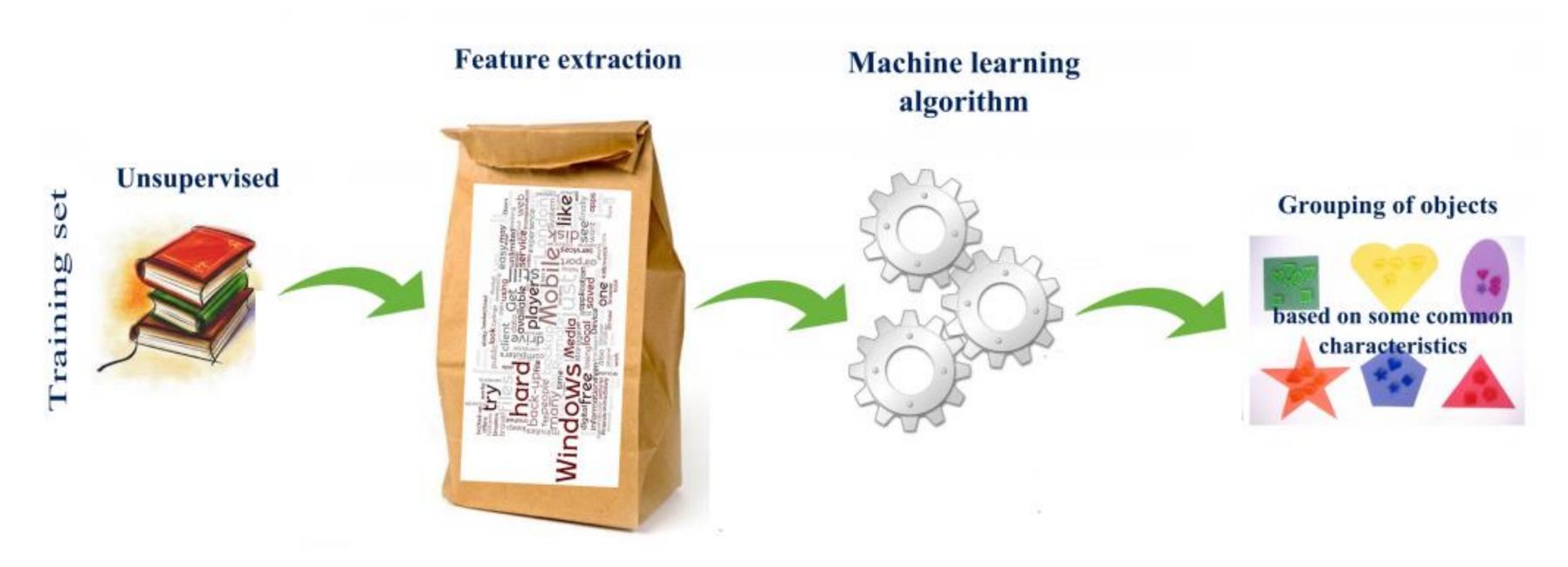
- ✓ **7 Types of Regression Techniques you should know!**, https://www.analyticsvidhya.com/blog/2015/08/comprehensive-guide-regression/

- ✓ **Rule-Based Classification,** https://link.springer.com/referenceworkentry/10.1007/978-0-387-39940-9_559

TERIMA KASIH

Unsupervised

✓ Learning without teacher. No label / class in the data.

✓ Algorithms that create a new representation of the data which might be easier for humans or other machine learning algorithms to understand compared to the original representation of the data.

✓ Study the patterns in the input dataset to identify similar patterns that can be grouped into specific classes / events.
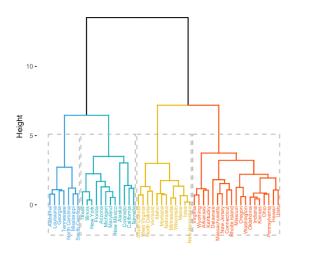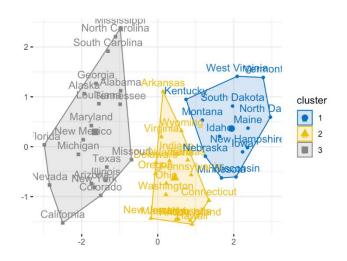
Machine Learning

Clustering

Is the process of partitioning a set of data objects (or observations) into subsets. Each subset is a **cluster**, such that objects in a cluster are similar to one another, yet dissimilar to objects in other clusters.

Clustering is also called **data segmentation** in some applications because clustering partitions large data sets into groups according to their *similarity*. Clustering can also be used for **outlier detection**, where outliers may be more interesting than common cases. Applications of outlier detection include the detection of credit card fraud and the monitoring of criminal activities in electronic commerce.
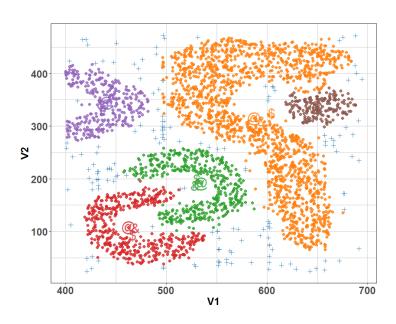
Type of Clustering

Hierarchical Methods

Partition Methods

Density-Based Methods