JEONBUK
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Introduction to AI

HyungGi Jo
Div. of Electronics
Jeonbuk National University

Introduction

AI Robotics Lab
Jeonbuk National Univ

PI : 조형기 (HyungGi Jo)

2023 한국로봇학회 평창

2023 ICRA 런던

연구실 현황 ('23 기준)

- ✓ (개요) AI Robotics Lab. 전자공학부, 2021년 설립
- ✓ (인력) 총 10명
  - (full-time) 석사과정 5명
  - (part-time) 박사과정 2명, 석사과정 3명
- ✓ Research Interests: 지능형 로봇의 인식 SW
  - Spatial AI
  - 센서 융합, 지능형 로봇/모빌리티 SLAM
  - 딥러닝 기반 Visual Localization

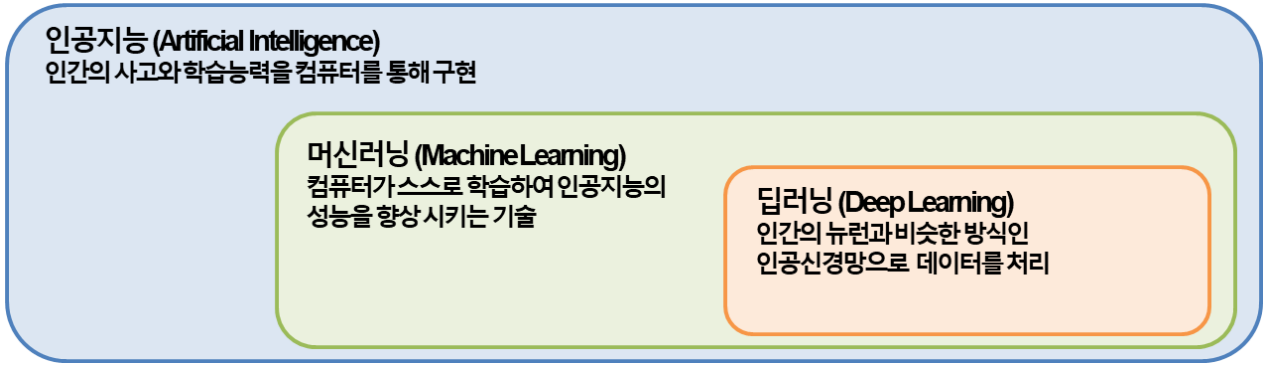
연구과제 수행현황

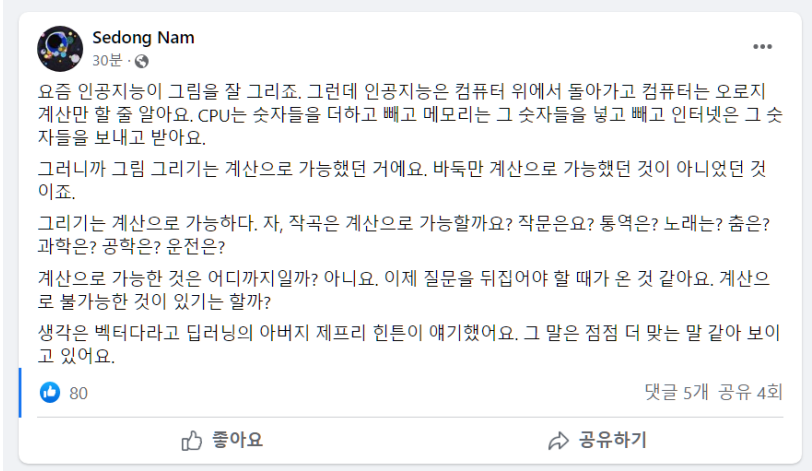
SAMSUNG 삼성전자	22.05 ~ 25.04	엑시노스 오토 向 주행환경인식을 위한 어라운드뷰 뎁스추정 기반의 Visual Localization 기술 개발
LIG 넥스원	23.05 ~ 25.03	자기/음향 스텔스 표적 대응을 위한 SLAM 기반 발화 최적화 기술 개발
ETRI 한국전자통신연구원	23.04 ~ 23.11	무인이동체 VPS 기반 고정밀 실내지도 작성 및 위치추정 기술 연구
BSTAR Robotics, Inc.	23.01 ~ 24.08	실내 자율주행 로봇을 위한 센서 융합 기반 SLAM 기술 개발
NRF 한국연구재단	21.09 ~ 24.02	다양한 환경에 적용 가능한 모바일 로봇의 전역 위치인식 및 Visual Localization 기술 개발

Course Description

- AI + X (국방, 물류, 미술, 음악, 언어, 법, 모빌리티, 서비스, 통계, 로봇, etc.)
- Machine Learning Basic Course
  - (Prerequisites): Probability & Random Variables, Optimization, Linear Algebra
  - (Prerequisites): Python (numpy, pandas)
  - Linear Regression
  - Bias-variance tradeoff
  - Logistic Regression
  - Multiclass Regression
  - Decision Tree
  - Adaboost
  - Clustering Methods
  - Dimension Reduction

+ AI 시대에서 사는 법..?

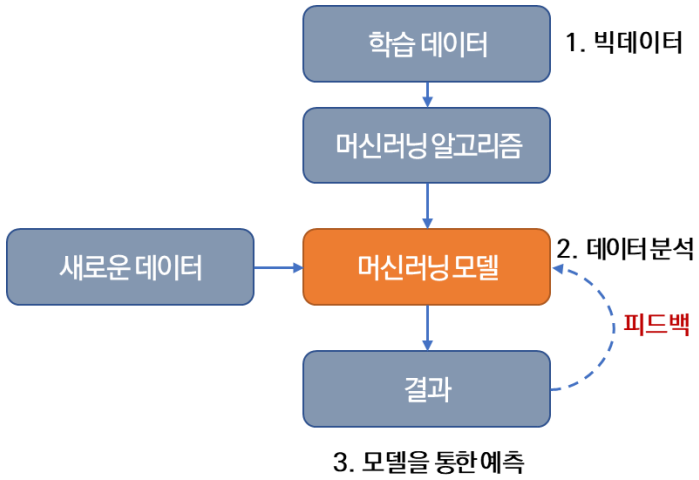




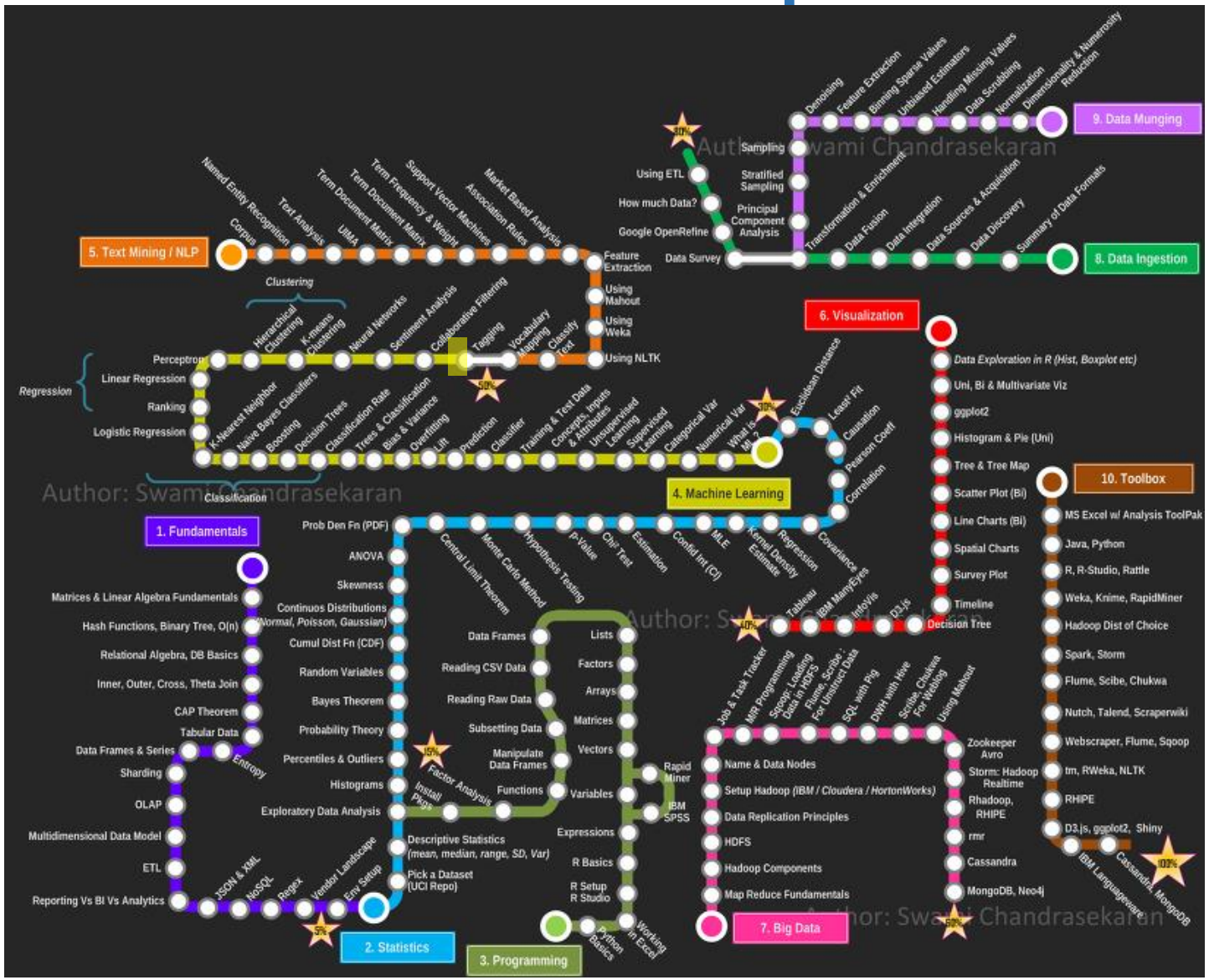
Course Description

- AI Main Goal:
  - Study of algorithms that
    - improve their **performance**
    - at some **work**
    - with **experience**
  - Make predictions or decision from data (image, video, text, speech, etc.)

- Lab class requirements:
  - 본인이 편한대로 개인 노트북 사용



Course Description



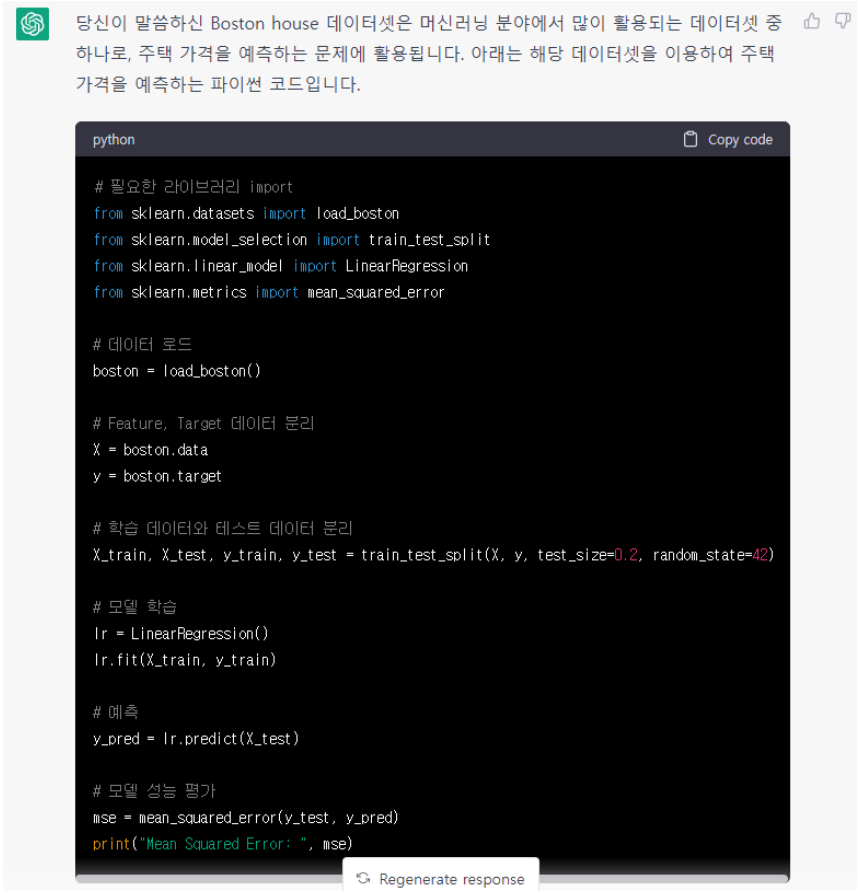
https://fayimora.com/machine-learning-roadmap/

Course Description

- Programming Language : Python
- 머신러닝 관련 파이썬 패키지
  - Pandas, Numpy
  - Scikit-learn
  - Tensorflow
  - Pytorch
- Useful Tools
  - MarkDown
  - Github
  - Virtual Environment, Anaconda
  - Google Colab (Jupyter Notebook)

Course Description

- ChatGPT
  - Boston house 데이터셋으로 집 값을 예측하는 파이썬 코드 작성해줘



당신이 말씀하신 Boston house 데이터셋은 머신러닝 분야에서 많이 활용되는 데이터셋 중 하나로, 주택 가격을 예측하는 문제에 활용됩니다. 아래는 해당 데이터셋을 이용하여 주택 가격을 예측하는 파이썬 코드입니다.

python Copy code

```python
# 필요한 라이브러리 import
from sklearn.datasets import load_boston
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error

# 데이터 로드
boston = load_boston()

# Feature, Target 데이터 분리
X = boston.data
y = boston.target

# 학습 데이터와 테스트 데이터 분리
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# 모델 학습
lr = LinearRegression()
lr.fit(X_train, y_train)

# 예측
y_pred = lr.predict(X_test)

# 모델 성능 평가
mse = mean_squared_error(y_test, y_pred)
print("Mean Squared Error: ", mse)
```

Regenerate response

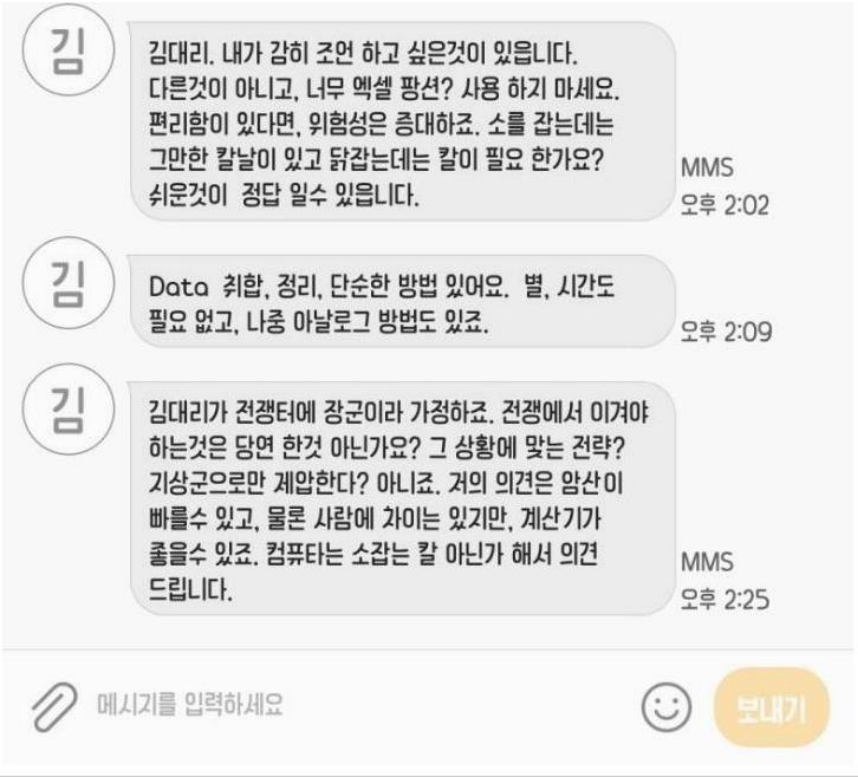
- 이 설명을 이해할 수 있는 능력
- 강력한 AI 성능을 본인의 영역(X)으로 가지고 오는 능력→ Boston house 데이터가 아닌 내가 가지고 있는 데이터에 적용?

위 코드에서는 scikit-learn 라이브러리의 `load_boston()` 함수를 사용하여 데이터를 로드하고, `train_test_split()` 함수를 사용하여 학습 데이터와 테스트 데이터를 분리합니다. 그리고 `LinearRegression()` 함수를 사용하여 선형 회귀 모델을 학습시키고, `predict()` 함수를 사용하여 테스트 데이터에 대한 예측 값을 구합니다. 마지막으로 `mean_squared_error()` 함수를 사용하여 모델 성능을 평가합니다.

위 코드를 실행하면 주택 가격을 예측하는 데에 대한 Mean Squared Error 값을 출력할 수 있습니다. 이 값은 모델의 예측 성능을 나타내는 지표 중 하나이며, 값이 작을수록 모델의 성능이 좋다는 것을 의미합니다.

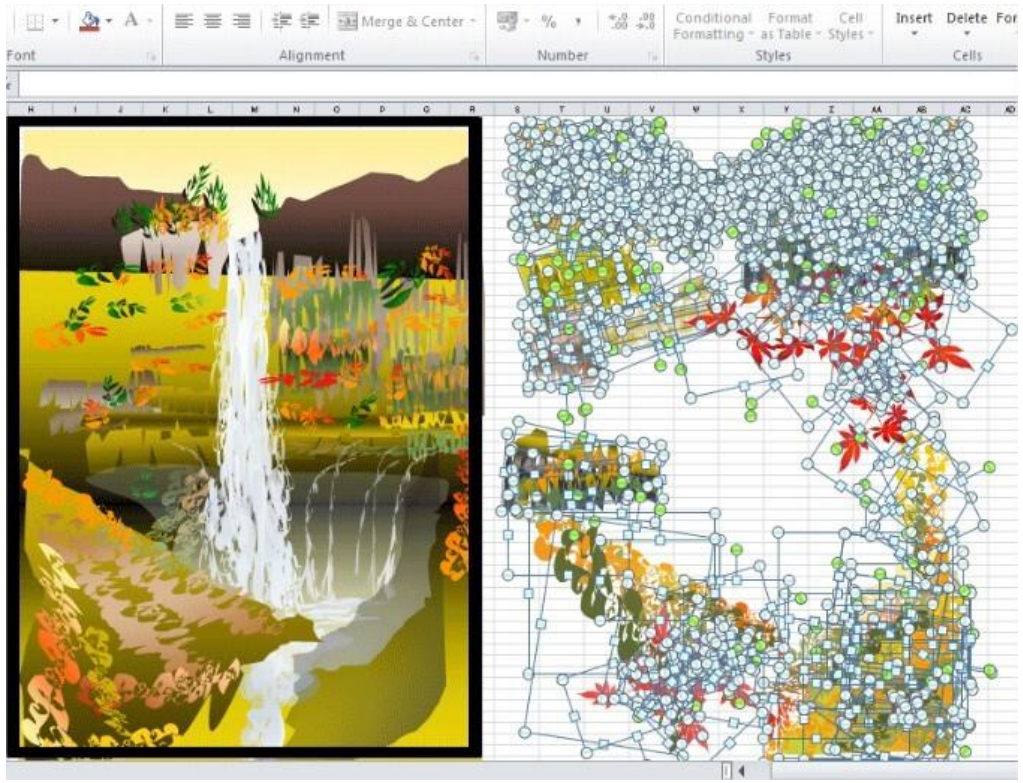
Course Description

- ChatGPT 그리고 우리가 나아가야 할 방향 → 새로운 것을 만들어내는 것
- **본인의 도메인(domain)에 AI를 잘 적용하는 것이 1차 경쟁력**
- 도구를 잘 쓰거나 **도구를 만들어 내거나**



엑셀 팡션 싫어하는 김대리의 상사

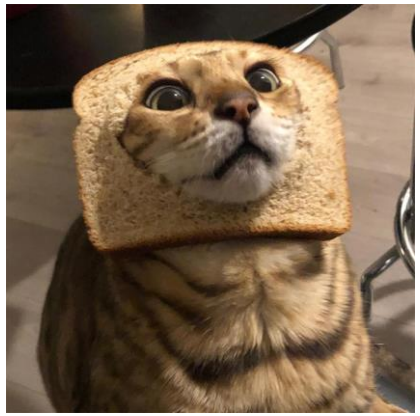
vs

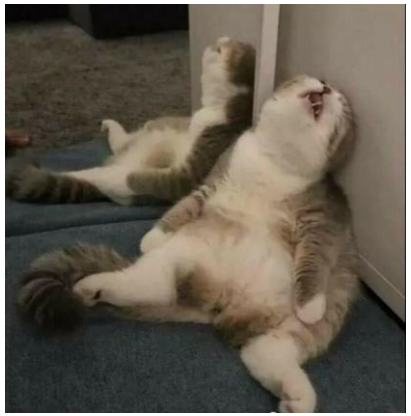


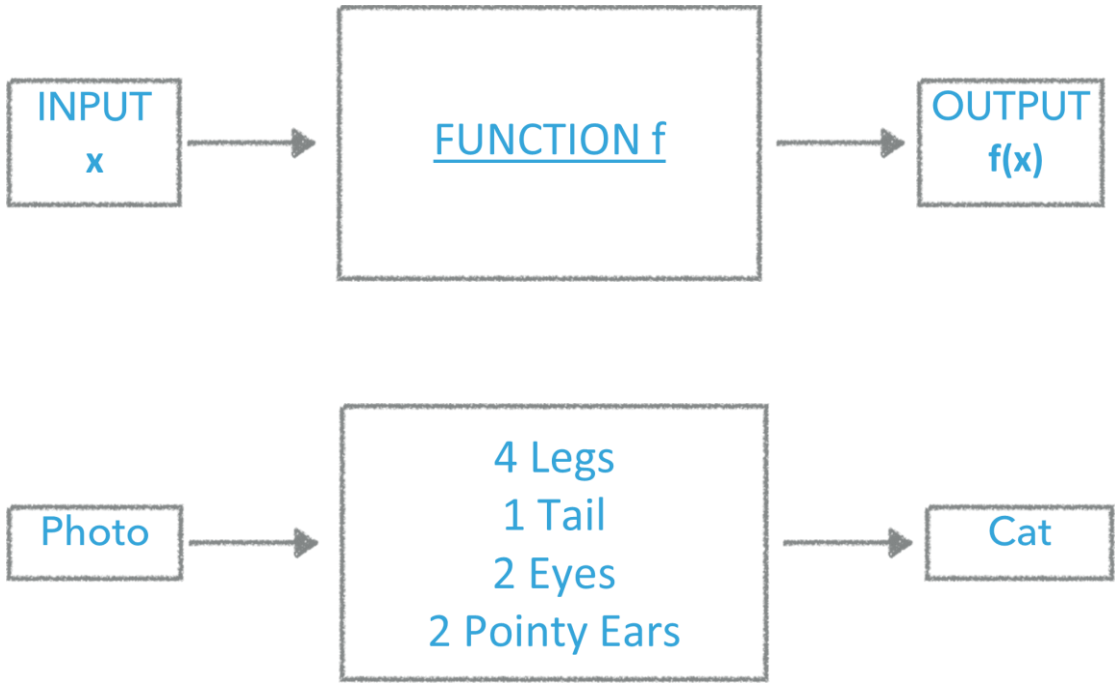
엑셀로 그림 그리는 80세 할아버지

Introduction to AI

- 기존 방법



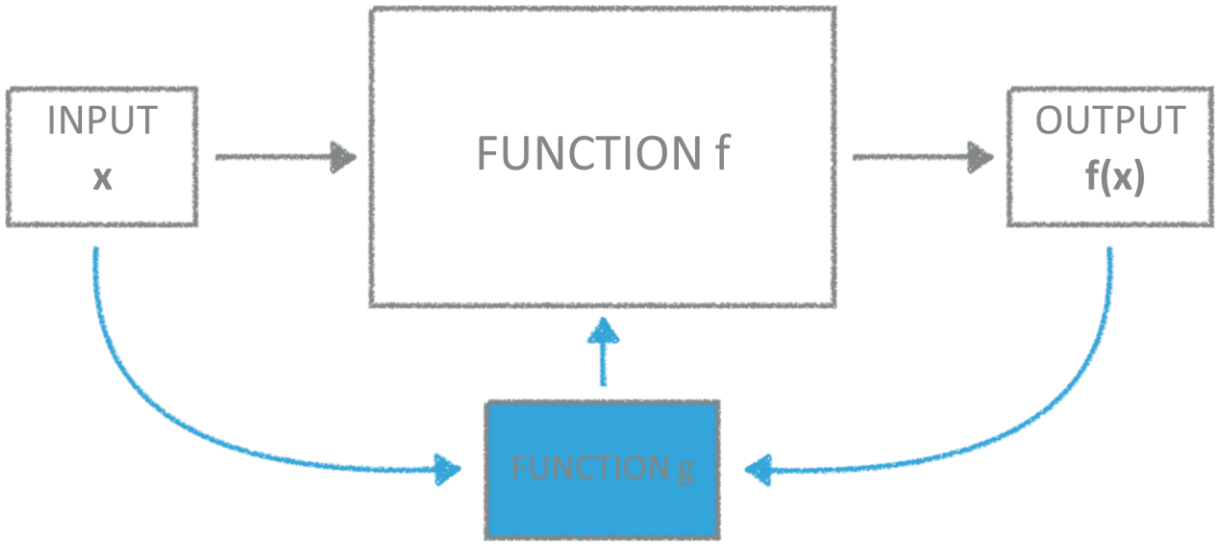




고양이 판별

Introduction to AI

- AI의 방법



Introduction to AI

- Learning Mechanism

$$L = \frac{1}{N}\sum_{i} L_i(f(x_i, W), y_i)$$

The dataset consists of (x_i, y_i) where:

y_i is a label

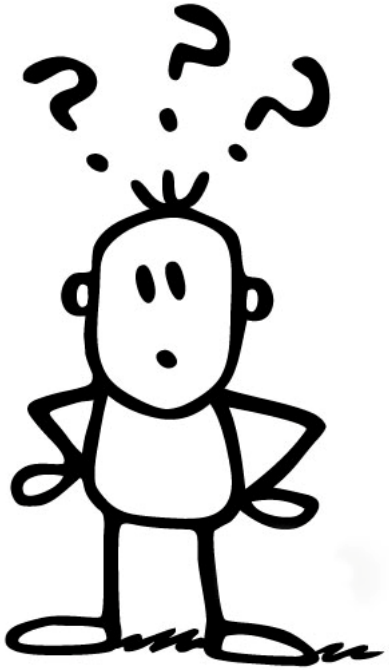
x_i is an input

$\hat{y}_i = f(x_i, W)$ is a predicted output.

The Loss L is the average of all losses over all the dataset.

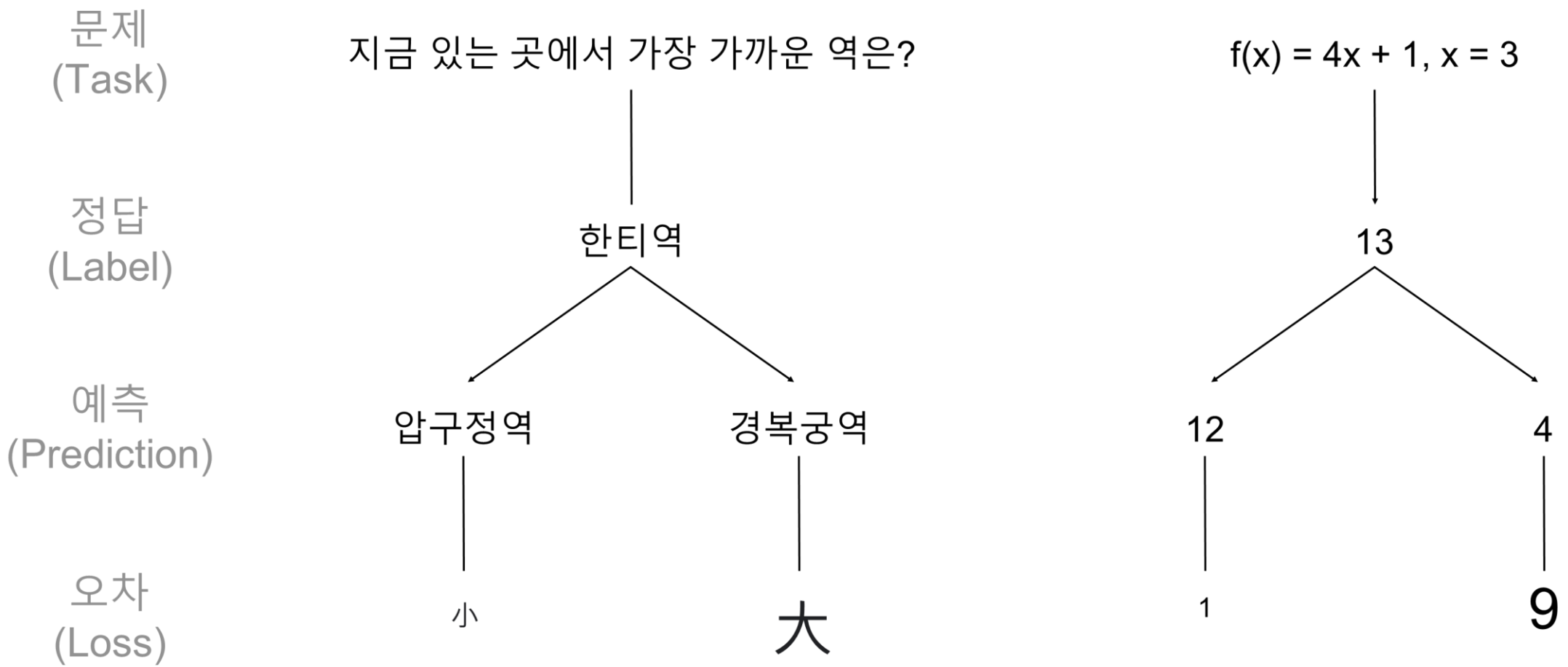
$$\lambda_{\text{coord}} \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{\text{obj}} \left[(x_i - \hat{x}_i)^2 + (y_i - \hat{y}_i)^2 \right]$$

$$+ \lambda_{\text{coord}} \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{\text{obj}} \left[\left(\sqrt{w_i} - \sqrt{\hat{w}_i} \right)^2 + \left(\sqrt{h_i} - \sqrt{\hat{h}_i} \right)^2 \right]$$



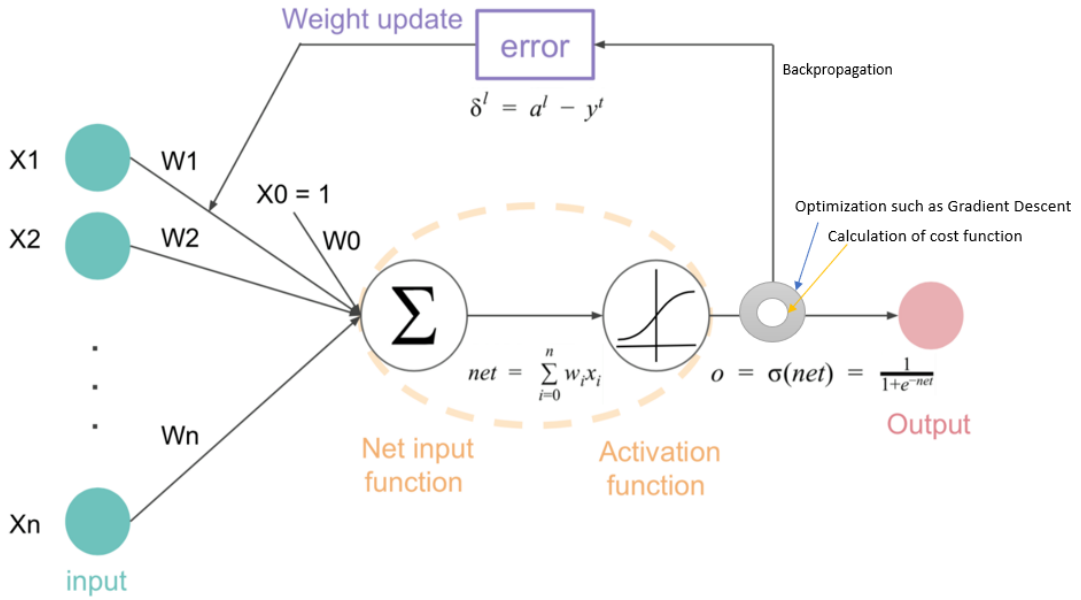
Introduction to AI

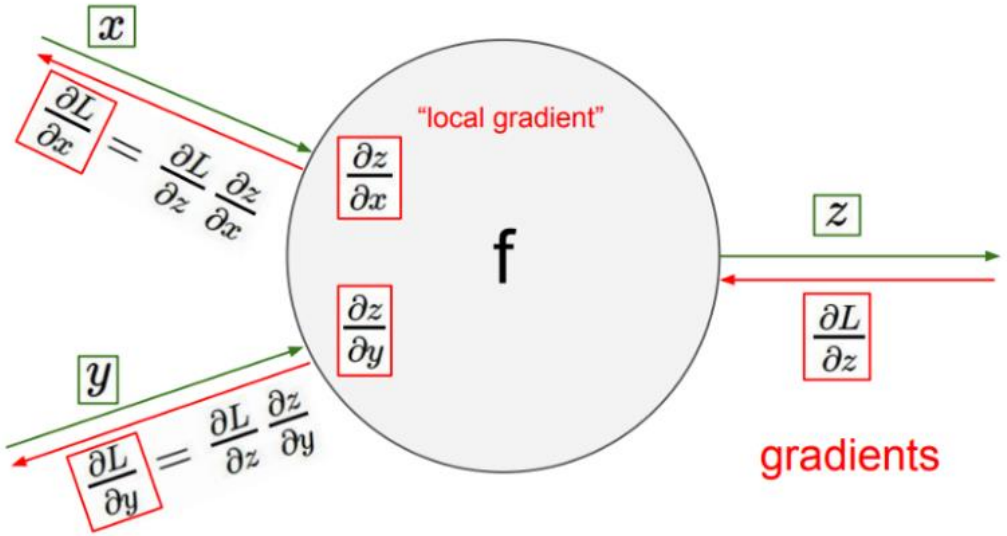
- Learning Mechanism

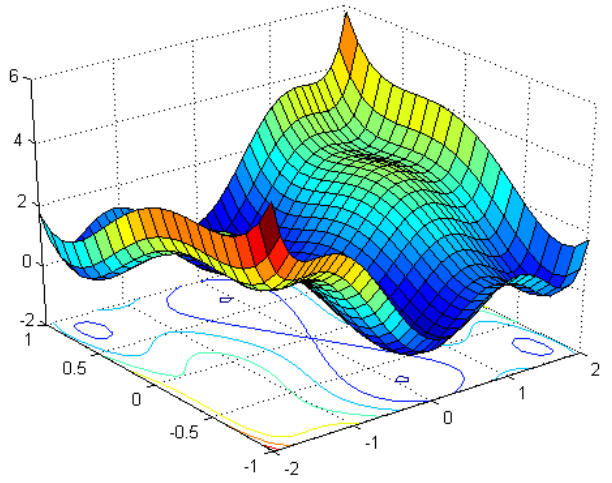


Introduction to AI

- Learning Mechanism – Backpropagation (역전파)

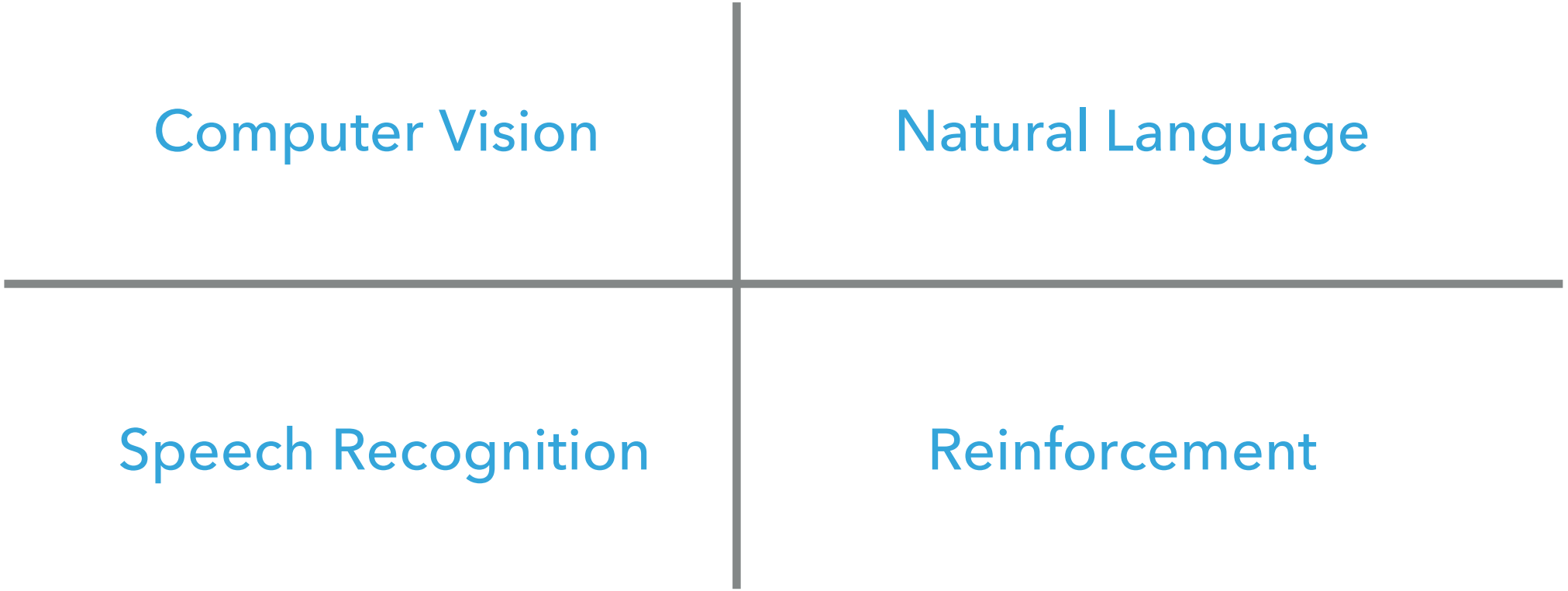






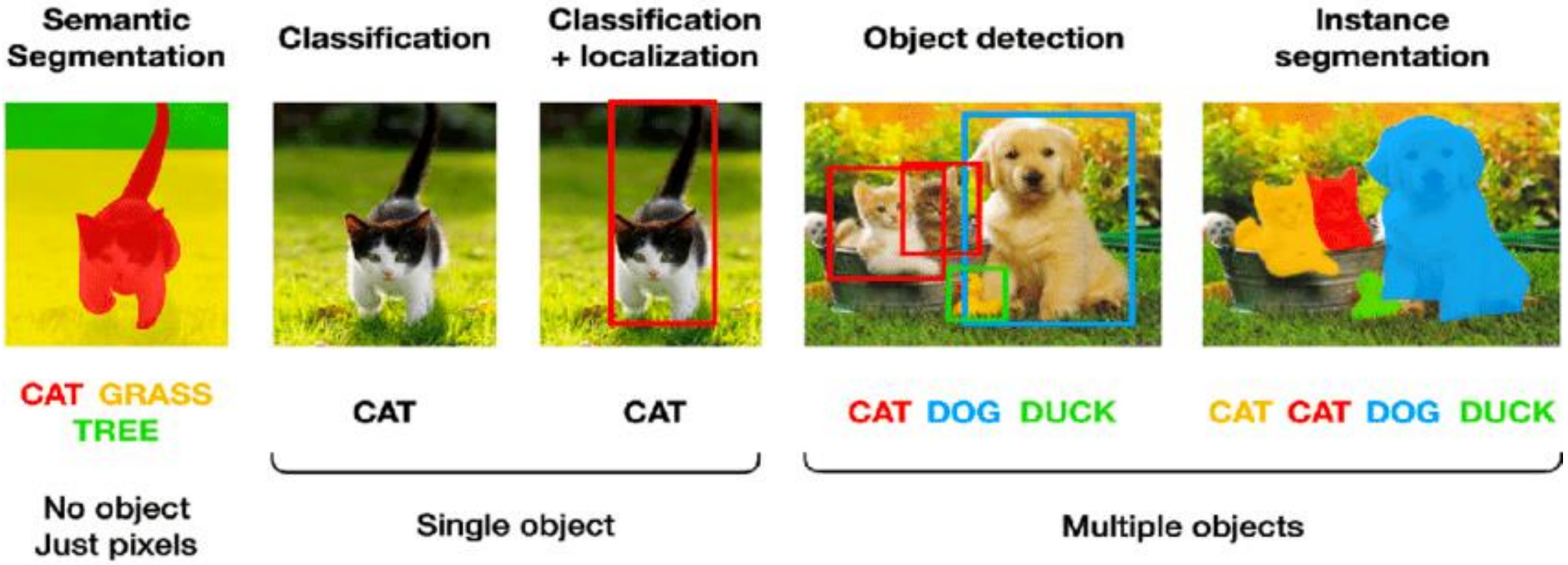
3blue1brown – https://youtu.be/IHZwWFHWa-w

What can AI do?



실습!
https://quickdraw.withgoogle.com/

What can AI do?

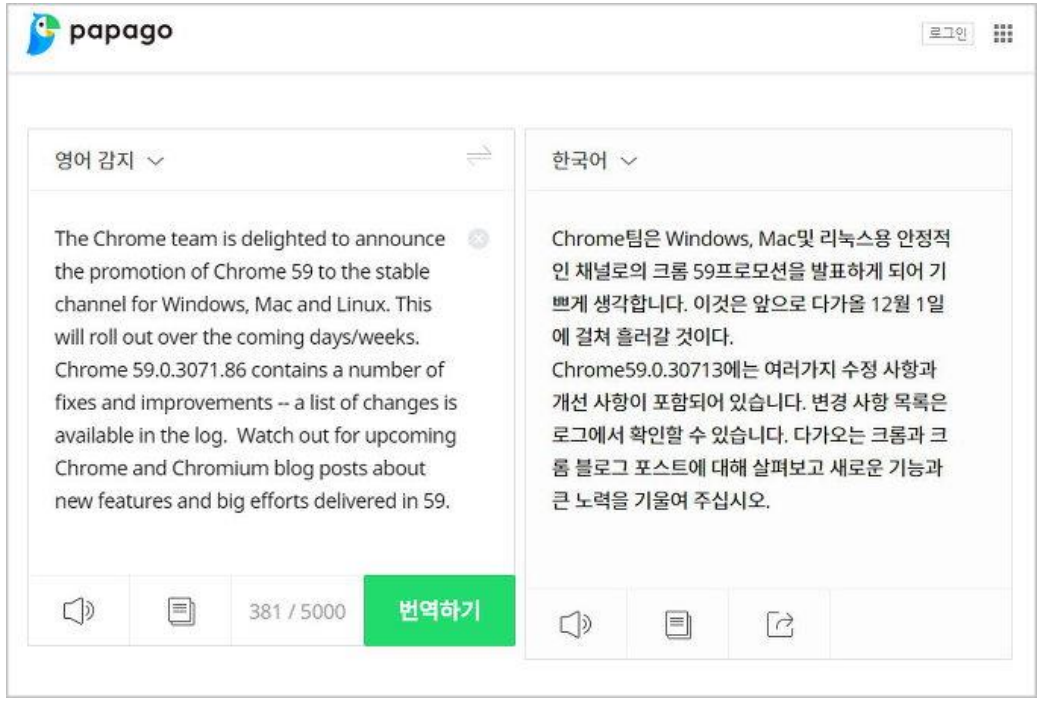


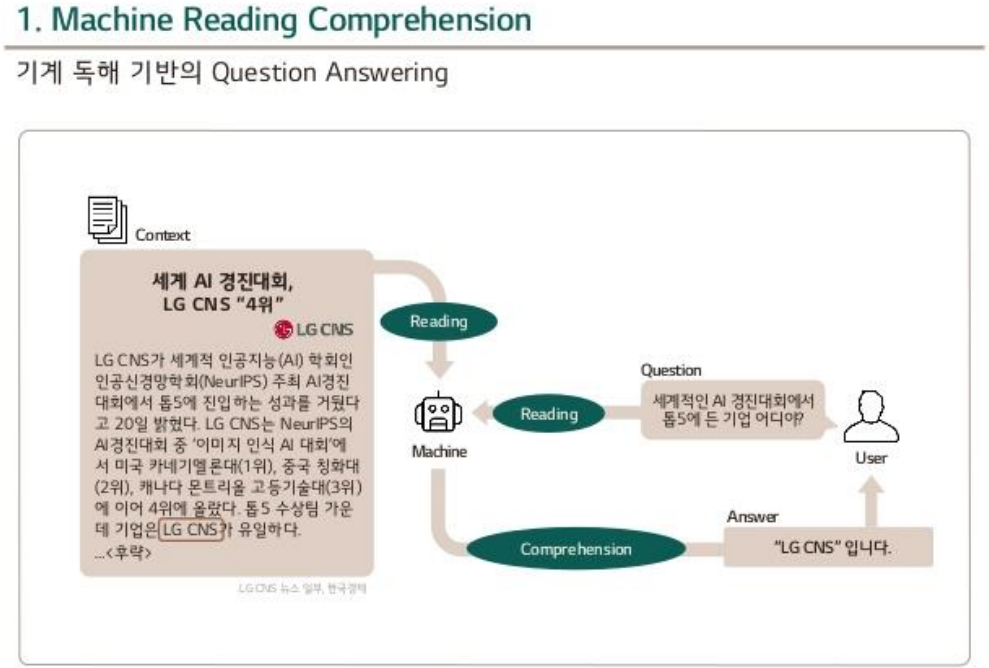
+ Deepfake, Linguistic-Visual, Video, 3D, AR/VR, ..

https://www.youtube.com/watch?v=Gb1WT9WutBg
https://www.youtube.com/watch?v=mRAKVQj5LRA

실습!
https://research.google.com/semantris/

What can AI do?

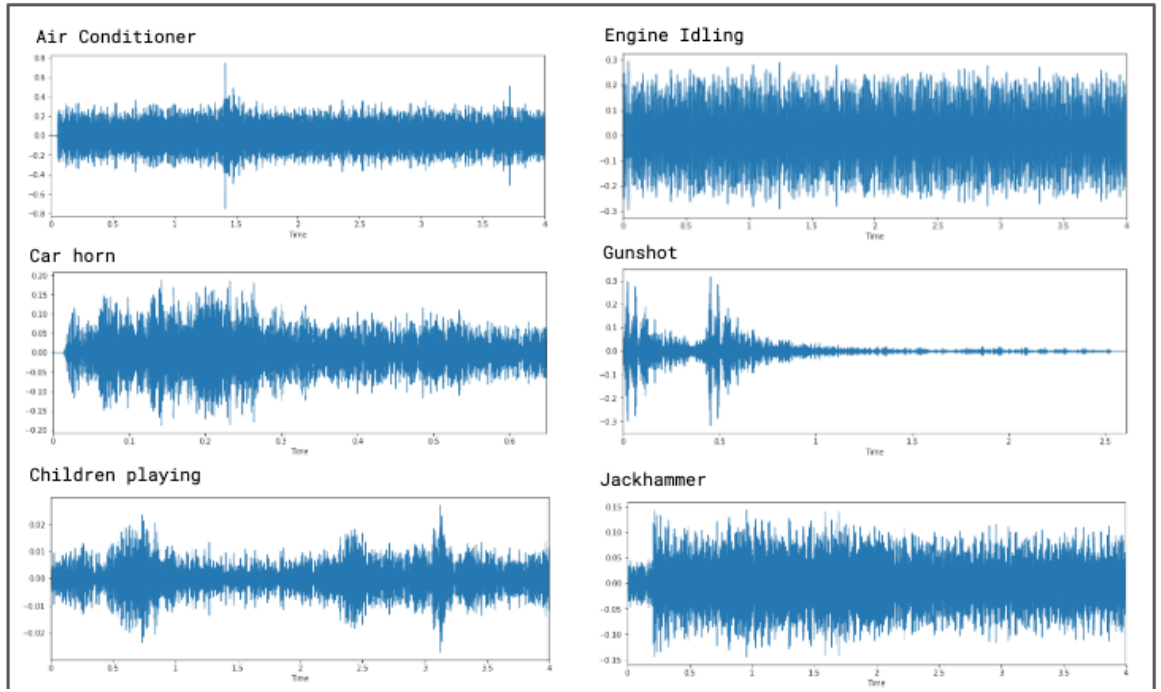




+ Text Toxicity Detection, Summarization, Lyrics Generation, ..

https://openai.com/blog/better-language-models/#sample8
https://www.youtube.com/watch?v=yDI5oVn0RgM

What can AI do?



+ Smart Speaker, Speech Synthesis, ..

https://www.youtube.com/watch?v=NRld3PTpMdA
https://www.youtube.com/watch?v=NxQSxM0OkkY

What can AI do?

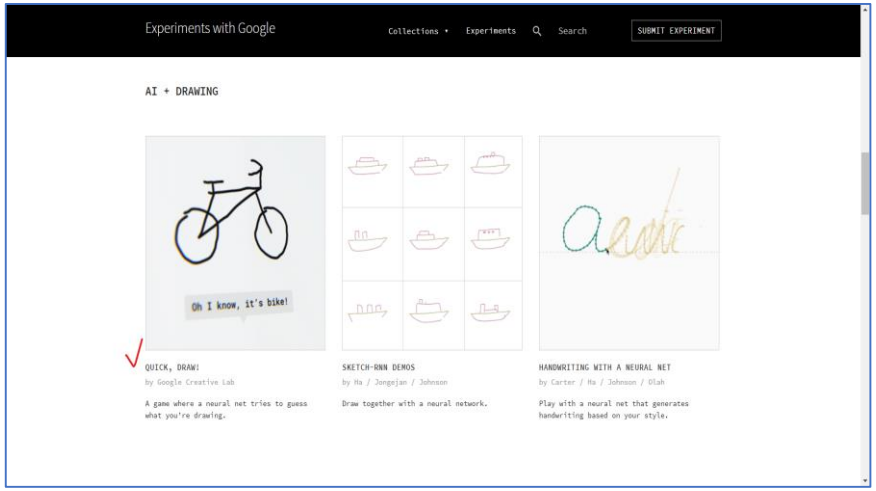
+ Game, System Control, ..

https://www.youtube.com/watch?v=V1eYniJ0Rnk

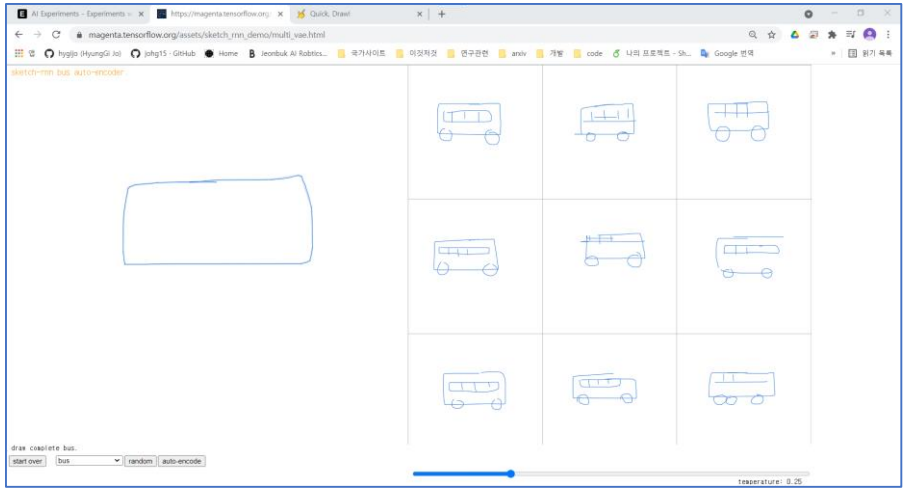
https://www.youtube.com/watch?v=n2gE7n11h1Y

Introduction to AI

- Google 인공지능 실험실
- https://experiments.withgoogle.com/collection/ai



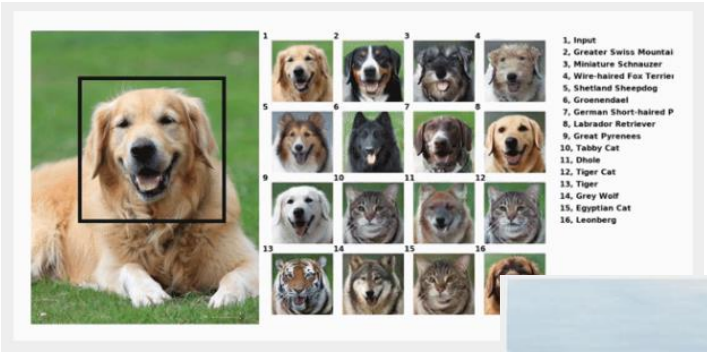
AI + DRAWING의 QUICK, DRAW!



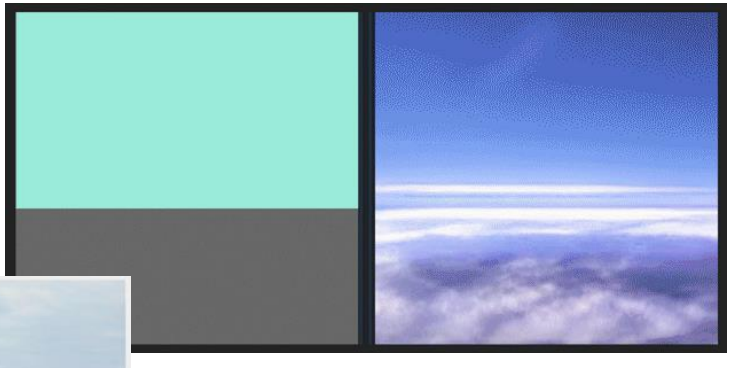
Auto-Encoder Demo

Introduction to AI

- NVIDIA 인공지능 실험실
- https://www.nvidia.com/en-us/research/ai-demos/



NVIDIA GANIMAL



NVIDIA GAUGAN

NVIDIA 이미지 인페인팅

Machine Learning

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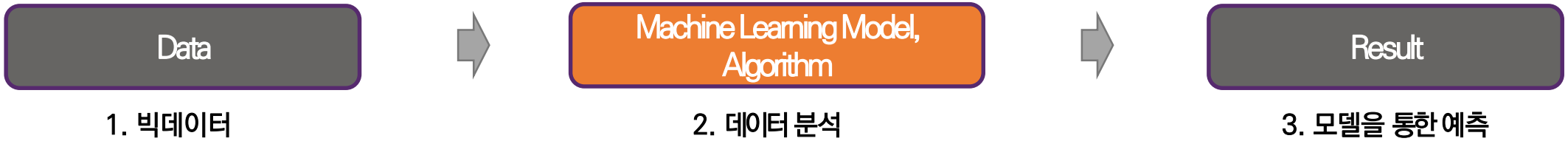
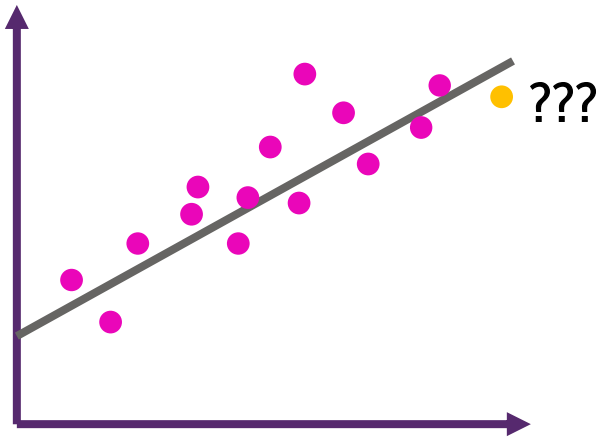
    - improve their **performance**
    - at some **work**
    - with **experience**
  - Make predictions or decision from data (image, video, text, speech, etc.)



Machine Learning

- Regression
  - Predicting Stock Price of Apple

Past 10 years prices
Past 10 days prices
Global Crude Oil prices
PER
PBR
Exchange Rate
# of JBNU-AI lecture students



Data → Machine Learning Model, Algorithm → Result

1. 빅데이터

2. 데이터 분석

3. 모델을 통한 예측

Regression

- Regression
  - Predicting Stock Prices

Input x:
Features
(pre-defined/derived from data)

Learning relationship between
input x and output y

Predicted y:
Continuous Output

1. 빅데이터

2. 데이터 분석

3. 모델을 통한 예측

Regression

- Regression
  - Tomorrow temperature (y = °C)
  - Depends on x =
    - today temperature
    - today humidity
    - yesterday temperature
    - yesterday degree of my grandmother's knee pain
    - etc..

Data → 머신러닝 모델, 알고리즘 → 결과

1. 빅데이터

2. 데이터 분석

3. 모델을 통한 예측

Regression

- Regression
  - # of Instagram likes
  - Depends on x =
    - # of followers
    - # of followers of followers
    - popularity of hashtag
    - # of hashtags
    - upload time

Data → 머신러닝 모델, 알고리즘 → 결과

1. 빅데이터

2. 데이터 분석

3. 모델을 통한 예측

Regression

- Regression
  - Your salary (y = $$)
  - Depends on x =
    - quality of projects
    - grade
    - # of

Data → 머신러닝 모델, 알고리즘 → 결과

1. 빅데이터

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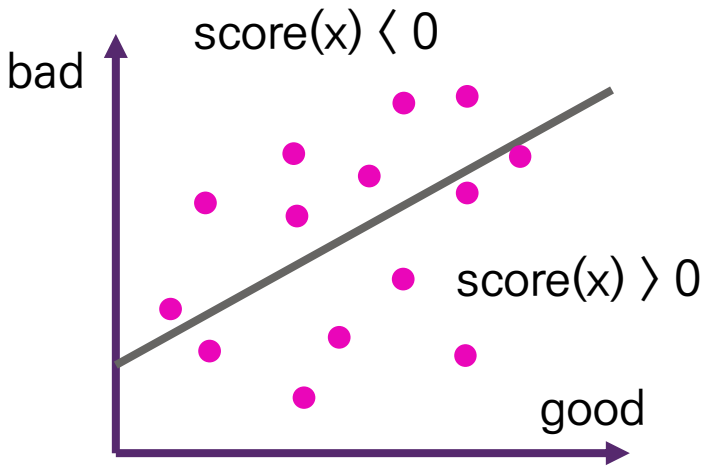
Classification

- Classification
  - Movie review good or bad?

This movie was good.
Also, actors were really good.
But the music was bad.



This movie is good or bad?

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Classification

- Classification
  - Movie review good or bad?

Input x:
Features
(pre-defined/derived from data)

Learning relationship between input x and output y

Predicted y:
Discrete Output (label, class)

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Classification

- Classification
  - Spam filter
    - Input : frequency of text, IP, sender address, etc.
    - Output : spam or not

Data → Machine Learning Model, Algorithm → Result

1. 빅데이터

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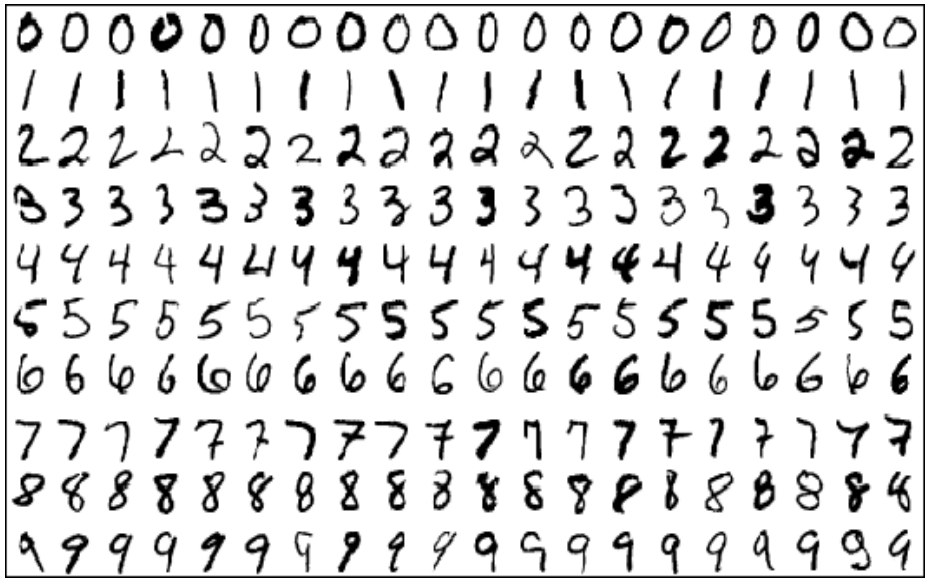
Classification

- Classification
  - Multiclass Output
    - output y has more than 2 categories
    - Image Classifier



Input :
handwriting number

1 2 3 4 5 6 7 8 9 10

Output :
predicted number

Classification

- Classification
  - Multiclass Output

Input :
Webpage

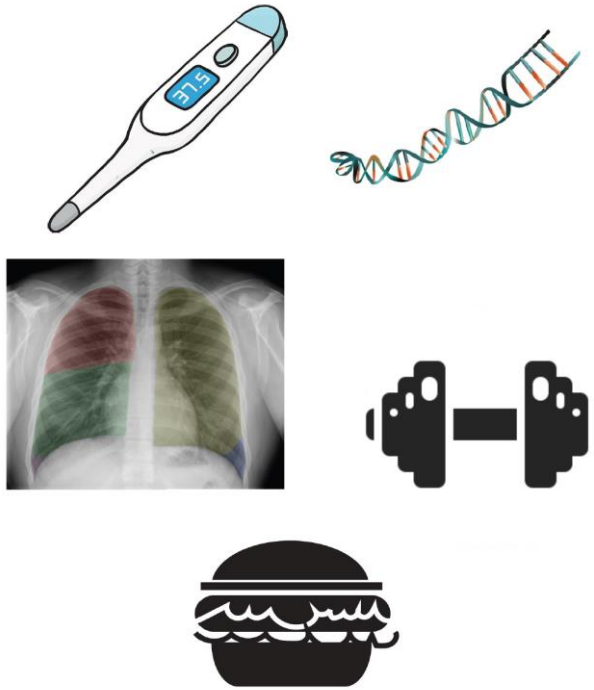
Webpage Classifier

Education
Finance
Sports
Technology
...

Output :
predicted categories

Classification

- Classification
  - Multiclass Output



Input :
건강 상태와 관련된 인자들

Output :
predicted disease

Classification

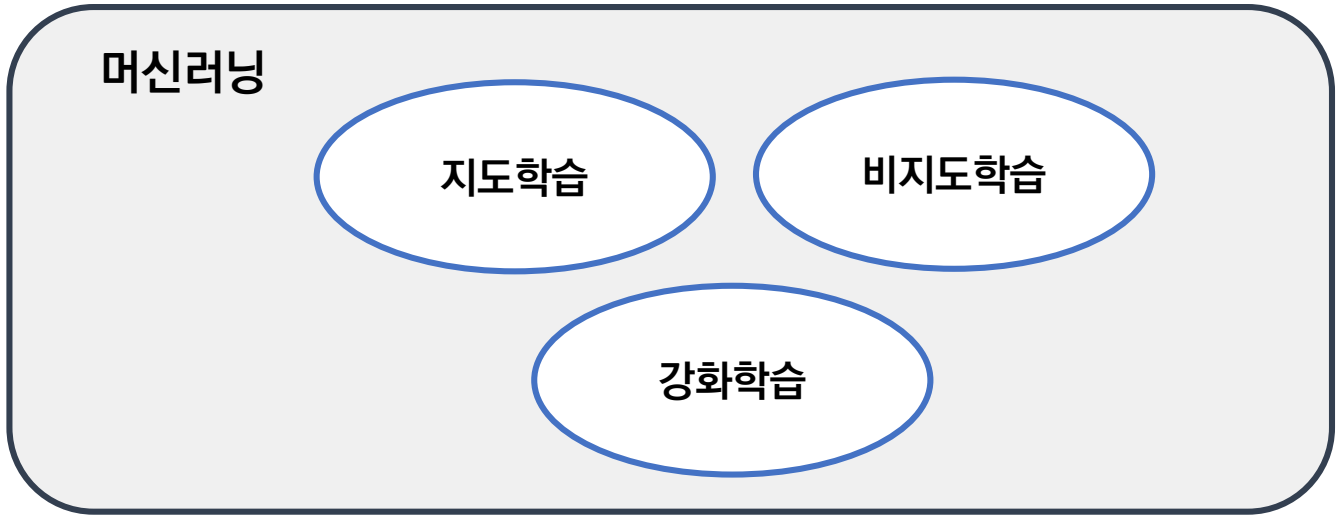
- Image Classification
  - Multiclass Output

Image Classifier

Aircraft carrier
Destroyer
Submarine
Container ship
Bulk carrier
Cruise ship
Tugboat

Input :
Ship images

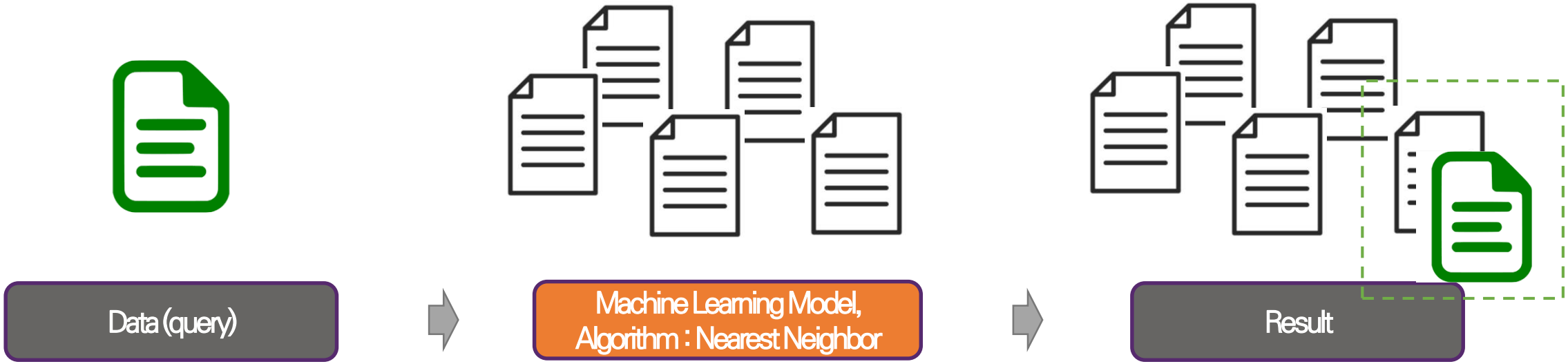
Output :
predicted class of ship



- 지도 학습 (Supervised Learning) – 정답 값이 존재함
- 비지도 학습 (Unsupervised Learning) – 정답 값이 존재 안함
- 강화 학습 (Reinforcement Learning) – 보상과 벌점을 통해 학습

Retrieval

- **Retrieval:**
  - Similarity/finding data
  - Document structuring for retrieval



Retrieval

- **Retrieval:**
  - Similarity/finding data
  - Document structuring for retrieval

Input x, {x'}:
features for query, features of all other data

Compute distances to other x'

Output y:
Nearest point to query

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Clustering

- **Clustering:**
  - Document structuring for retrieval

Data → Machine Learning Model, Algorithm – Clustering → Result

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Clustering

- Clustering:
  - Document structuring for retrieval

Input x:
Features for points in dataset

Seperate points into disjoint sets

Output y:
Cluster labels per data point

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