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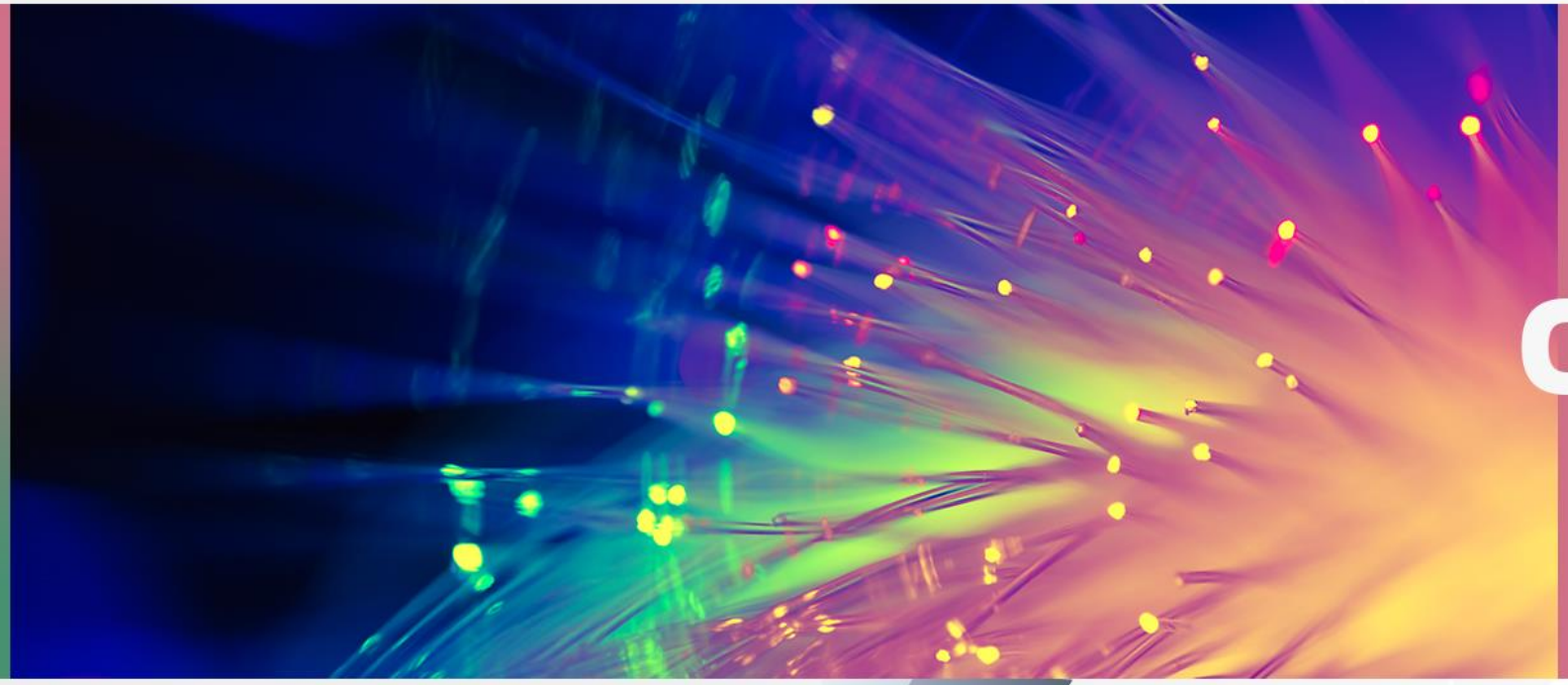
INNOVATION
SCHOOL

TAUTOLOGY



AI OVERVIEW

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AI OVERVIEW

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AI Overview

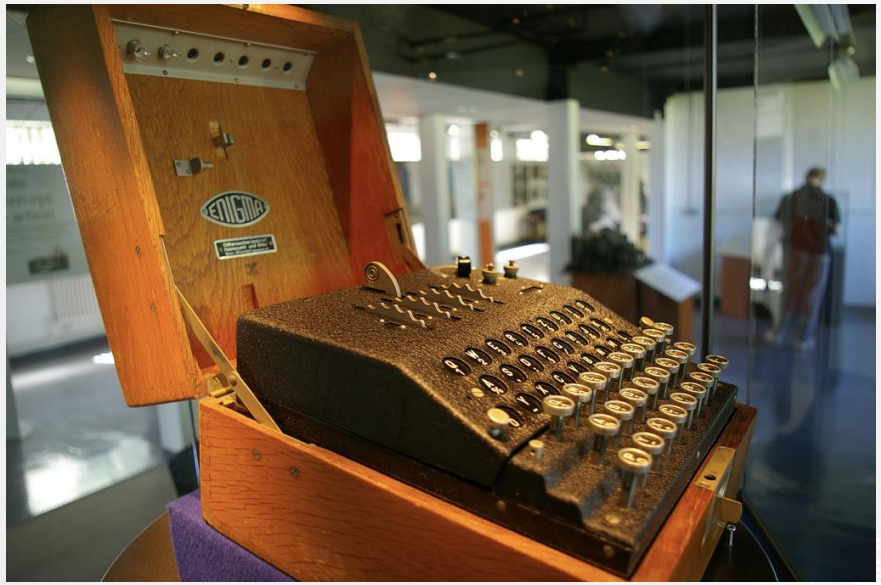
History of AI

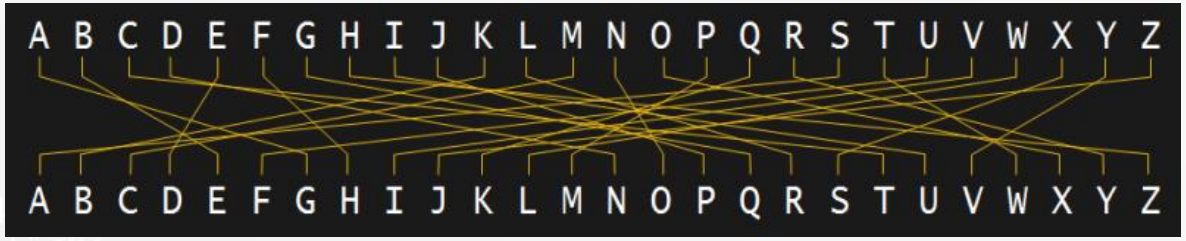
History of AI

- **ประวัติศาสตร์ของ AI** เริ่มต้นขึ้นในสมัยสงครามโลกครั้งที่ 2 (September 1, 1939 – September 2, 1945)

History of AI

- **Enigma Code**

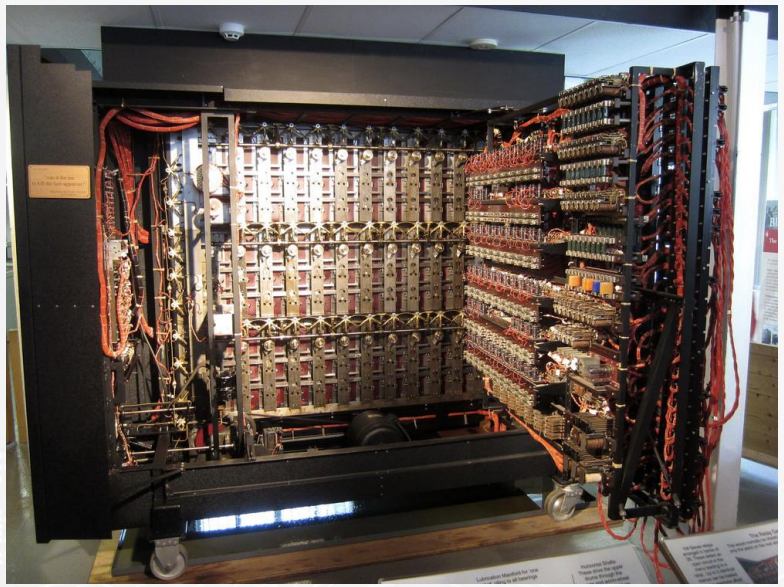




History of AI

- **The Bombe** : Enigma code-breaking machine

(paper : 1936, เครื่องจริง : 14 March 1940)



History of AI

คนฉลาด vs คอมพิวเตอร์

ปี 1956 บัญญัติศัพท์คำว่า Artificial Intelligence ขึ้นมาเป็นครั้งแรก

History of AI

- Linear Regression เกิดขึ้นในปี 1795
- Gaussian Process เกิดขึ้นในปี 1809
- Logistic Regression เกิดขึ้นในปี 1844
- Linear Discriminant Analysis เกิดขึ้นในปี 1936
- k Nearest Neighbor เกิดขึ้นในปี 1951

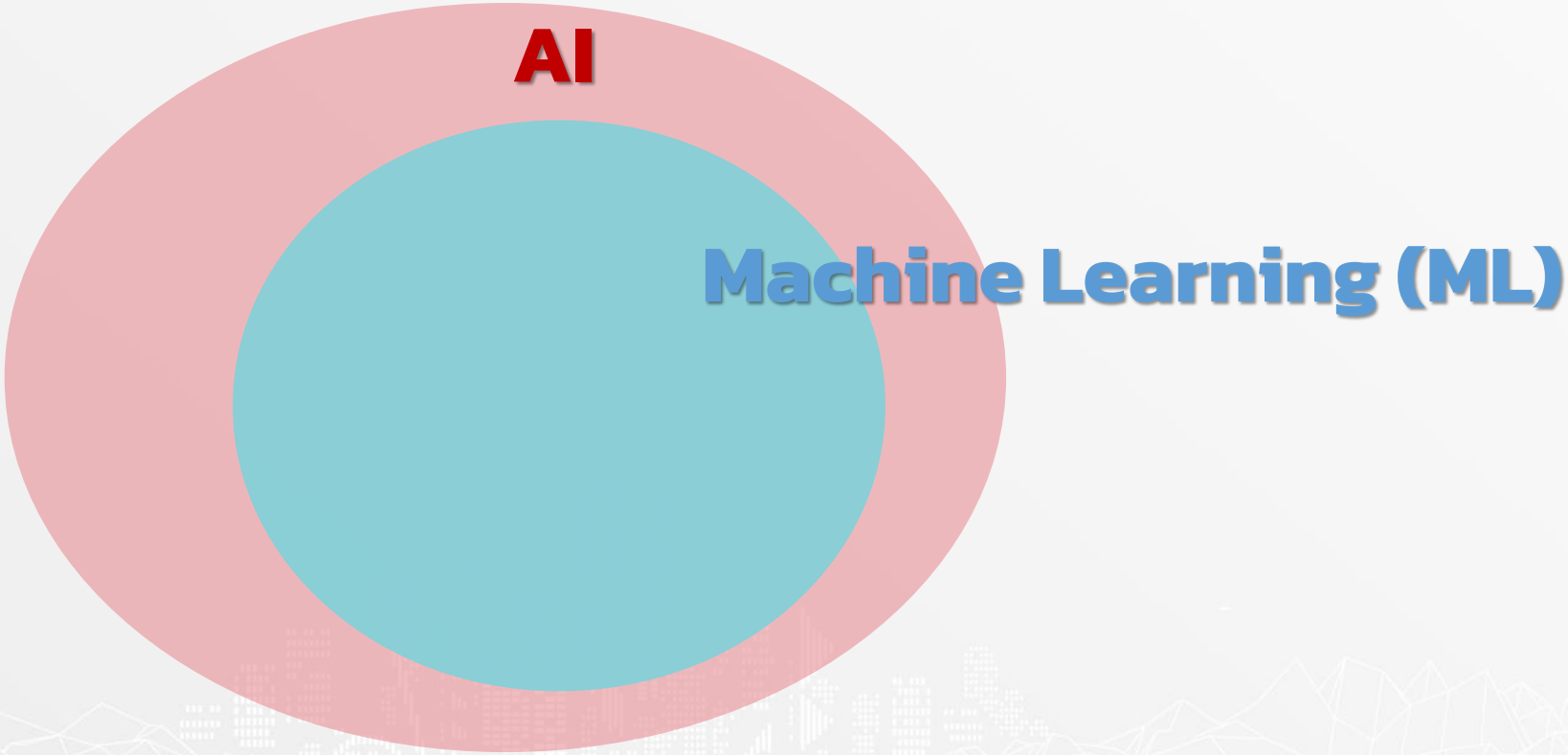
History of AI

- Neural Network & Deep Learning concept 1943, เกิดขึ้นจริงในปี 1958
- Naïve Bayes เกิดขึ้นในปี 1973
- Decision Tree เกิดขึ้นในปี 1977
- Support Vector Machine เกิดขึ้นในปี 1995

History of AI

- ปี 1959 บัญญัติศัพท์คำว่า Machine Learning ขึ้นมาเป็นครั้งแรก

History of AI



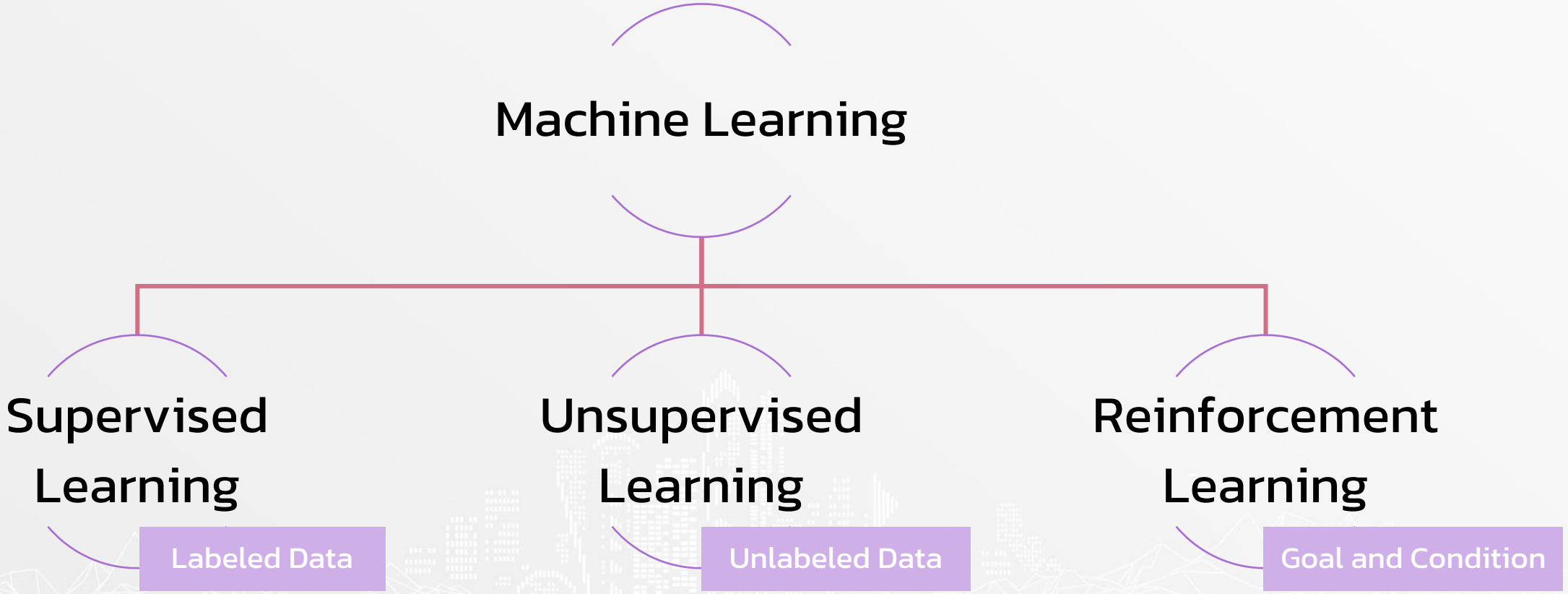
AI Overview

Machine Learning

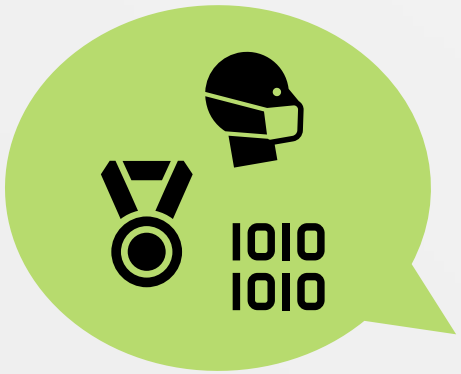
Type of Machine Learning

1. Supervised Learning Algorithms
2. Unsupervised Learning Algorithms
3. Reinforcement Learning Algorithms

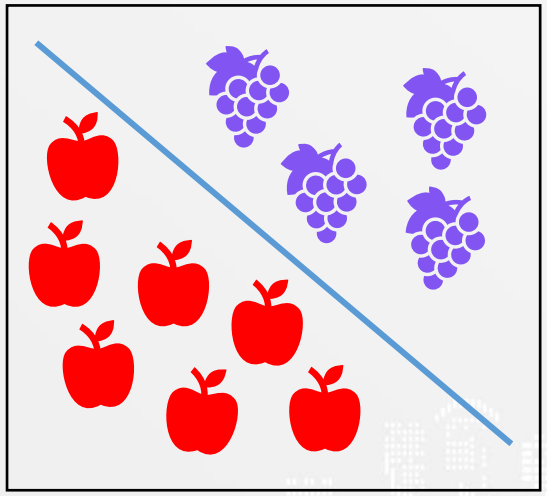
Type of Machine Learning



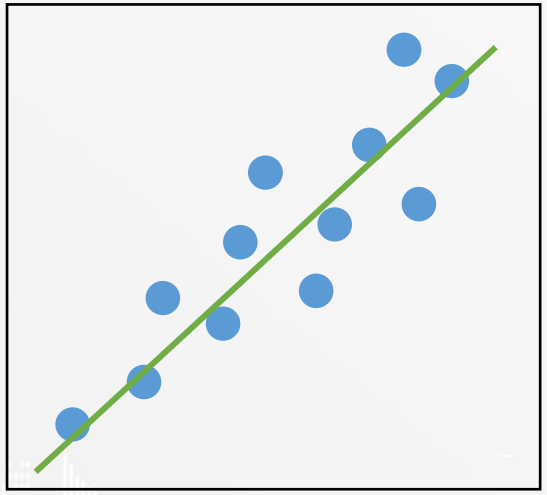
Supervised Learning



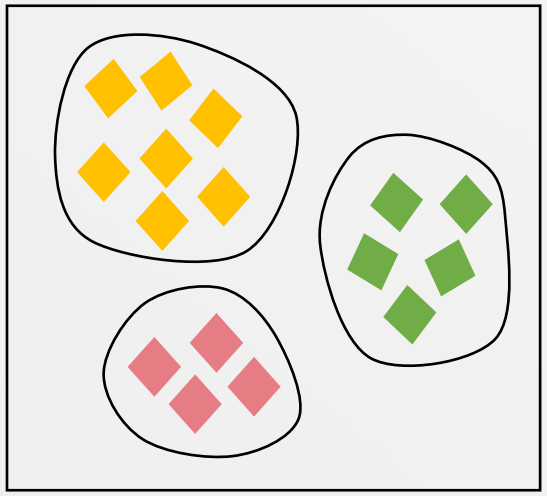
Classification



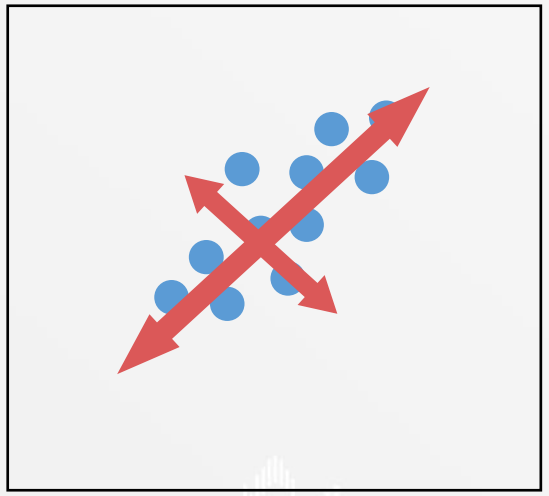
Regression



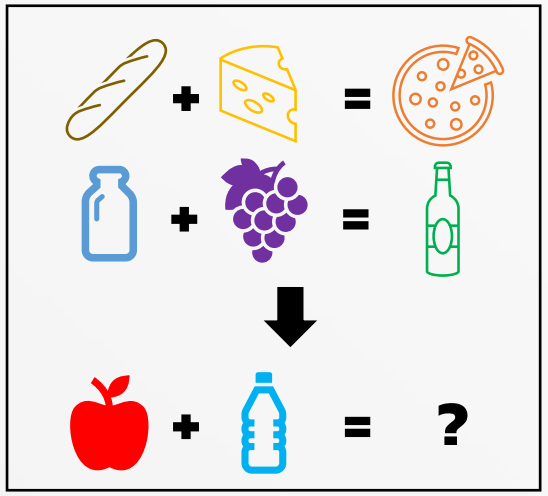
Unsupervised Learning



Clustering

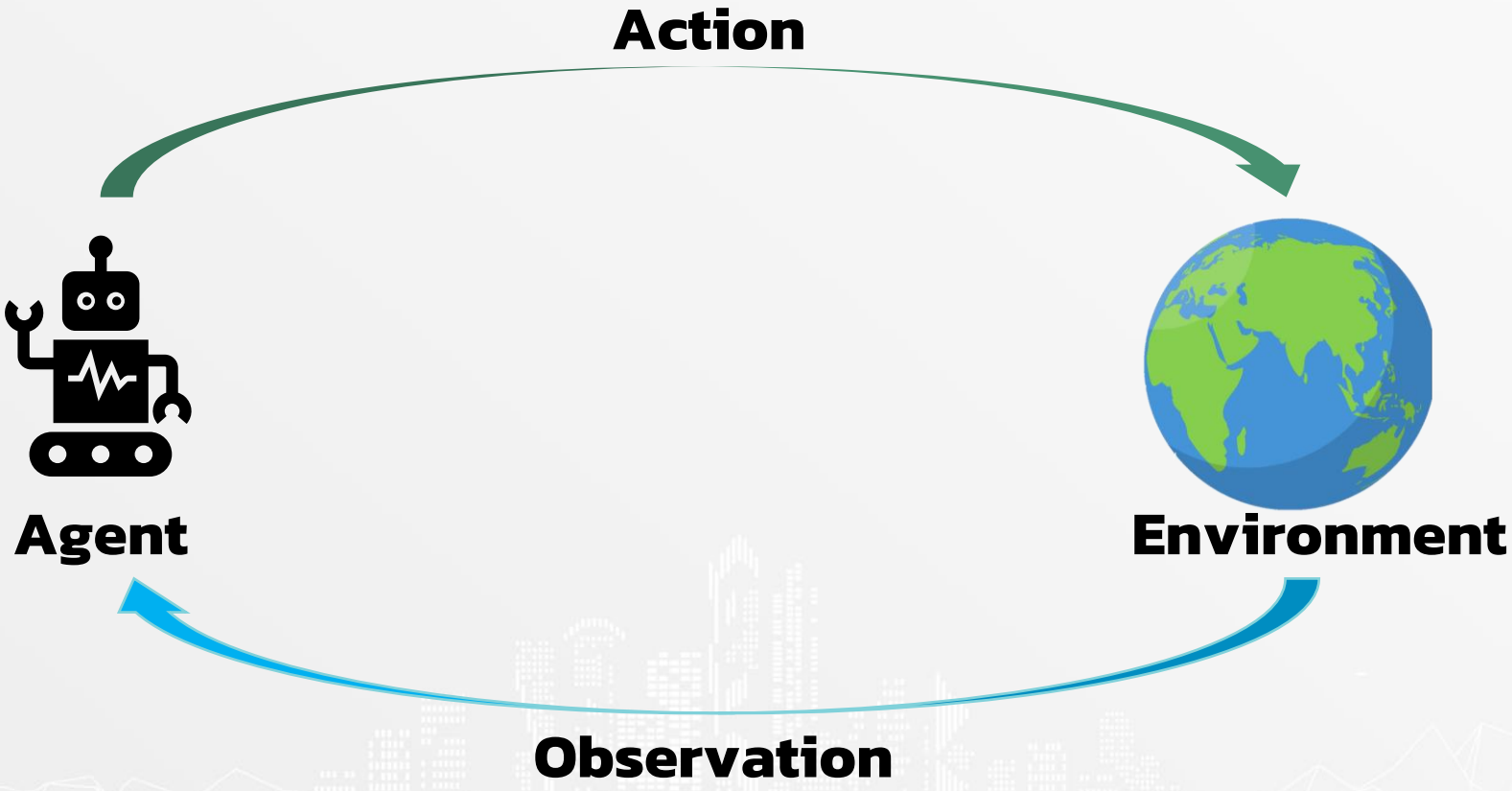


Dimensionality Reduction

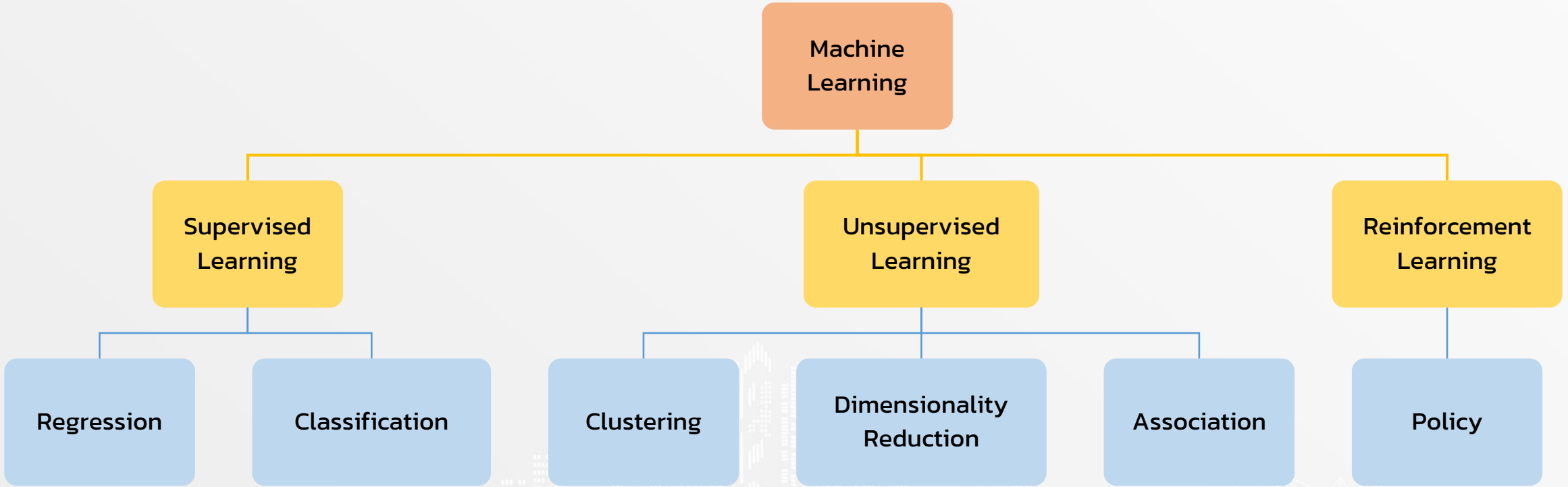


Association

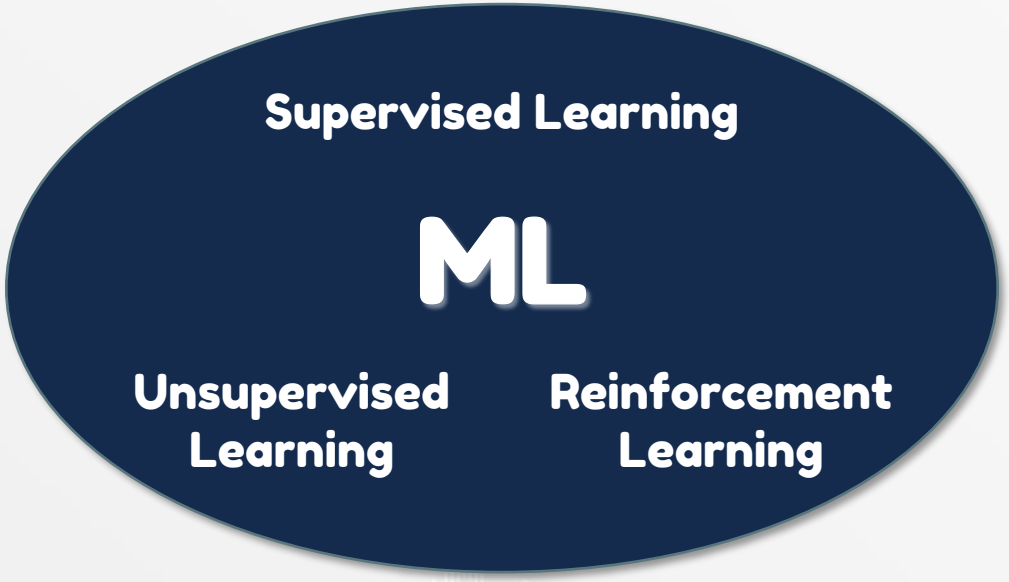
Reinforcement Learning



Type of Machine Learning



Machine Learning Overview



- Computer Vision
- Natural Language Process
- Recommendation System
- Generative AI

AI Overview

Completed Roadmap

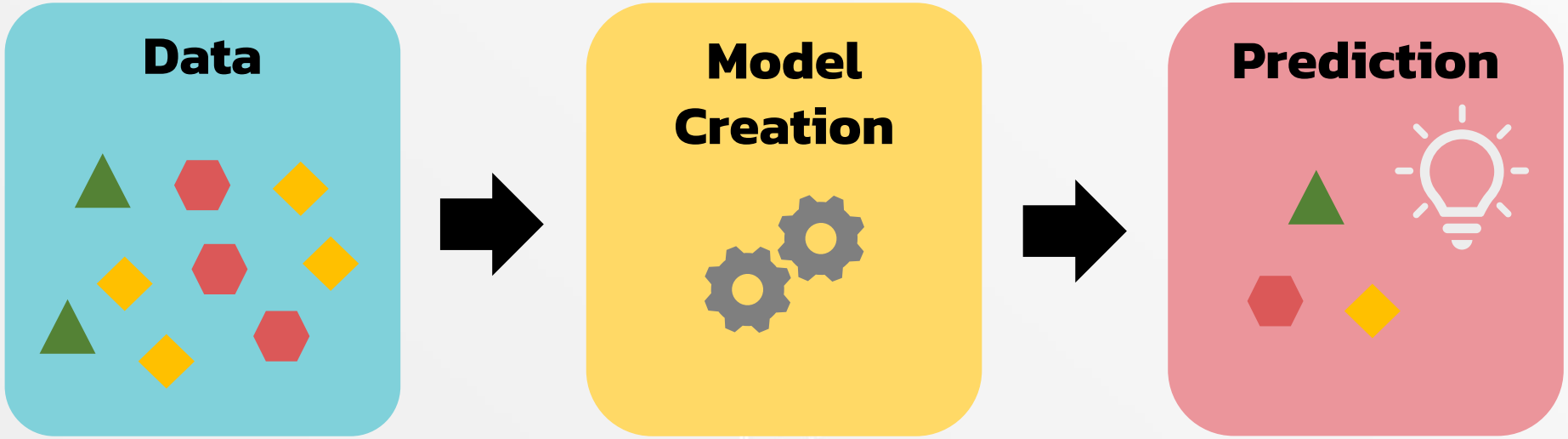
Completed Roadmap

- ❑ Supervised Learning
- ❑ Concept Drift
- ❑ Ensemble Learning
- ❑ Unsupervised Learning
- ❑ Reinforcement Learning
- ❑ Related Task in Machine Learning
  - Computer Vision
  - NLP
  - Recommendation System
  - Generative AI

AI Overview

Supervised Learning

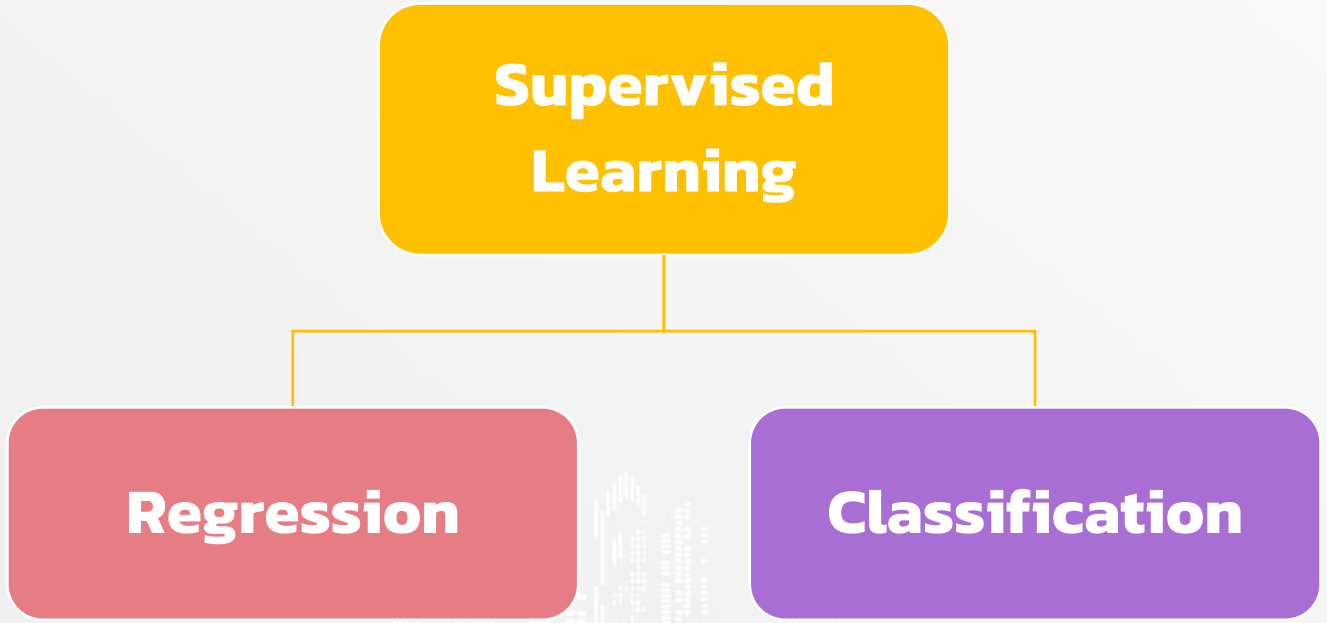
Concept of Supervised Learning



Concept of Supervised Learning

Data ⇨ Model ⇨ Prediction

Regression and Classification



Classification

น้ำหนัก (kg)	ความดัน (mmHg)	เป็นโรคเบาหวาน
65	130	ไม่เป็น
42	142	ไม่เป็น
56	171	เป็น
71	129	เป็น
59	135	ไม่เป็น
60	**127**	**?**

ตัวอย่างการพยากรณ์โรคเบาหวาน โดยใช้ตัวแปรต้น คือ น้ำหนัก และ ความดัน

Classification

น้ำหนัก (kg)	ความดัน (mmHg)	เป็นโรคเบาหวาน
65	130	ไม่เป็น
42	142	ไม่เป็น
56	171	เป็น
71	129	เป็น
59	135	ไม่เป็น

Data

Model

น้ำหนัก (kg)	ความดัน (mmHg)	เป็นโรคเบาหวาน
60	127	?

Prediction

Regression

พื้นที่บ้าน (ตร.ม.)	จำนวนชั้น	ราคา (ล้านบาท)
165	1	4.89
350	2	17.03
600	2	30.1
145	1	4.69
187	2	8.5
142	**1**	**?**

ตัวอย่างการพยากรณ์ราคาบ้าน โดยใช้ตัวแปรต้น คือ พื้นที่บ้าน และ จำนวนชั้นของบ้าน

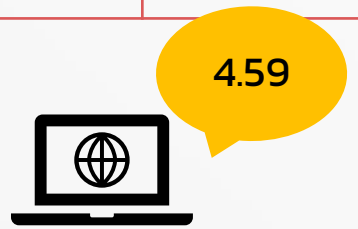
Regression

พื้นที่บ้าน (ตร.ม.)	จำนวนชั้น	ราคา (ล้านบาท)
165	1	4.89
350	2	17.03
600	2	30.1
145	1	4.69
187	2	8.5

Data

Model

พื้นที่บ้าน (ตร.ม.)	จำนวนชั้น	ราคา (ล้านบาท)
142	1	?



Prediction

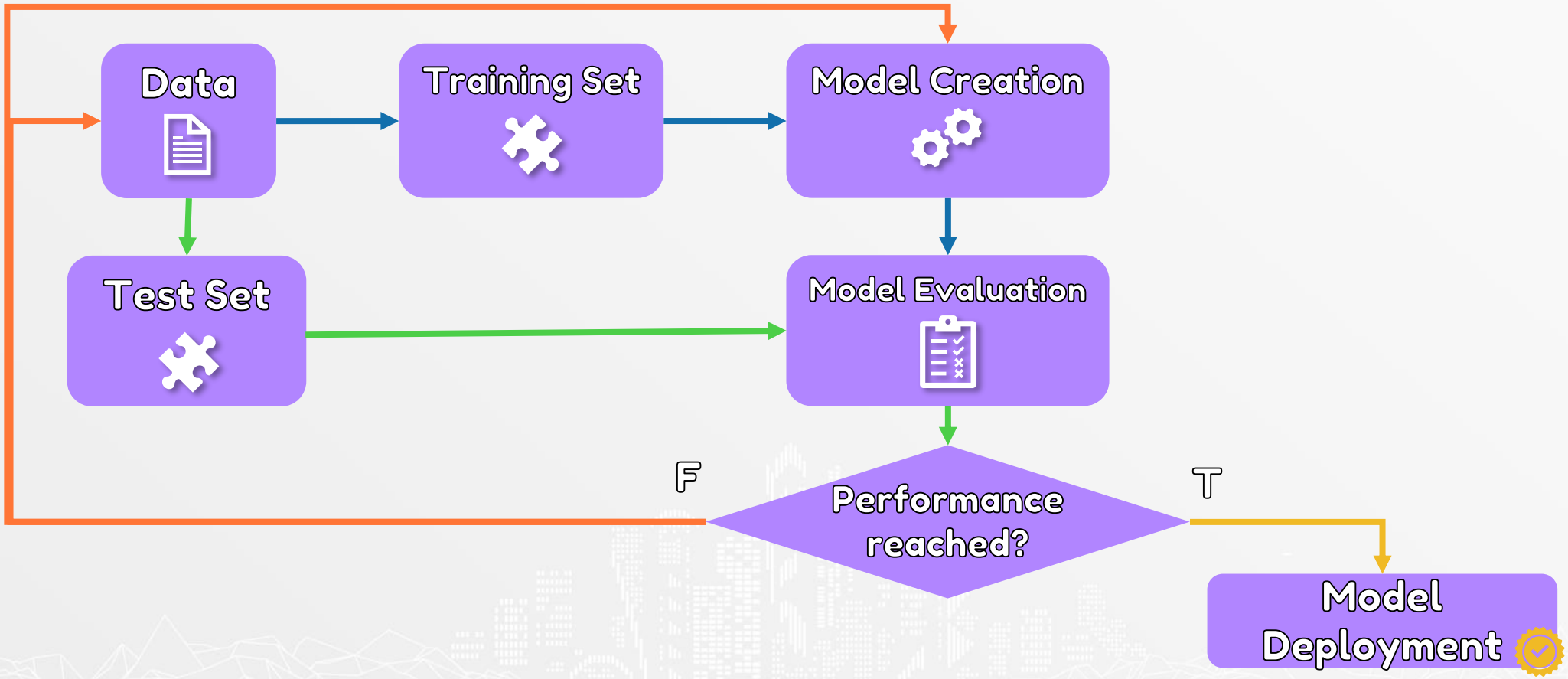
Supervised Learning Algorithm

- Linear Regression
- Logistic Regression
- Neural Network
- Deep Learning
- Convolutional Neural Network
- Recurrent Neural Network
- Classification Tree
- Regression Tree
- k Nearest Neighbor
- Support Vector Classification
- Support Vector Regression
- Gaussian Process
- Linear Discriminant Analysis
- Naive Bayes

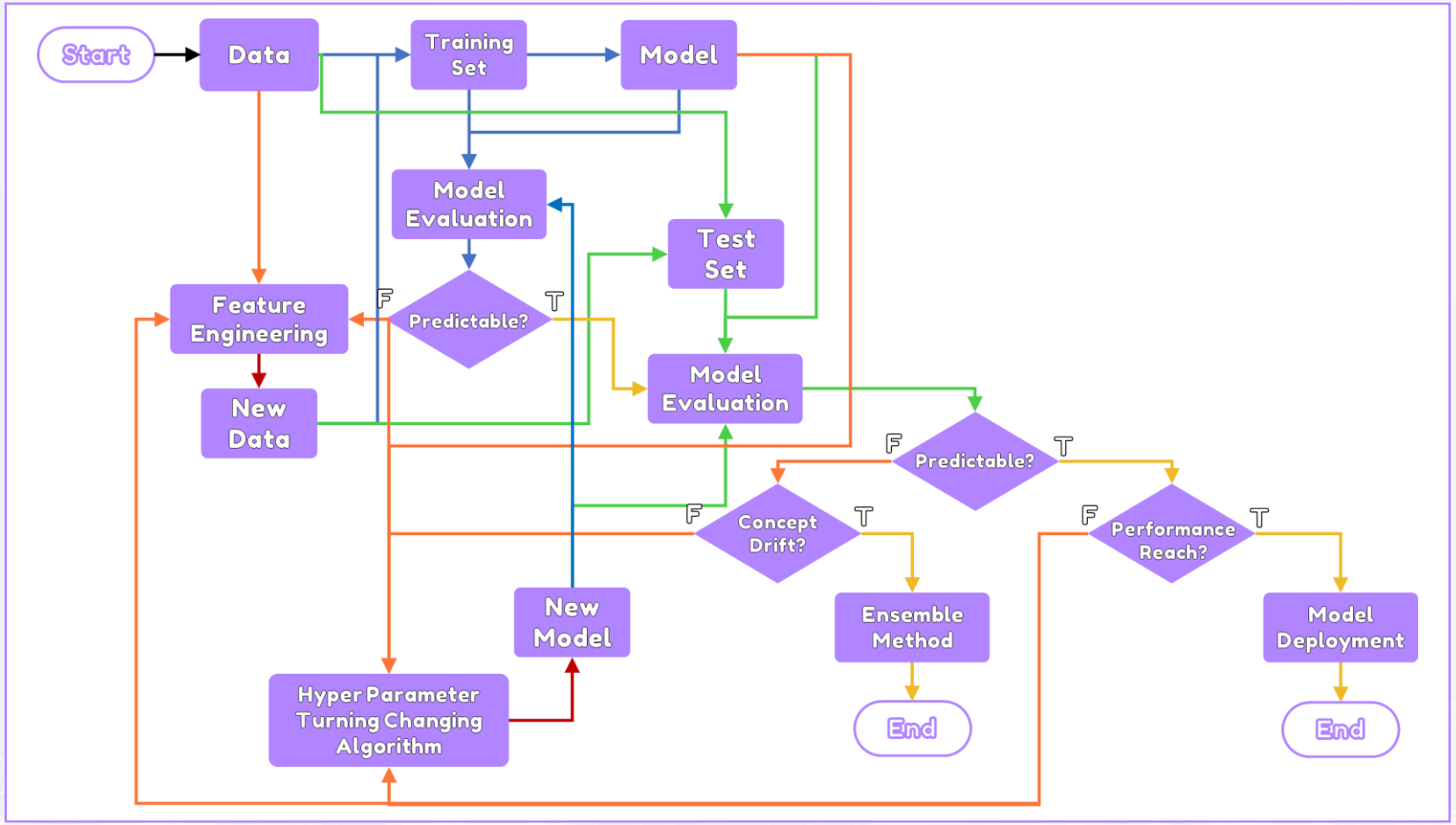
AI Overview

Supervised Learning Workflow

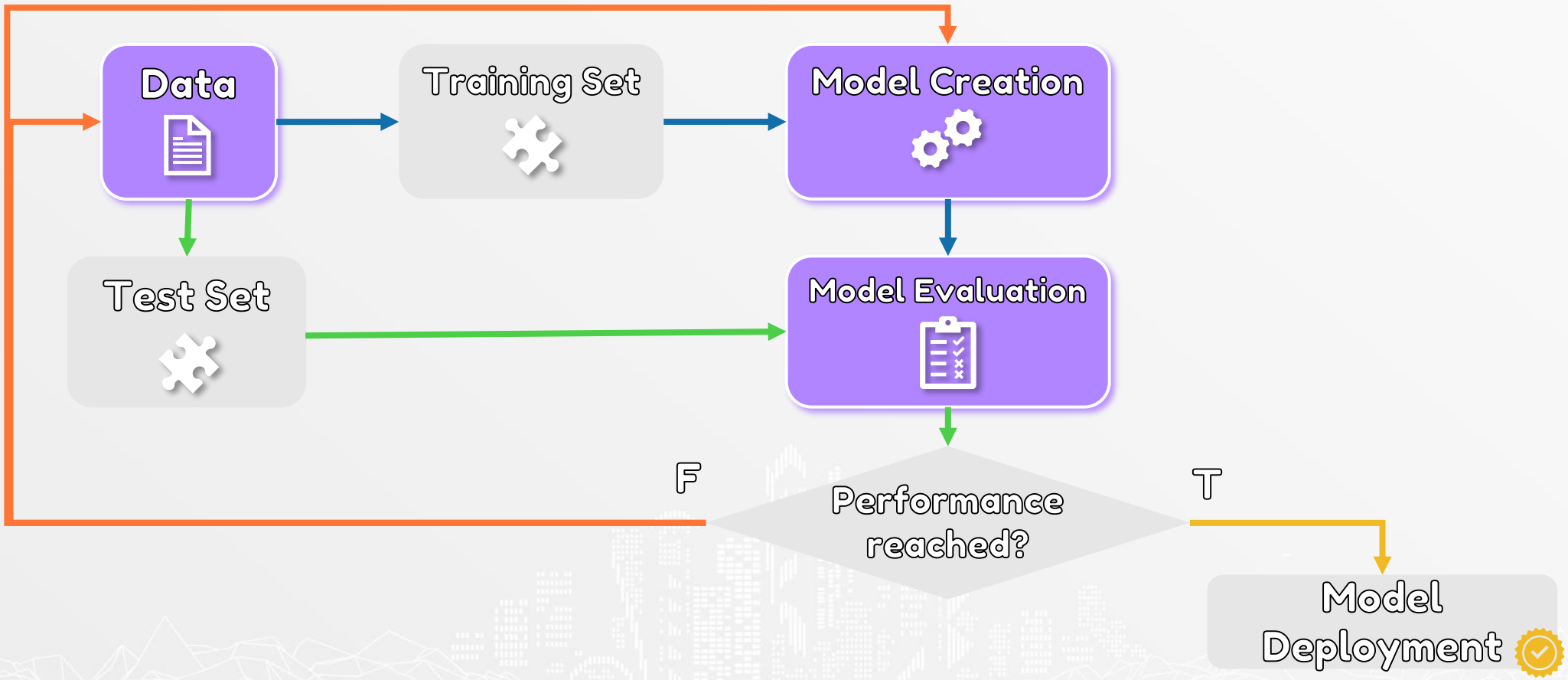
Supervised Learning Workflow



Supervised Learning Workflow



Supervised Learning Workflow



AI Overview

Key Success of AI Creation

Key Success of AI Creation

- Right Feature + Right Data Preparation
- Right Algorithm

AI Overview

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UNSUPERVISED LEARNING

UNSUPERVISED LEARNING

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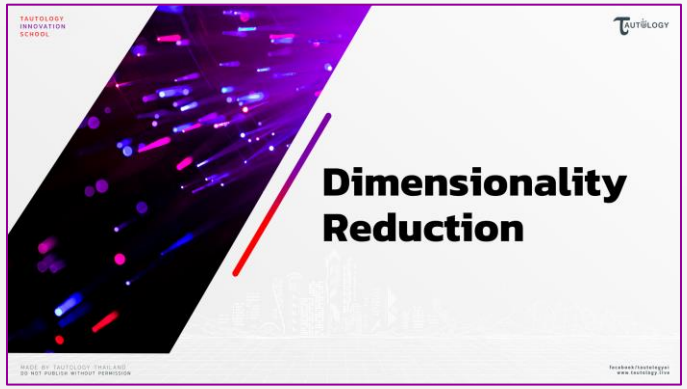
Unsupervised Learning



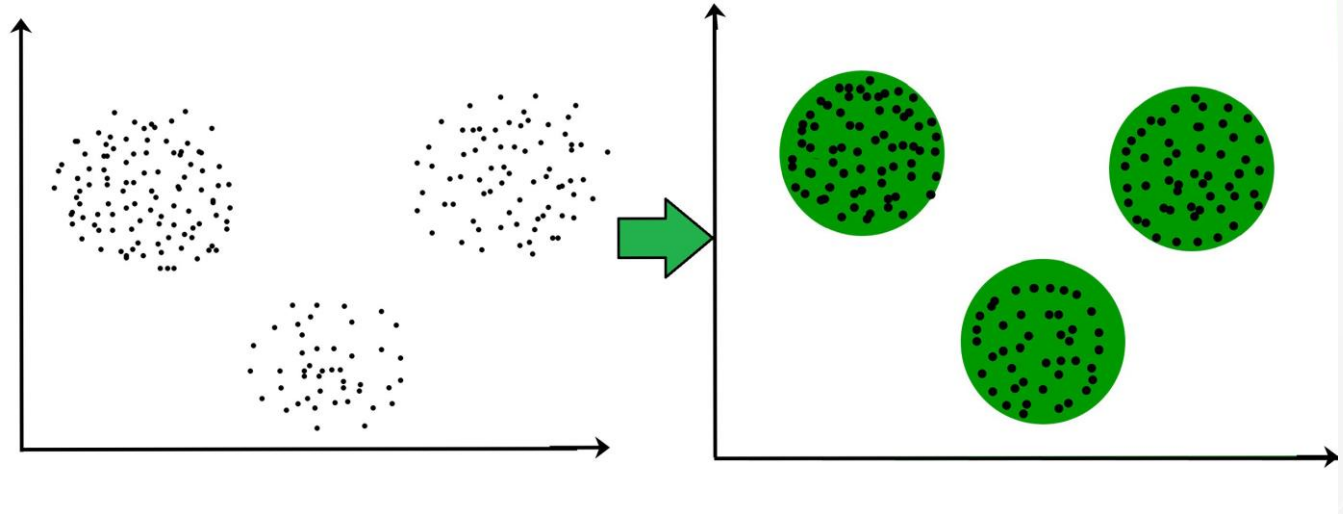
Clustering

Clustering

- ☐ What is Clustering?
- ☐ Benefit of Clustering
- ☐ Algorithms in Clustering

What is Clustering?

Clustering Model คือ การแบ่งข้อมูลประเภท unlabeled data ออกเป็นกลุ่ม ๆ โดยข้อมูลที่มีโครงสร้างคล้ายคลึงกันจะอยู่ในกลุ่มเดียวกัน



Ref : https://www.geeksforgeeks.org/clustering-in-machine-learning/

Clustering

- [x] **What is Clustering?**
- [ ] Benefit of Clustering
- [ ] Algorithms in Clustering

Benefit of Clustering

- ในบางสถานการณ์ที่เราต้องการสร้าง supervised learning model แต่ว่าข้อมูลของเราเป็น unlabeled data เราก็สามารถใช้ clustering เพื่อใส่ label ให้กับ data ก่อนได้
- ในหลาย ๆ กรณี การแบ่งกลุ่มข้อมูลก่อน แล้วค่อยนำข้อมูลแต่ละกลุ่มไปสร้าง supervised learning model จะทำให้ได้ผลลัพธ์จาก model ที่ดียิ่งขึ้น

Clustering

- [x] **What is Clustering?**
- [x] **Benefit of Clustering**
- [ ] Algorithms in Clustering

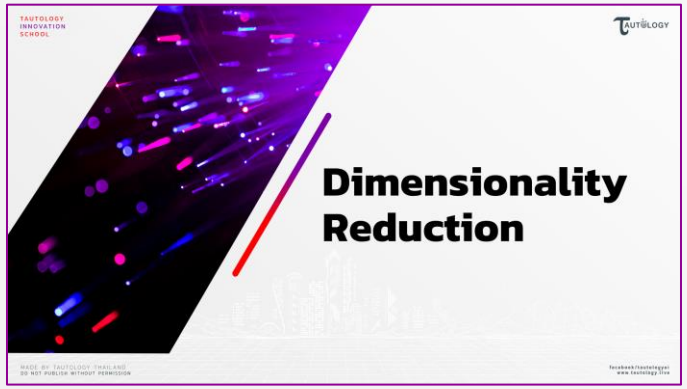
Algorithms in Clustering

- K-means Clustering
- DBSCAN
- Gaussian Mixture Model
- BIRCH
- Affinity Propagation Clustering
- Mean-Shift Clustering
- OPTICS
- Agglomerative Hierarchy Clustering

Clustering

- ☑ What is Clustering?
- ☑ Benefit of Clustering
- ☑ Algorithms in Clustering

Unsupervised Learning



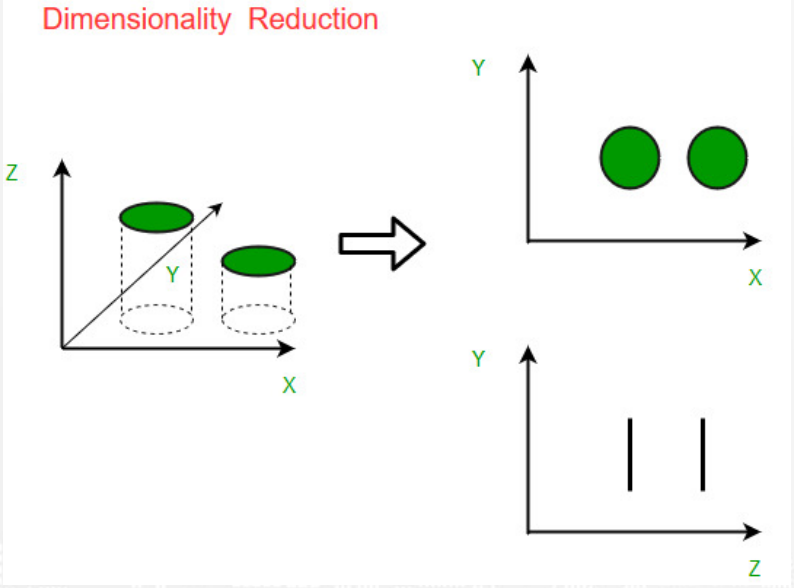
Dimensionality Reduction

Dimensionality Reduction

- ☐ What is Dimensionality Reduction?
- ☐ Benefit of Dimensionality Reduction
- ☐ Algorithms in Dimensionality Reduction

What is Dimensionality Reduction?

Dimensionality Reduction คือ การลดมิติของข้อมูล โดยการลดจำนวน feature ใน dataset แต่ยังคงสามารถรักษาคุณสมบัติที่สำคัญของ dataset ตั้งต้นไว้ได้



Ref : https://www.geeksforgeeks.org/dimensionality-reduction/

Dimensionality Reduction

- [x] **What is Dimensionality Reduction?**
- [ ] Benefit of Dimensionality Reduction
- [ ] Algorithms in Dimensionality Reduction

Benefit of Dimensionality Reduction

- สร้างคุณสมบัติใหม่ให้กับข้อมูล (Feature Engineering)

Dimensionality Reduction

- [x] **What is Dimensionality Reduction?**
- [x] **Benefit of Dimensionality Reduction**
- [ ] Algorithms in Dimensionality Reduction

Algorithms in Dimensionality Reduction

- Principal Component Analysis
- Kernel Principal Component Analysis
- Independent Component Analysis

Dimensionality Reduction

- ☑ What is Dimensionality Reduction?
- ☑ Benefit of Dimensionality Reduction
- ☑ Algorithms in Dimensionality Reduction

Unsupervised Learning

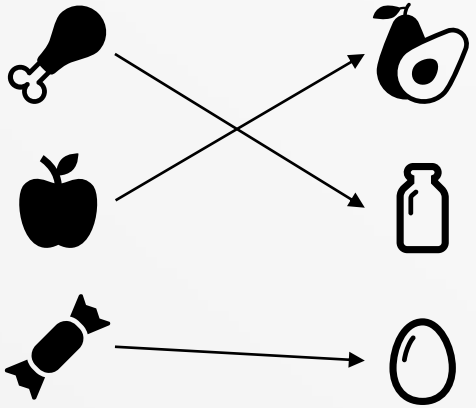
Association Mining

Association Mining

- ☐ What is Association Mining?
- ☐ Benefit of Association Mining
- ☐ Algorithms in Association Mining

What is Association Mining?

Association Mining คือ การหาความสัมพันธ์ของข้อมูล



96% of customers who purchase product A also purchase product B.

Association Mining

- [x] **What is Association Mining?**
- [ ] Benefit of Association Mining
- [ ] Algorithms in Association Mining

Benefit of Association Mining

- ใช้วิเคราะห์พฤติกรรมของลูกค้าที่มีต่อการซื้อสินค้า เพื่อช่วยในการปรับกลยุทธ์การตลาด
- ในทางการแพทย์ ใช้เพื่อหาความสัมพันธ์ระหว่างอาการของคนไข้ กับโรคต่างๆ
- ในทางธนาคาร ใช้วิเคราะห์ความเชื่อมโยงระหว่างธุรกรรมทางการเงินบางอย่างกับโอกาสที่จะเกิดการฉ้อโกงได้

Association Mining

- [x] **What is Association Mining?**
- [x] **Benefit of Association Mining**
- [ ] Algorithms in Association Mining

Algorithms in Association Mining

- Apriori Algorithm
- FP-Growth Algorithm

Association Mining

- ☑ What is Association Mining?
- ☑ Benefit of Association Mining
- ☑ Algorithms in Association Mining

Unsupervised Learning

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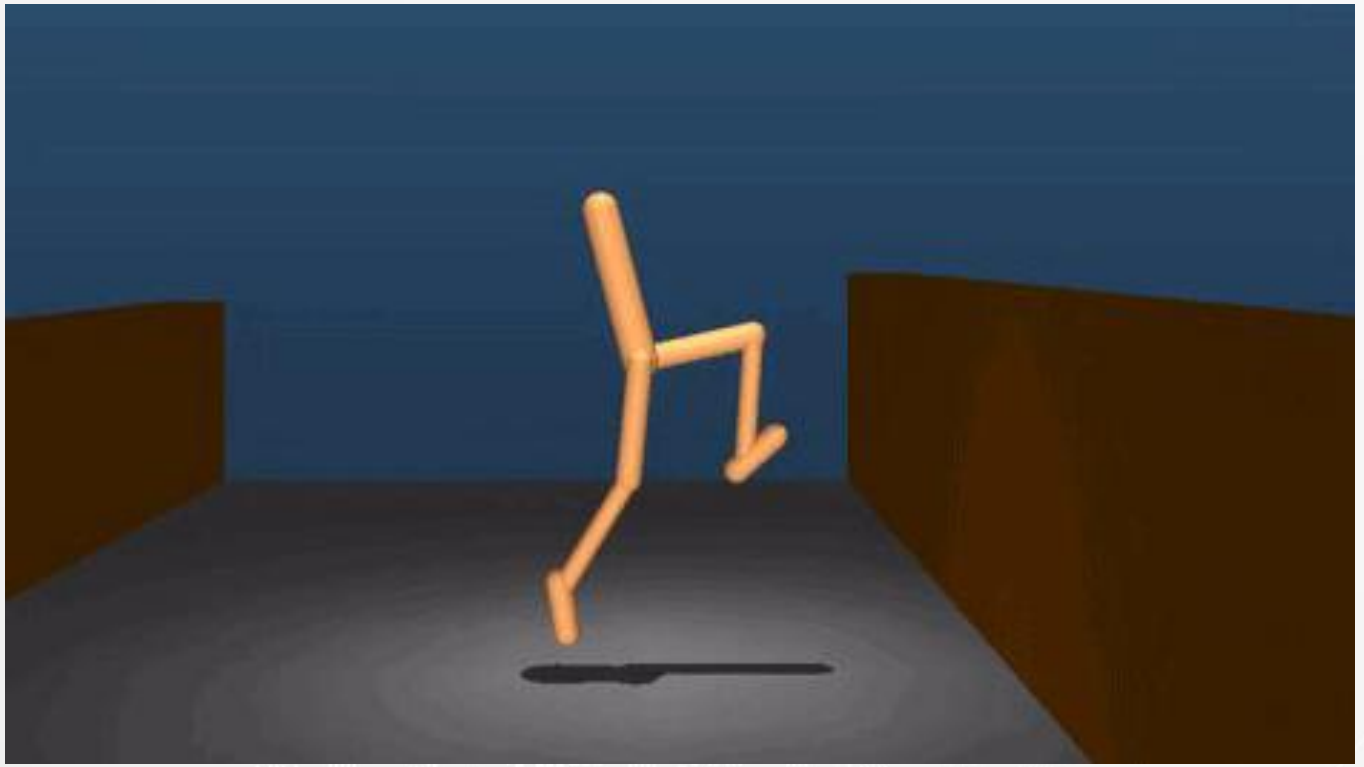
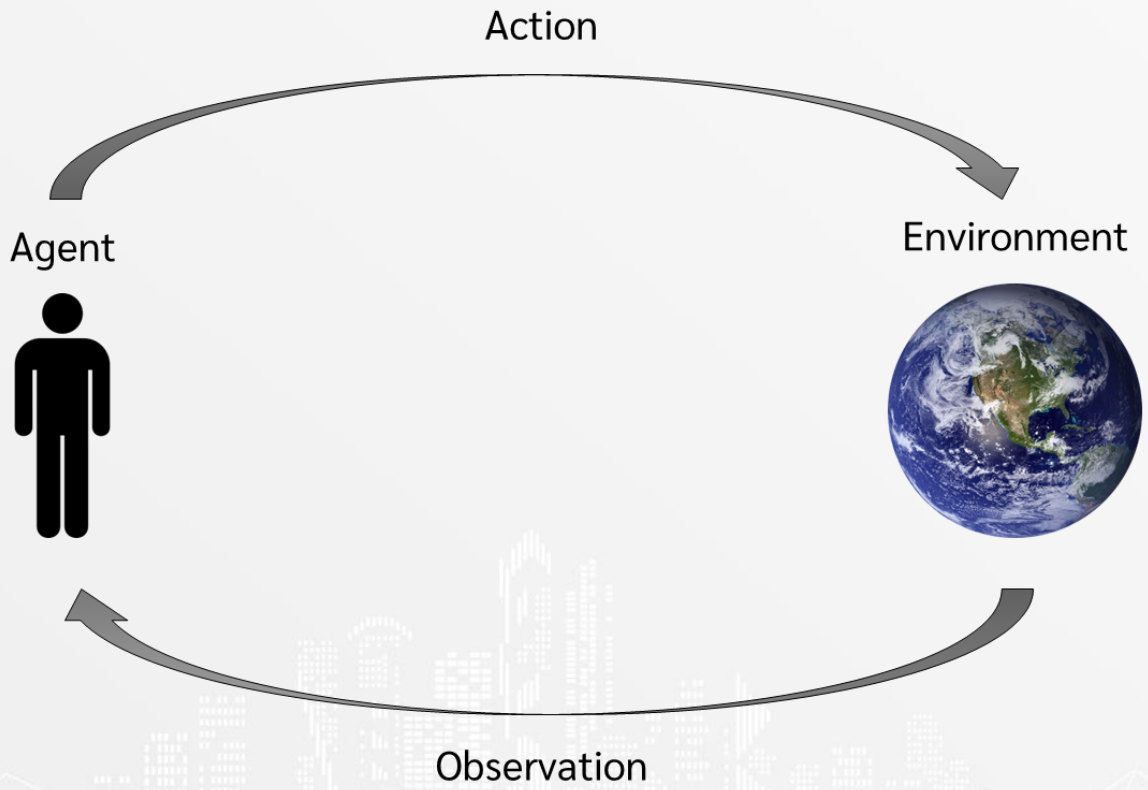
Reinforcement Learning

What is RL?

What is Reinforcement Learning ?



Core Concepts



Gridworld

$$\mathcal{S} = \{$$
$$(0,0), (0,1), (0,2), (0,3),$$
$$(1,0), (1,1), (1,2), (1,3),$$
$$(2,0), (2,1), (2,2), (2,3),$$
$$(3,0), (3,1), (3,2), (3,3)$$
$$\}$$

$$\mathcal{A} = \{ up, down, left, right \}$$

$$\mathcal{R} = \{ -1 , 10 \}$$

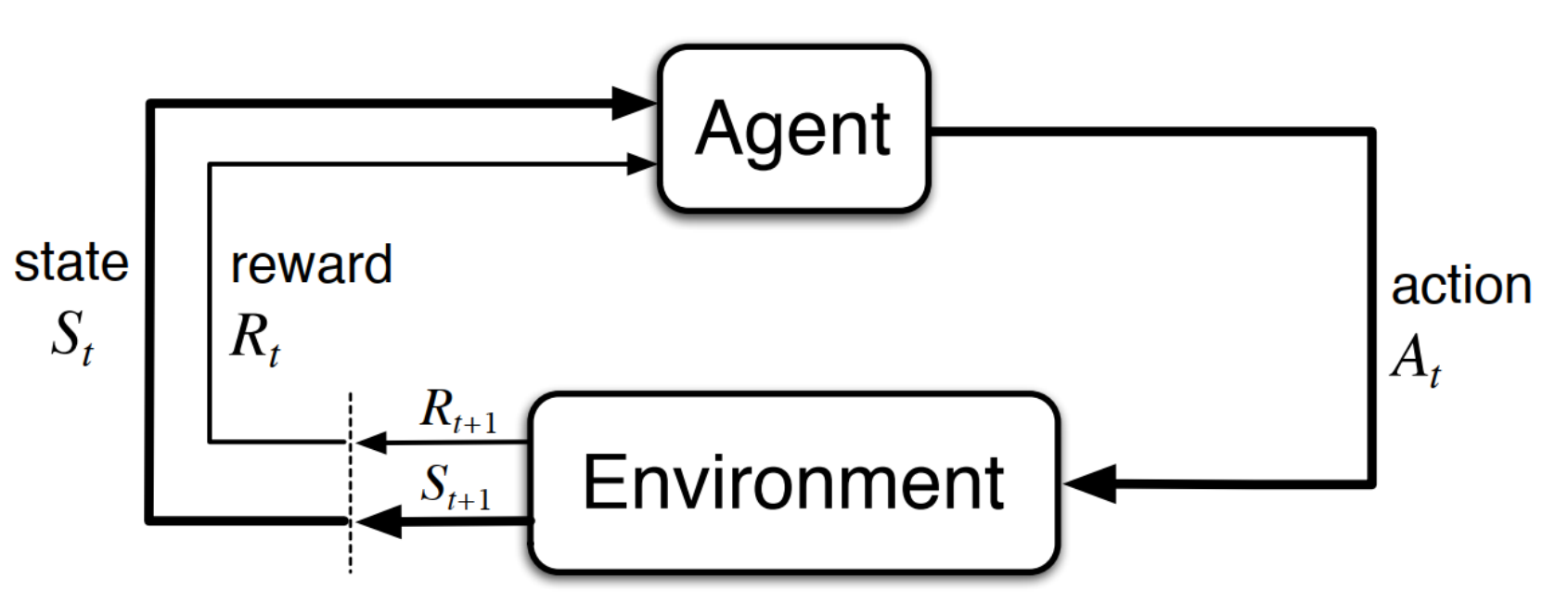
Goal

“ Maximize expected cumulative reward ”

Reinforcement Learning

Agent–Environment Interaction

Agent–Environment Interaction



reference: Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. MIT press, 2018.

$$S_0, A_0, R_1, S_1, A_1, R_2, \ldots, R_T, S_T$$

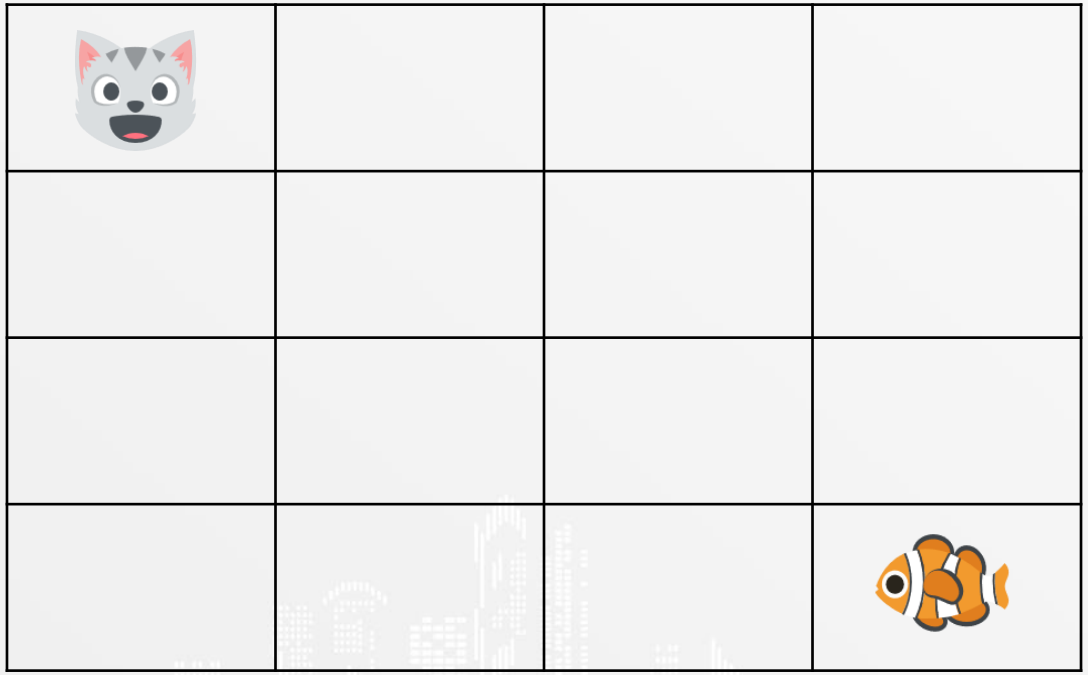
Gridworld

t = 0

$S_0 = (0,0)$

$A_0 = right$

$R_1 = -1$



Gridworld

t = 1

$S_1 = (0,1)$

$A_1 = down$

$R_2 = -1$

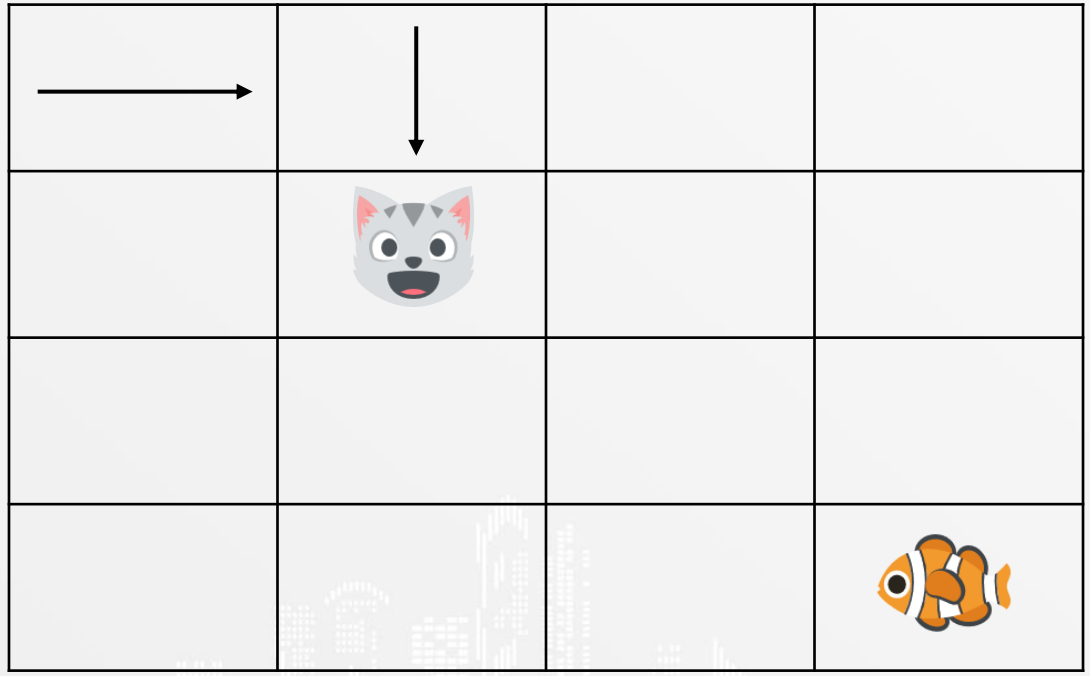
Gridworld

t = 2

$S_2 = (1,1)$

$A_2 = right$

$R_3 = -1$



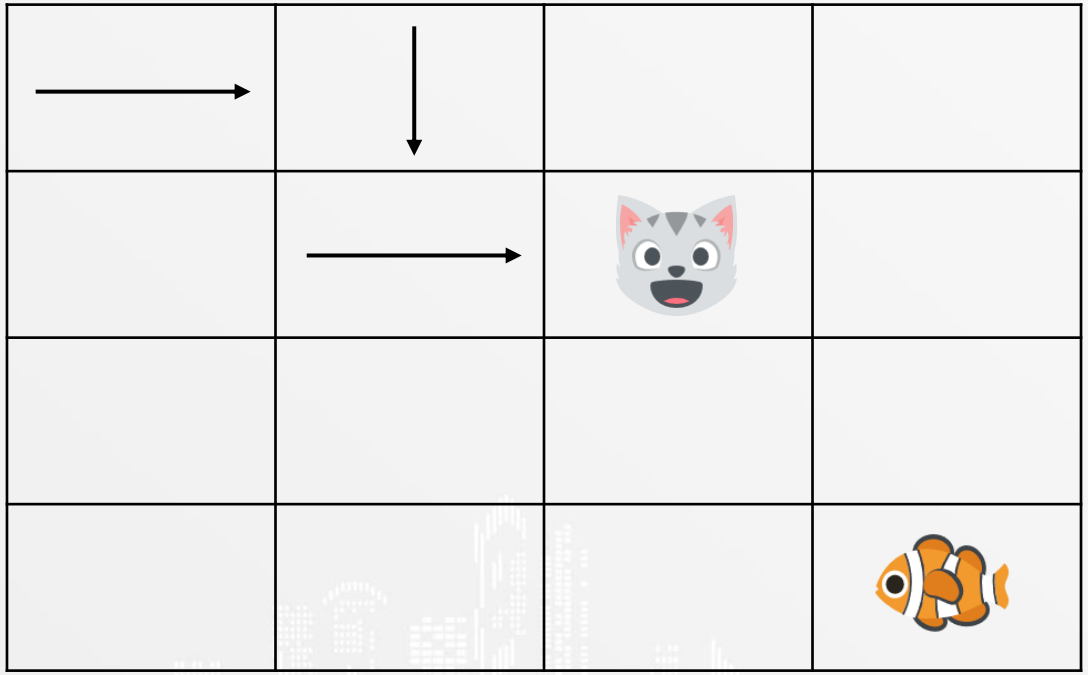
Gridworld

t = 3

$S_3 = (1,2)$

$A_3 = right$

$R_4 = -1$



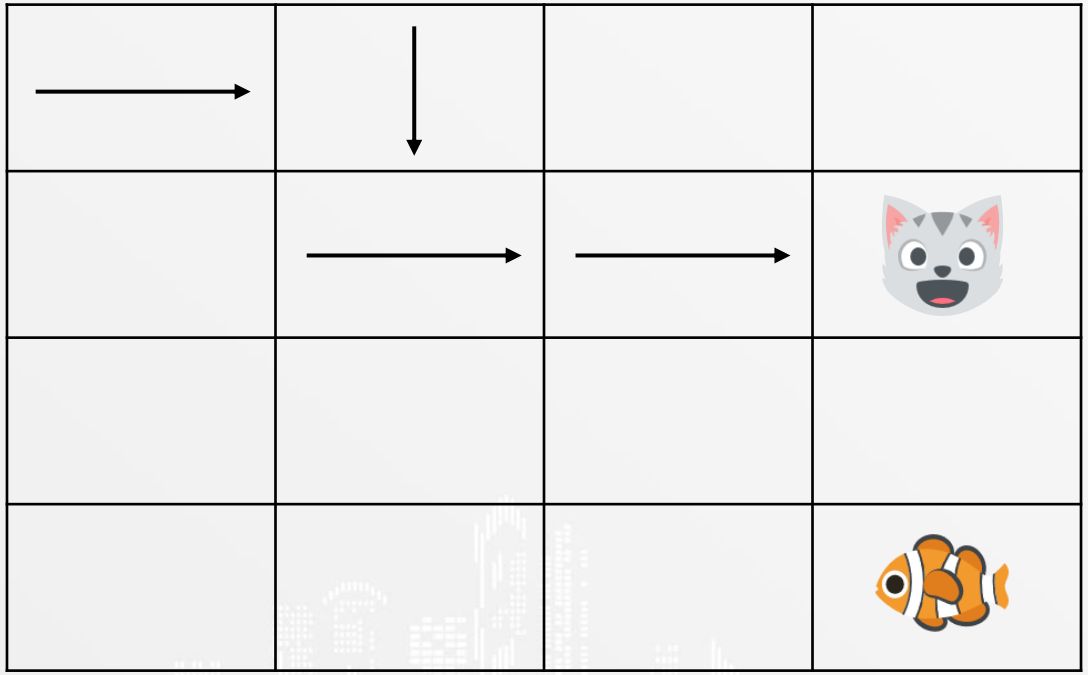
Gridworld

$S_4 = (1,3)$

$A_4 = down$

$R_5 = -1$

t = 4



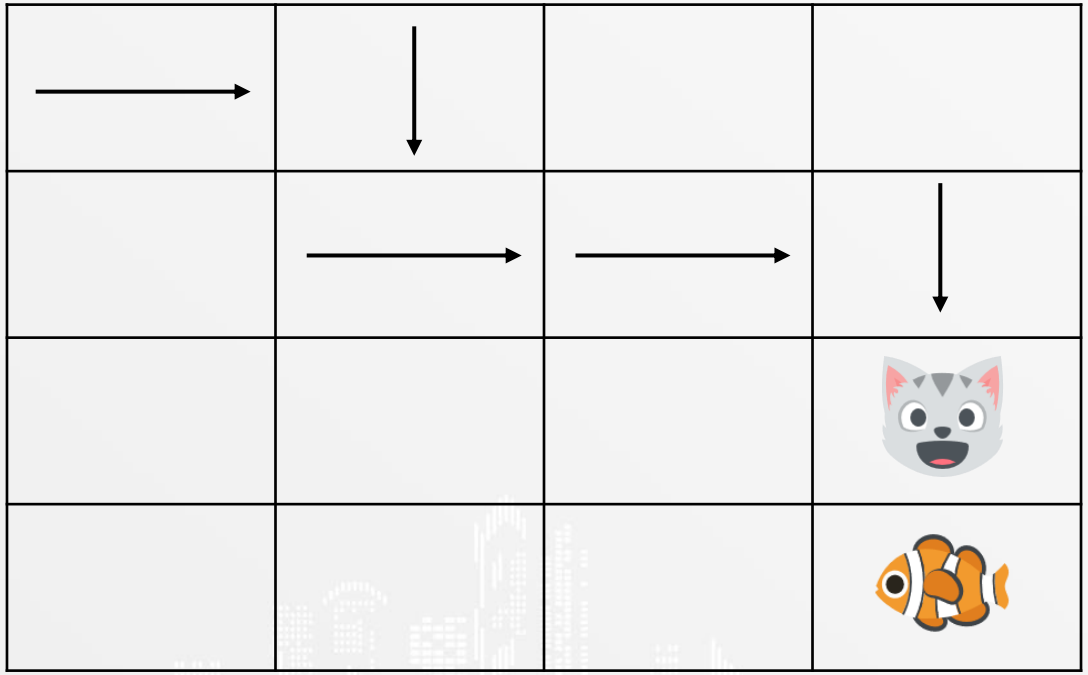
Gridworld

$S_5 = (2,3)$

$A_5 = down$

$R_6 = 10$

t = 5

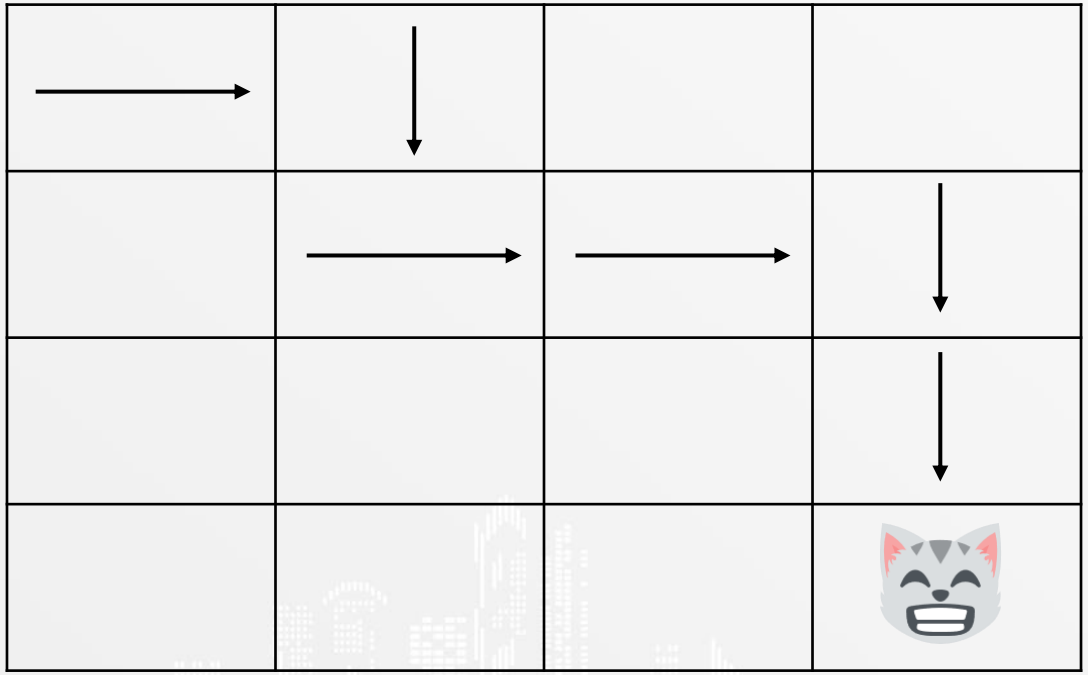


Gridworld

t = 6

$S_6 = (3,3)$

Teminal state



$$S_0, A_0, R_1, S_1, A_1, R_2, S_2, A_2, R_3, S_3, A_3, R_4, S_4, A_4, R_5, S_5, A_5, R_6, S_6$$

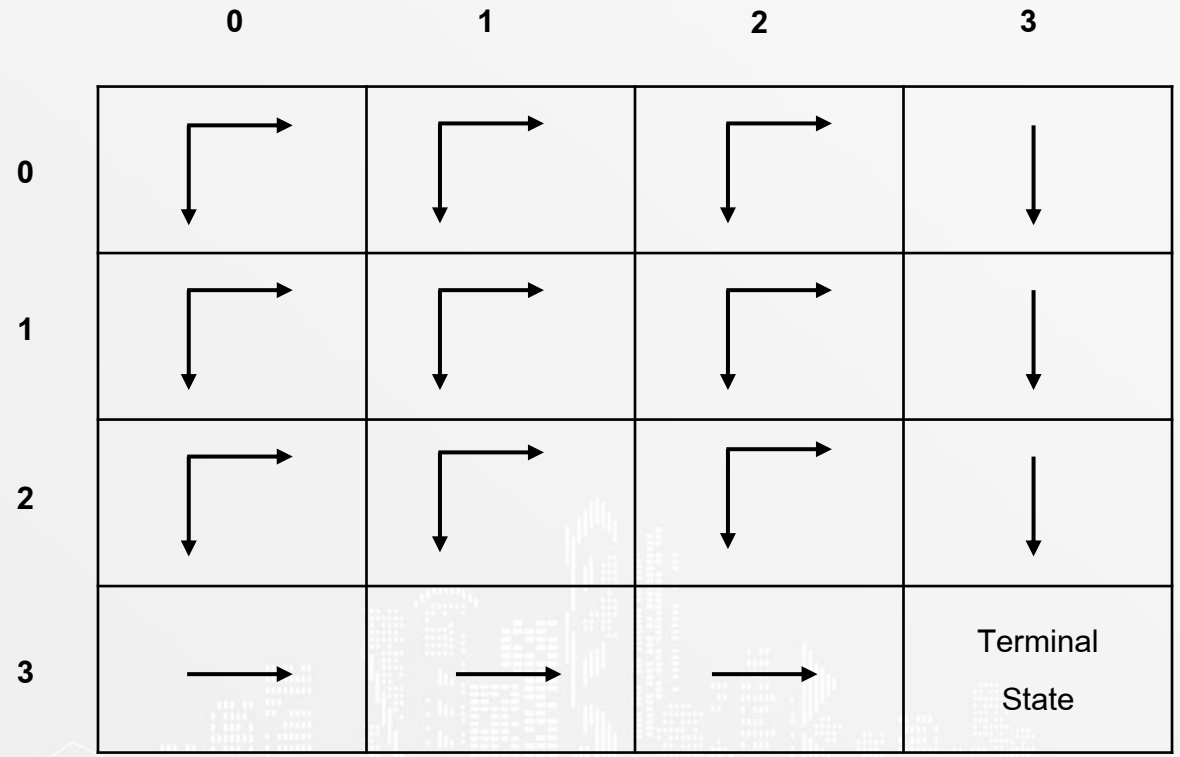
Reinforcement Learning

Policy

Why is agent so smart ?

Action / State	Up	Down	Left	Right
(0, 0)	4	5	4	5
(0, 1)	4	6	5	6
(0, 2)	4	7	5	6
⋮	⋮	⋮	⋮	⋮
(3, 2)	8	9	8	10

Policy



Q table

State \ Action	Up	Down	Left	Right
(0, 0)	4	5	4	5
(0, 1)	4	6	5	6
(0, 2)	4	7	5	6
⋮	⋮	⋮	⋮	⋮
(3, 2)	8	9	8	10

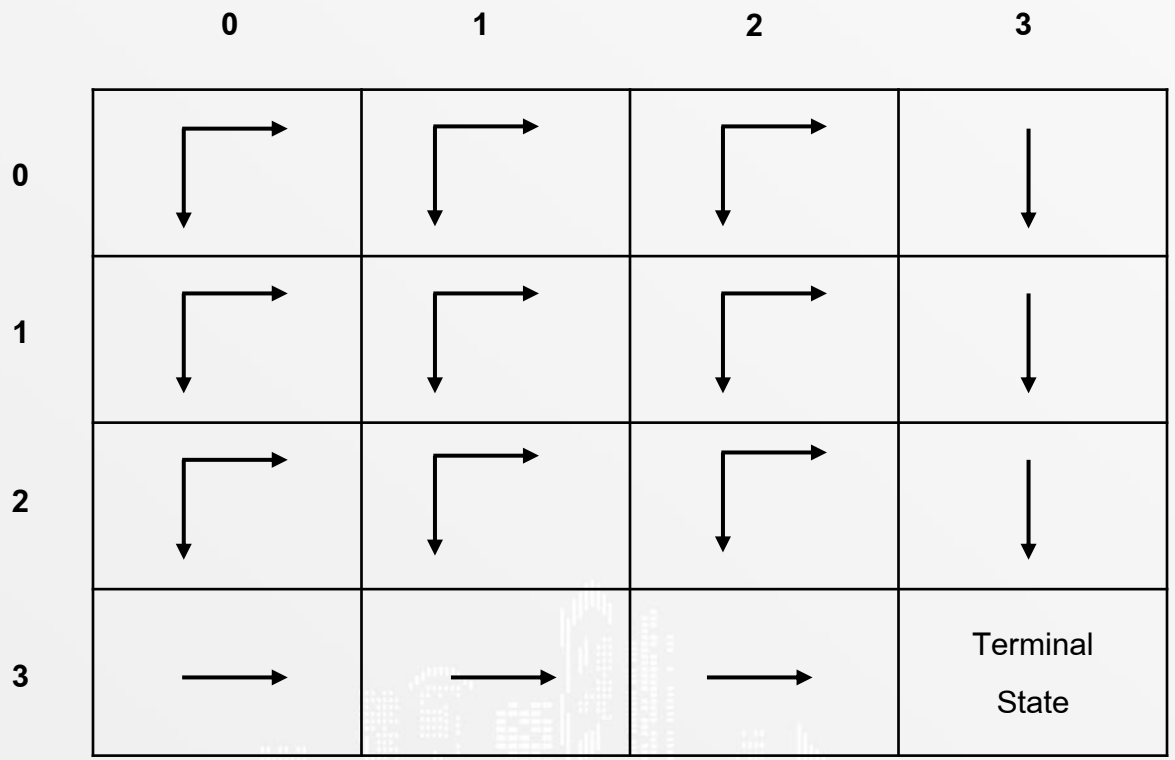
Q table

	0	1	2	3
0	4 4 5 5	4 5 6 6	4 5 7 7	4 5 6 7
1	4 5 6 6	5 5 7 7	6 6 8 8	7 7 8 9
2	5 6 7 7	6 6 8 8	7 7 9 9	8 8 9 10
3	6 7 8 7	7 7 9 8	8 8 10 9	Terminal State

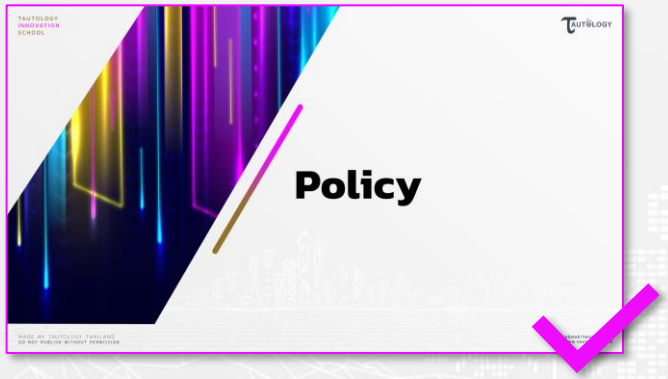
Q table

	0	1	2	3
0	4 / 4 5 / 5	4 / 5 6 / 6	4 / 5 7 / 7	4 / 5 6 / 7
1	4 / 5 6 / 6	5 / 5 7 / 7	6 / 6 8 / 8	7 / 7 8 / 9
2	5 / 6 7 / 7	6 / 6 8 / 8	7 / 7 9 / 9	8 / 8 9 / 10
3	6 / 7 8 / 7	7 / 7 9 / 8	8 / 8 10 / 9	Terminal State

Policy



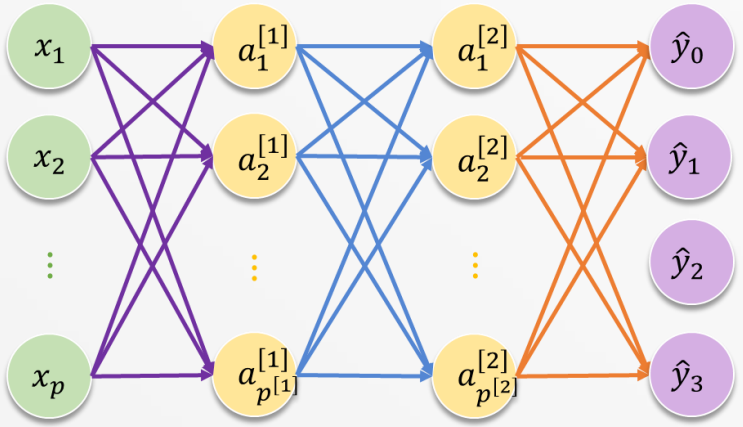
Reinforcement Learning



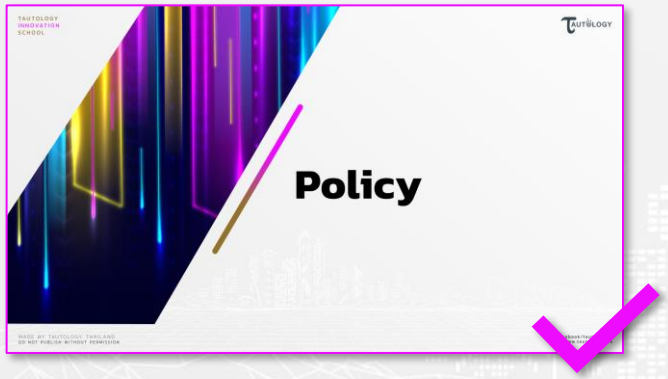
Deep Reinforcement Learning

Deep Reinforcement Learning

State \ Action	Up	Down	Left	Right
(0, 0)	4	5	4	5
(0, 1)	4	6	5	6
(0, 2)	4	7	5	6
⋮	⋮	⋮	⋮	⋮
(3, 2)	8	9	8	10



Reinforcement Learning



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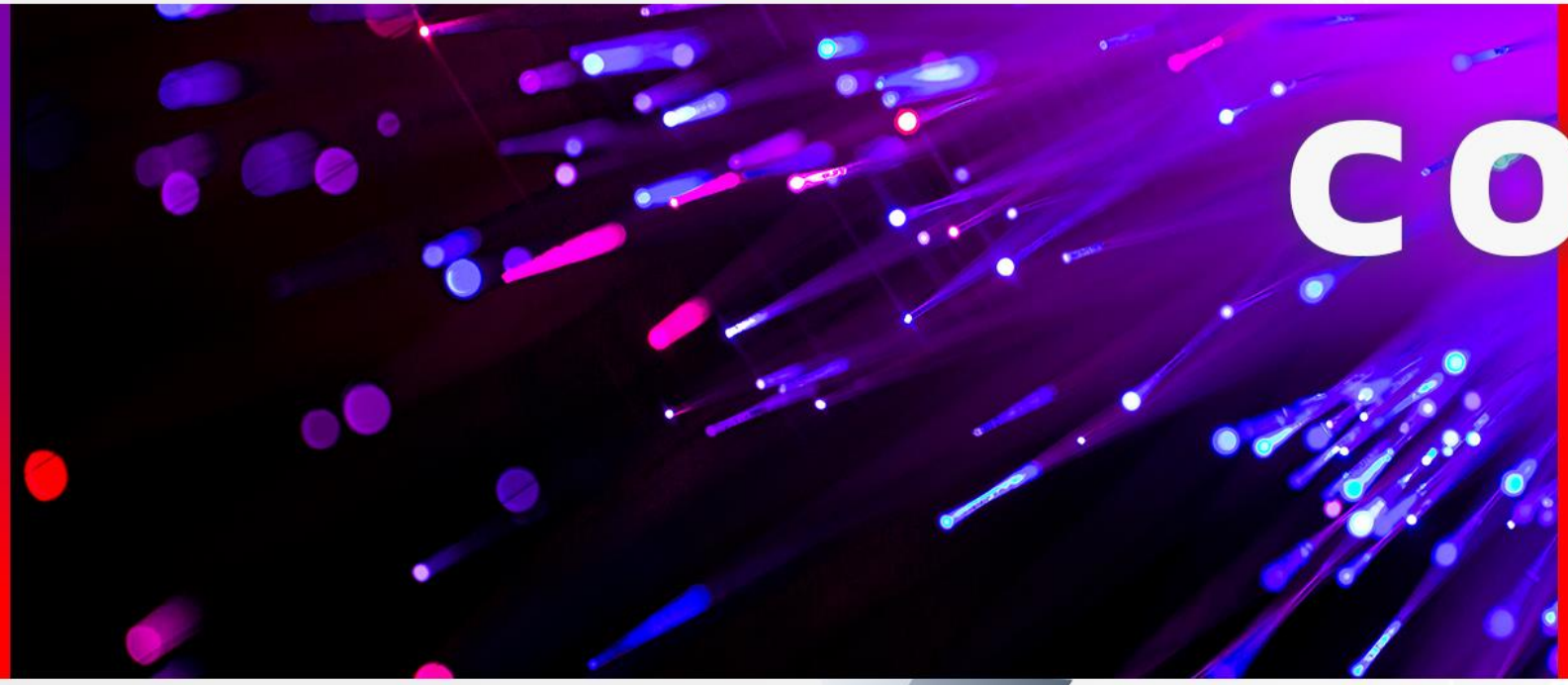
CONCEPT DRIFT



CONCEPT DRIFT

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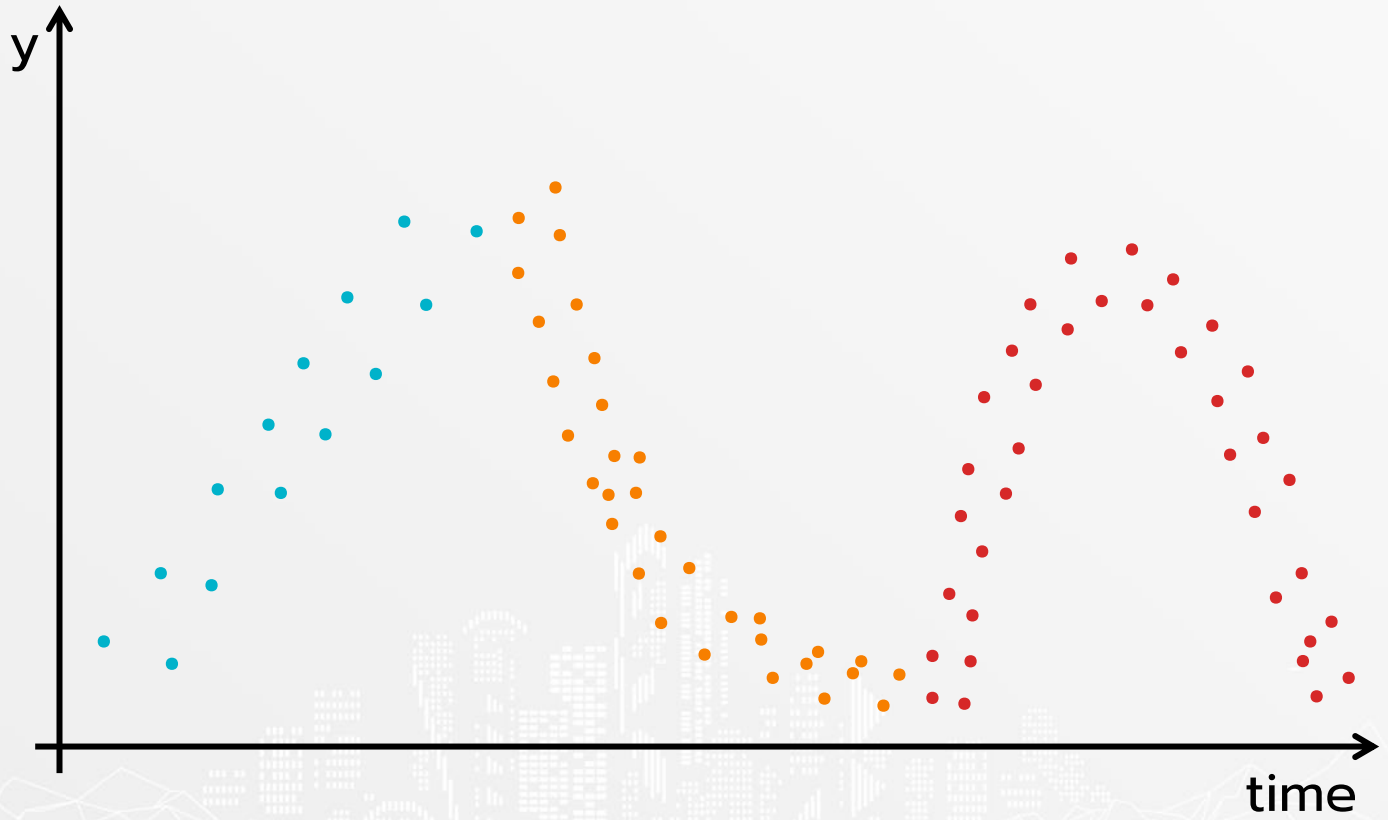
The Right Way to Use Machine Learning

Introduction

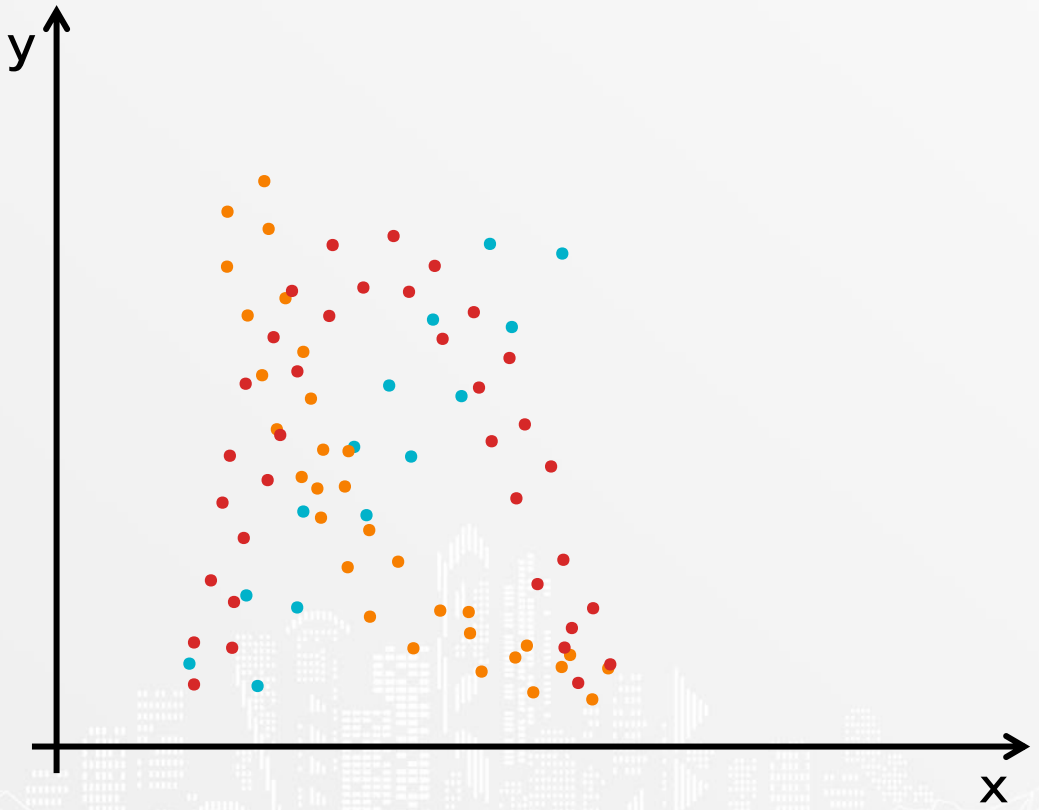
INTRODUCTION

1. Common Problems
2. Root Cause of Problems

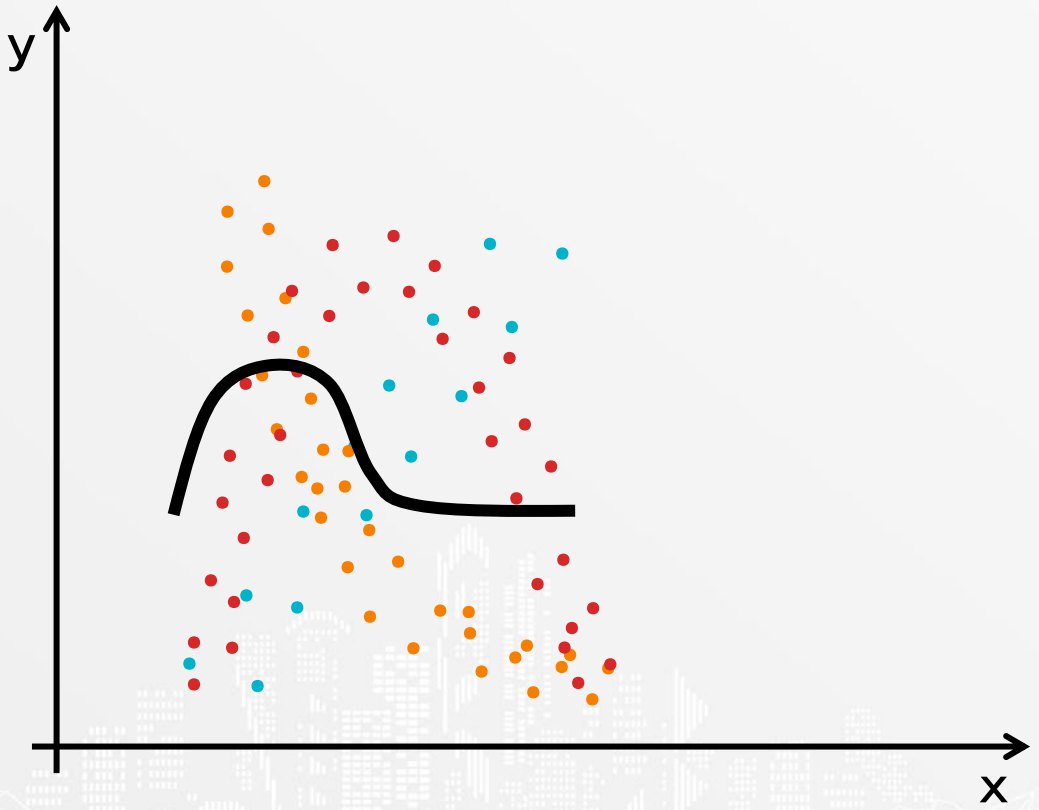
Common Problems



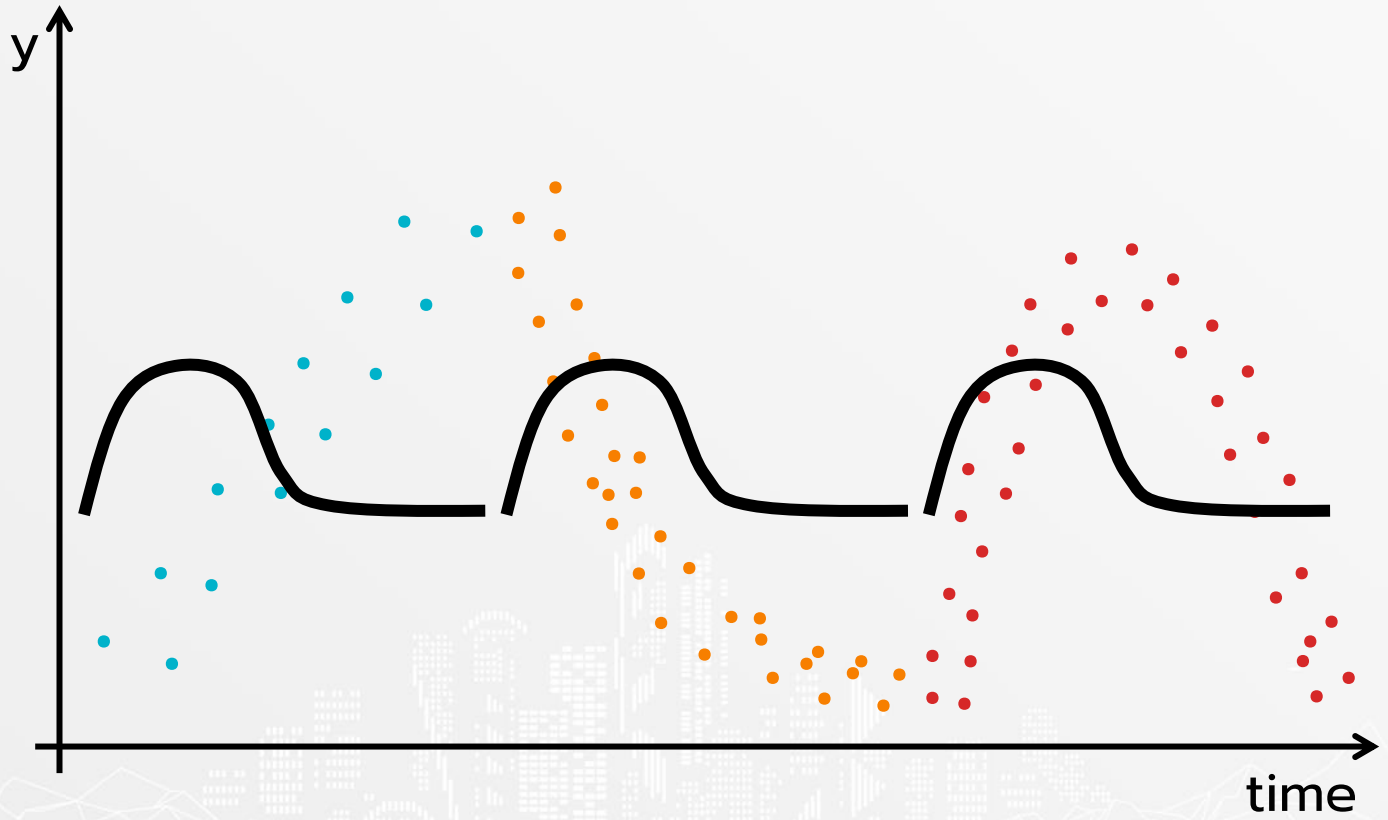
Common Problems



Common Problems



Common Problems



Common Problems

สิ่งที่พบเห็นตามมาบ่อย ๆ คือ

การเพิ่ม non informative feature เข้าไป เพื่อให้ ML สามารถ fit โมเดลได้ → นำไปสู่การ overfitting ในที่สุด

นี่คือหลุมพรางสำหรับหลาย ๆ คนที่เข้ามาแก้ปัญหานี้

INTRODUCTION

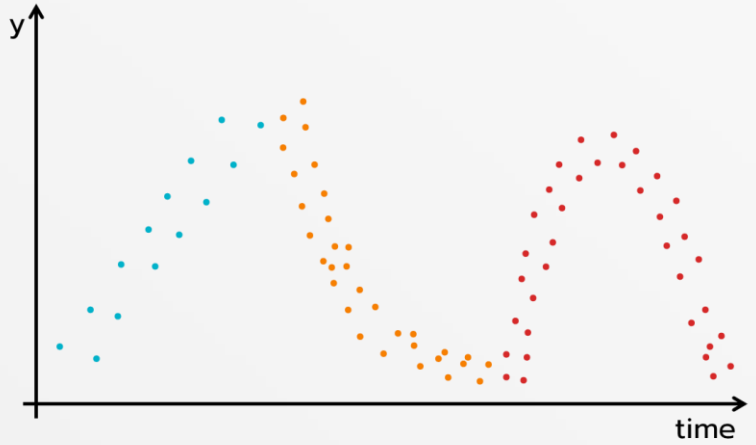
1 Common Problems

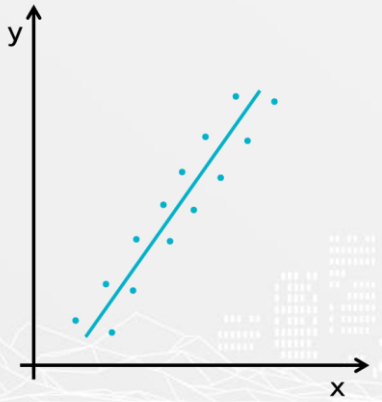
2 Root Cause of Problems

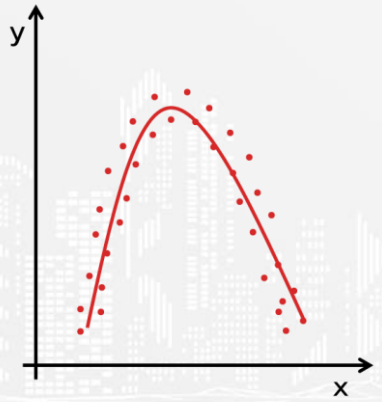
Root Cause of Problems

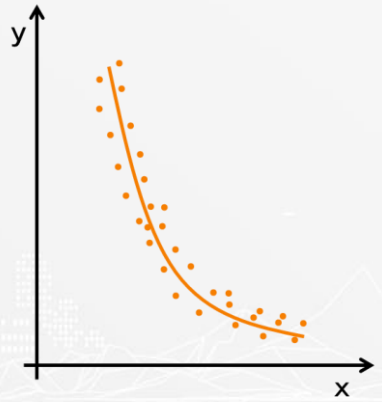
CONCEPT DRIFT

Root Cause of Problems









INTRODUCTION

1 Common Problems

2 Root Cause of Problems

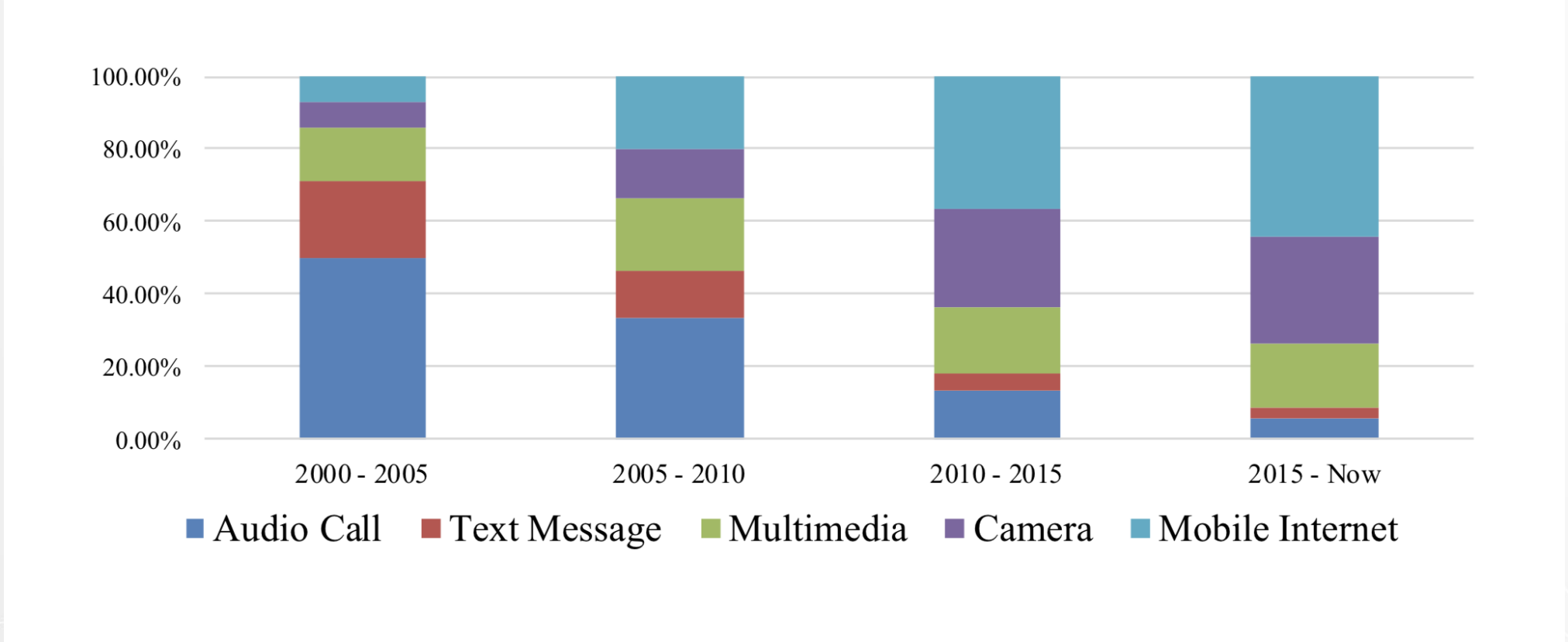
The Right Way to Use Machine Learning

Concept Drift

CONCEPT DRIFT

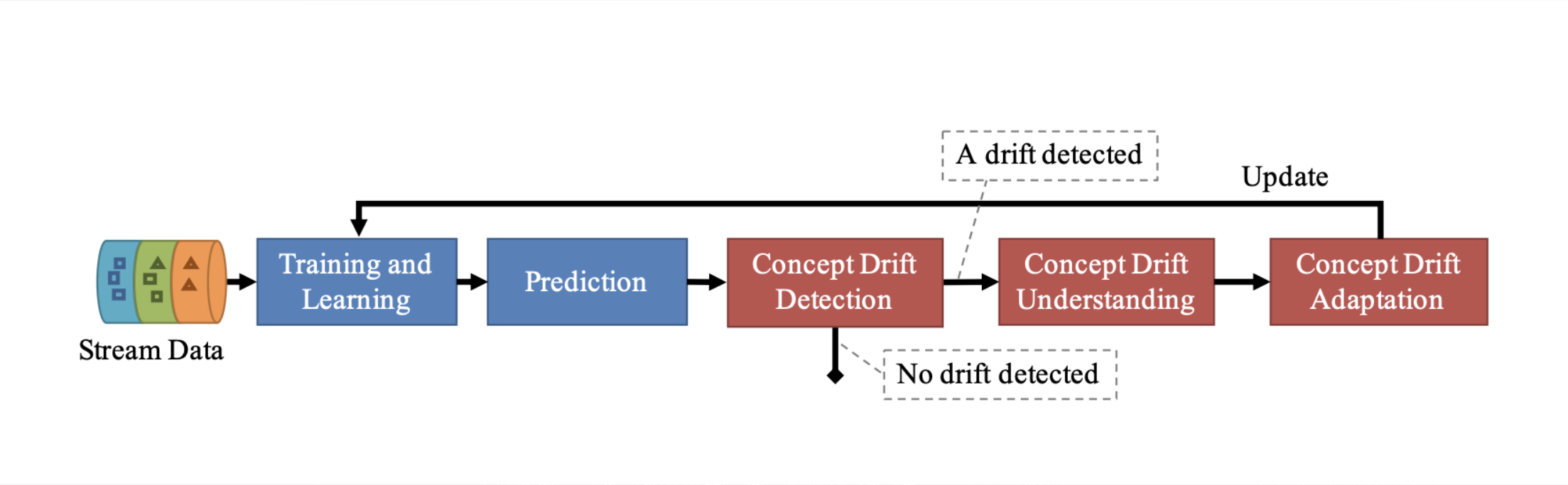
1. What is Concept Drift?
2. Component of Machine Learning with Concept Drift
3. Definition of Concept Drift
4. Types of Concept Drift
5. Framework of Concept Drift Detection
6. Concept Drift Detection Algorithm
7. Concept Drift Understanding
8. Concept Drift Adaptation

What is Concept Drift?



CONCEPT DRIFT

Component of Machine Learning with Concept Drift



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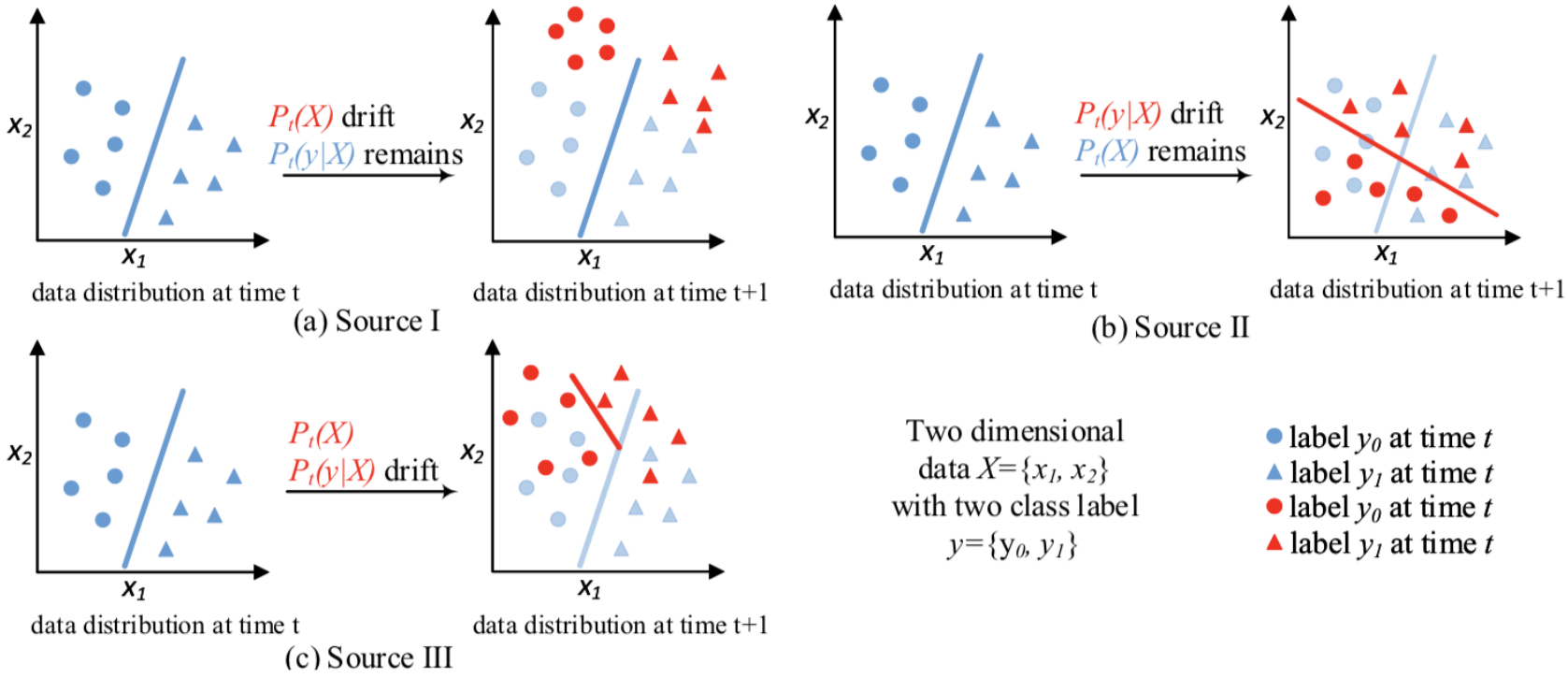
Definition of Concept Drift

$$P_t(X, y) = P_t(X) \times P_t(y|X)$$

Definition of Concept Drift



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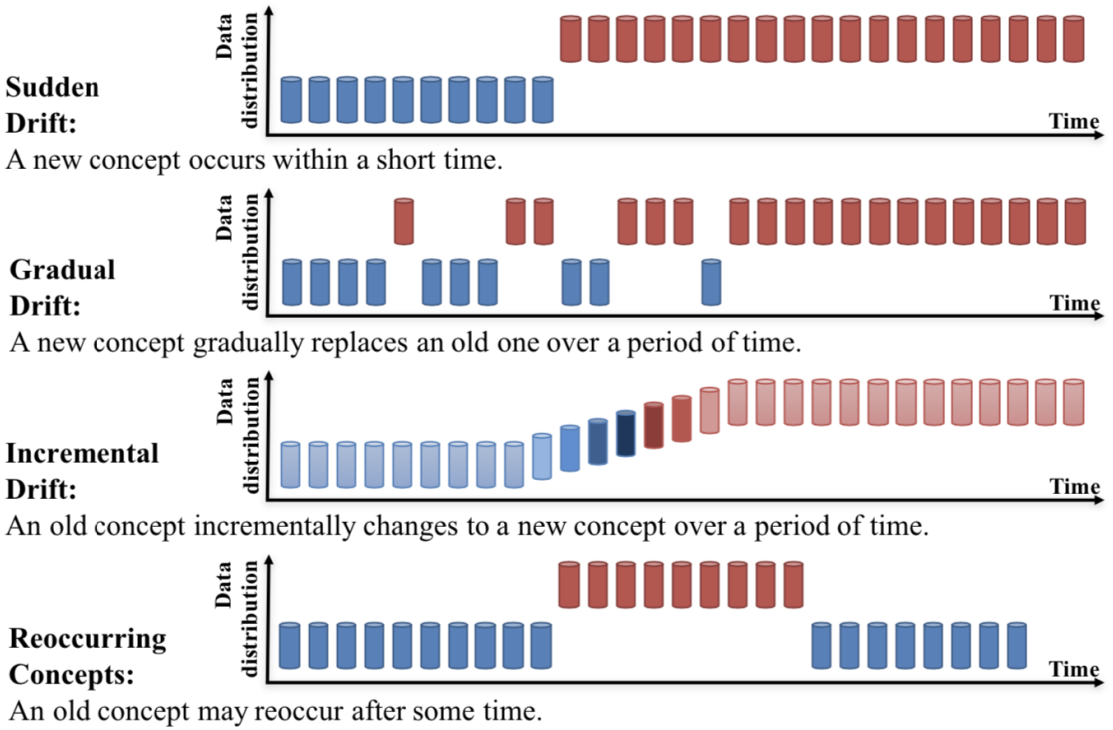
Types of Concept Drift



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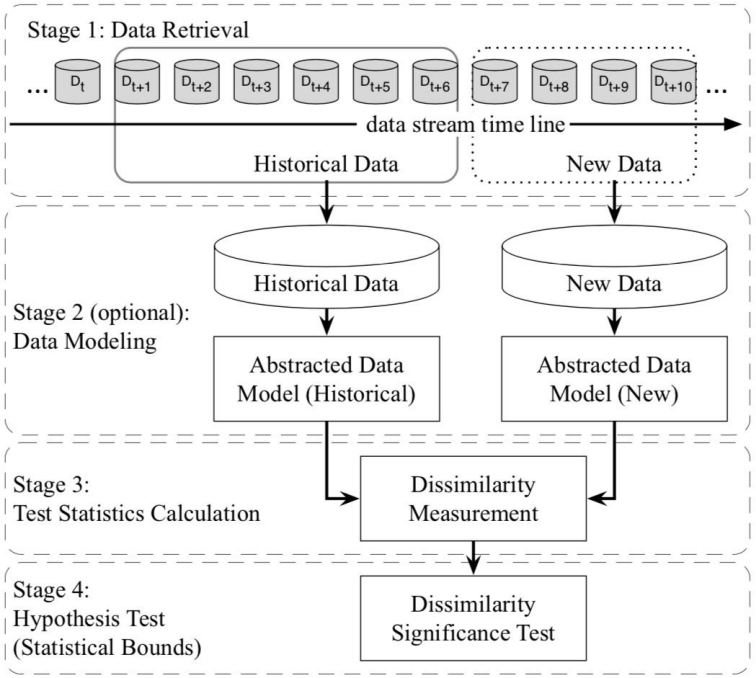
Framework of Concept Drift Detection



CONCEPT DRIFT

1 What is Concept Drift?

2 Component of Machine Learning with Concept Drift

3 Definition of Concept Drift

4 Types of Concept Drift

5 Framework of Concept Drift Detection

6 Concept Drift Detection Algorithm

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8 Concept Drift Adaptation

Concept Drift Detection Algorithm

- Error Rate-based Drift Detection
- Data Distribution-based Drift Detection
- Multiple Hypothesis Test Drift Detection

Concept Drift Detection Algorithm

Error Rate-based Drift Detection

- Learning with drift detection
- Exponentially weighted moving average charts for detecting concept drift
- Detecting concept drift using statistical testing
- Learning from time-changing data with adaptive windowing

Concept Drift Detection Algorithm

Data Distribution-based Drift Detection

- Detecting change in data streams
- An information-theoretic approach to detecting changes in multi- dimensional data streams
- Concept drift detection via competence models

Concept Drift Detection Algorithm

Multiple Hypothesis Test Drift Detection

- A selective detector ensemble for concept drift detection
- Three-layer concept drifting detection in text data streams
- Just-in-time adaptive classifiers part i: Detecting nonstationary changes

CONCEPT DRIFT

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8 Concept Drift Adaptation

Concept Drift Understanding

When?

How?

Where?

Concept Drift Understanding

How

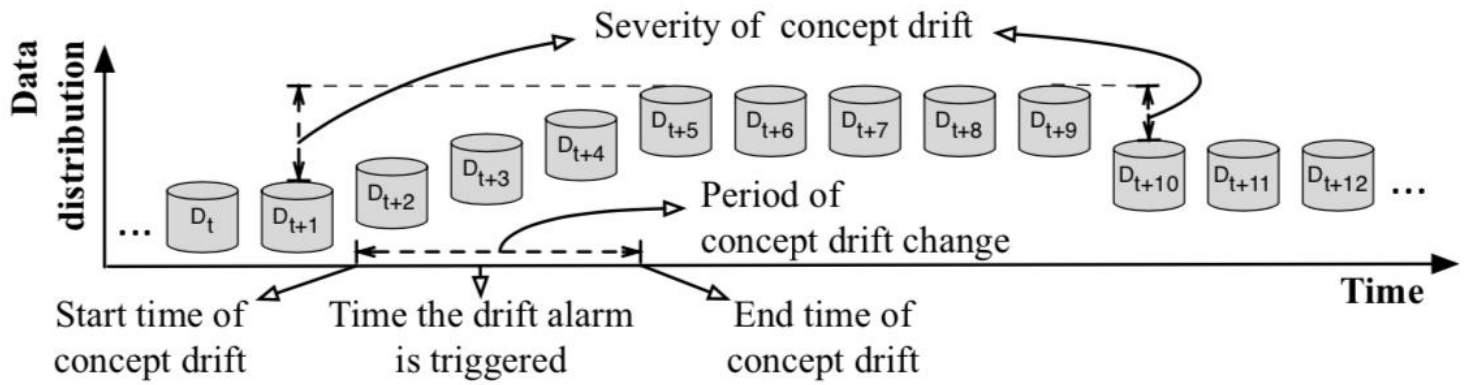
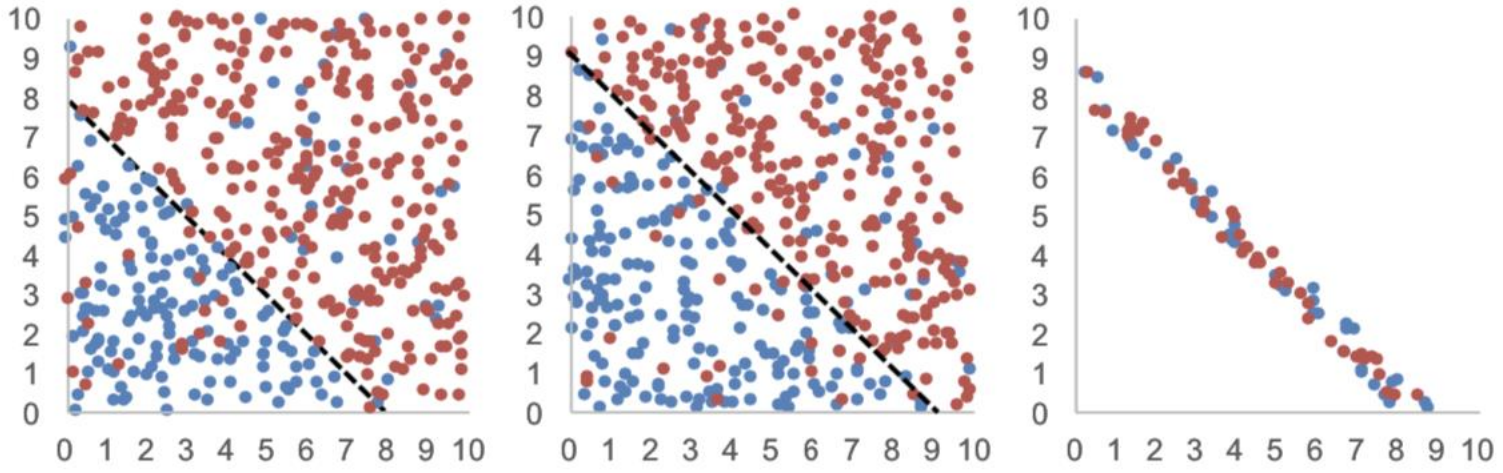


Fig. 11. An example of the occurrence time and the severity of concept drift. One incremental drift starts to change at $t+1$ and ends at $t+5$. The other sudden drift occurs between $t+9$ and $t+10$. The severity of these two concept drifts (D_{t+1}-D_{t+5} and D_{t+9}-D_{t+10}) is marked with brackets.

Concept Drift Understanding

Where



(a) Data at time t (b) Data at time $t+1$ (c) Data in drift regions

Fig. 12. An example of the drift regions of concept drift.

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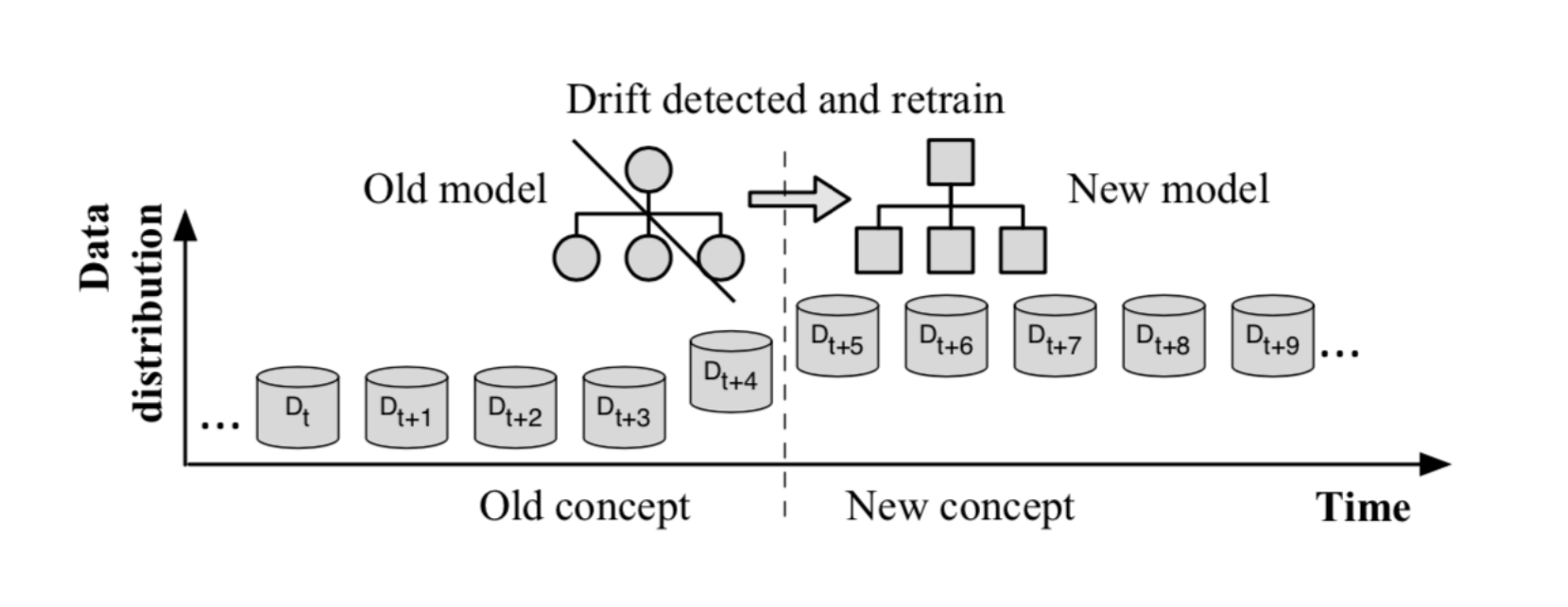
Concept Drift Adaptation

- Retrain
- Adaptive Ensemble Method
- Partially Update Model

Concept Drift Adaptation

- **Retrain**



Concept Drift Adaptation

Adaptive Ensemble Method

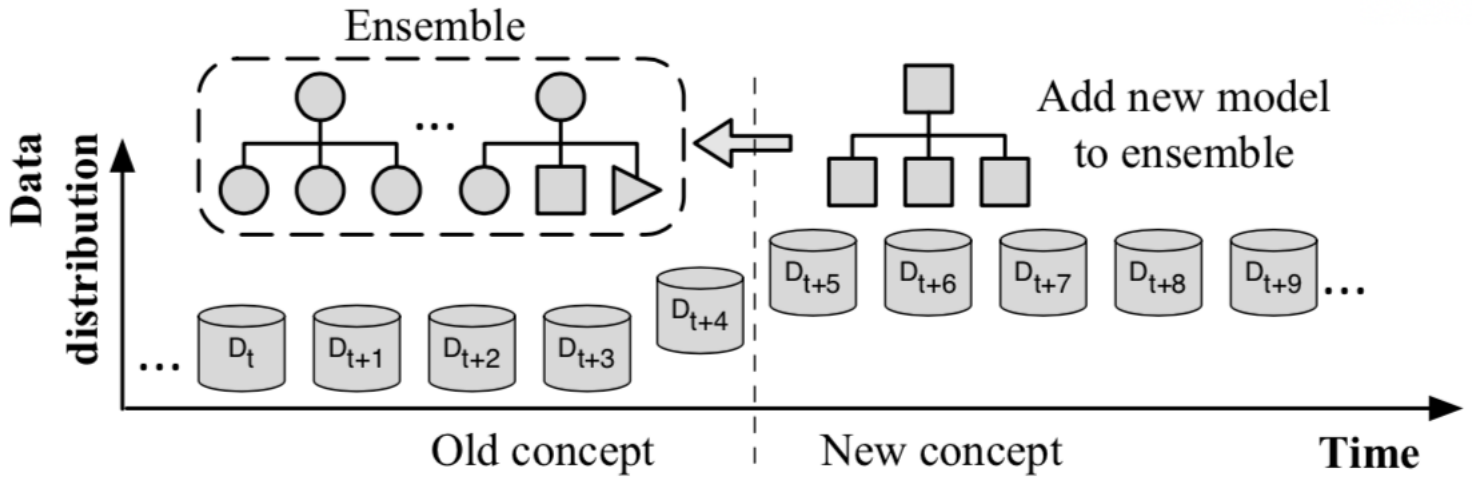


Fig. 14. A new base classifier is added to the ensemble when a concept drift occurs.

Concept Drift Adaptation

- **Partially Update Model**

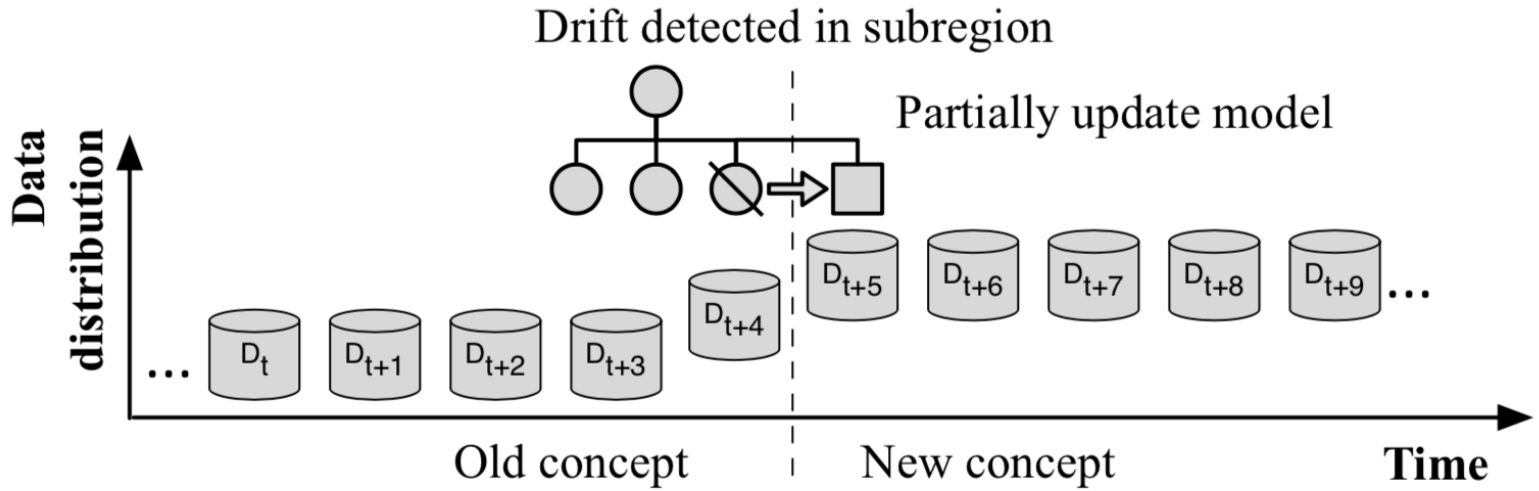


Fig. 15. A decision tree node is replaced with a new one as its performance deteriorates when a concept drift occurs in a subregion.

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The Right Way to Use Machine Learning

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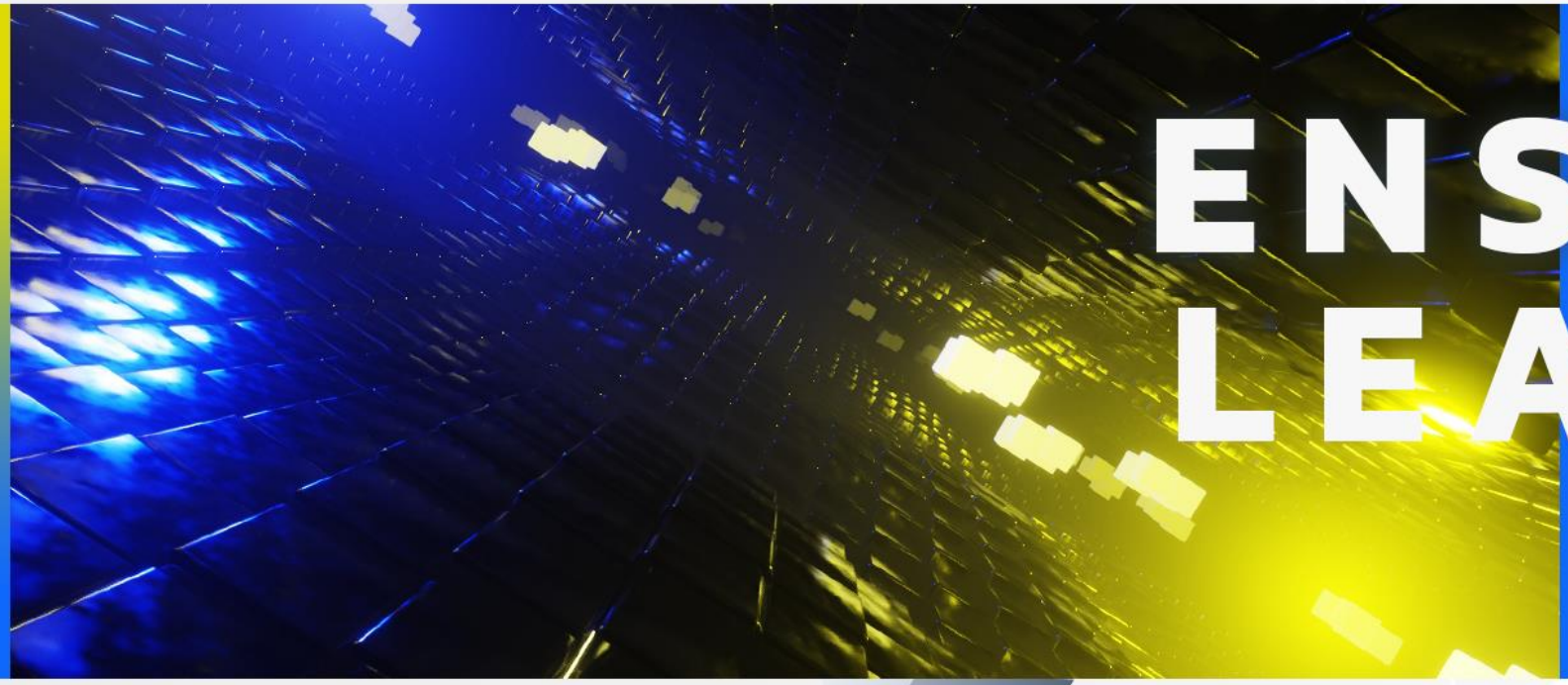

ENSEMBLE LEARNING

ENSEMBLE LEARNING

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Ensemble Learning

- ☐ Relationship between Based Model and Ensemble Learning
- ☐ Bagging
- ☐ Boosting
- ☐ Stacking

Relationship between Based Model and Ensemble Learning

“ การรวมผู้เชี่ยวชาญเก่ง ๆ ที่มีความเห็นหลายมุมมอง หลาย ๆ คนมาร่วมกันวิเคราะห์ข้อมูล จะให้ผลลัพธ์การวิเคราะห์ข้อมูลที่ดีขึ้นอย่างมีเสถียรภาพ ”

(ผู้เชี่ยวชาญแต่ละคน = based model, การร่วมมือกัน = ensemble learning)

Relationship between Based Model and Ensemble Learning

เราสามารถตั้งหน่วยผู้เชี่ยวชาญใหม่เพื่อต่อสู้กับ concept drift ได้

Ensemble Learning

- [x] **Relationship between Based Model and Ensemble Learning**
- [ ] Bagging
- [ ] Boosting
- [ ] Stacking

Explaination

Ensemble Learning

- ☑ Relationship between Based Model and Ensemble Learning
- ☑ Bagging
- ☑ Boosting
- ☑ Stacking

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RELATED TASKS IN MACHINE LEARNING

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Related Tasks in Machine Learning

Computer Vision

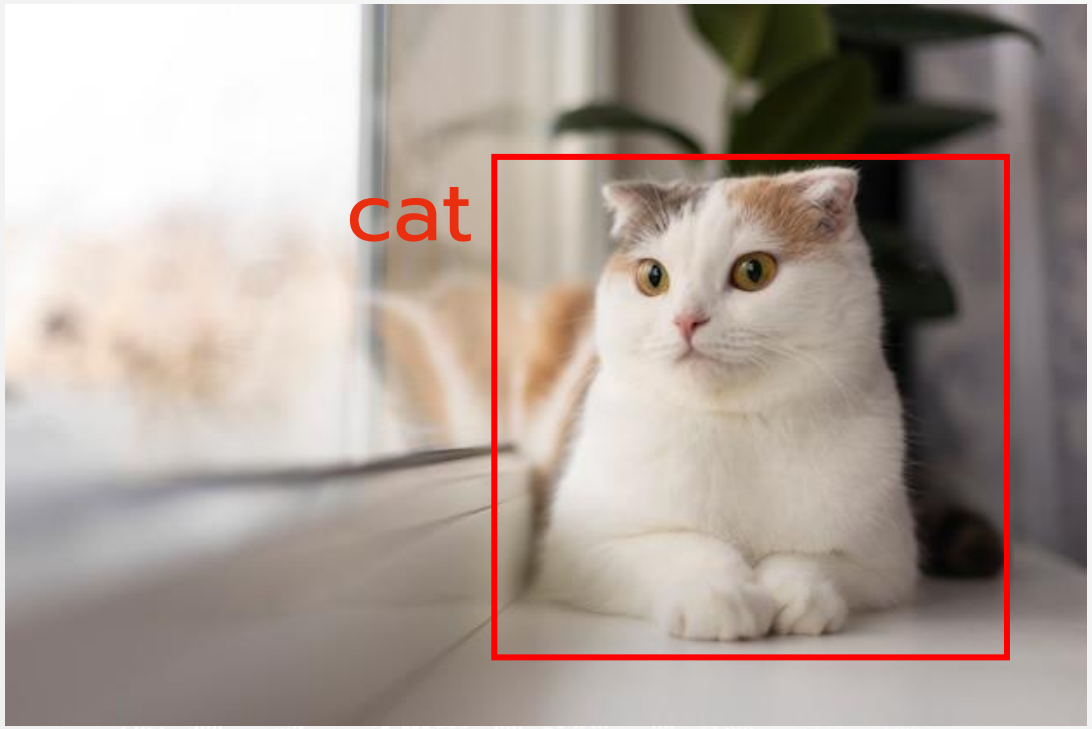
Computer Vision

- Image Classification
- Localization
- Object Detection
- Semantic Segmentation
- Instance Segmentation
- Pose Estimation
- Image Captioning

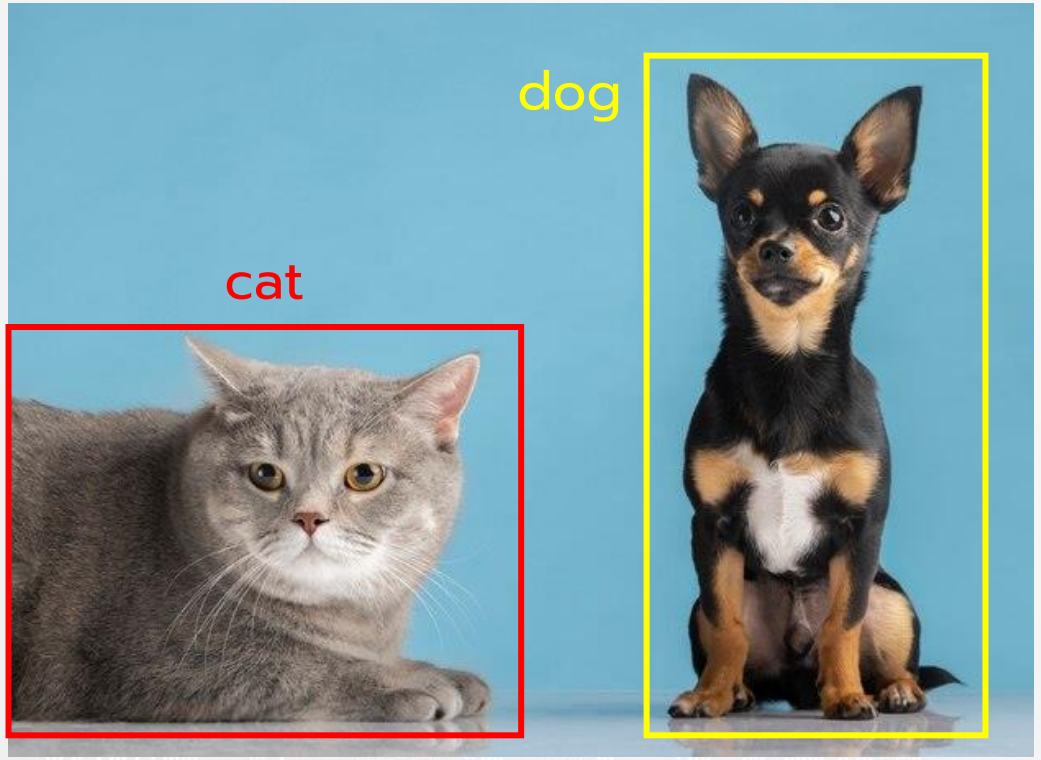
Computer Vision :
Image Classification

cat

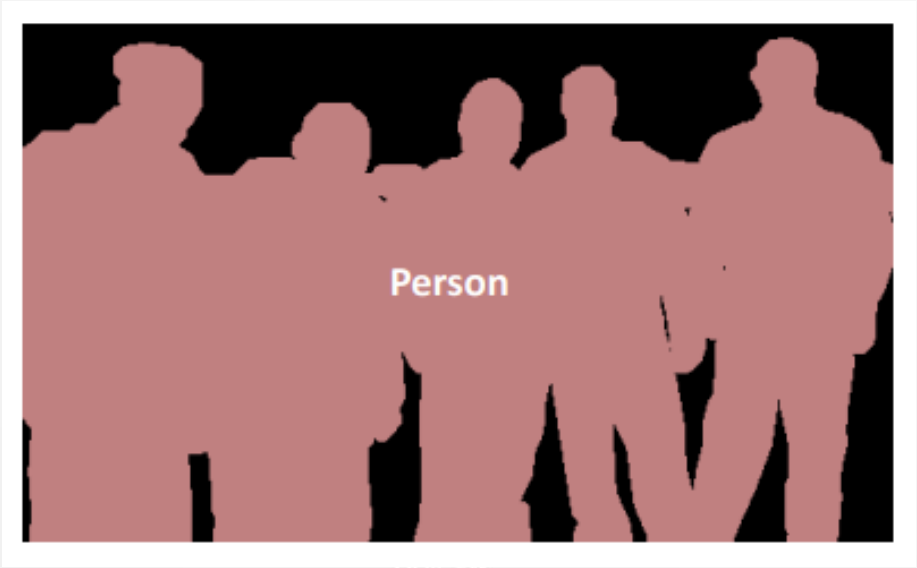
Computer Vision :
Localization



Computer Vision :
Object Detection

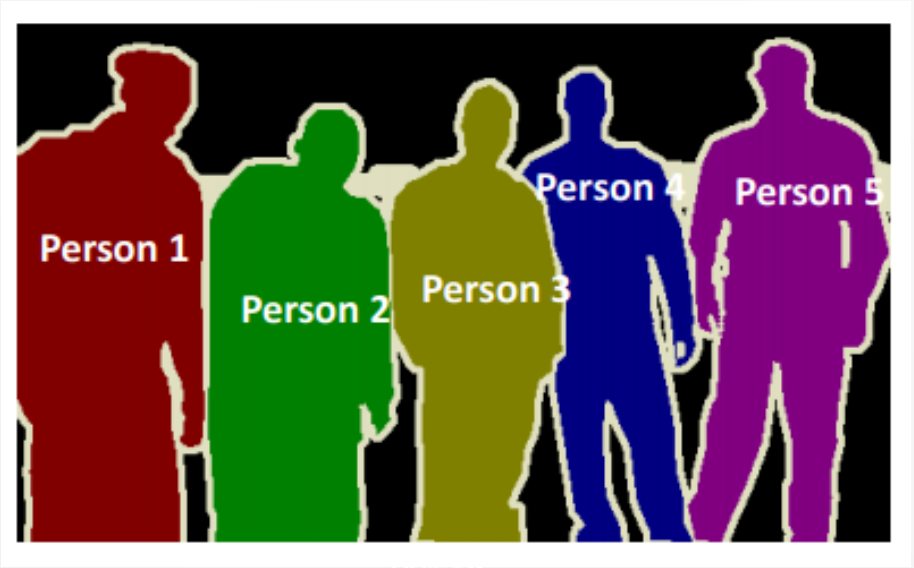


Computer Vision :
Semantic Segmentation



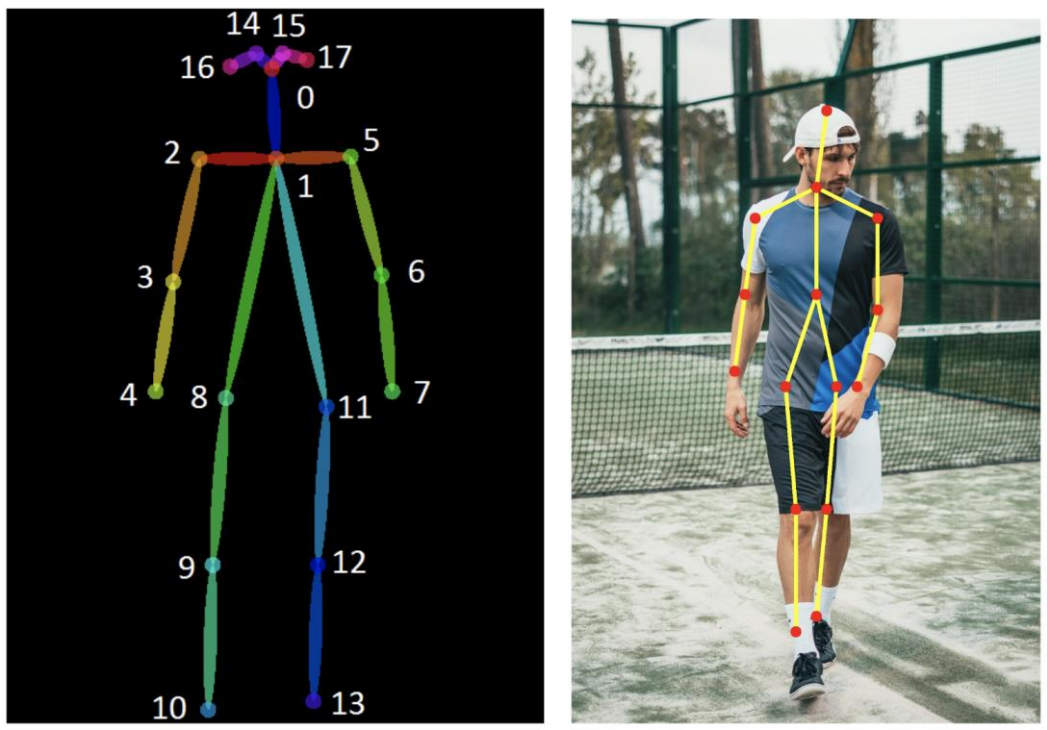
Ref : https://www.analyticsvidhya.com/blog/2019/02/tutorial-semantic-segmentation-google-deeplab/

Computer Vision :
Instance Segmentation



Ref : https://www.analyticsvidhya.com/blog/2019/02/tutorial-semantic-segmentation-google-deeplab/

Computer Vision :
Pose Estimation



Ref : https://nanonets.com/blog/human-pose-estimation-2d-guide/

Computer Vision :
Image Captioning

Ref : https://mobidev.biz/blog/exploring-deep-learning-image-captioning

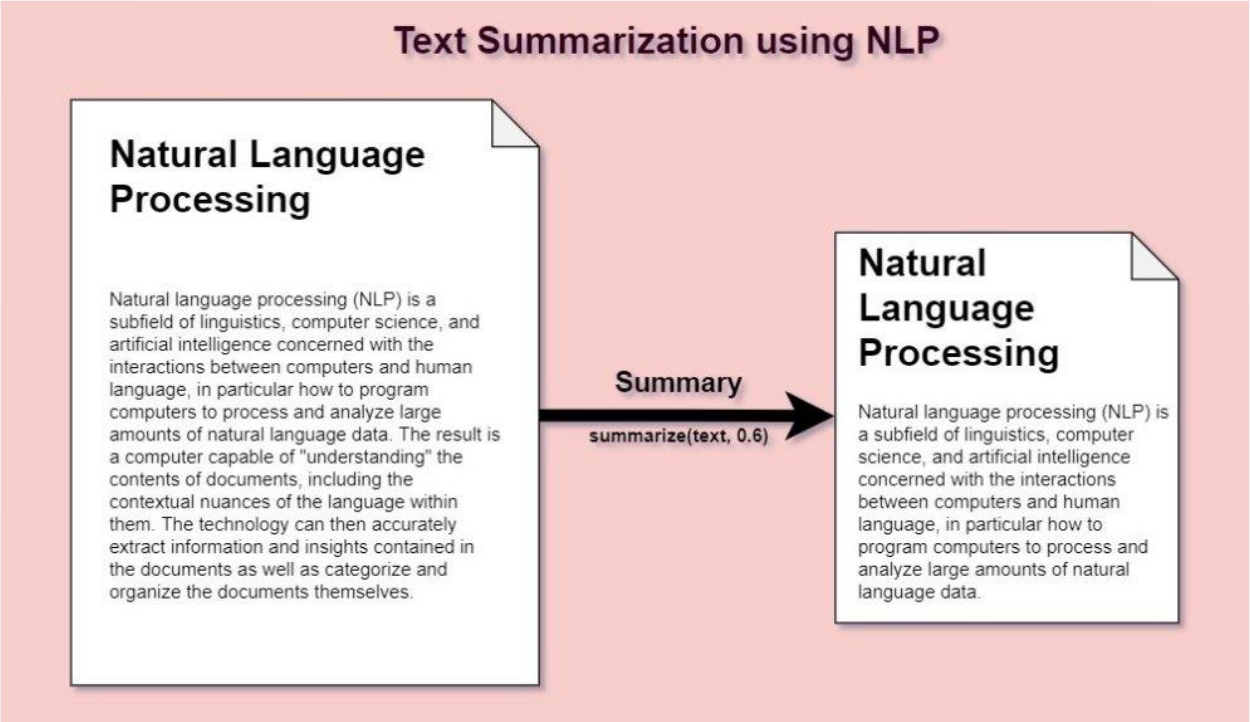
Related Tasks in Machine Learning

Natural Language Process

Natural Language Processing

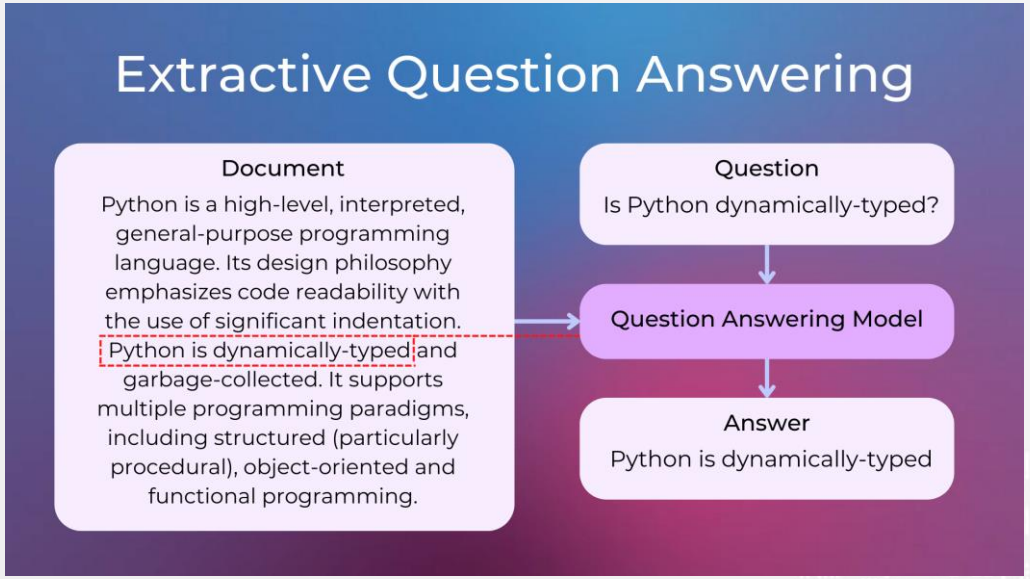
- Text Summarization
- Question Answering
- Machine Translation
- Sentimental Analysis
- Language Understanding
- Text Generation

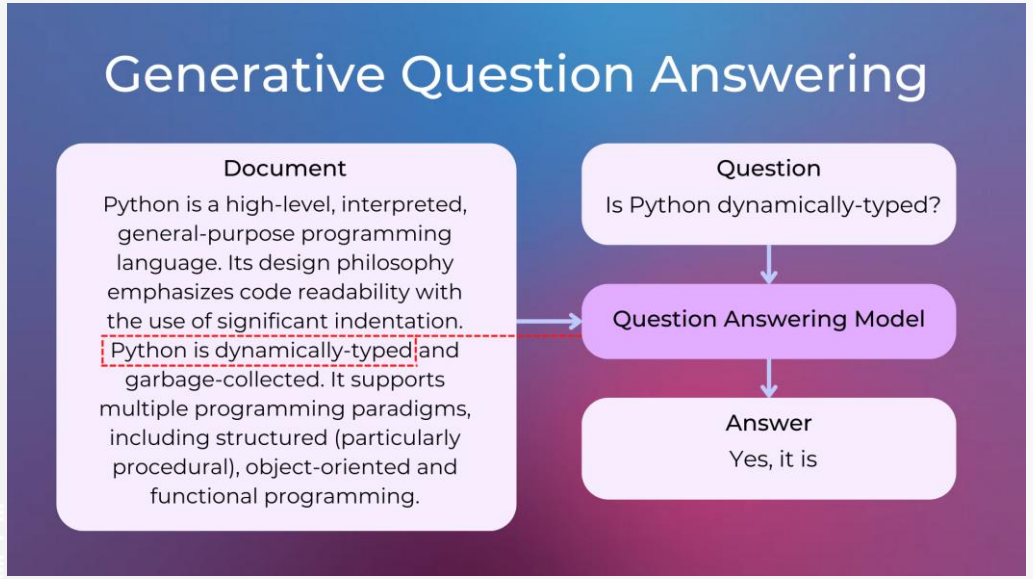
NLP :
Text Summarization



Ref : https://turbolab.in/types-of-text-summarization-extractive-and-abstractive-summarization-basics/

NLP :
Question Answering





Ref : https://www.nlplanet.org/course-practical-nlp/02-practical-nlp-first-tasks/17-question-answering

NLP :
Machine Translation

Microsoft Translator

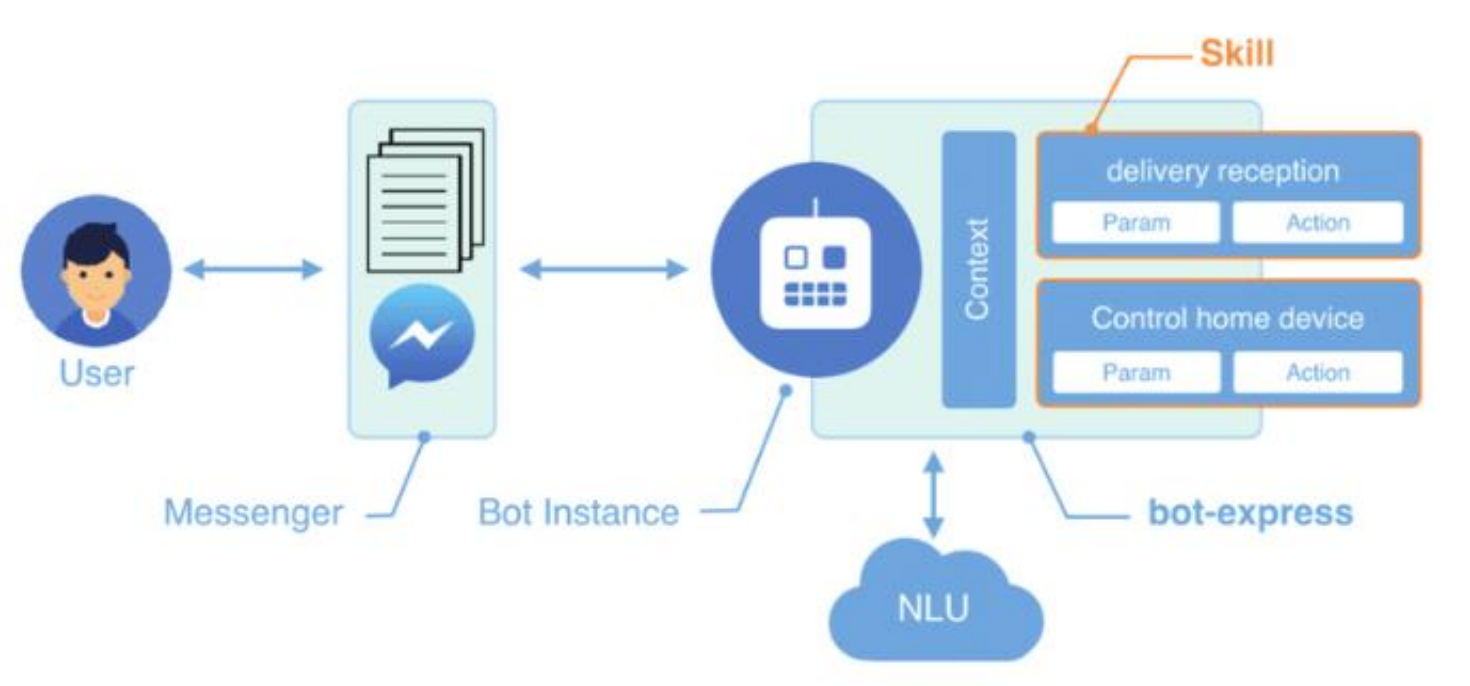
Google Translate

iTranslate

NLP :
Sentimental Analysis

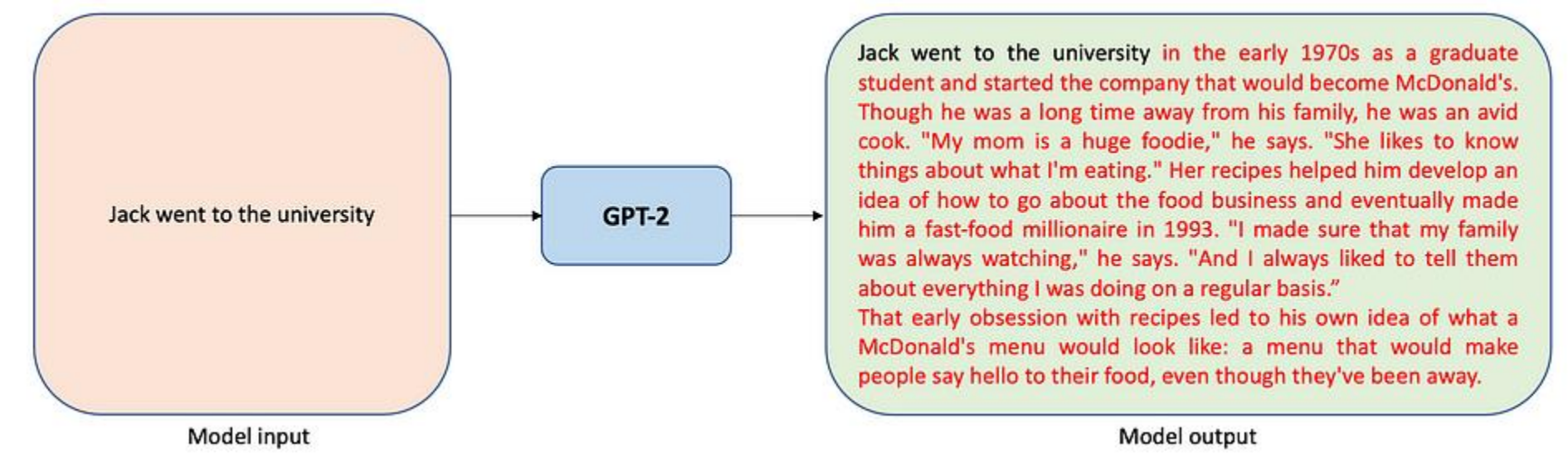
Ref : https://www.kdnuggets.com/2018/03/5-things-sentiment-analysis-classification.html

NLP :
Language Understanding



Ref : https://research.aimultiple.com/nlu/

NLP :
Text Generation



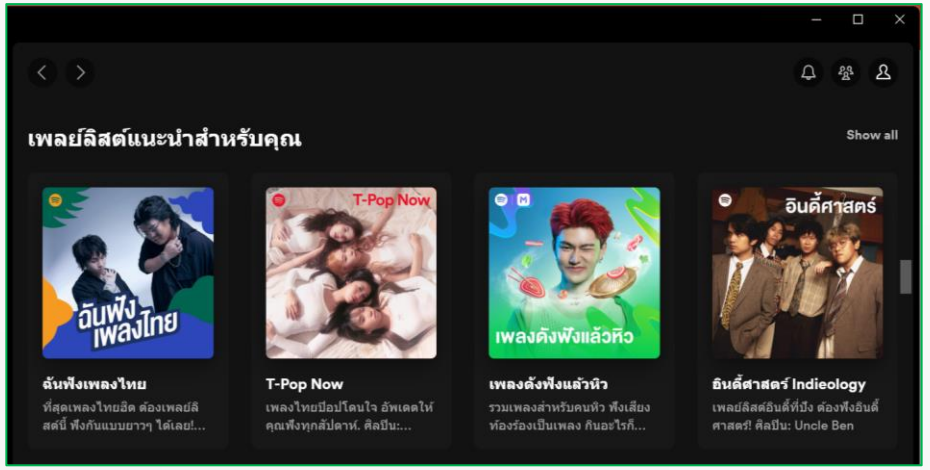
Ref : https://medium.com/@sharathhebbar24/text-generation-v-s-text2text-generation-3a2b235ac19b

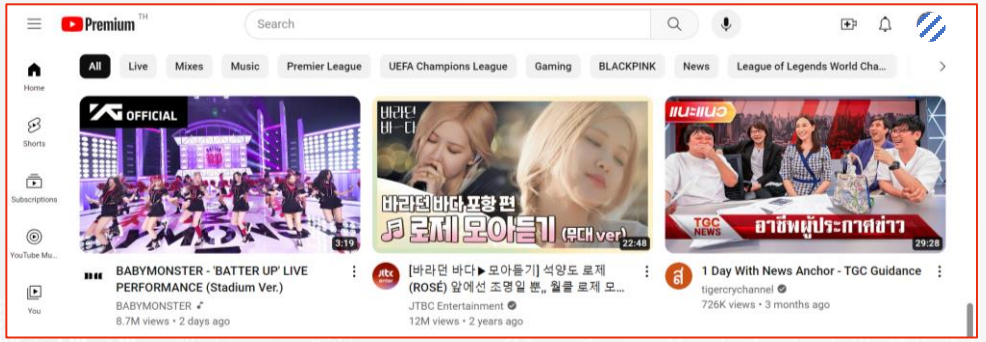
Related Tasks in Machine Learning

Recommendation System

Recommendation System

- Netflix
- YouTube
- Spotify





Related Tasks in Machine Learning

Generative AI

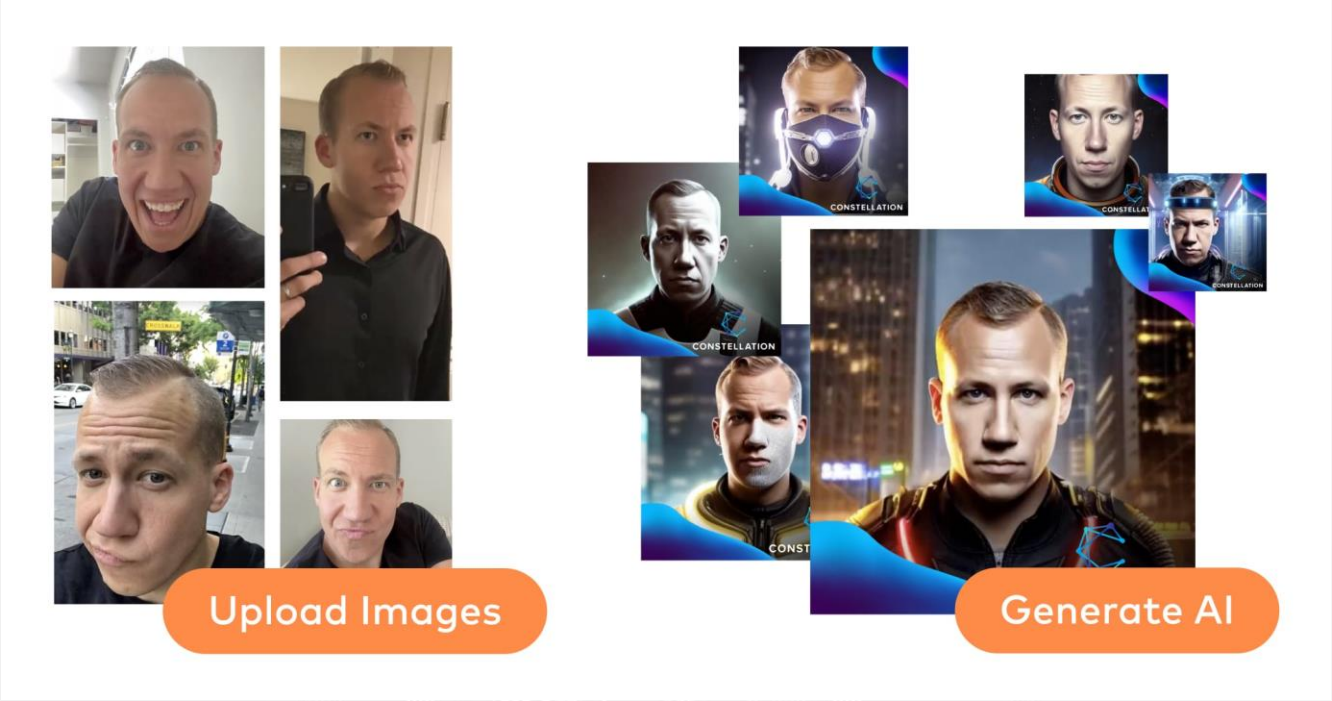
Generative AI

- สร้างเสียง 🎙
- สร้างรูปภาพ 🖼
- สร้างวิดีโอ 📹
- สร้างข้อความ 💬

Generative AI :
สร้างเสียง

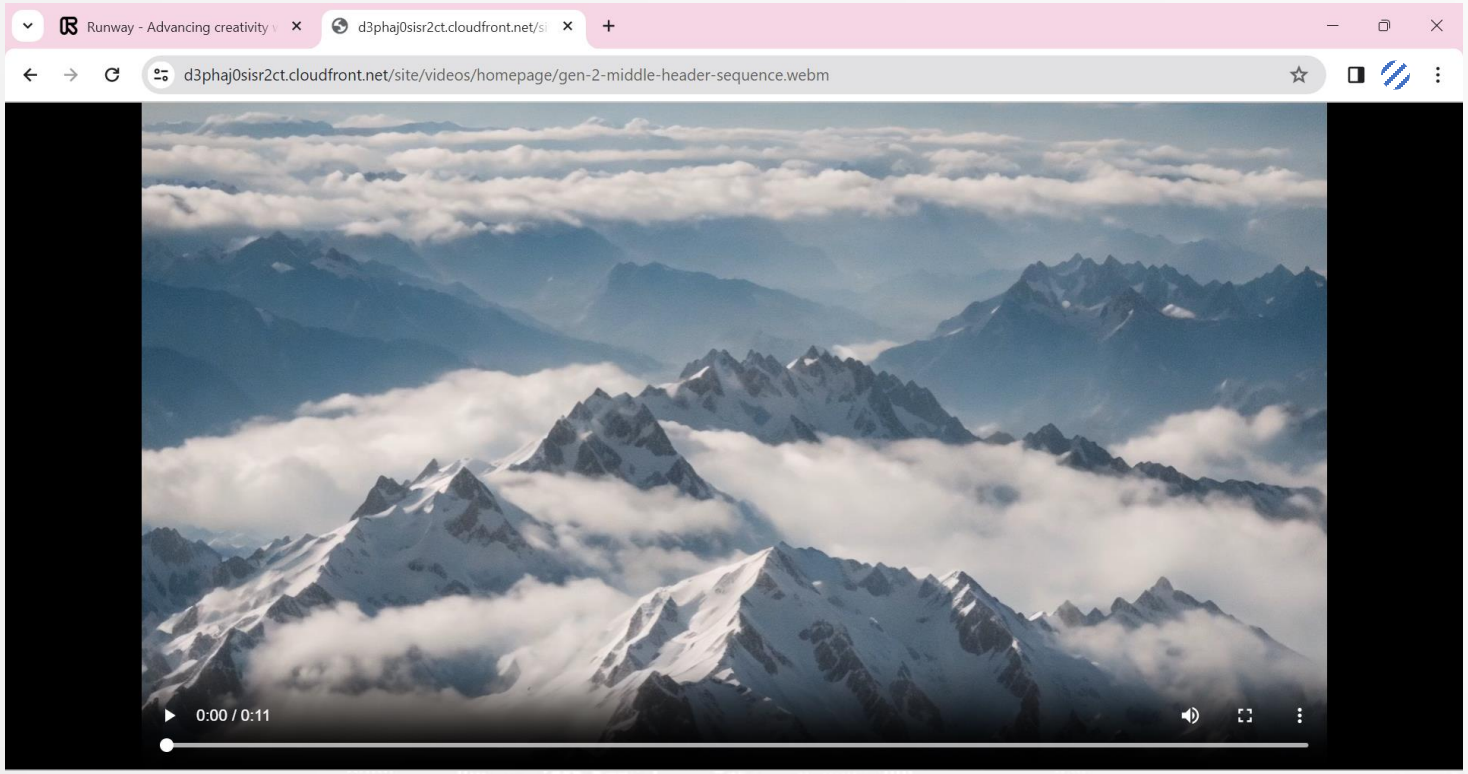
Ref : https://x.com/heyBarsee/status/1625034897155887104?s=20

Generative AI :
สร้างรูปภาพ



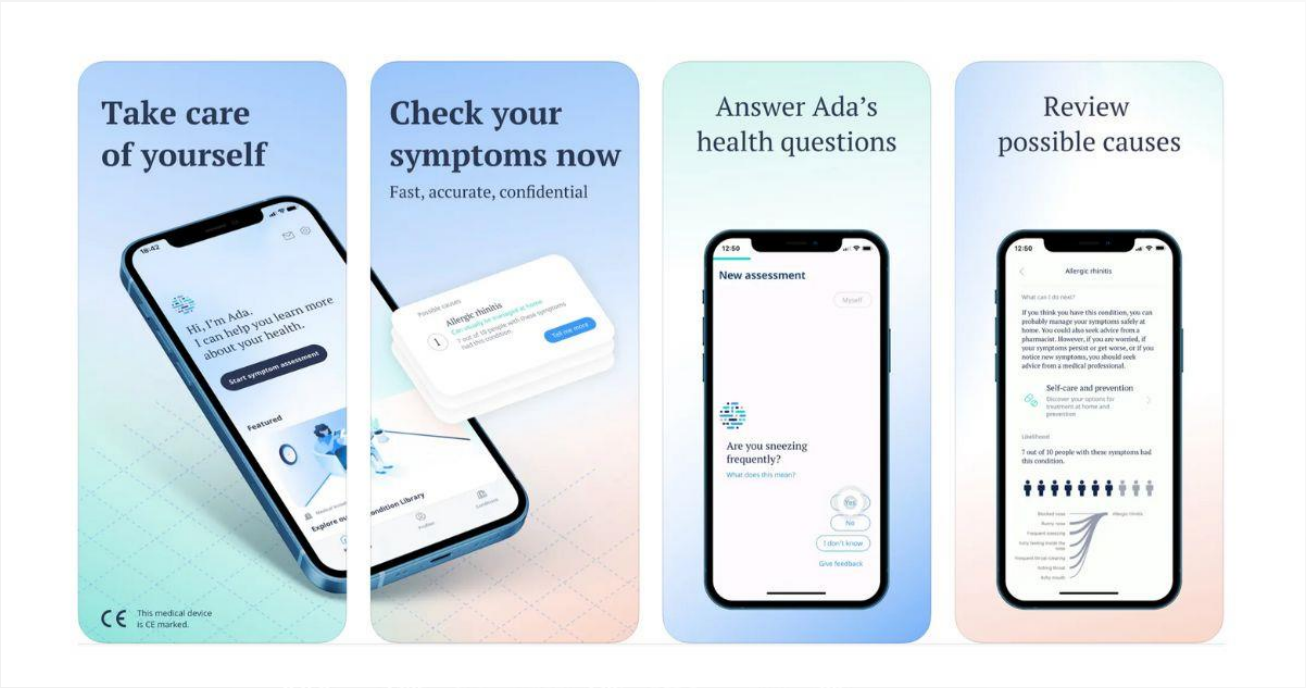
Ref : https://snapbar.com/blog/how-ai-photo-booths-generative-ai-work

Generative AI :
สร้างวิดีโอ



Ref : https://d3phaj0sisr2ct.cloudfront.net/site/videos/homepage/gen-2-middle-header-sequence.webm

Generative AI :
สร้างข้อความ



Ada – check your health Application

Related Tasks in Machine Learning