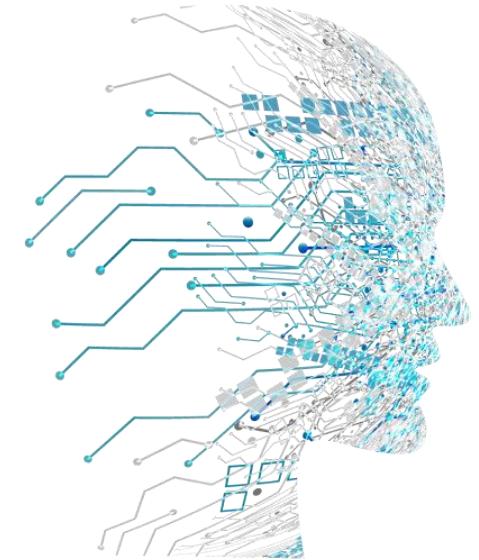


INTRODUCTION to MACHINE LEARNING



**Computer Engineering
Srinakharinwirot University Ongkharak Campus**

By Khwanchai K.

23. 01. 2023

AGENDA



Machine Learning

What's Machine Learning
History of Machine Learning
Type of Machine Learning



Real World ML

Applications of ML
Understanding AI, ML & DL
Material for Study



Applied ML

ML Process Flow
Tool & Frameworks



Work Shop

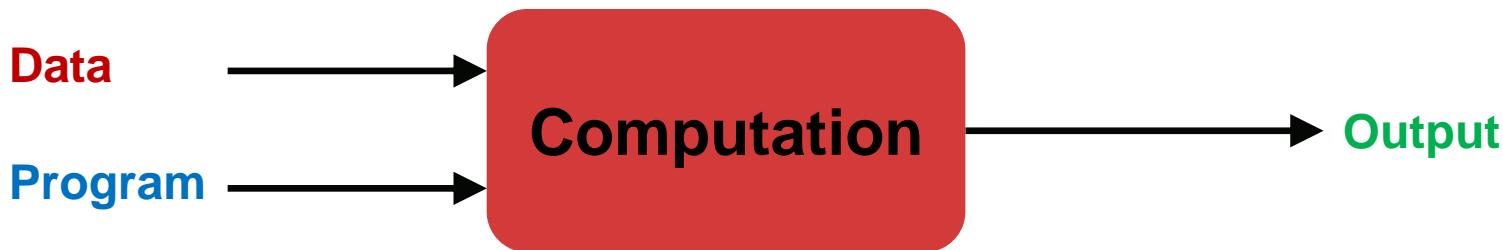
Linear Regression
K-Mean Clustering
Reinforcement Learning

MACHINE LEARNING

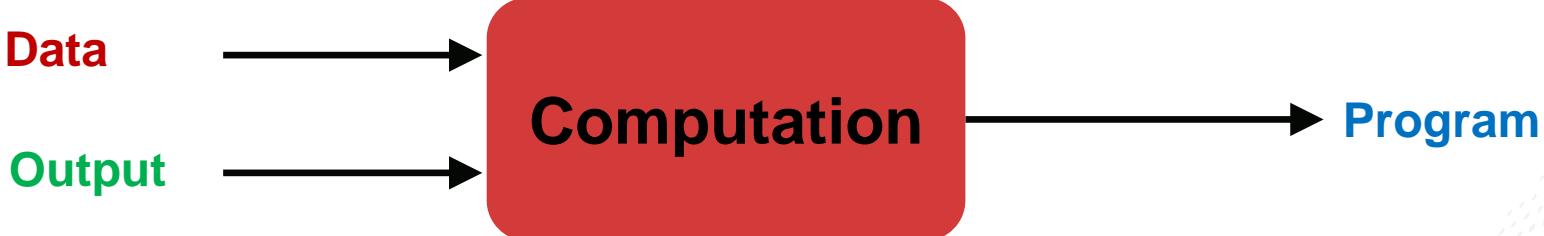


• What's Machine Learning?

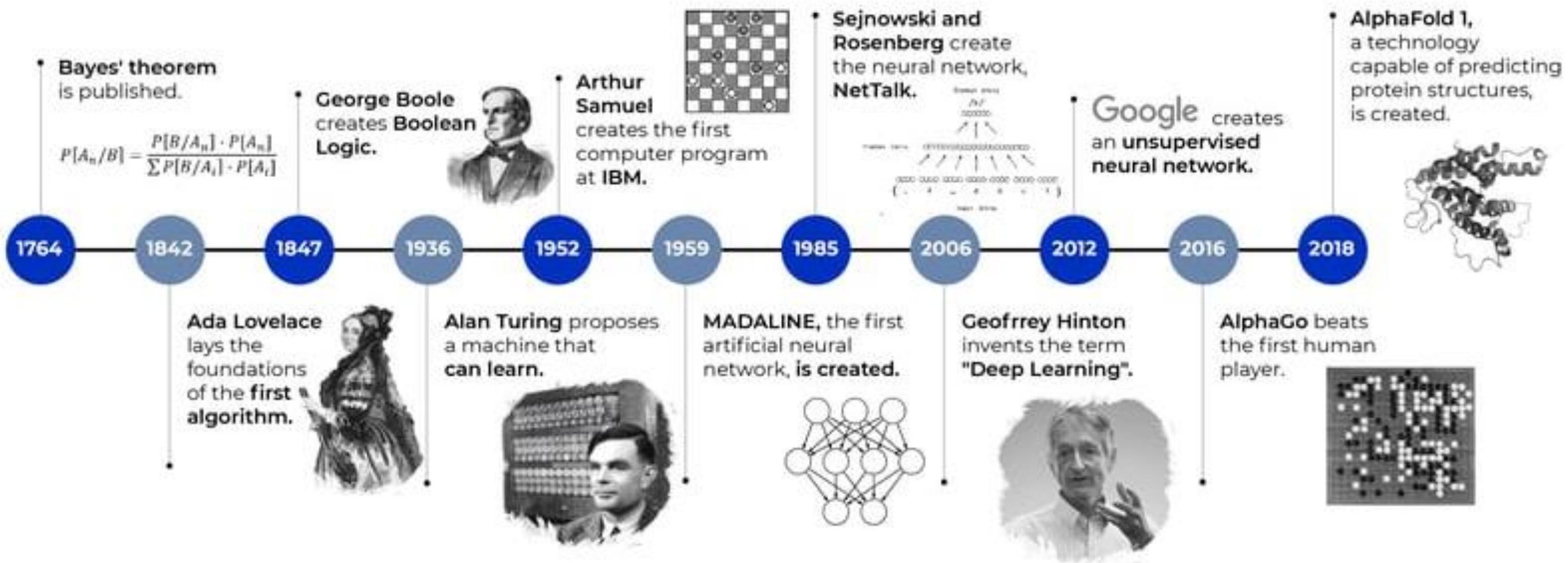
Traditional Programming



Machine Learning



History of Machine Learning



● Why Machine Learning?

Availability

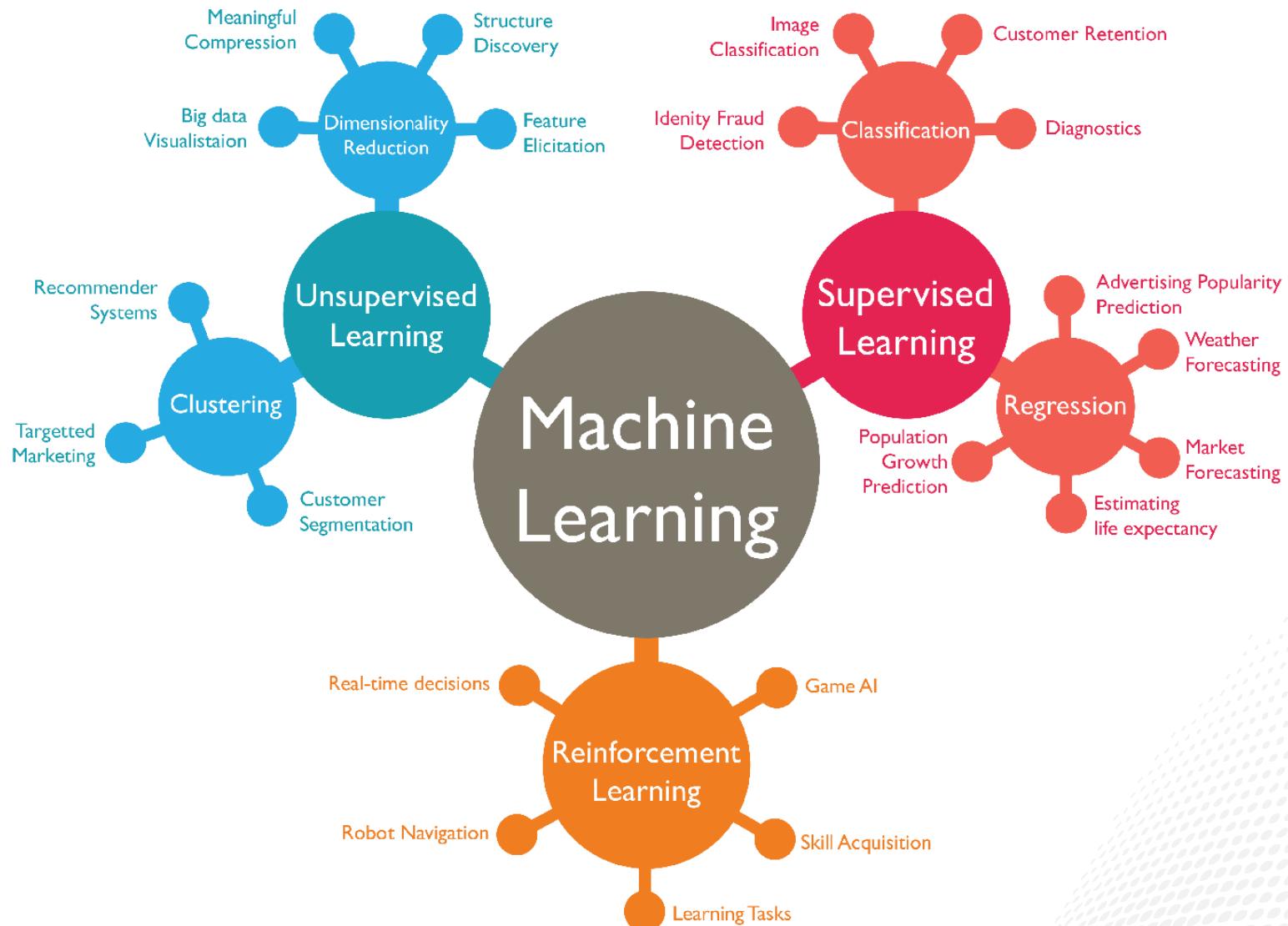
- **Data**
- **Data Storage**
- **Developer**
- **Processing**

Such as.

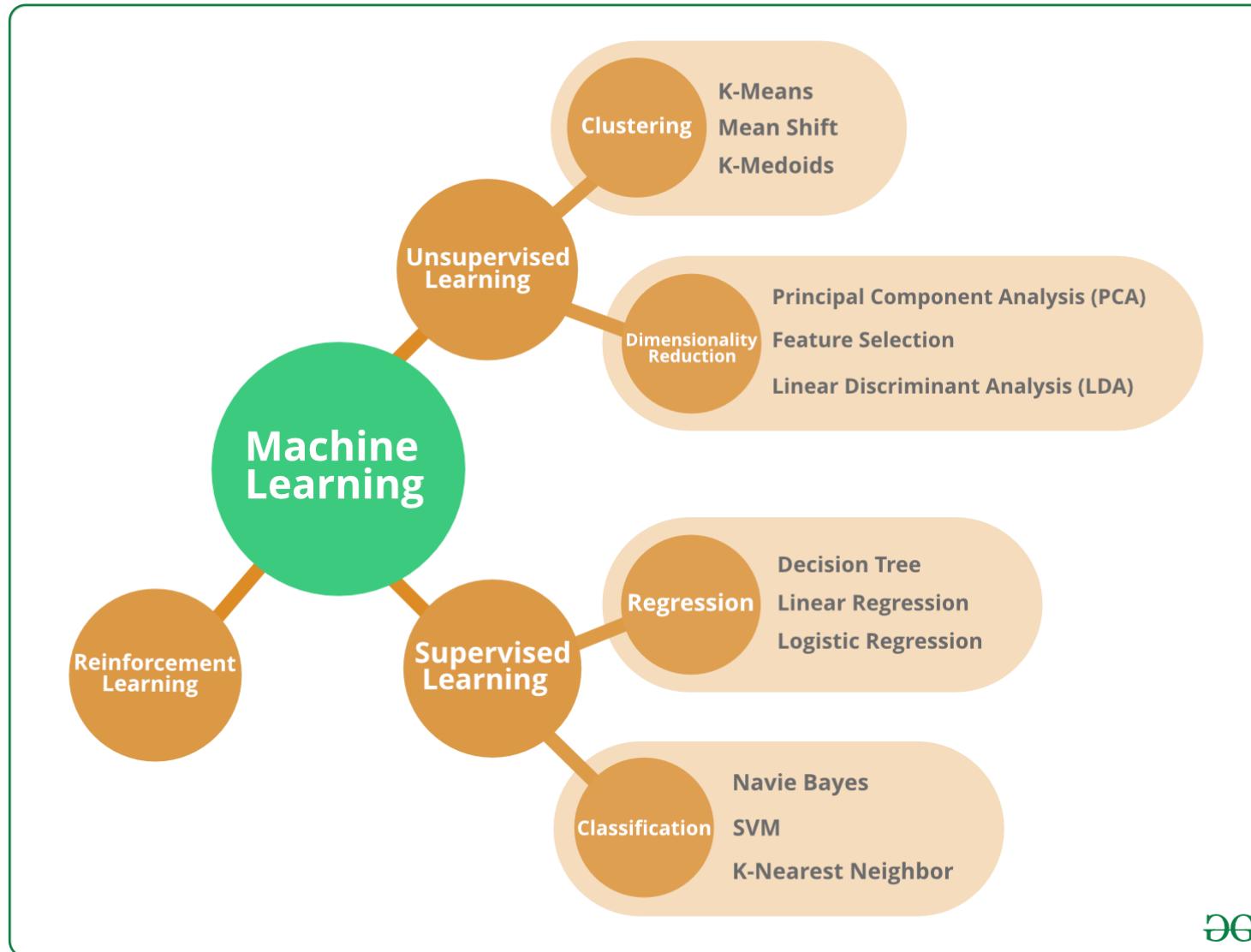
- **Manufacturing.** Predictive maintenance and condition monitoring
- **Retail.** Upselling and cross-channel marketing
- **Healthcare and life sciences.** Disease identification and risk satisfaction
- **Travel and hospitality.** Dynamic pricing
- **Financial services.** Risk analytics and regulation
- **Energy.** Energy demand and supply optimization



Type of Machine Learning



Type of Machine Learning

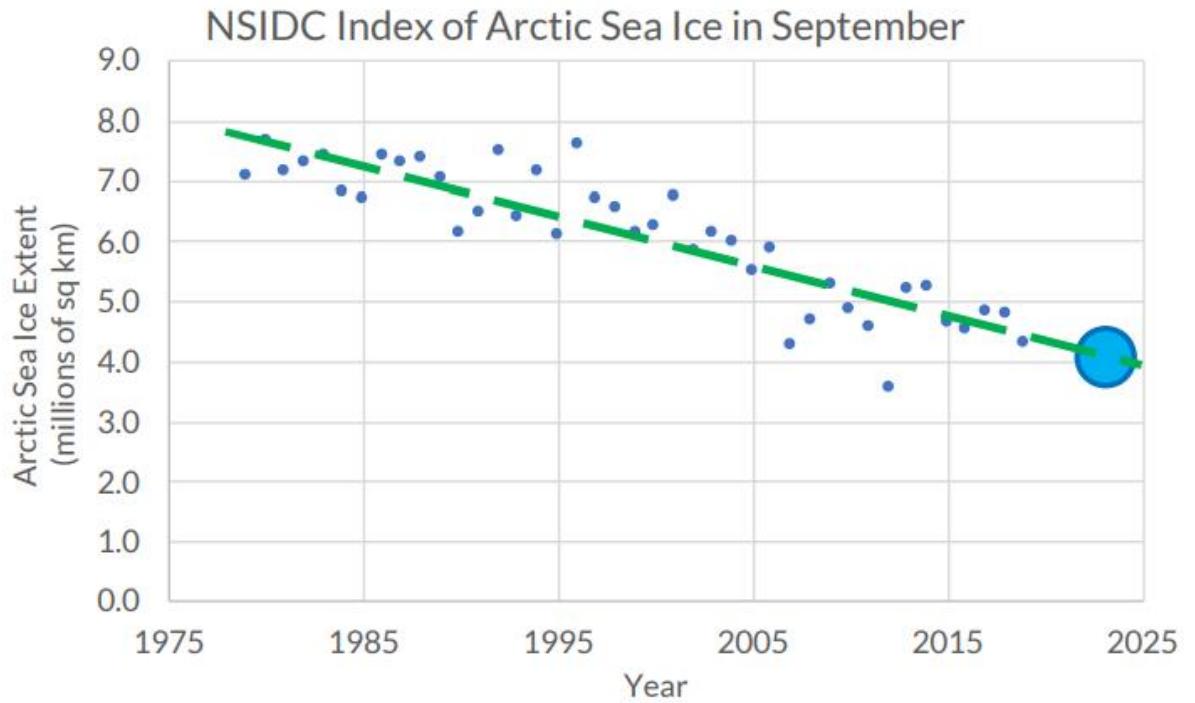


● Supervised Learning

- Given $(x_1, y_1), \dots, (x_n, y_n)$, learn a function that predicts y given x
- **Regression:** Labels y are real-valued

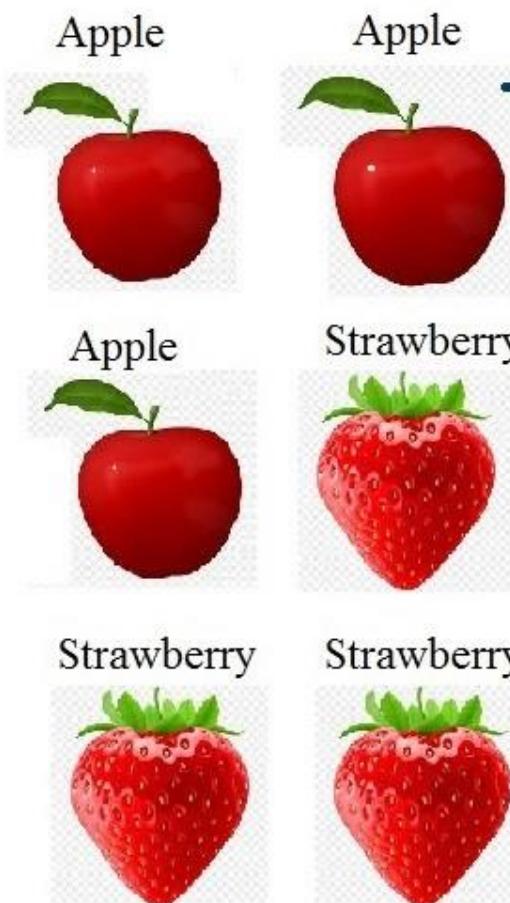


Photo by NASA Goddard



● Supervised Learning

Labelled Data



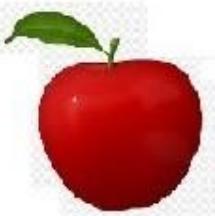
Machine
Learning Model



Training

Output for
future inputs

Apple

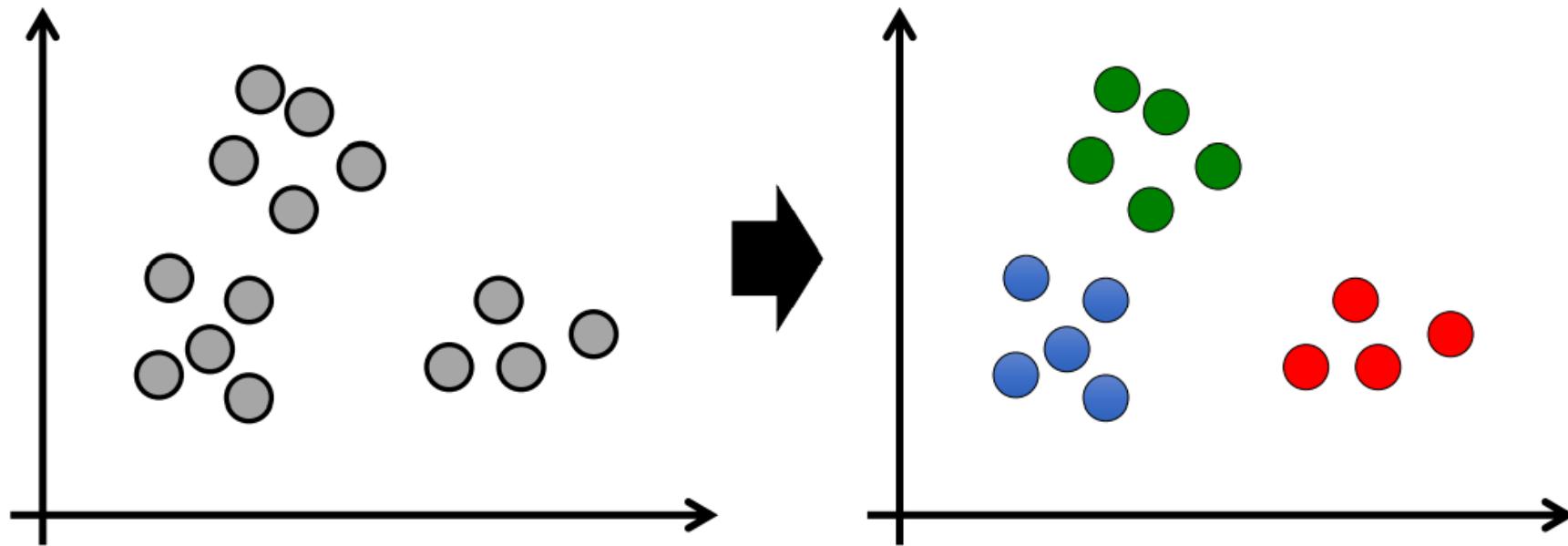


Strawberry

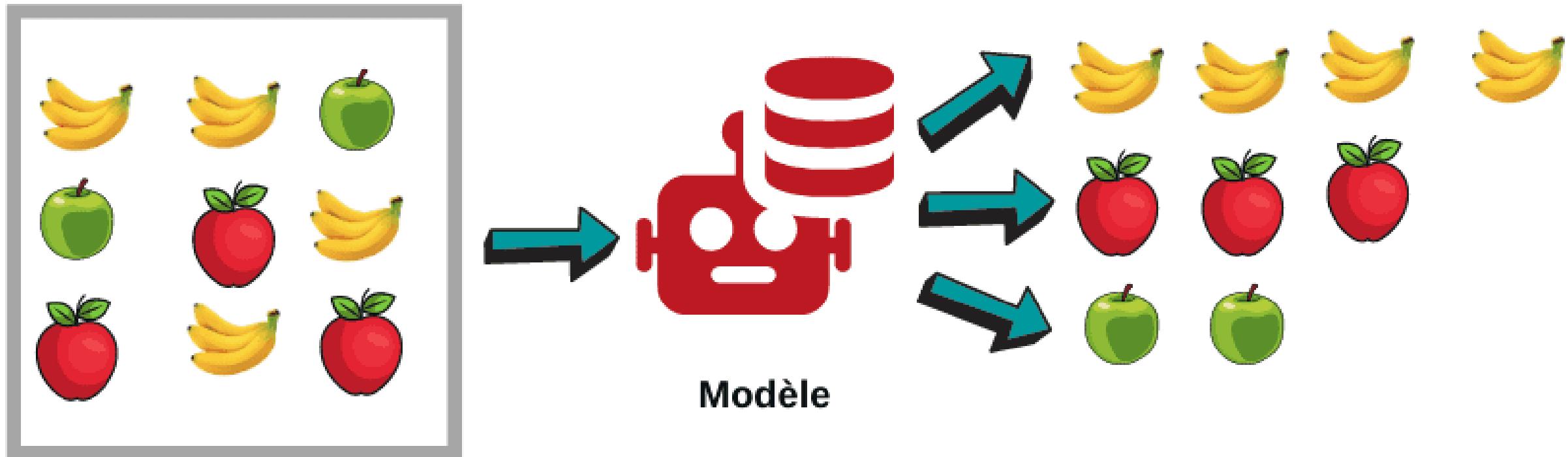


● Unsupervised Learning

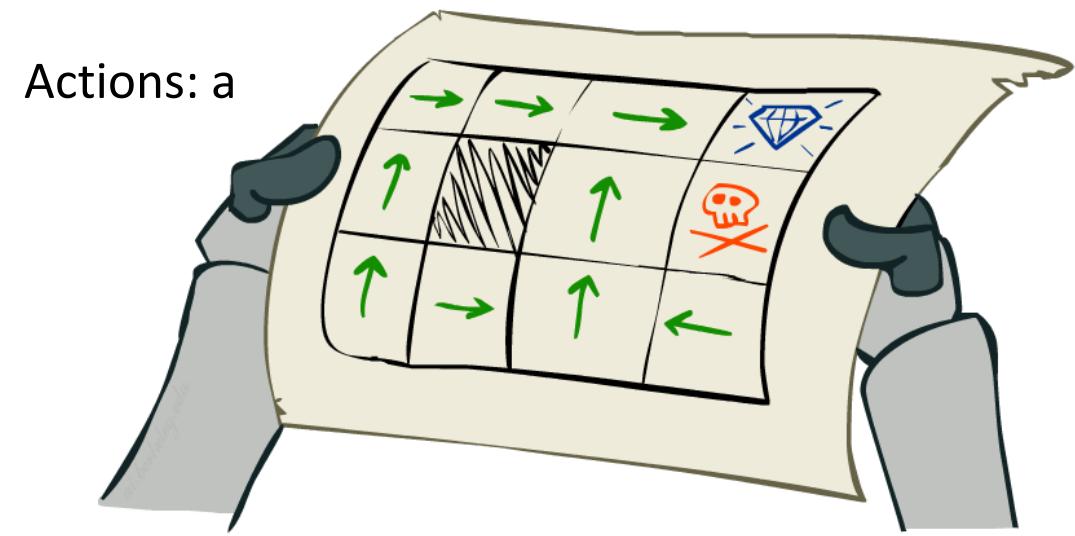
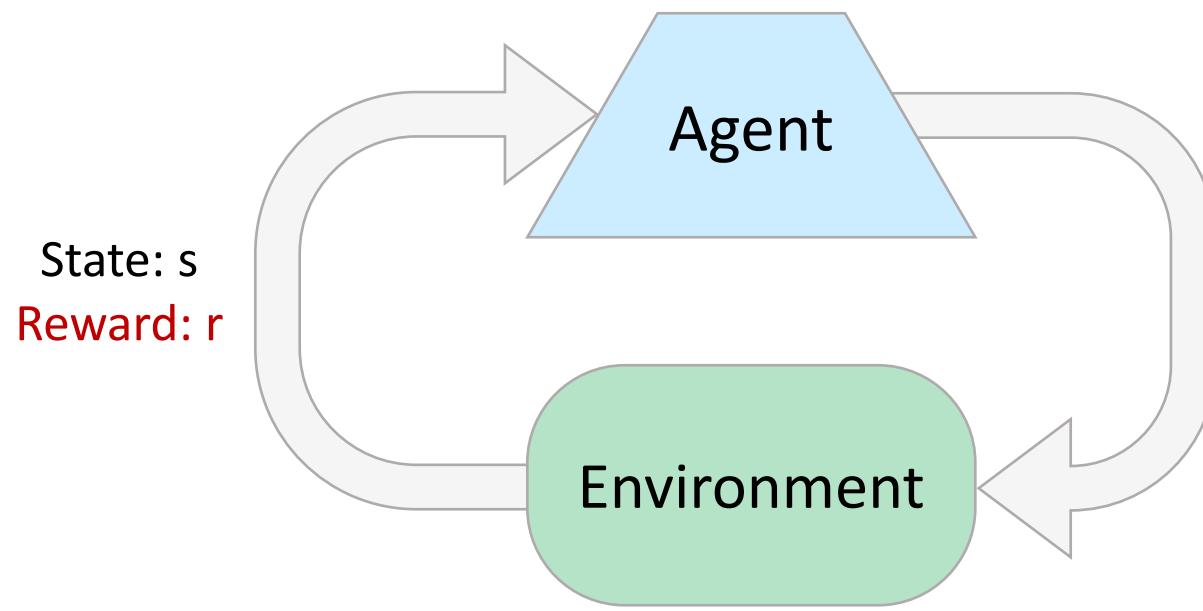
- Given x_1, \dots, x_n (no labels), output hidden structure in x 's
 - E.g., clustering



● Unsupervised Learning



● Reinforcement Learning

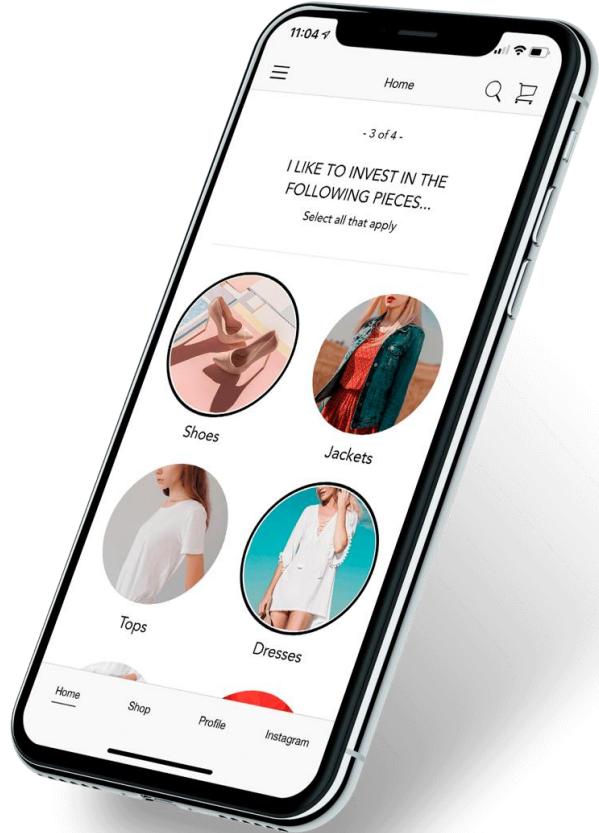


- Idea:
 - Receive feedback in the form of **rewards**
 - Agent's utility is defined by the reward function
 - Must (learn to) act so as to **maximize expected rewards**
 - All learning is based on observed samples of outcomes!

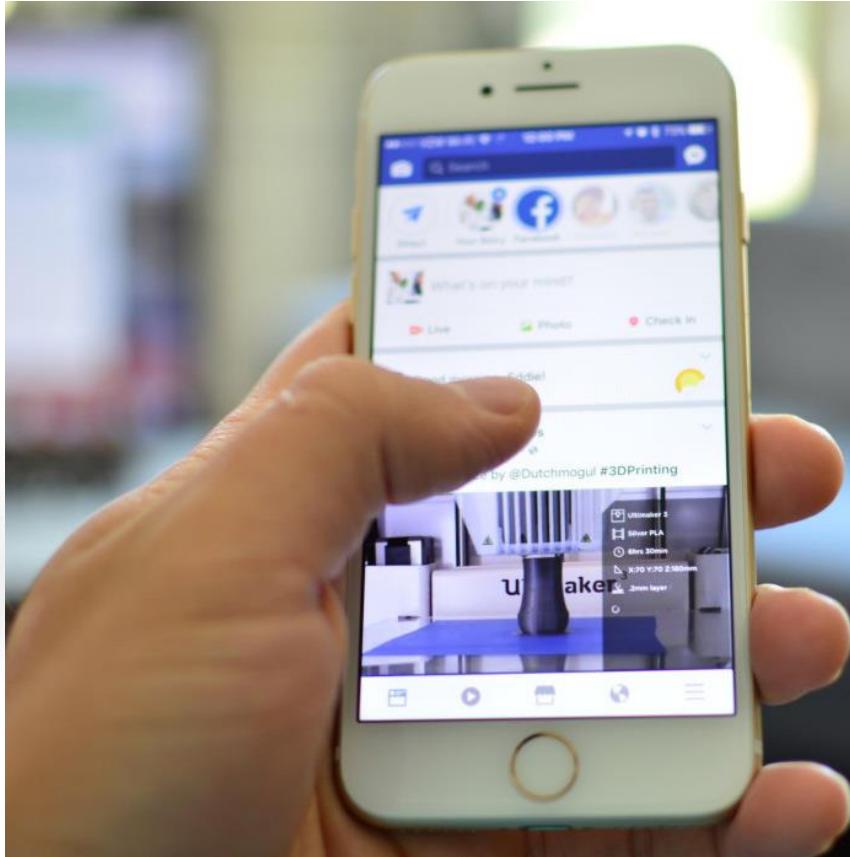
REAL WORLD MACHINE LEARNING



● Applications of Machine Learning



Personalized Shopping



Facebook Ads

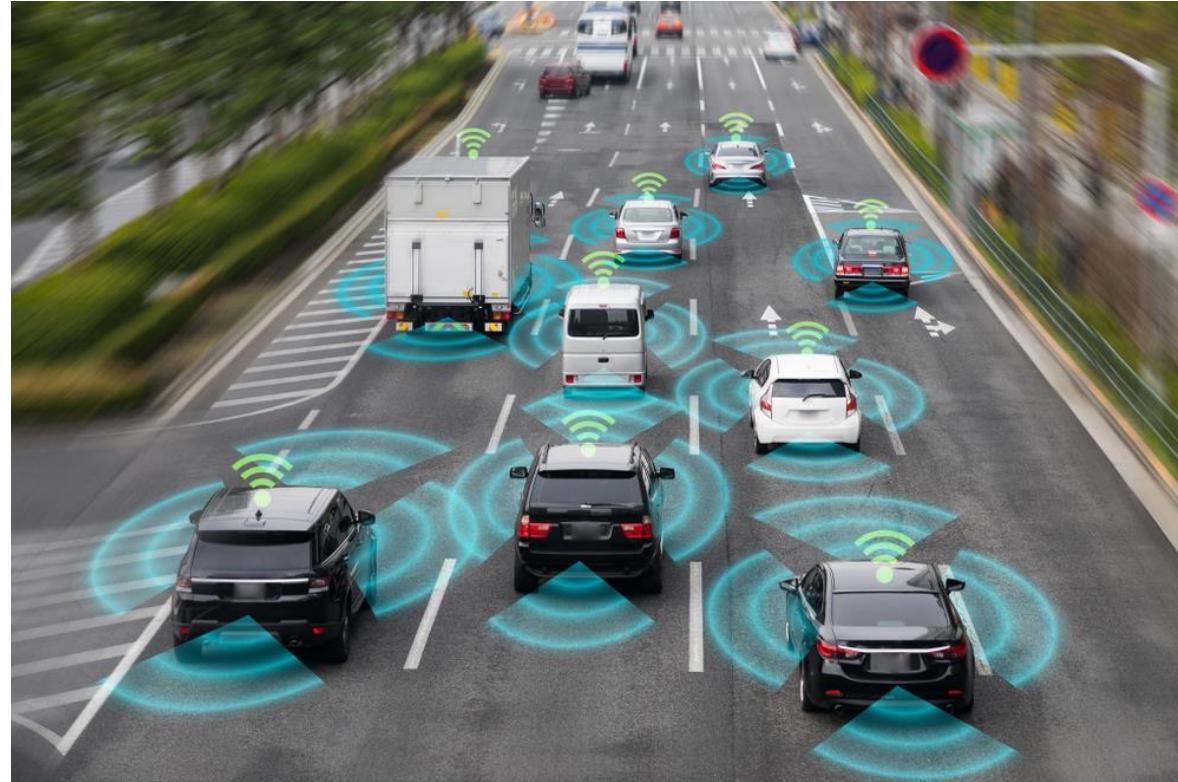


Fraud Prevention

● Applications of Machine Learning

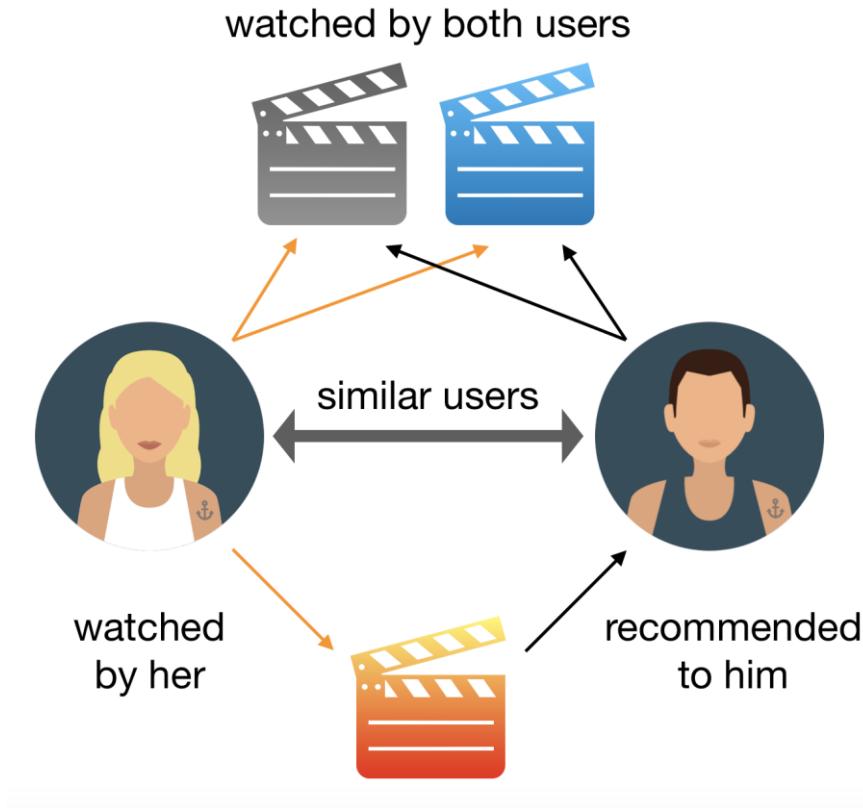


Voice Assistants

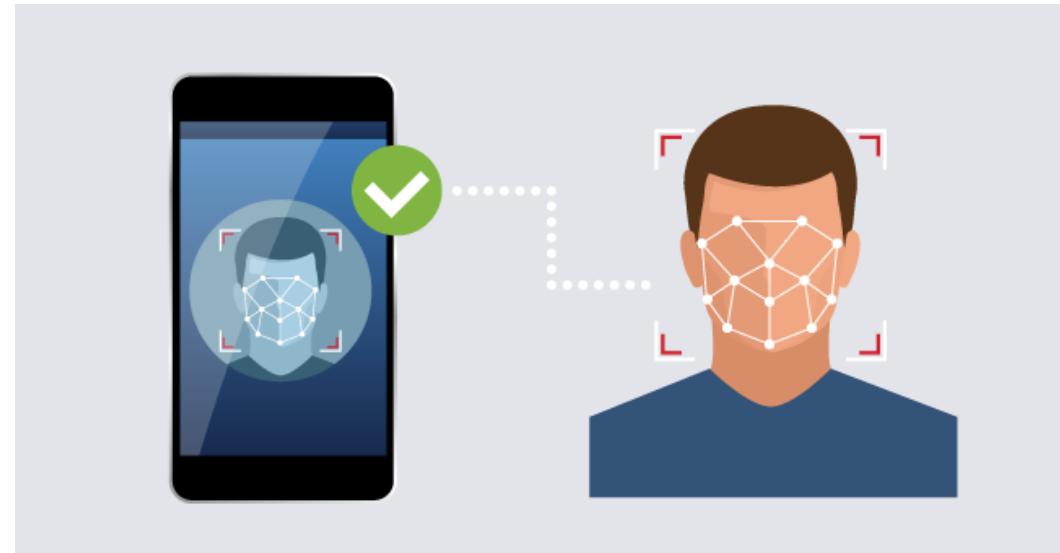


Autonomous Vehicles

● Applications of Machine Learning



Recommendation System



Source: Golden Sikorka/stock.adobe.com. | GAO-21-526

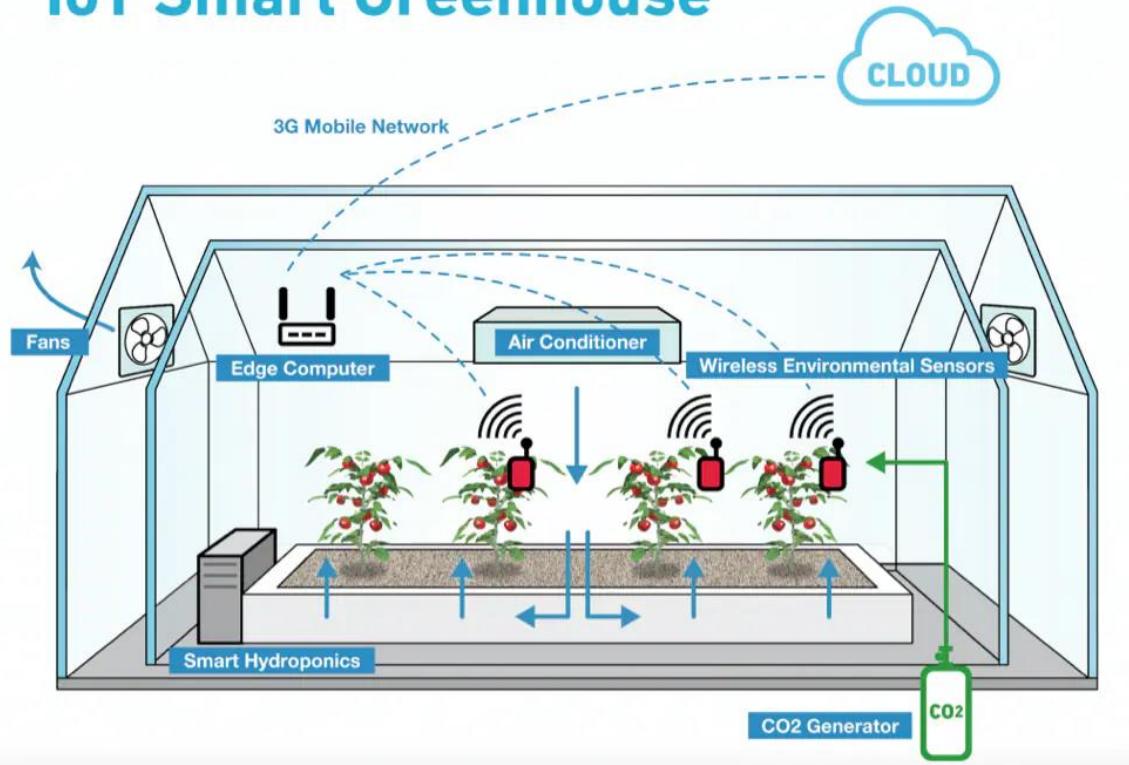
Facial Recognition

● Applications of Machine Learning



Google Map

IoT Smart Greenhouse

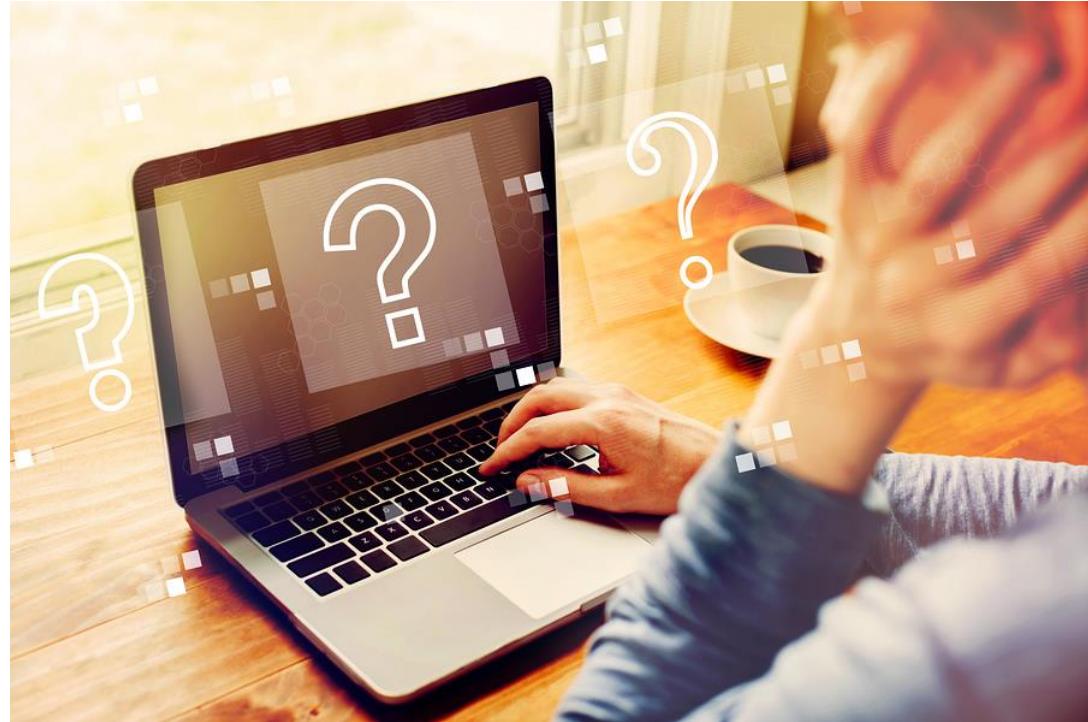


Smart Farm

● Applications of Machine Learning

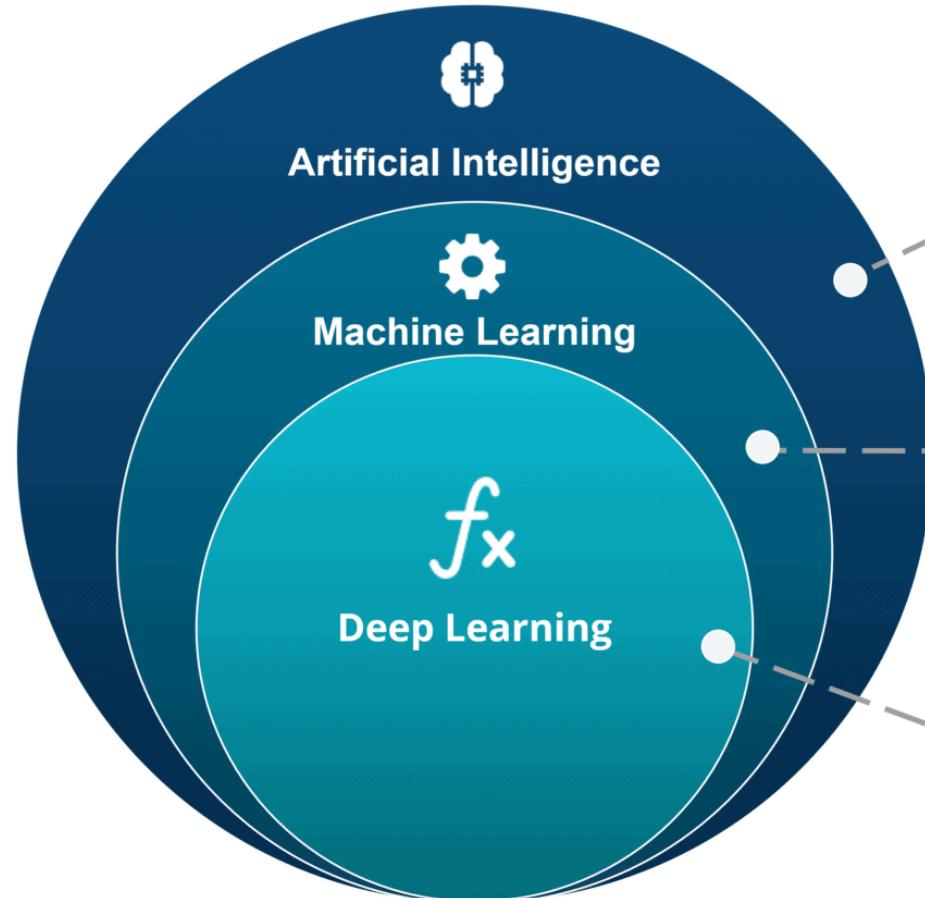


Chat Bot



Letter of Recommendation

Understanding AI, ML & DL



ARTIFICIAL INTELLIGENCE

A technique which enables machines to mimic human behaviour

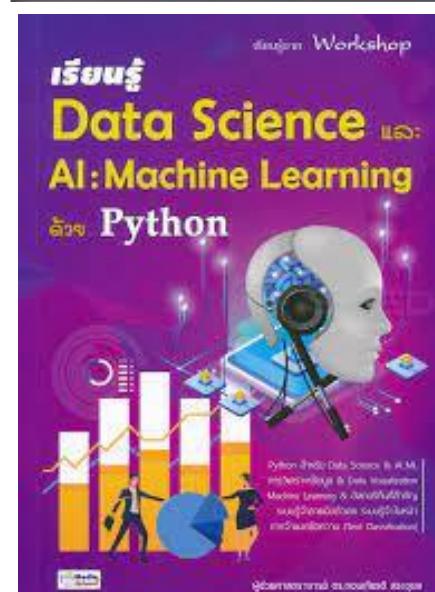
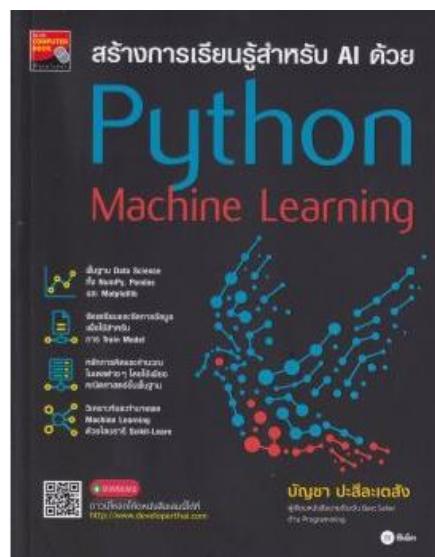
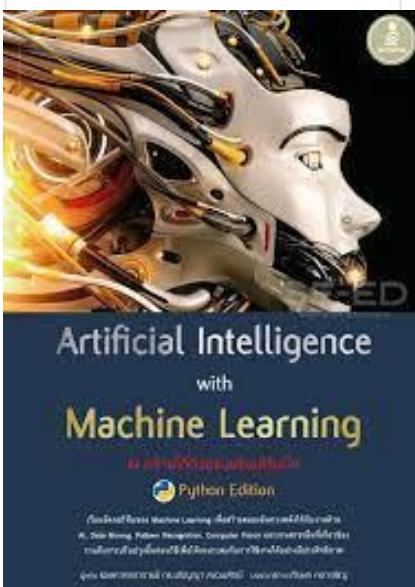
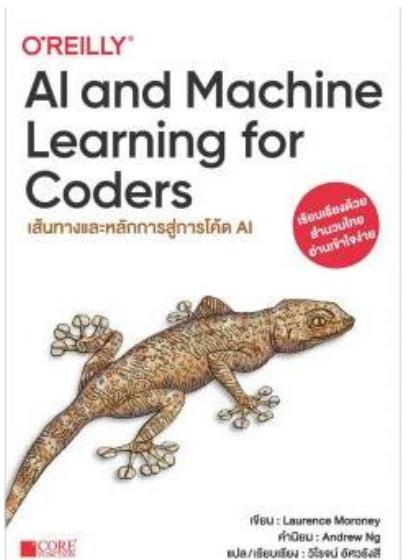
MACHINE LEARNING

Subset of AI technique which use statistical methods to enable machines to improve with experience

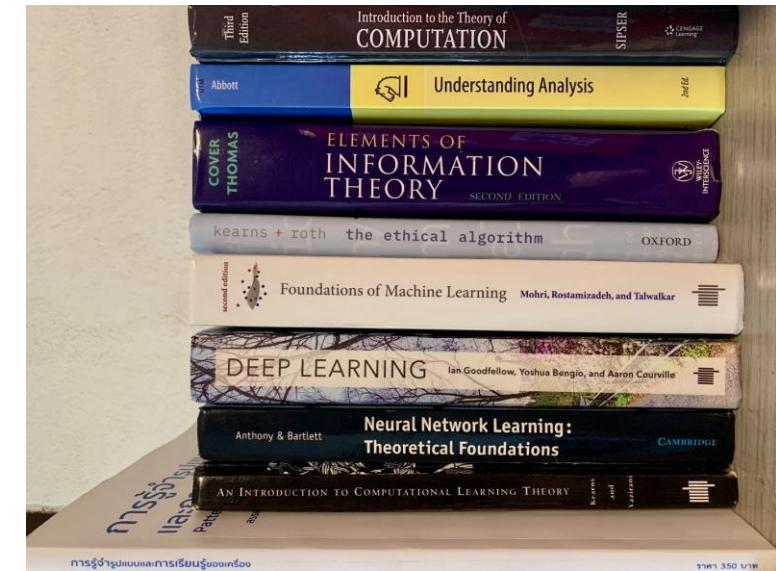
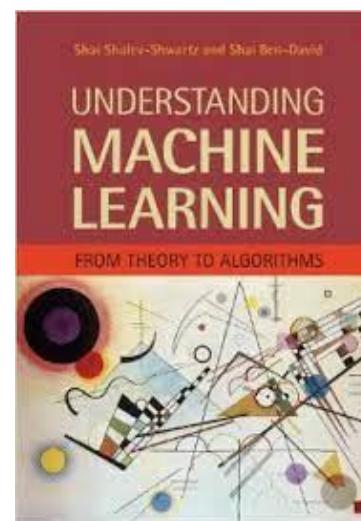
DEEP LEARNING

Subset of ML which make the computation of multi-layer neural network feasible

● Material for Study



<https://guopai.github.io>



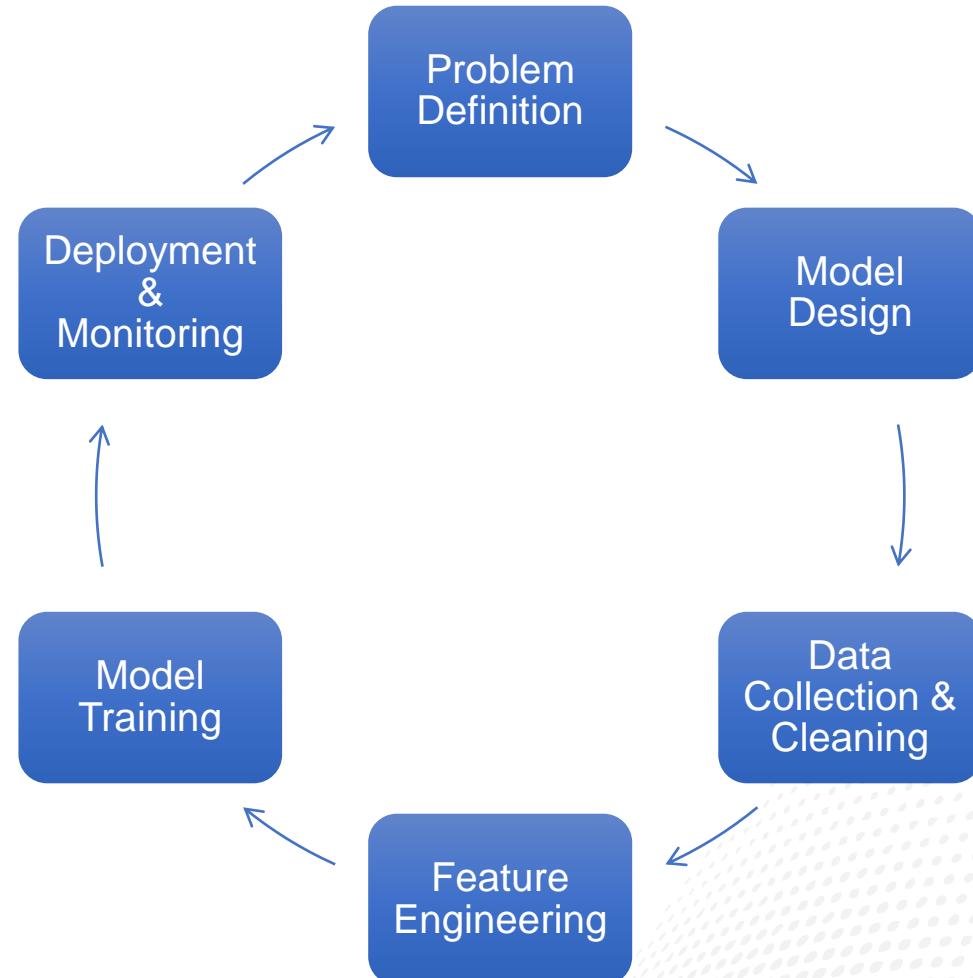
<https://medium.com/@vacharapatt/วิวัฒนาลีด-mchine-learning-ล้านบทที่-bf856f90283>

APPLIED MACHINE LEARNING



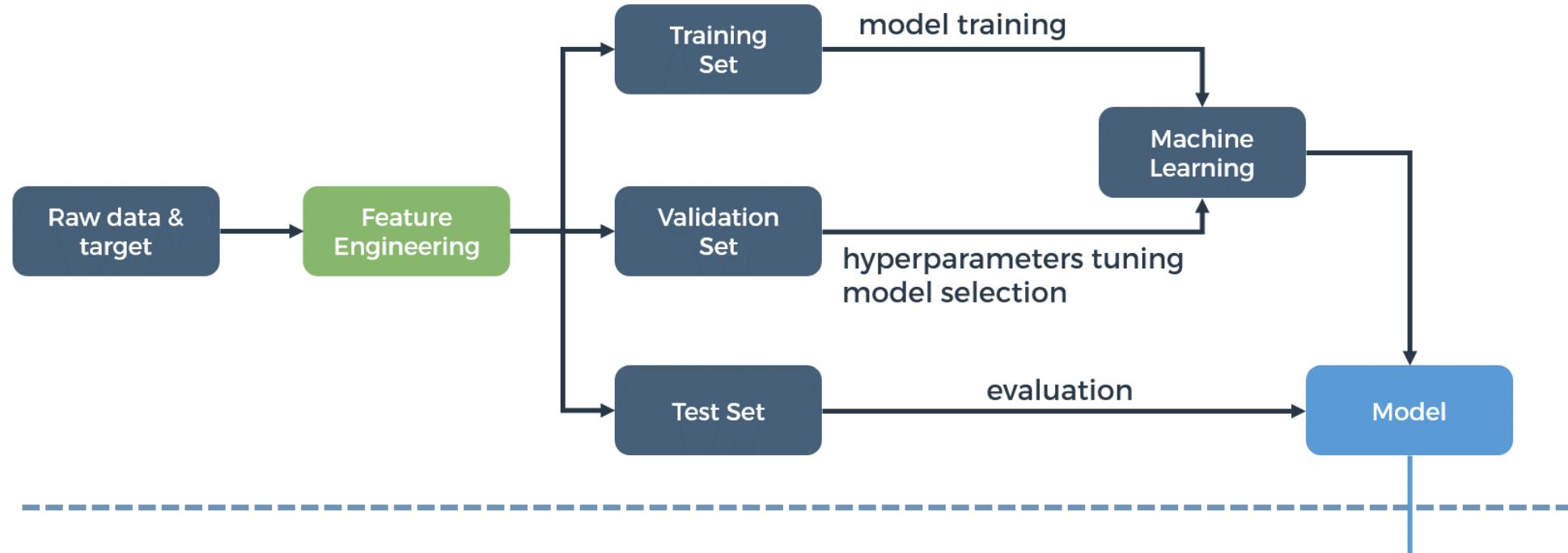
Machine Learning Project Flow

1. **Problem definition and framing**
2. **Model design**
3. **Data collection, labelling, and cleaning**
4. **Feature engineering**
5. **Model training and offline validation**
6. **Model deployment, monitoring & online training**



Machine Learning Process

TRAINING



PREDICTING



● Tools & Frameworks

ML Languages



General ML Frameworks



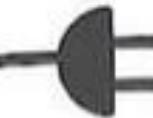
Data Analysis and Visualization tools



ML Frameworks for neural network modelling



unplug



WORK SHOP

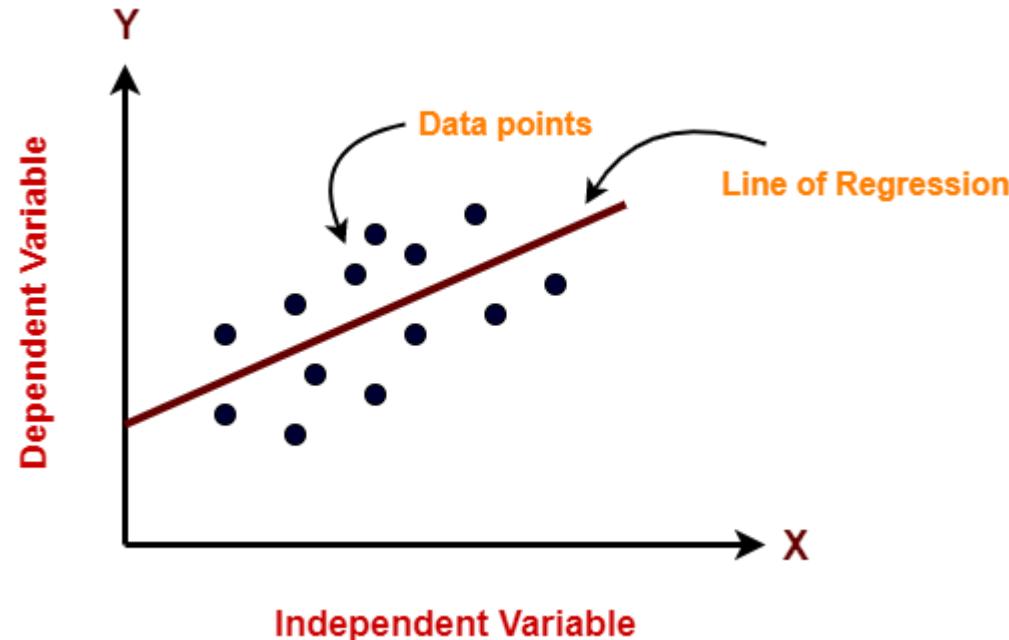
MACHINE LEARNING



● Linear Regression

Simple Linear Regression

$$Y = \beta_0 + \beta_1 X$$



- Y is a dependent variable.
- X is an independent variable.
- β_0 and β_1 are the regression coefficients.
- β_0 is the intercept or the bias that fixes the offset to a line.
- β_1 is the slope or weight that specifies the factor by which X has an impact on Y.

● Linear Regression

What is the best Model?

1. R Square/Adjusted R Square

$$R^2 = 1 - \frac{SS_{Regression}}{SS_{Total}} = 1 - \frac{\sum_i (y_i - \hat{y}_i)^2}{\sum_i (y_i - \bar{y})^2}$$

2. Mean Square Error(MSE)/Root Mean Square Error(RMSE)

$$MSE = \frac{1}{N} \sum_{i=1}^N (y_i - \hat{y}_i)^2$$

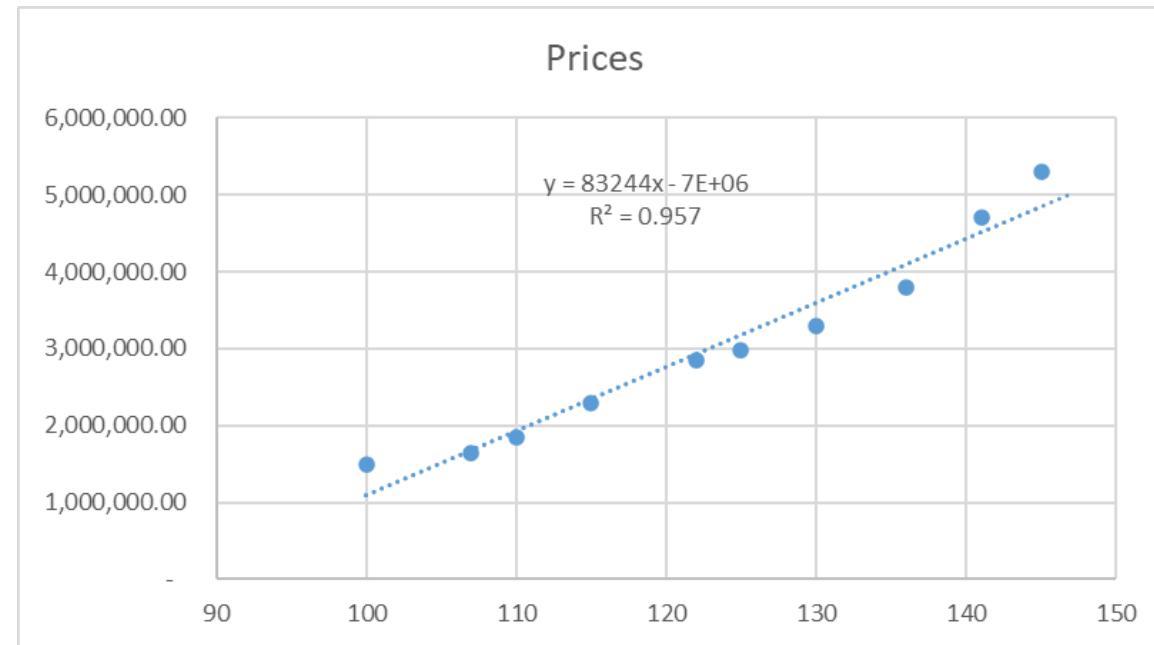
3. Mean Absolute Error(MAE)

$$MAE = \frac{1}{N} \sum_{i=1}^N |y_i - \hat{y}_i|$$

● Linear Regression

Ex. Simple Linear Regression

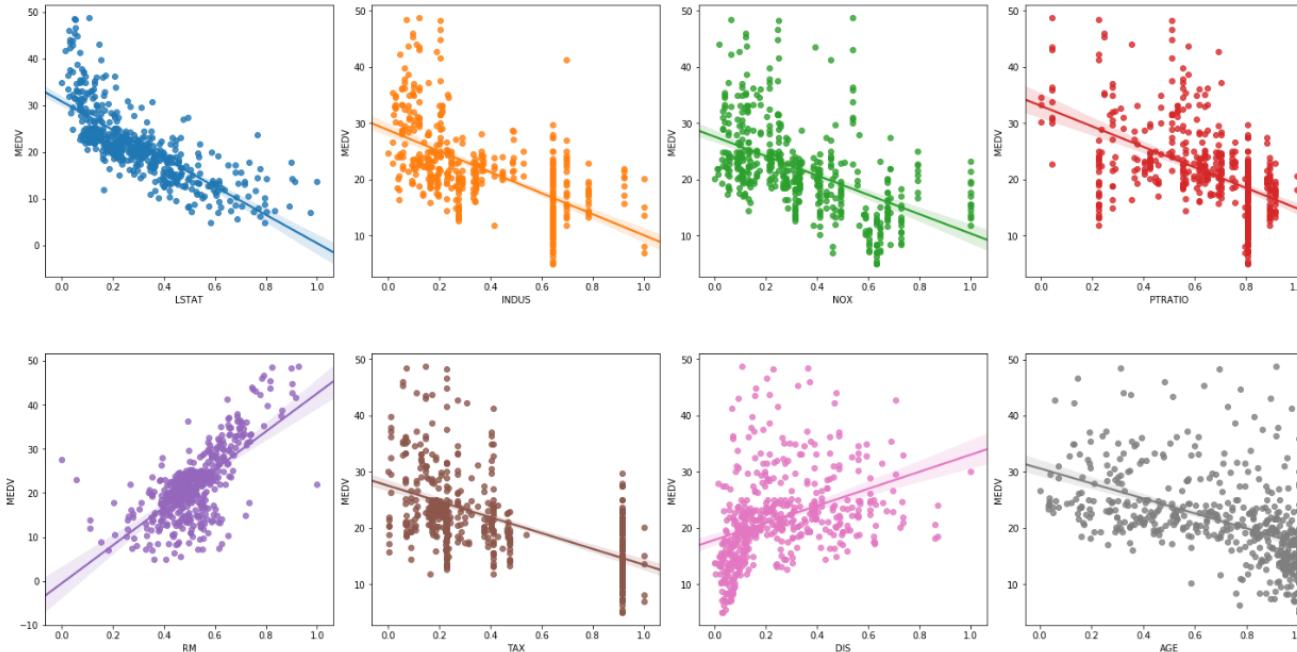
Square Meter	Prices
100	1,500,000.00
107	1,650,000.00
110	1,840,000.00
115	2,300,000.00
122	2,850,000.00
125	2,975,000.00
130	3,300,000.00
136	3,800,000.00
141	4,700,000.00
145	5,300,000.00



Prediction = ??

● Linear Regression

Multiple Linear Regression

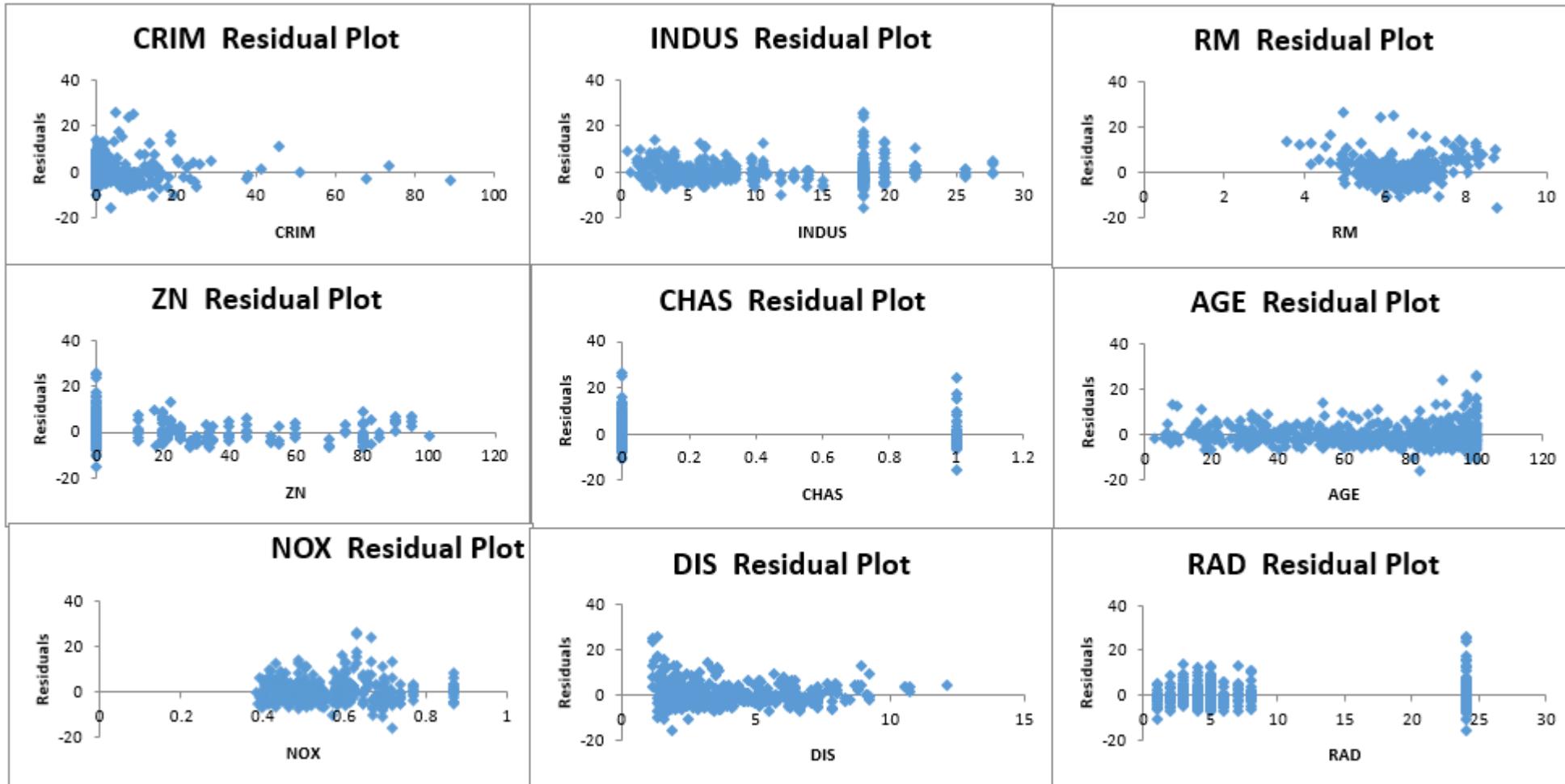


$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n$$

- Y is a dependent variable.
- X₁, X₂, ..., X_n are independent variables.
- β₀, β₁, ..., β_n are the regression coefficients.
- β_j (1 <= j <= n) is the slope or weight that specifies the factor by which X_j has an impact on Y.

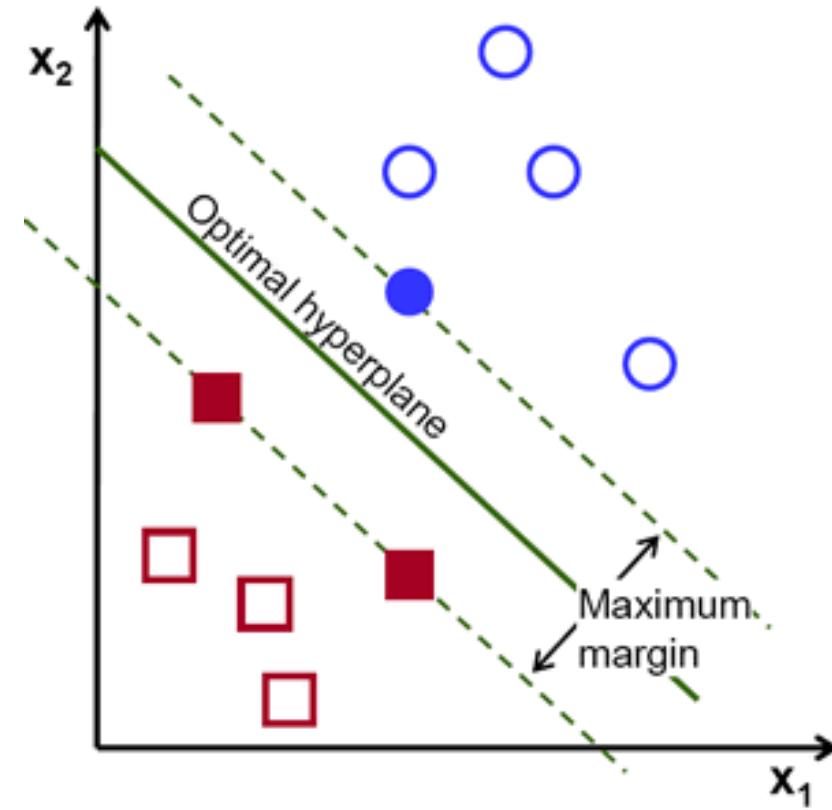
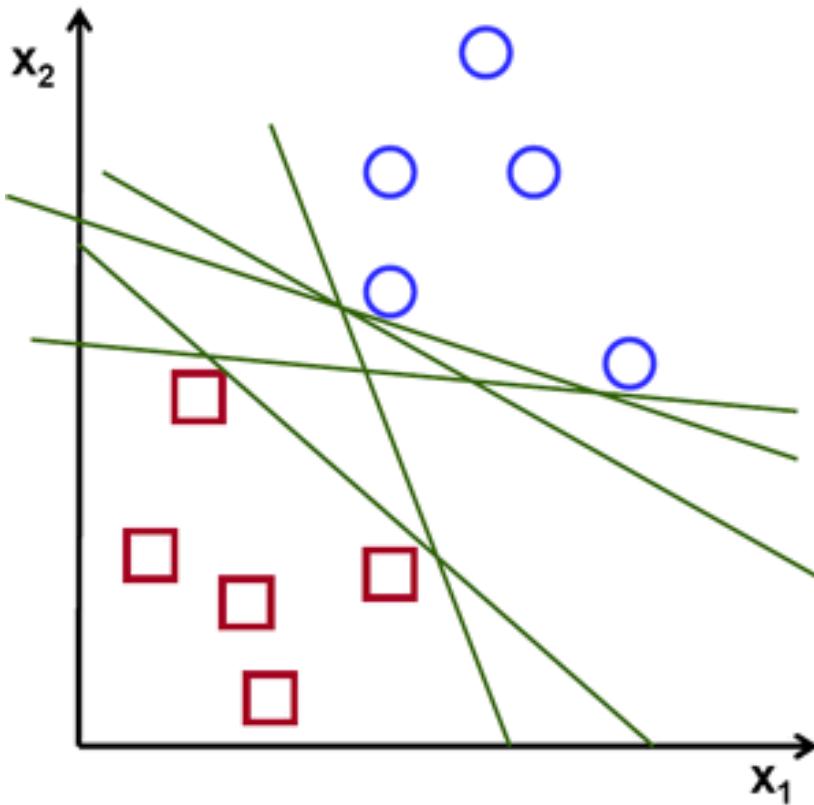
Linear Regression

Ex. Multiple Linear Regression

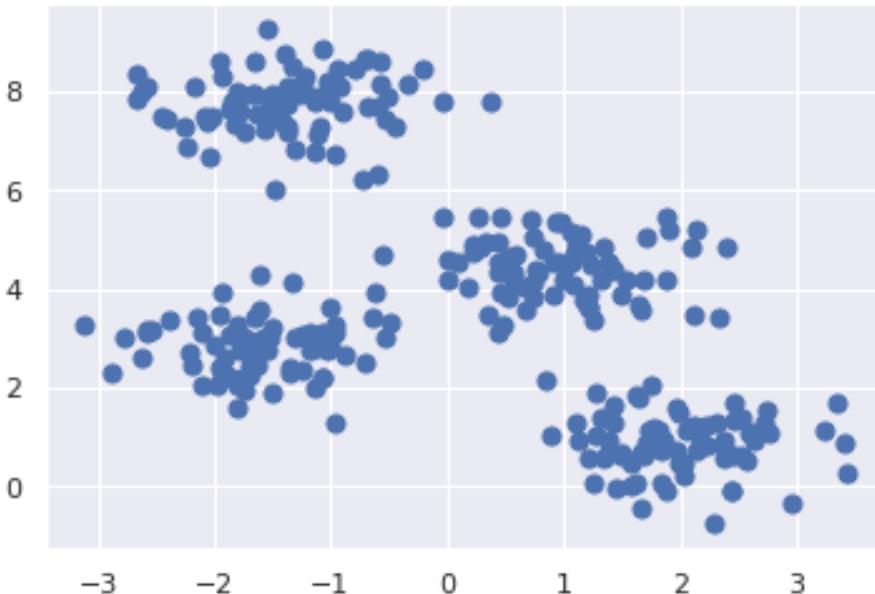


● Support-Vector Machines

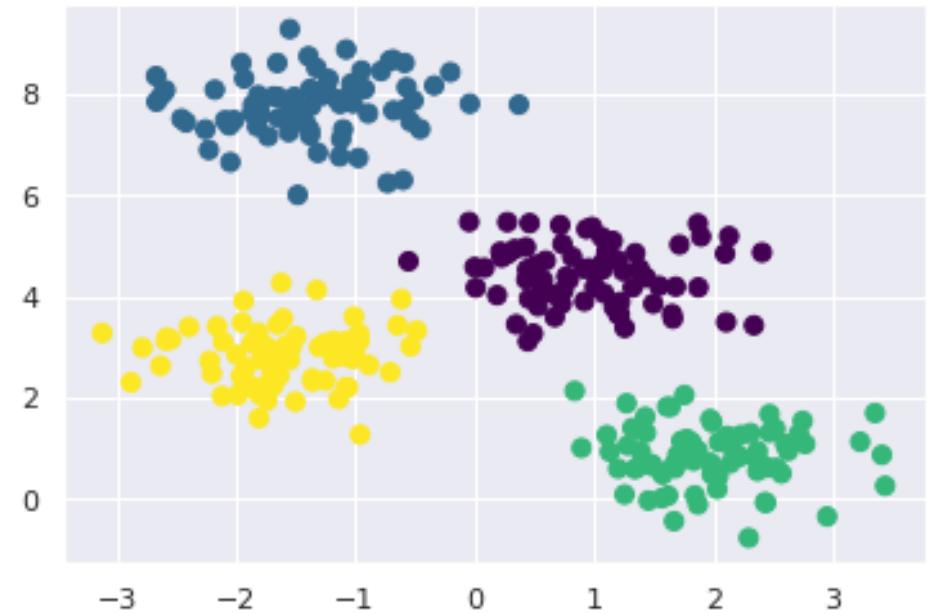
The objective of the support vector machine algorithm is to find a hyperplane in an N-dimensional space(N — the number of features) that distinctly classifies the data points.



● K-Mean Clustering



K-Mean



● Principal Component Analysis

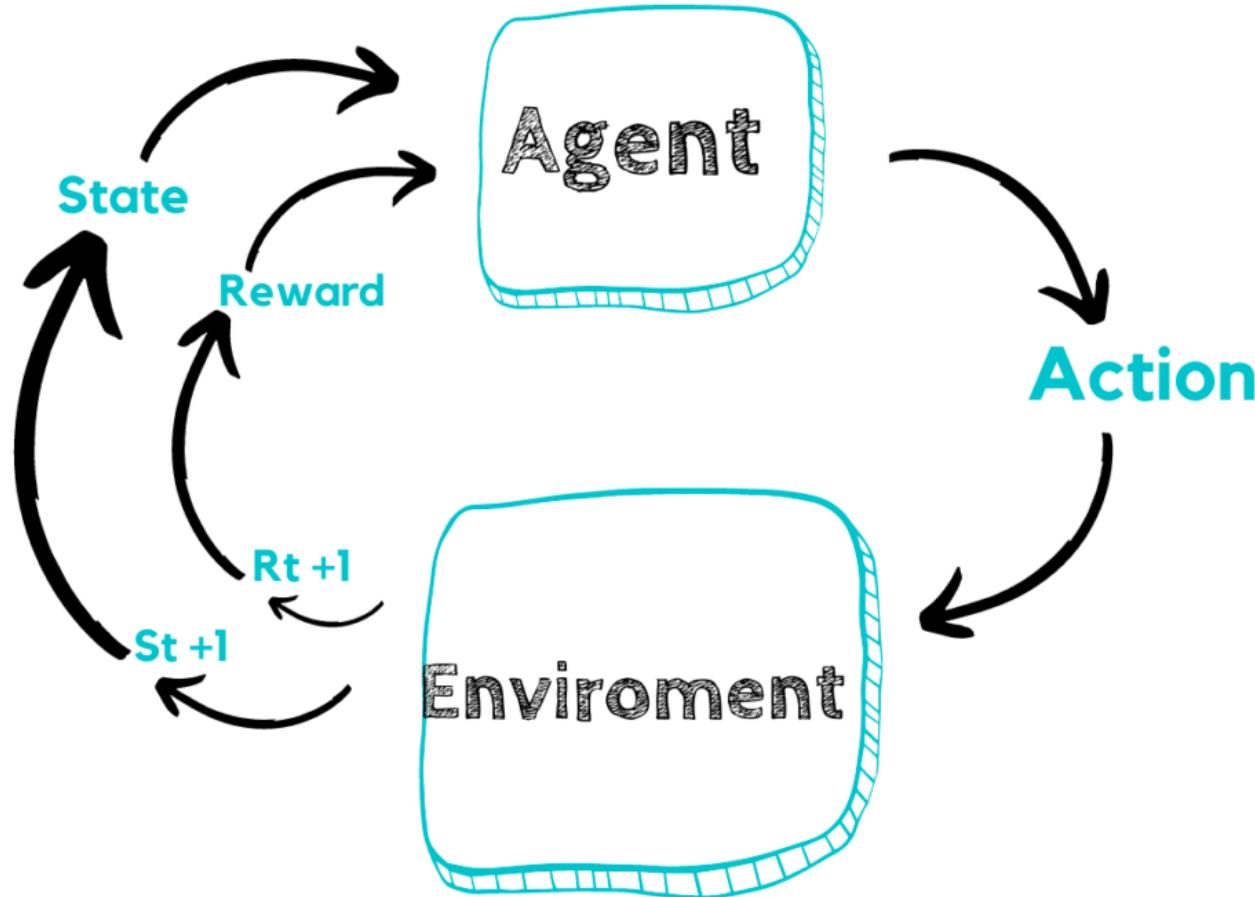


Noise in Dataset



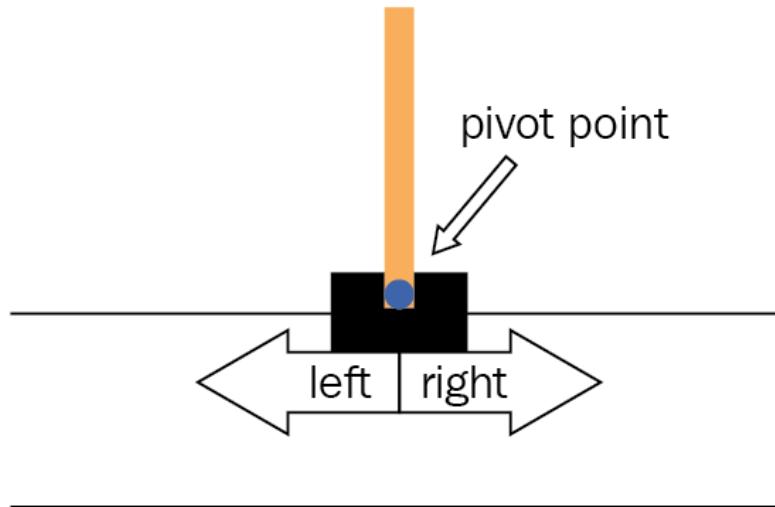
PCA as Noise Filtering

● Reinforcement Learning

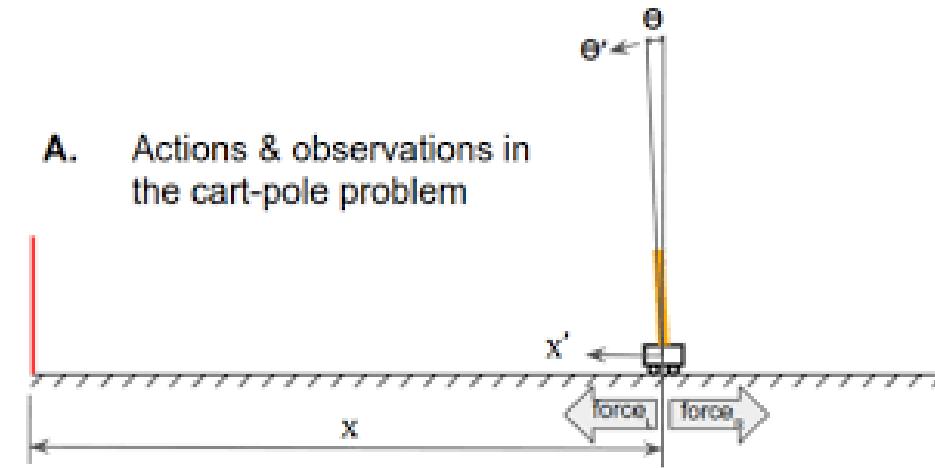


● Reinforcement Learning

Cartpole using RL



A. Actions & observations in the cart-pole problem



Thanks !