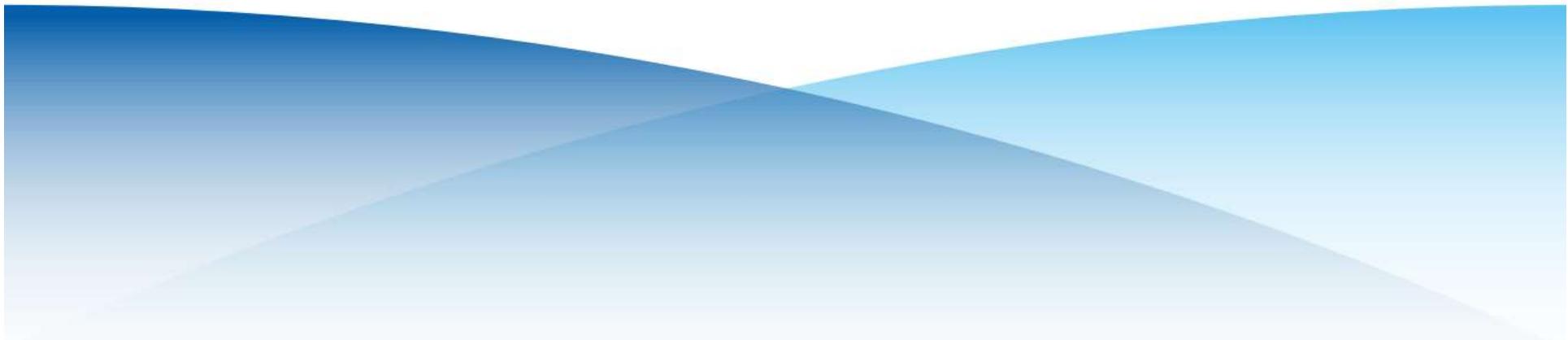


Introduction to AI

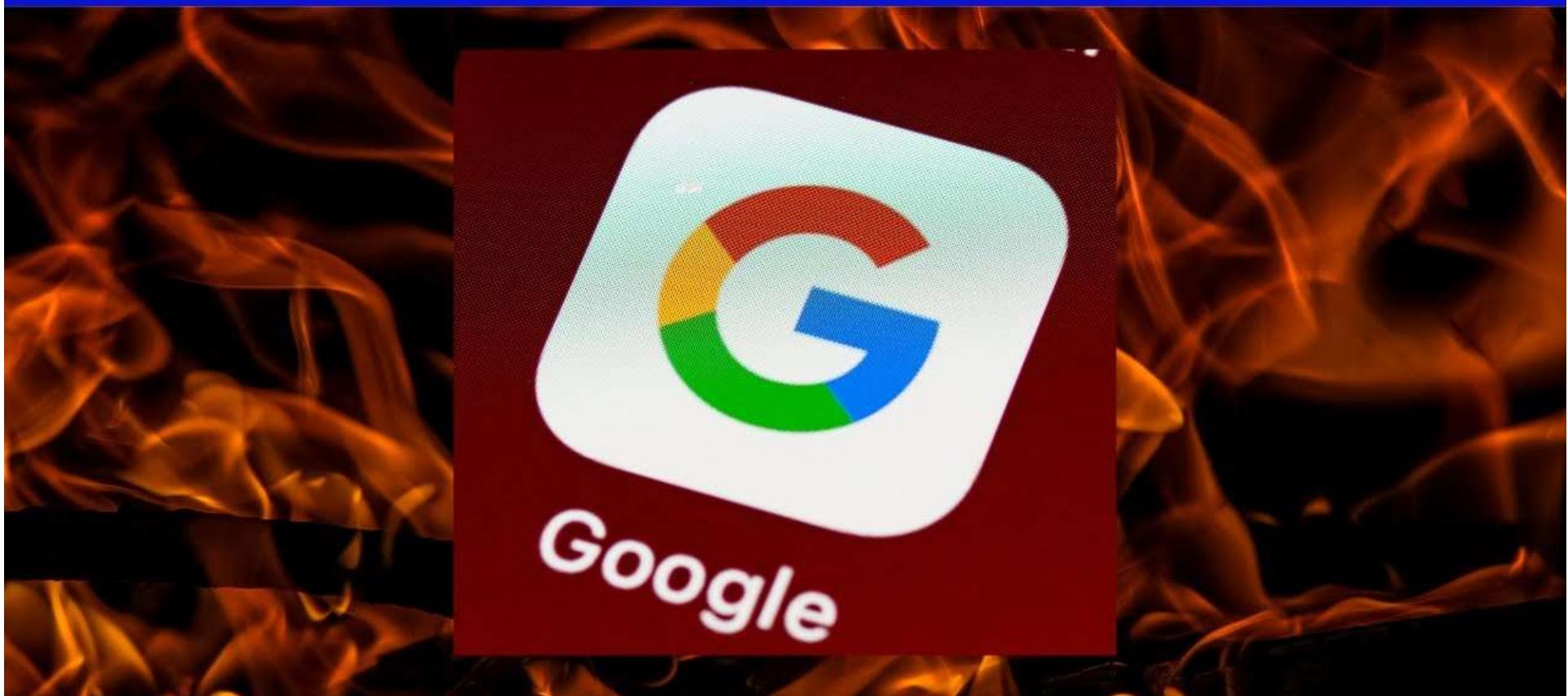
이원형 교수

Dr. Lee, WonHyong

whlee@handong.edu



Google Red Alert Over ChatGPT!



ICE BREAKING

❖ 질문0

- ✓ 나는 인공지능이 OO라고 생각한다.
 - 딥러닝 Deep Learning
 - 기계학습 Machine Learning
 - 알고리즘 Algorithm
 - 자동화 SW
 - 인식/분류
 - 예측
 - 수학
 - 데이터 활용

제목 없는 설문조사

Poll | 1 question | 52 of 53 (98%) participated

1. 나는 인공지능이 OO라고 생각한다. (Single Choice) *

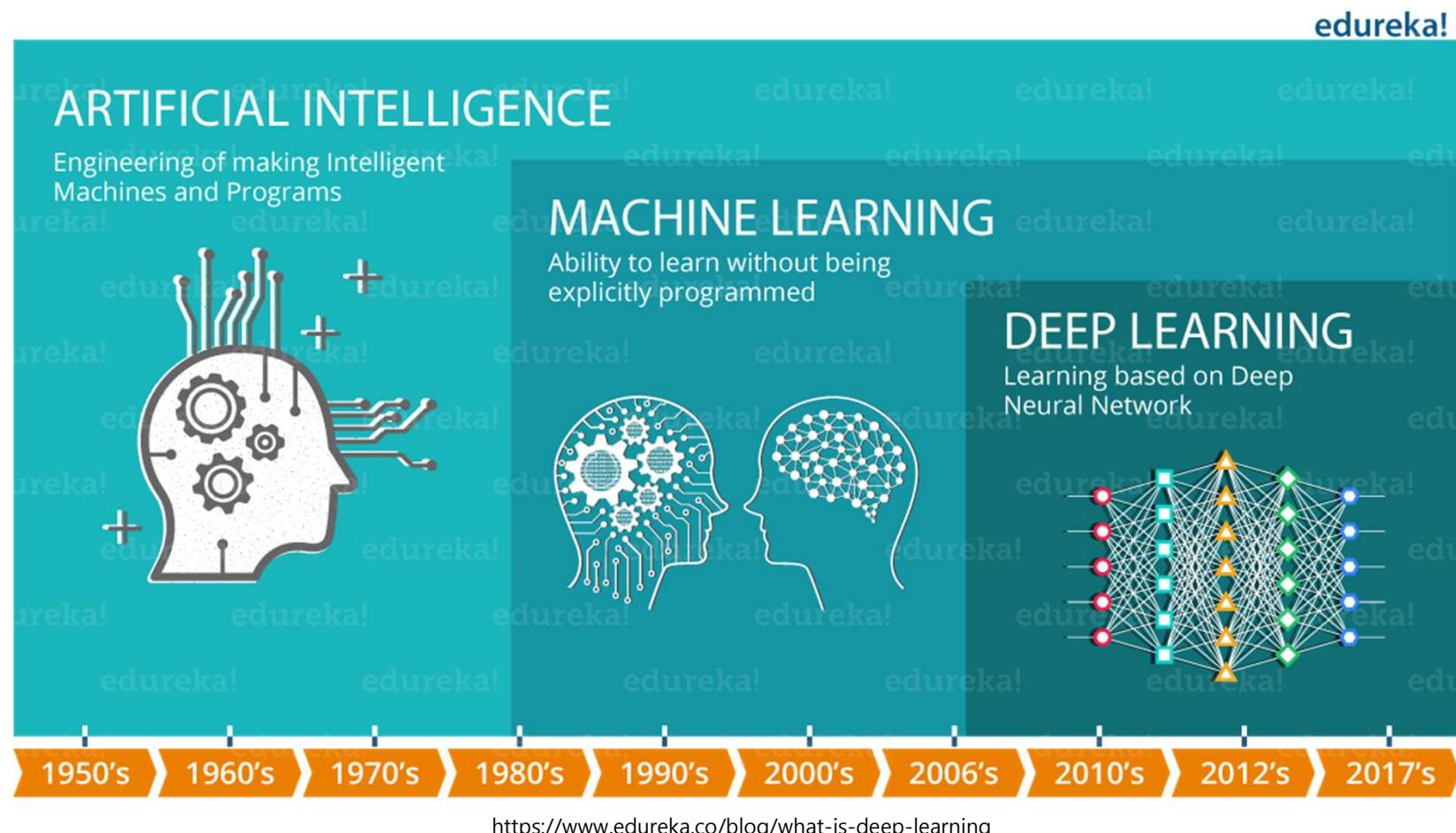
52/52 (100%) answered



ICE BREAKING

❖ 질문0

- ✓ 나는 인공지능이 OO라고 생각한다.



ICE BREAKING

❖ 질문1

- ✓ 나는 이 수업에 다음의 것을 기대하고 왔다.
 - 인공지능에 대한 교양 수준의 지식 습득
 - 인공지능에 대한 전문적 지식 습득
 - 인공지능 프로젝트 수행 경험
 - 인공지능에 필요한 부가 스킬 습득 (ex Python Programming)
 - 딥러닝에 대한 교양 수준의 지식 습득
 - 딥러닝에 대한 전문적 지식 습득
 - 아무 생각이 없다

ICE BREAKING

❖ 질문2

- ✓ 인공지능 관련 과목을 수강한 적이 있다.
 - 모두를 위한 인공지능
 - 머신러닝 캠프
 - 딥러닝 개론
 - 기타

ICE BREAKING

❖ 질문3

- ✓ 나는 파이썬 프로그래밍을 할 줄 안다.
 - 0 (전혀 못함)
 - 1
 - 2
 - 3
 - 4
 - 5 (매우 잘함)

❖ 참고 영상

- ✓ “인공지능, 딥러닝을 알고싶다면 이 영상을 보세요”
(안될과학x보이저엑스 남세동 대표) 인공지능 시리즈 1부
 - <https://youtu.be/CA5Ggqg5x6o> (Feb 25, 2022)
- ✓ “인공지능의 창의성과 테슬라의 자율주행 AI”
(안될과학x보이저엑스 남세동 대표) 인공지능 시리즈 2부
 - <https://youtu.be/jHYYggG7qq8> (Feb 26, 2022)
- ✓ “코딩, 과학, 수학 난제를 해결하려는 A.I.가 있다?!”
(안될과학x보이저엑스 남세동 대표) 인공지능 시리즈 3부
 - <https://youtu.be/BWJWAdMZGNY> (Feb 27, 2022)

- ✓ 남세동
 - 창업자, 사장 at VoyagerX
- ✓ VoyagerX
 - Vrew, vFlat, 온글잎

ICE BREAKING



Sedong Nam

January 15 ·

...

보이저엑스 (인턴/신입/경력) 딥러닝 개발자 면접에서 최근에 자주 묻고 있는 공통 기초 질문들 9개만: (순서 없이)

1년 정도 딥러닝 경력이 있는 분 기준으로 볼 때 일단 이러한 범위와 수준의 질문에 절반 이상 질문에 대해서 a까지는 잘 대답하기를 기대합니다.

1. sigmoid 대신 ReLU를 사용하는 이유가 뭔가요?

- a. ReLU는 미분 불가능한데 BP가 어떻게 가능한가요?
- b. Leaky-ReLU는 무엇인가요?

2. 이미지를 처리할 때 CNN이 좋은 이유가 뭔가요?

- a. CNN에서 MaxPool의 역할이 무엇인가요?
- b. MaxPool에서 BP가 어떻게 될까요?

3. softmax의 수식이 어떻게 되나요?

- a. e^x 를 미분하면 어떻게 되나요?
- b. softmax를 사용하는 이유가 뭘까요?

4. Mini-Batch를 사용하는 이유가 무엇인가요?

- a. 사양이 허락한다면 Mini-Batch보다 (Total) Batch가 좋을까요?
- b. Data Parallelism 시에 GD는 어떻게 동작하나요?

5. Loss surface에서 z축은 무엇인가요?

- a. x축, y축은 무엇일까요?
- b. Loss surface가 불연속일 수도 있을까요?

6. Optimizer에서 momentum은 무엇인가요?

- a. momentum을 수식으로 적어본다면 어떻게 되나요?
- b. ADAM은 어떻게 동작하나요?

7. Attention의 역할이 무엇인가요?

- a. Attention에서 K, Q, V는 무슨 뜻인가요?
- b. Transformer가 학습이 빠른 이유가 무엇인가요?

8. 딥러닝용으로 사용중인 GPU 사양이 어떻게 되나요?

- a. GPU 모니터링 시에 어떤 숫자들을 봐야 할까요?
- b. GPU utilization이 낮은 원인의 후보들은 무엇이 있나요?

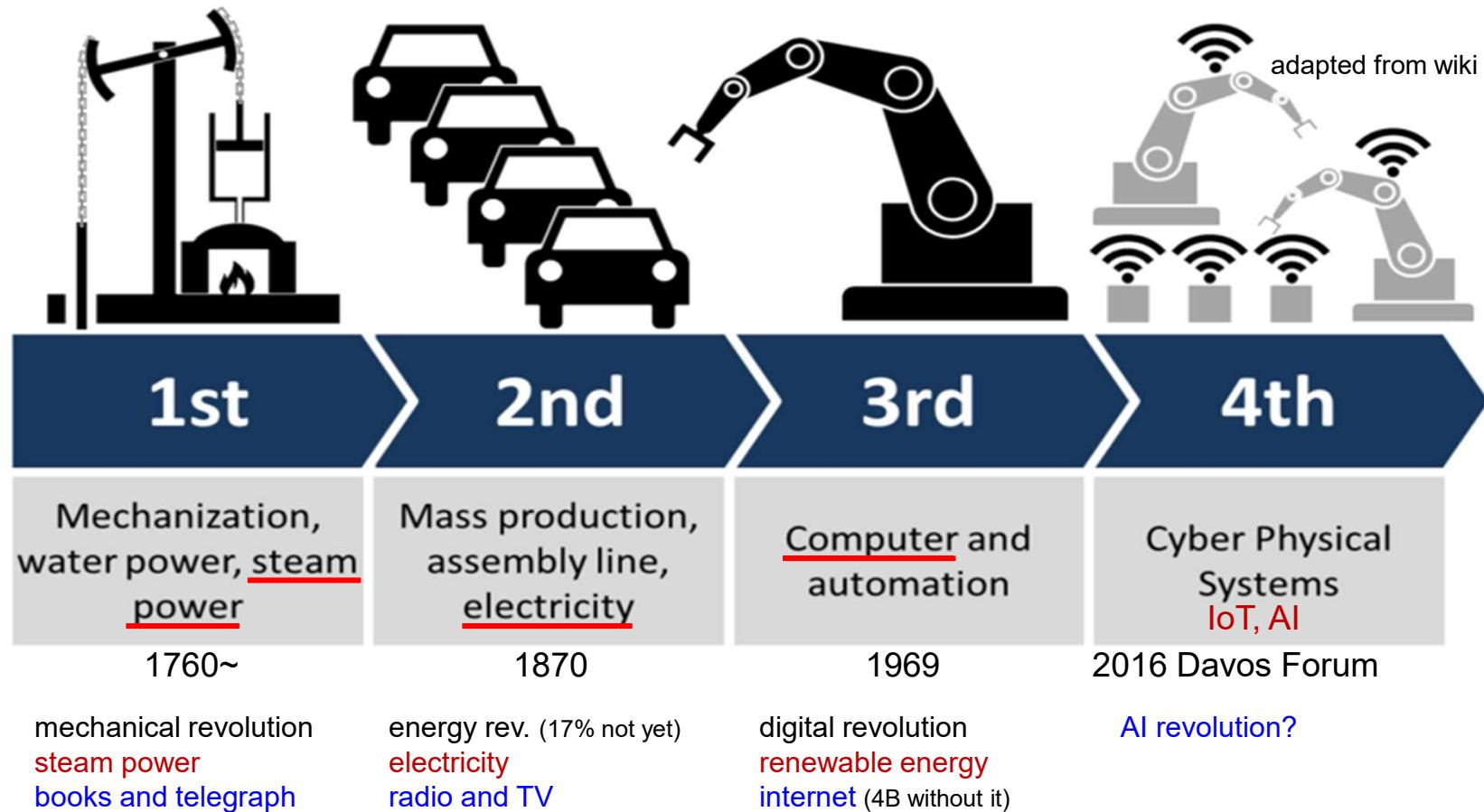
9. Python에서 generator가 무엇인가요?

- a. generator를 직접 작성하려면 어떻게 해야 하나요?
- b. yield를 python 내부에서 어떻게 처리할까요?

<https://www.facebook.com/dgtgrade/posts/4901689733223187>

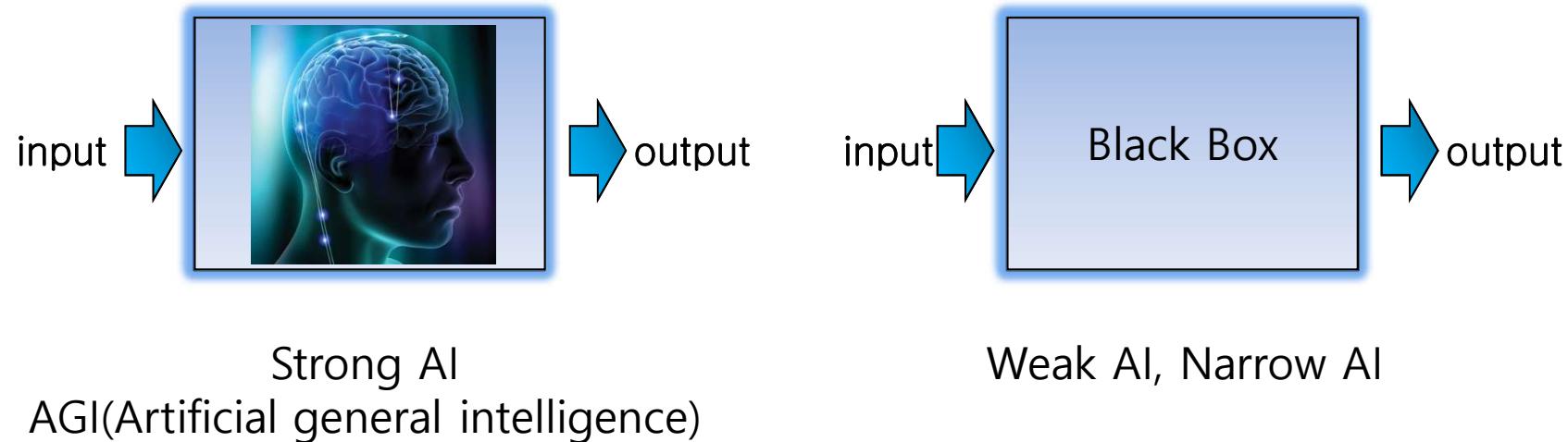
January 15, 2022

Industrial Revolution



Artificial Intelligence

- Artificial intelligence (AI) is **intelligence** exhibited by machines or software
- **Automation of tasks** that require intelligence
 - Recognition, prediction, learning, natural language processing, planning, reasoning, etc.



AI vs. Conventional SW

- Conventional SW
 - Perform tasks by following **predefined algorithm**
- Artificial intelligence targets
 - **Complex tasks** hard to solve by a fixed procedure
 - Tasks under **changing environment**
 - Decisions under **uncertainty** or **ambiguity**

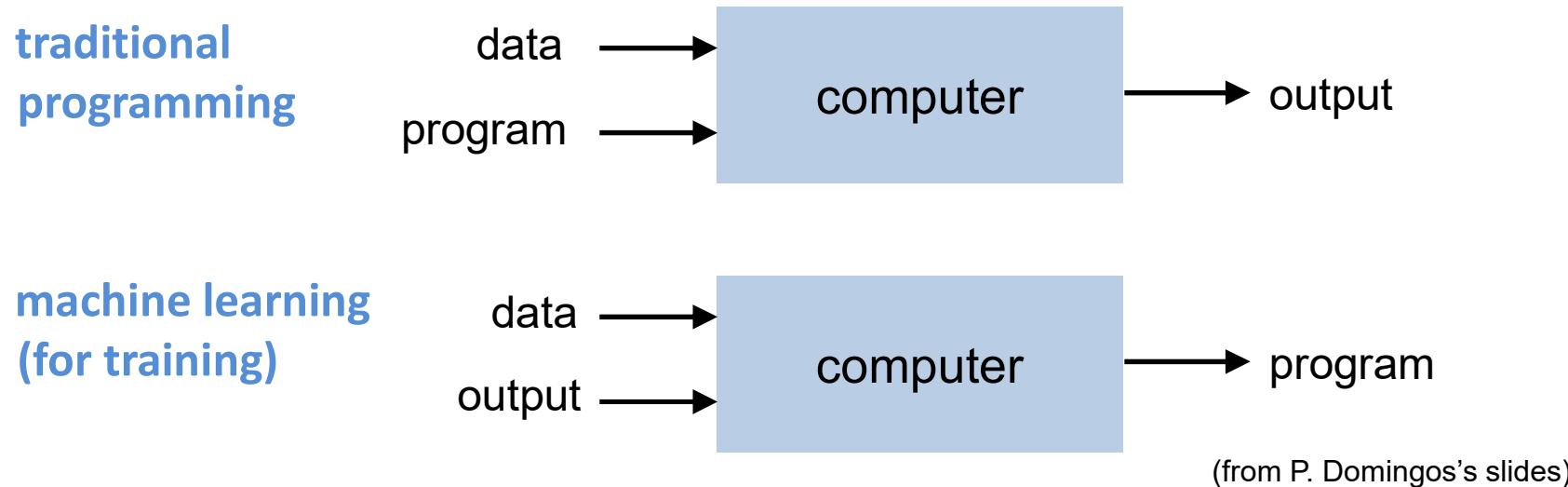


VS.

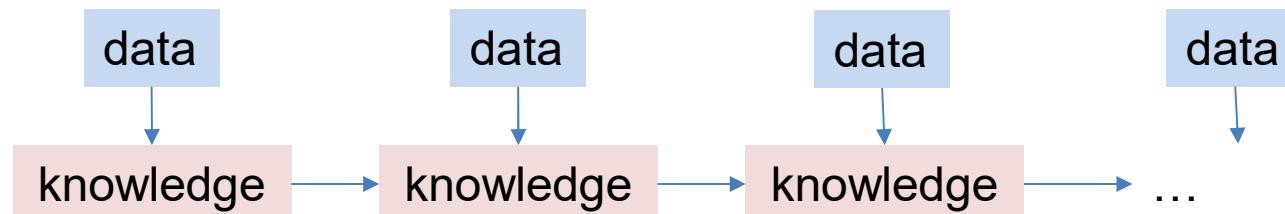


traditional programming vs machine learning

- machine learning generates “program” by training



- source of knowledge is data



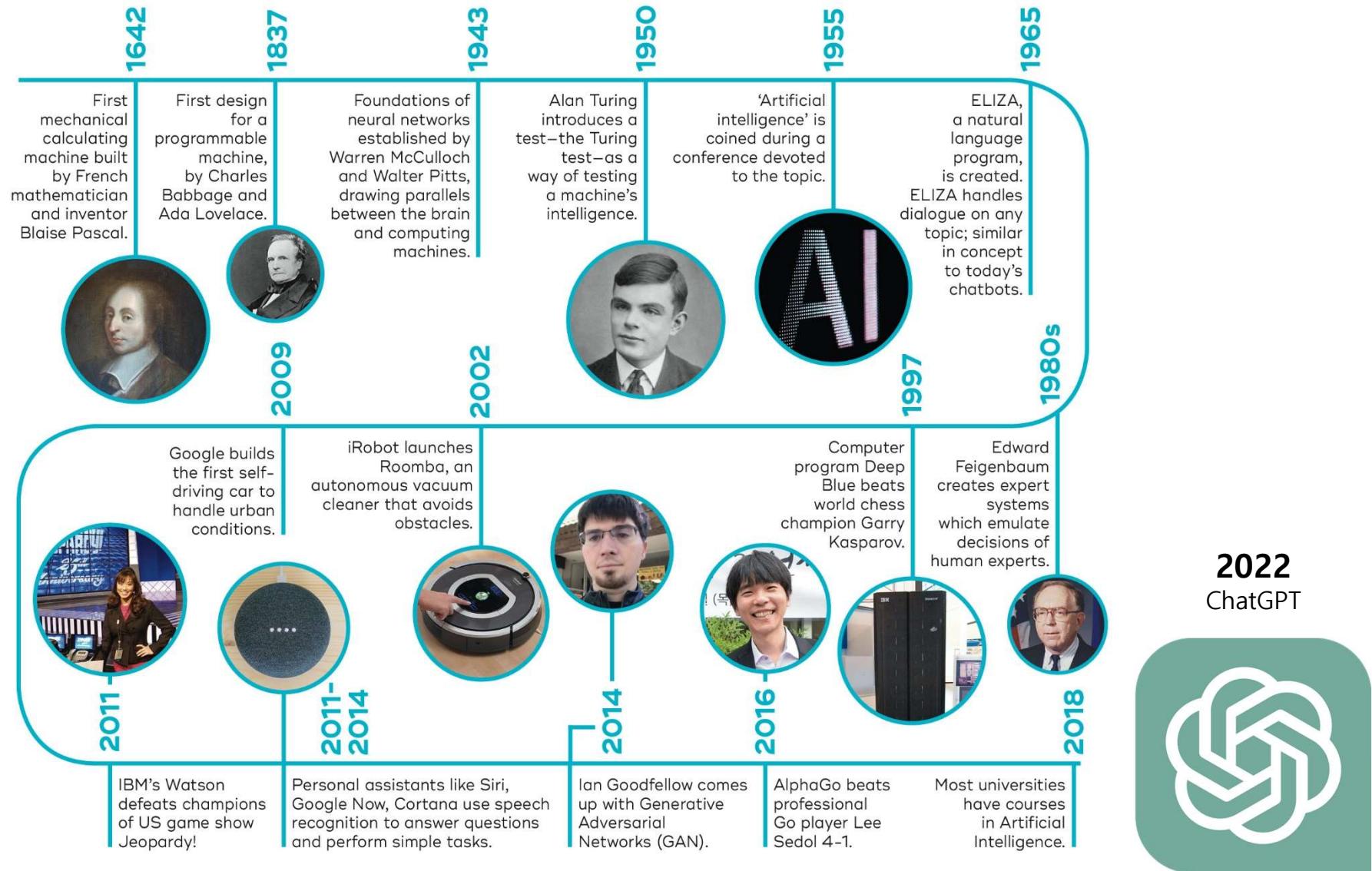
_MACHINE
기계가
LEARNING

I _LEARNING
배운다
LEARNING

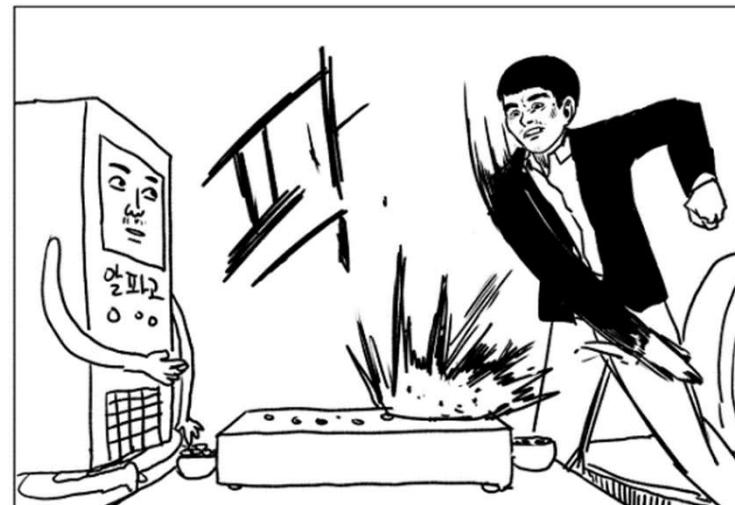
<https://youtu.be/mqaATsYP6j0>

14 / 46

History of Artificial Intelligence







매일경제

IT·과학

“이사람 인간 맞아? 수상한데”...인공지능과 바둑 15전14승

이상덕 기자

입력: 2023-02-19 10:18:07
수정: 2023-02-19 10:41:03



가



1

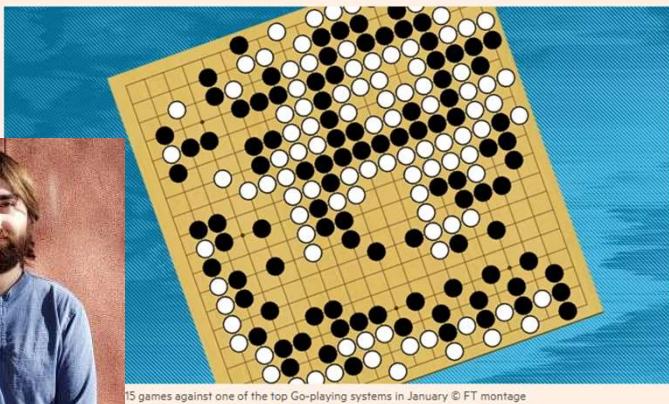
미국 아마추어 2위 켈린 펠린
현장 컴퓨터 도움 없이 15전 14승
비결은 AI가 가르쳐준 AI 약점 공략
“넓고 크게 뒤 산만하게 한 것 주효”

<https://m.mk.co.kr/news/it/10650403?fbclid=IwAR302feKY5tKRD8F-kvU4MgiEj0XuAtp9ixOQAgklNkoAuu-iQiOisxzs>

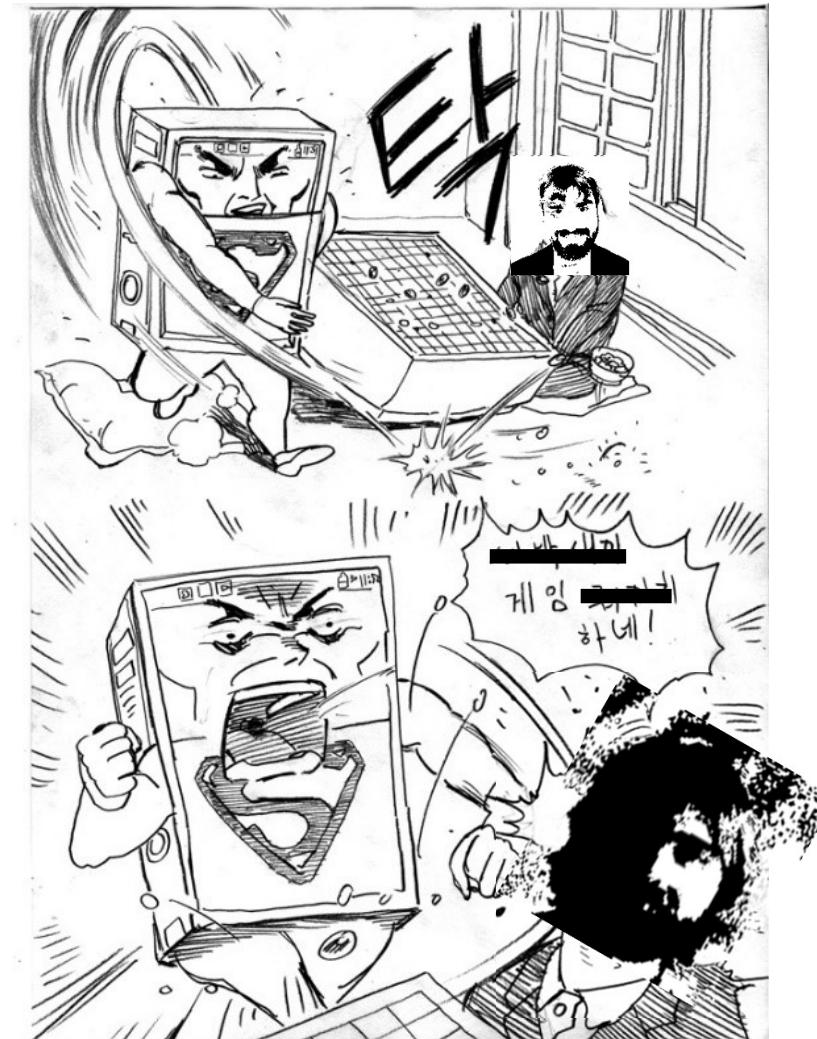
Artificial intelligence [+ Add to myFT](#)

Man beats machine at Go in human victory over AI

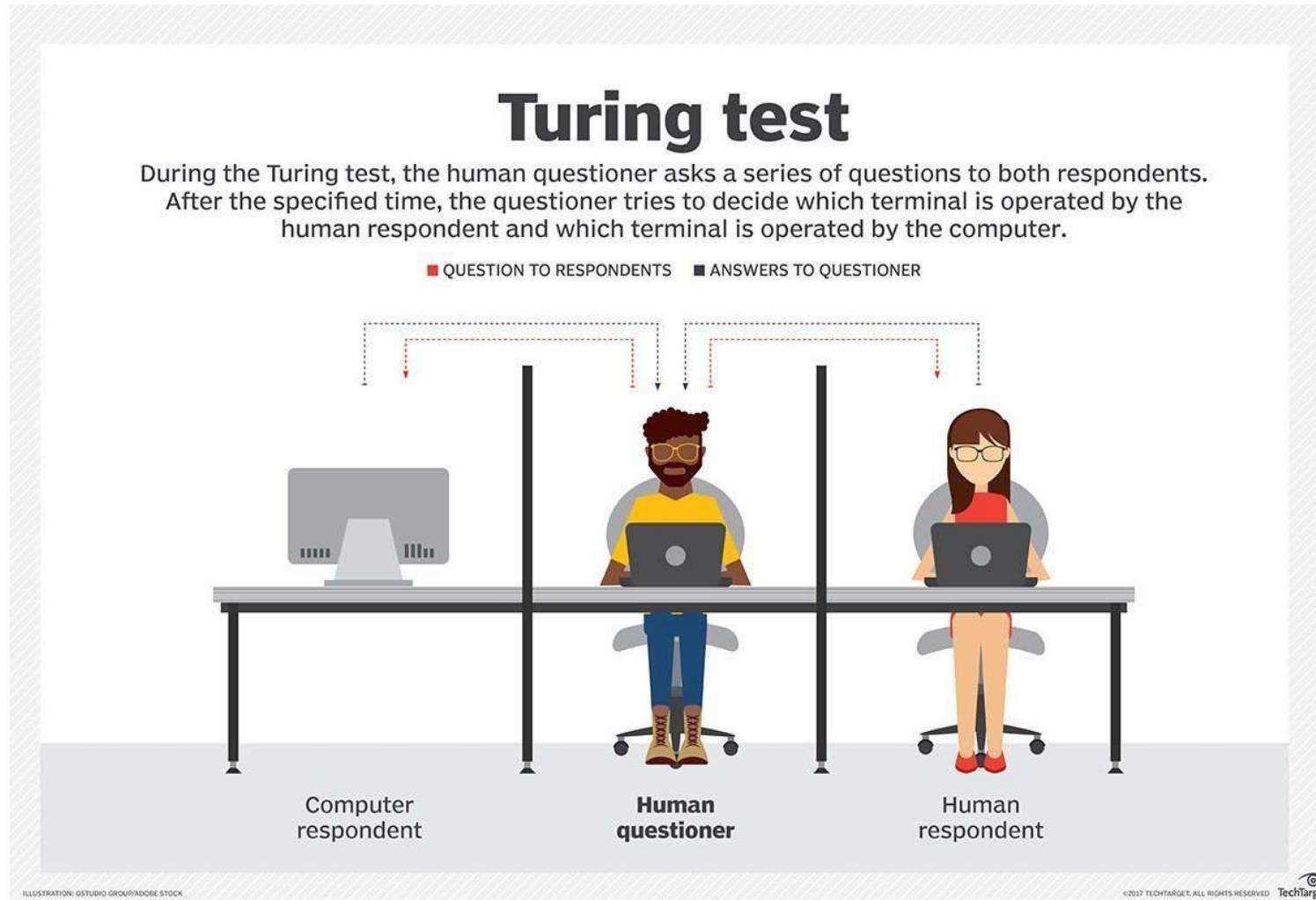
Amateur Kellin Pelrine exploited weakness in systems that have otherwise dominated board game's grandmasters



<https://www.ft.com/content/175e5314-a7f7-4741-a786-273219f433a1>



Imitation Game (Turing Test) by Alan Turing 1950





Question

Drawn by artificial intelligence? or Human?



AI



Human



The New York Times

An A.I.-Generated Picture Won an Art Prize. Artists Aren't Happy.

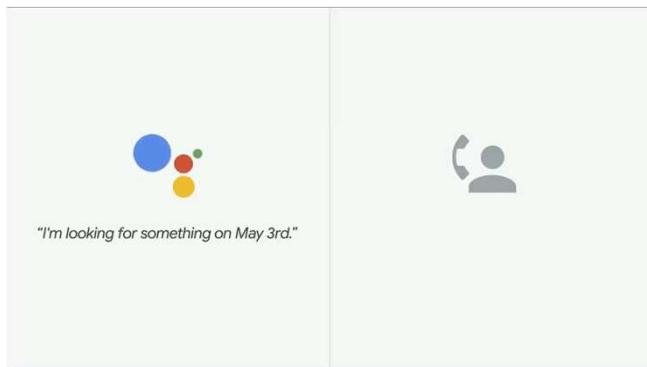
“I won, and I didn’t break any rules,” the artwork’s creator says.



Jason Allen's A.I.-generated work, "Théâtre D'opéra Spatial," took first place in the digital category at the Colorado State Fair.Credit...via Jason Allen

STATE OF THE ART(?)

Turing Test Level?



Google's Speech Recognition and Generation
<https://youtu.be/D5VN56jQMWM>

May 9, 2018



Face Generation
https://youtu.be/MVBe6_o4cMI

Jul 12, 2017

Chatterbots

- Eliza from 1964~1966 at MIT.
 - Created by Joseph Weizenbaum
 - Capable of attempting the Turing test.
 - Try Eliza through
<https://www.eclecticenergies.com/psyche/eliza>

```
=====
EEEEEEE L IIIIII ZZZZZZ AAA
E L I Z A A
EEEE L I Z A A
EEE L I Z A A
EEEEE L LLLLLL IIIIII ZZZZZZ A A
=====

ELIZA > (PLEASE TYPE IN ALL CAPS) WHAT'S YOUR NAME DEAR ?
AMIT
ELIZA > HI, I'M ELIZA. WHAT DO YOU WANT TO TALK ABOUT ?
AMIT > CAN I TALK ABOUT MY PROBLEM ?
ELIZA > SURE... !
AMIT > DUE TO ON GOING EXAMS IN COLLEGE, I HAVE A LOT OF STRESS.
ELIZA > PLEASE RELAX A LITTLE. SLEEP WELL.
AMIT > THANKS FOR YOUR ADVICE.
ELIZA > NO MENTION.
AMIT > BYE
ELIZA > BYE AND KEEP IN TOUCH...
=====
```

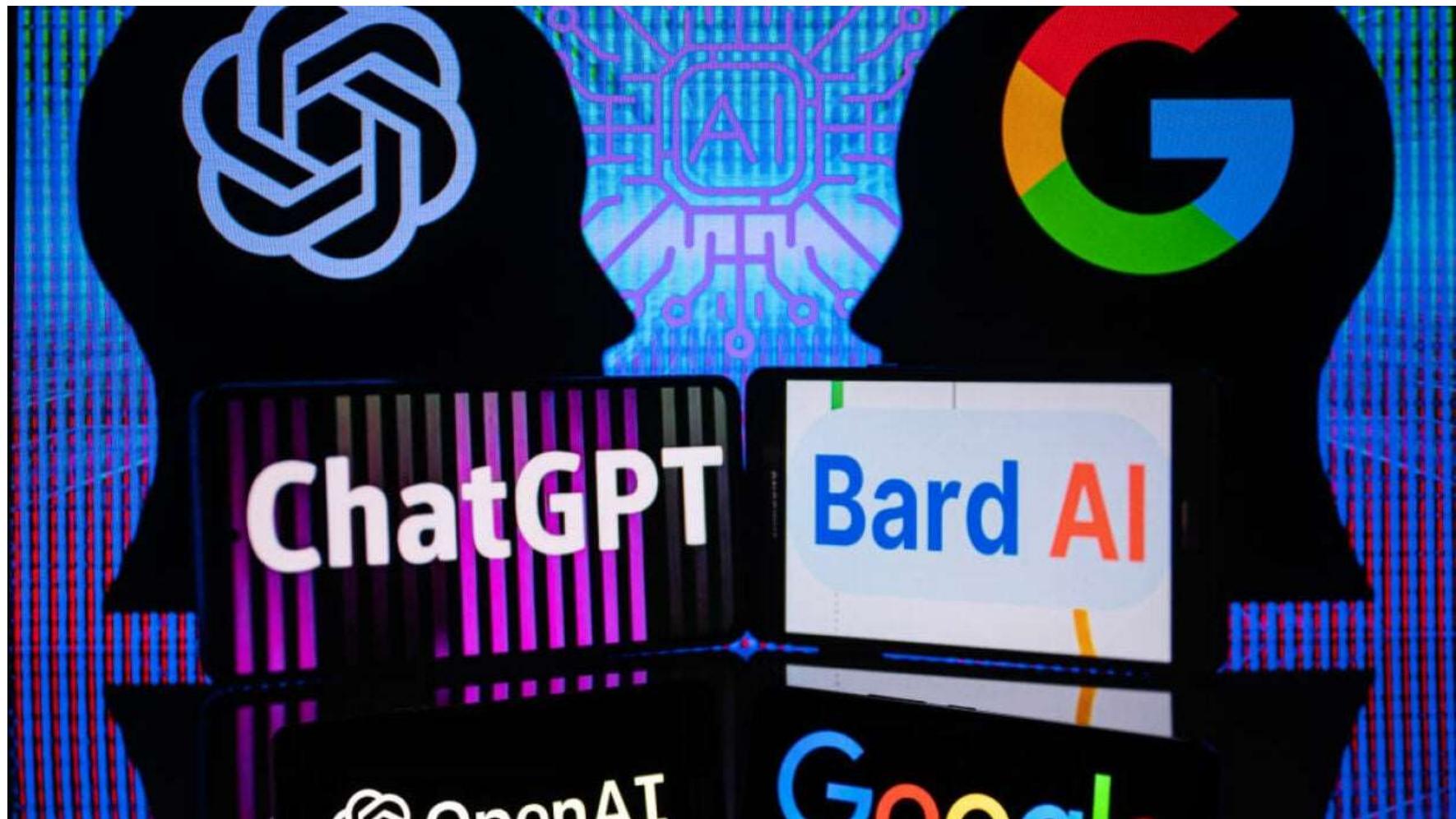
- Alice (Artificial Linguistic Internet Computer)
 - Created by Richard Wallace in 1995
 - Several honors and awards including Loebner prize (2000, 2001, 2004).
 - Used AIML(Artificial Intelligence Markup Language)
 - AIML lecture through
<https://inbi.ai/lecture.html>

* AIML example

```
<aiml>
  <category>
    <pattern>hi</pattern>
    <template>Hello!</template>
  </category>
</aiml>
```

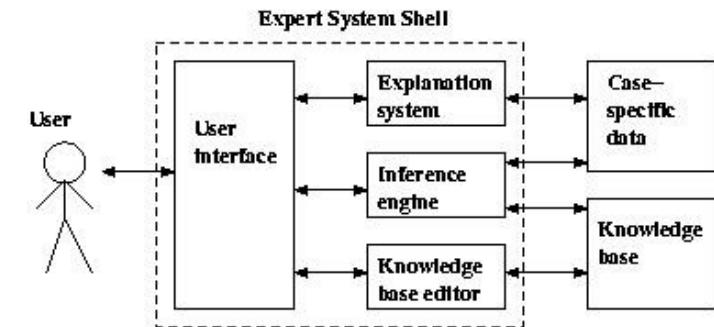
STATE OF THE ART

ChatGPT(OpenAI), BARD(Google)

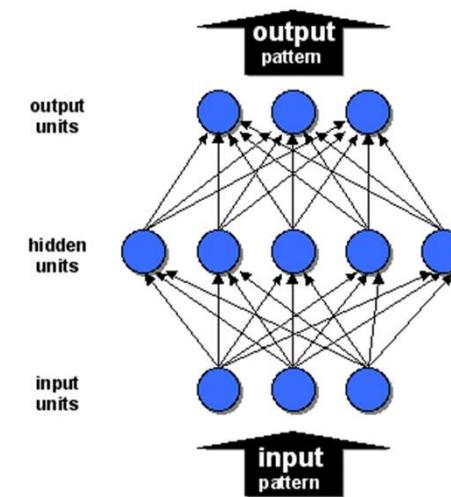


Two Major Approaches to AI

- Knowledge-based approach
 - Rules derived from designer's knowledge
 - **Symbolic AI**
 - Data-driven approach (machine learning)
 - Learn from data
 - **Connectionist AI**
- Ex) IBM Watson



Given sufficient training samples,
data-driven approach can be better
than knowledge-based approach

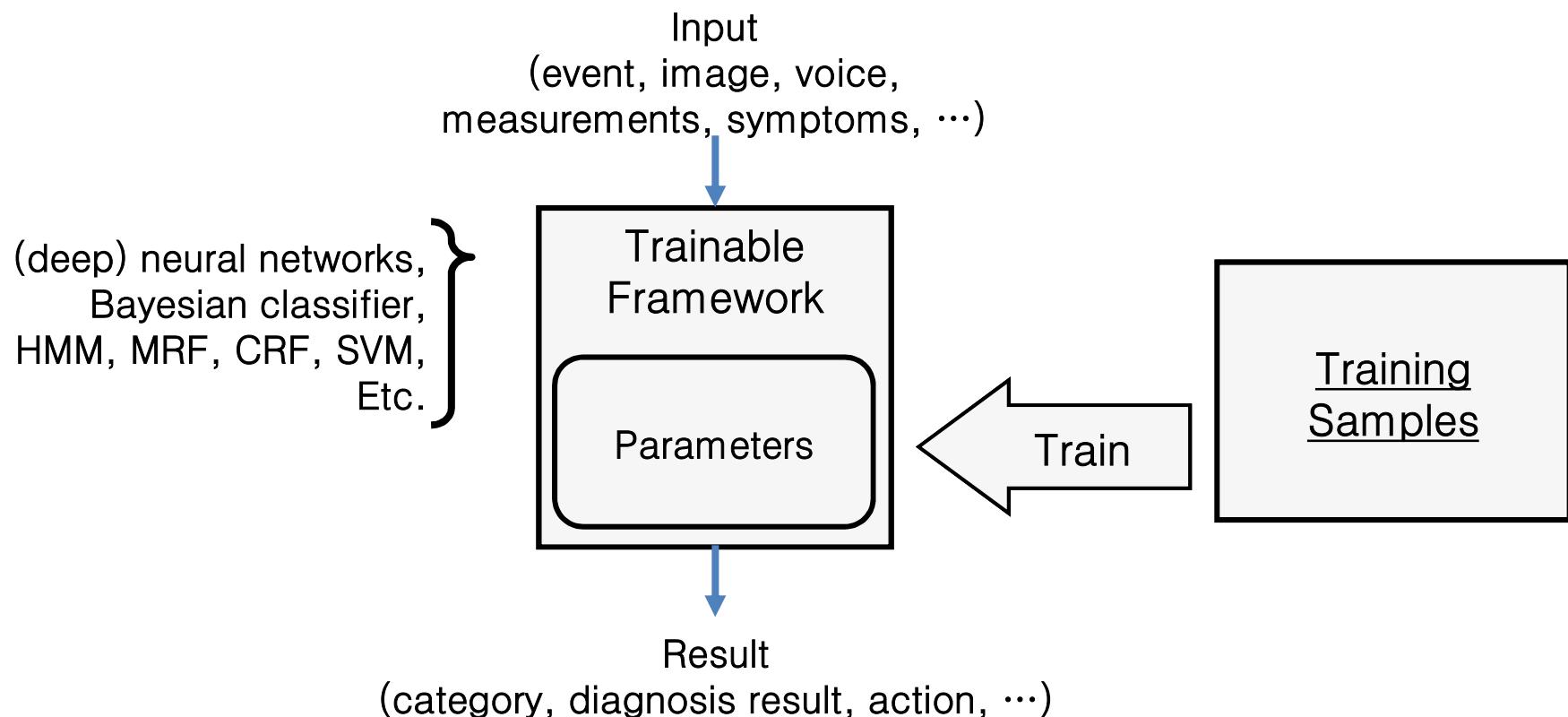


Knowledge-base Approaches

- Trials to formalize and automate “thinking”
- Symbolic, logic-based approach
 - Explicit symbolic representation of knowledge
 - Problem solving with searching/planning
 - Reasoning, inference, proof
- Logic, reasoning: form or operation on knowledge and concepts in abstraction
 - Ex) “All men are mortal.” + “Socrates is a man.”
→ “Socrates is mortal.”

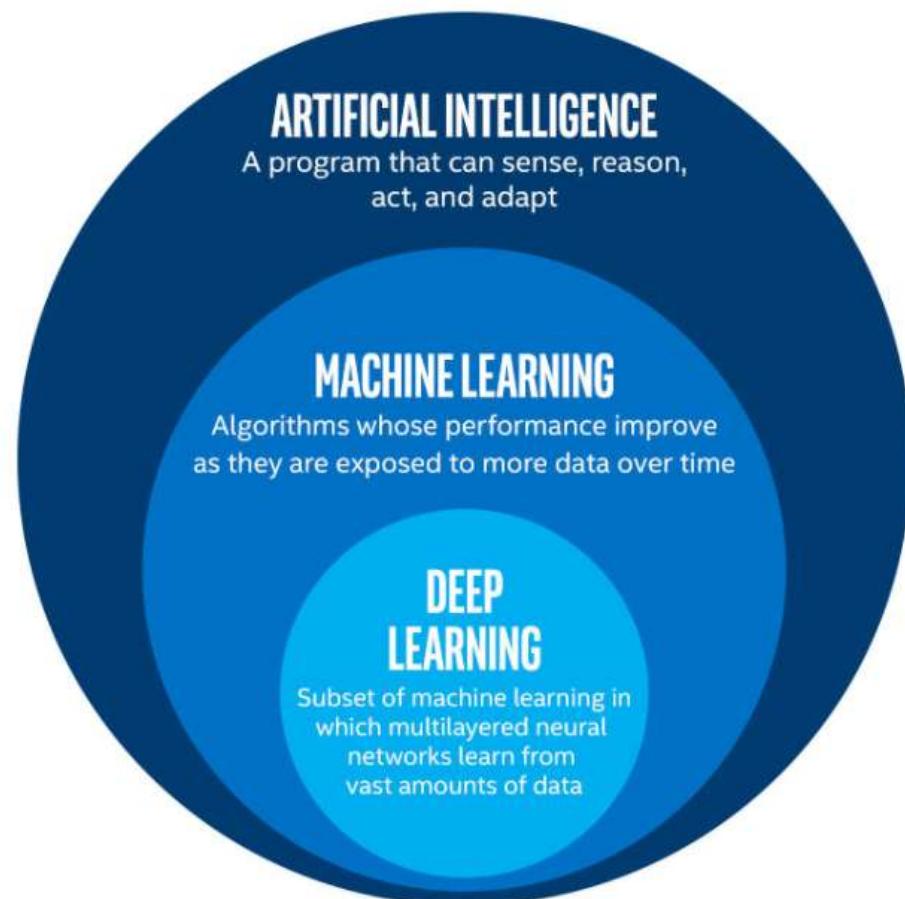
Machine Learning

- Field of study that gives computers the ability to learn without being explicitly programmed.
 - Data-driven approach



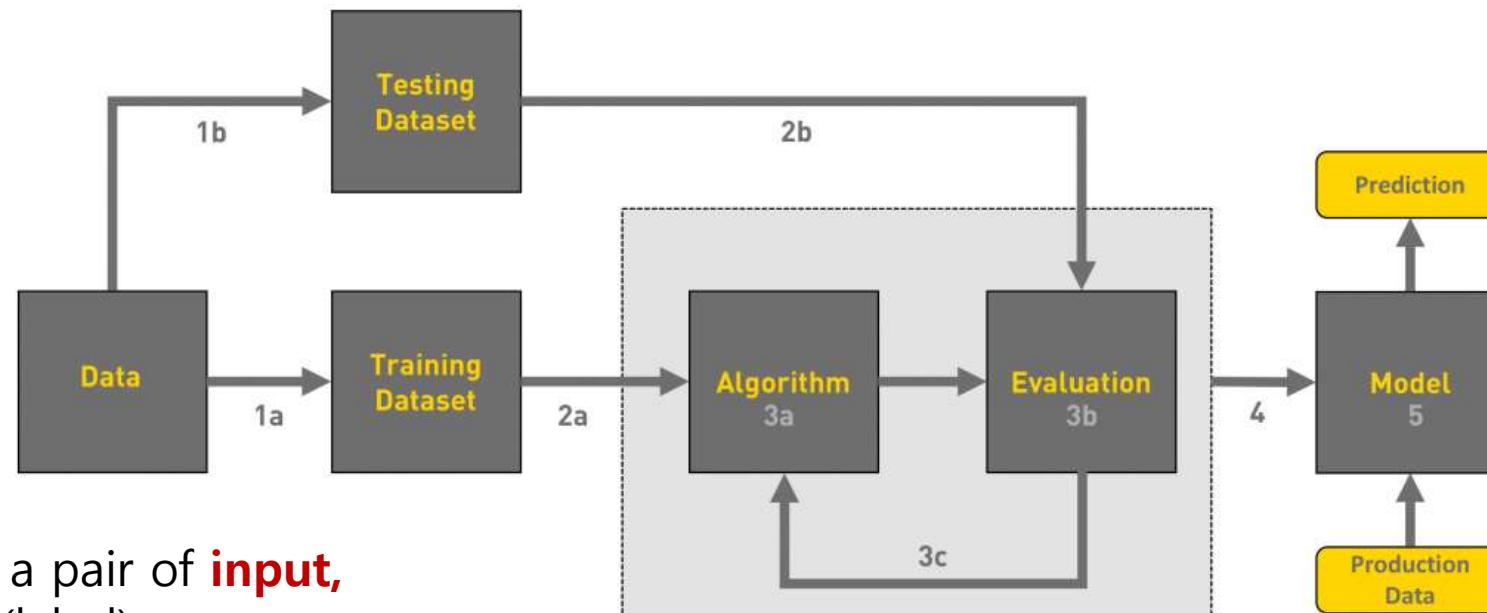
AI, Machine Learning, Deep Learning

- **Artificial intelligence**: **intelligence** exhibited by machines or software
- **Machine learning**: a field of study that gives computers the ability to **learn from data** without being explicitly programmed.
- **Deep learning**: a branch of machine learning based on a set of algorithms that attempt to model **high-level abstractions in data**, mostly, based on **deep neural networks**.



Common ML workflow

1. Gathering data
2. Data pre-processing
3. Researching the model that will be best for the type of data
4. Training and testing the model
5. Evaluation

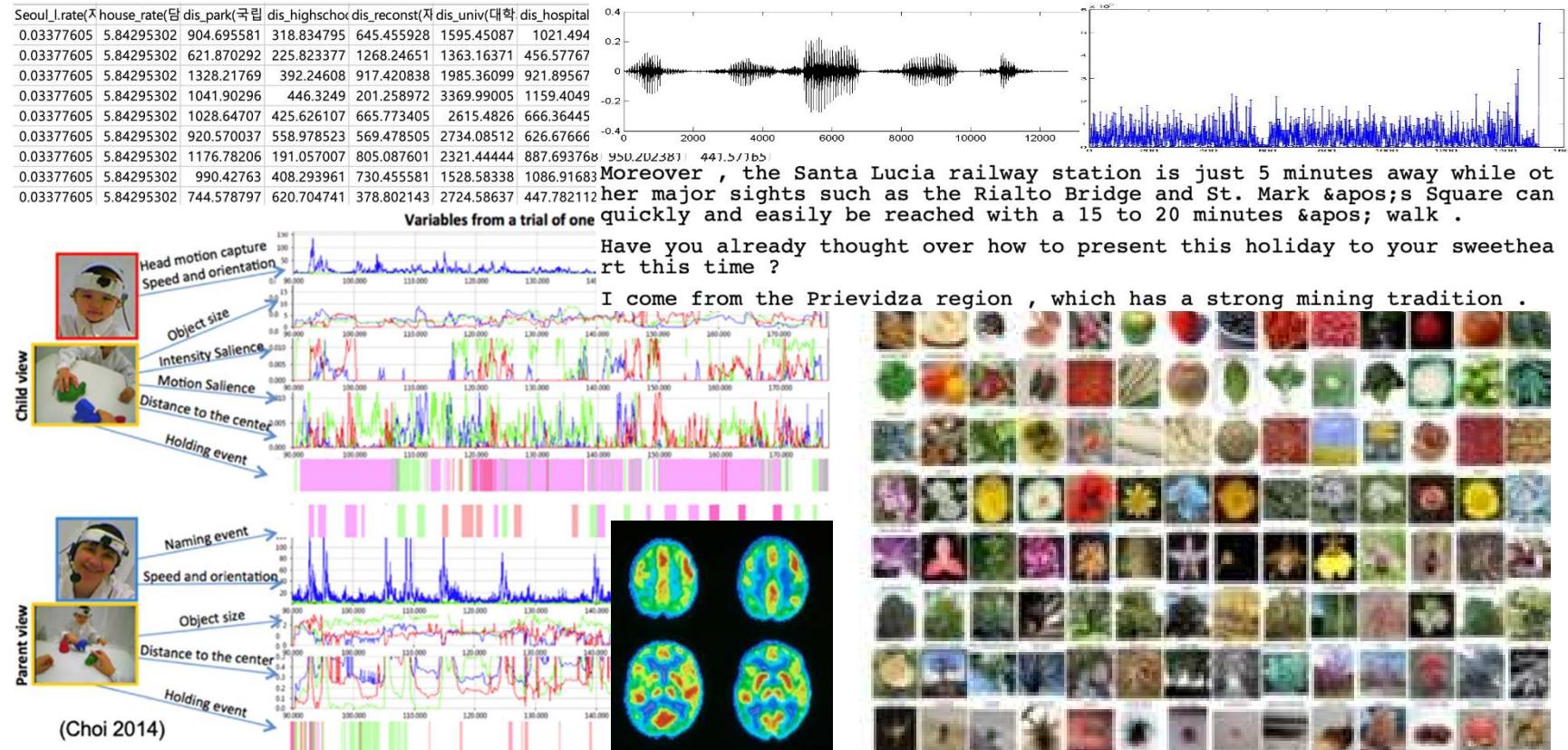


Data is
usually a pair of **input**,
output(label)



data

- a set of values of qualitative or quantitative variables
 - measured from nature, user behavior, industrial process, and so on
 - in many different types



how do data look?

- structured / unstructured
 - structured data: ex) review rate
 - a matrix (example, dimension) or
 - higher order tensor (example, dimension, time)
 - unstructured data: ex) review comments
- usually, it is messy
 - data cleansing and preparation is crucial and time-consuming process
 - it is crucial in ML to prepare a clean dataset.
 - quality and quantity both matter



<https://youtu.be/shK42mljGgY>

Machine Learning Taxonomy(분류 체계)

- Supervised Learning
 - Construct a model based on given data and labels (input-output pairs)
 - Ex) classification, regression etc.
- Unsupervised Learning
 - Draw inferences or find patterns from data without labels
 - Ex) Clustering, outlier detection, dimension reduction, autoencoders etc.
- Reinforcement Learning
- Self-supervised Learning

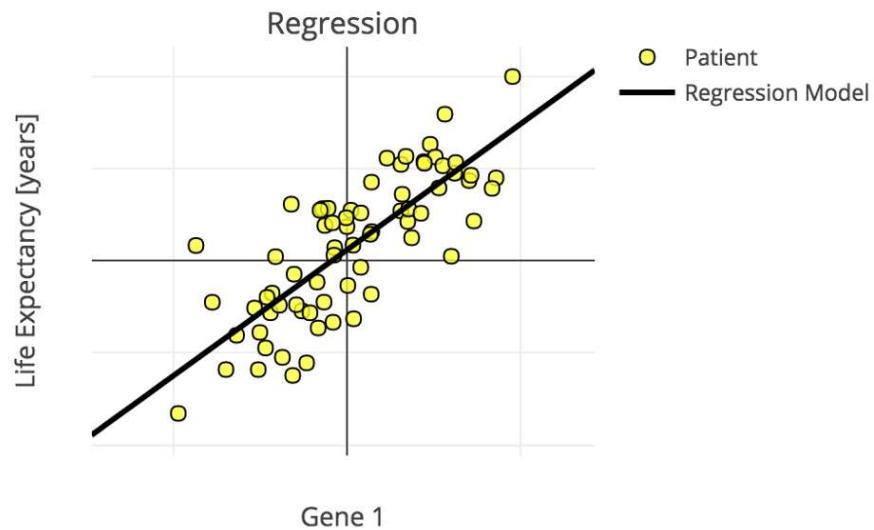
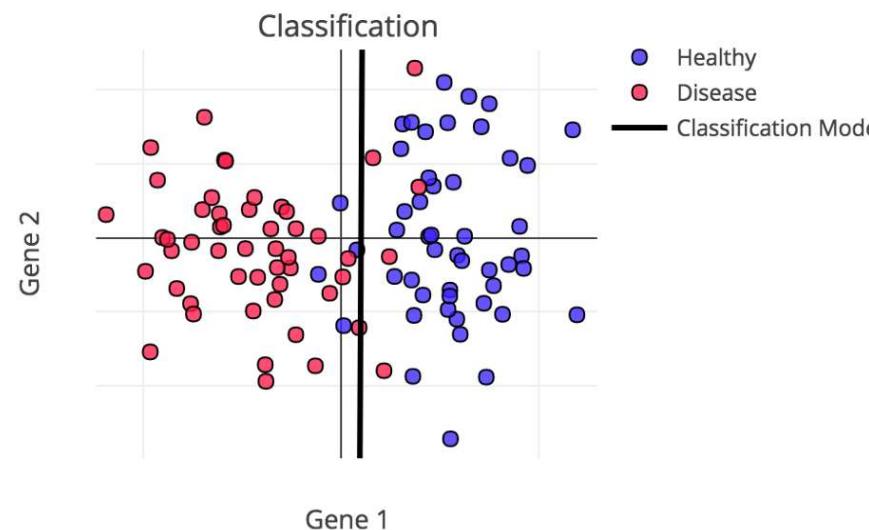
Machine Learning Taxonomy (supervised)

Classification

- inputs are divided into two or more classes, and the learner must produce a model that assigns unseen inputs to one or more (multi-label classification) of these classes.

Regression

- the outputs are continuous rather than discrete.



Machine Learning Taxonomy (unsupervised)

Clustering

- a set of inputs is to be divided into groups. Unlike in classification, the groups are not known beforehand.

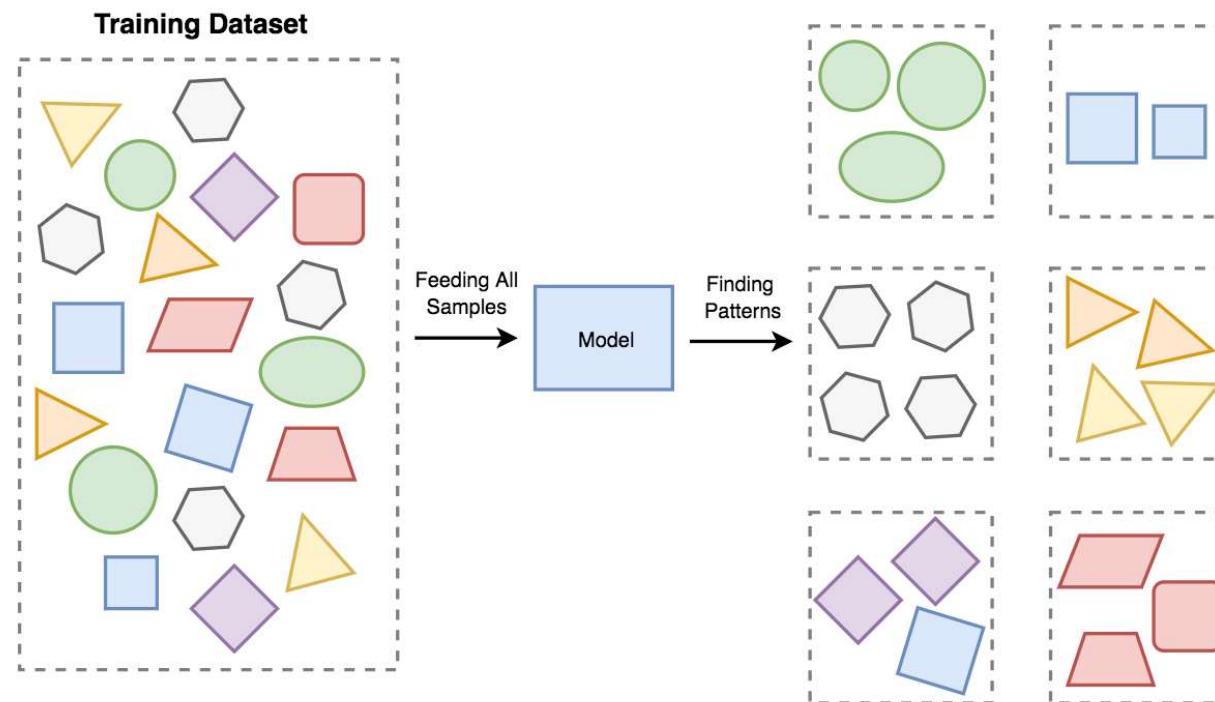
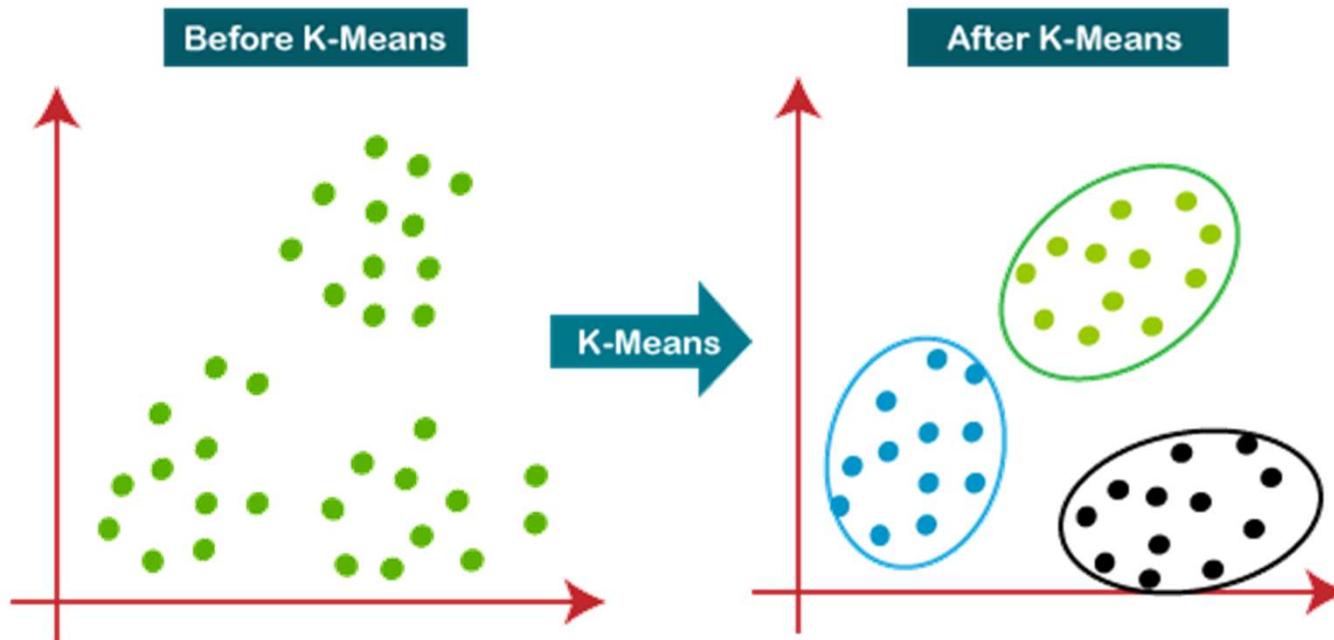


Image source: <https://towardsdatascience.com/coding-deep-learning-for-beginners-types-of-machine-learning-b9e651e1ed9d>

Machine Learning Taxonomy (unsupervised)

Clustering

- a set of inputs is to be divided into groups. Unlike in classification, the groups are not known beforehand.



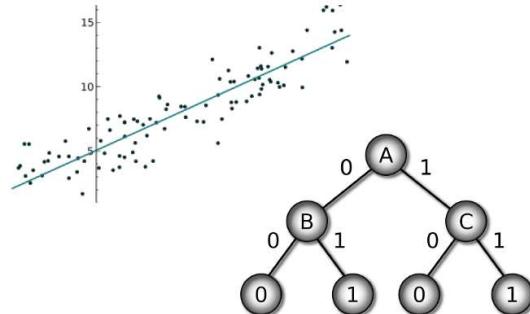
<https://www.analyticsvidhya.com/blog/2021/04/k-means-clustering-simplified-in-python/>

Models

Classification	Regression	Clustering
<ul style="list-style-type: none">• K-Nearest Neighbor• Naive Bayes• Decision Trees/Random Forest• Support Vector Machine• Logistic Regression• Neural Networks	<ul style="list-style-type: none">• Linear Regression• Support Vector Regression• Decision Trees/Random Forest• Gaussian Processes Regression• Ensemble Methods• Neural Networks	<ul style="list-style-type: none">• Gaussian mixtures• K-Means Clustering• Boosting• Hierarchical Clustering• K-Means Clustering• Spectral Clustering• Neural Networks

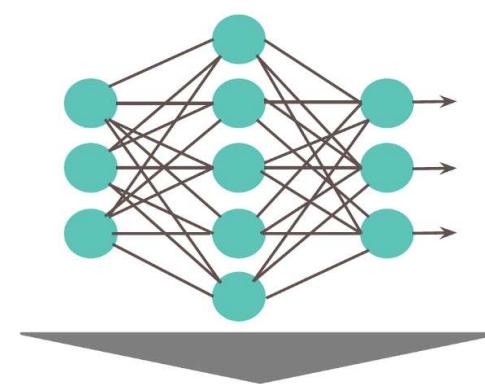
Lin. regression / decision trees:

Decision mechanism can be easily explained



Neural networks:

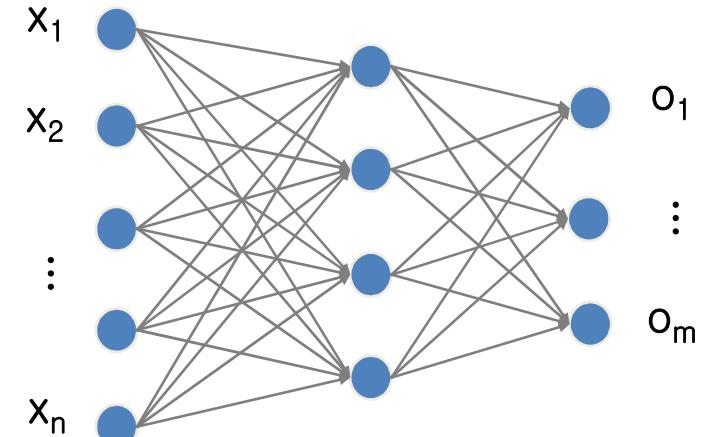
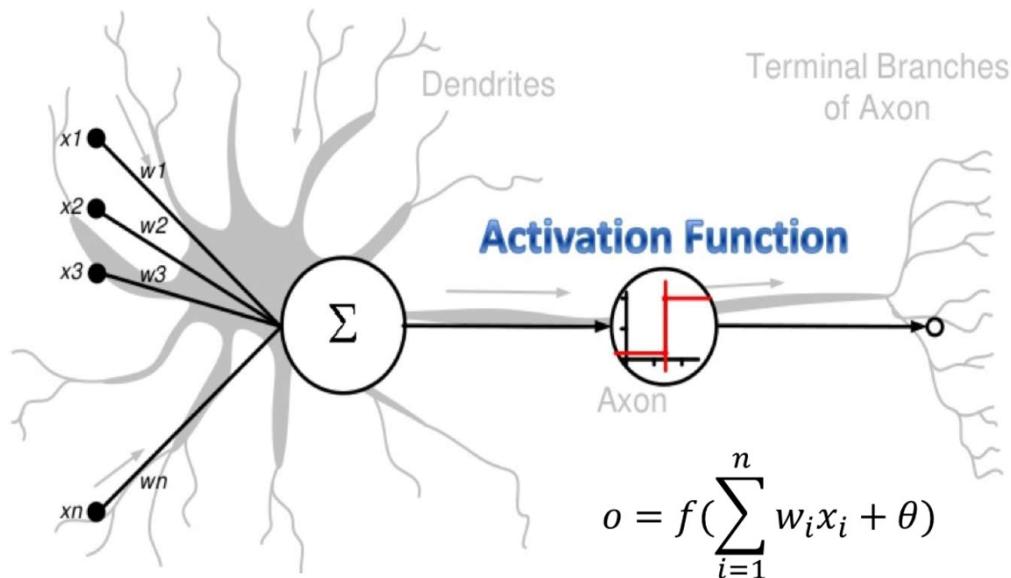
Complex systems that are hard to understand!



Often **100m+** parameters....

Artificial Neural Networks

- **Artificial neural network**: a mathematical model inspired by biological neural networks.
 - Mapping between vectors or sequences
 - Classification, regression, prediction, diagnosis, etc.
 - Learns probabilistic density
 - Sample generation, transform, restoration, etc.



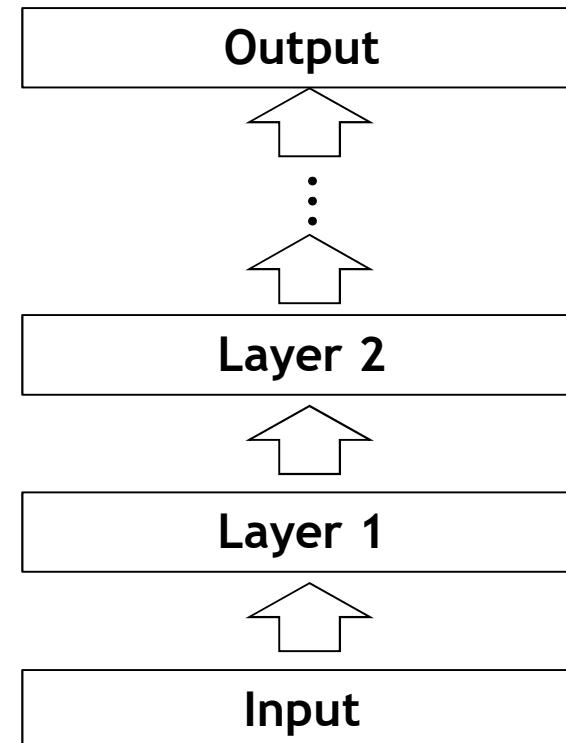
Deep Learning

- A branch of machine learning to model **high-level abstractions in data**, mostly, based on **deep networks**.

- Each layer combines input features to produce high-level features.

$$o = f\left(\sum_{i=1}^n w_i x_i + \theta\right)$$

- A neural network with many layers can learn high-level features.



AI in our life

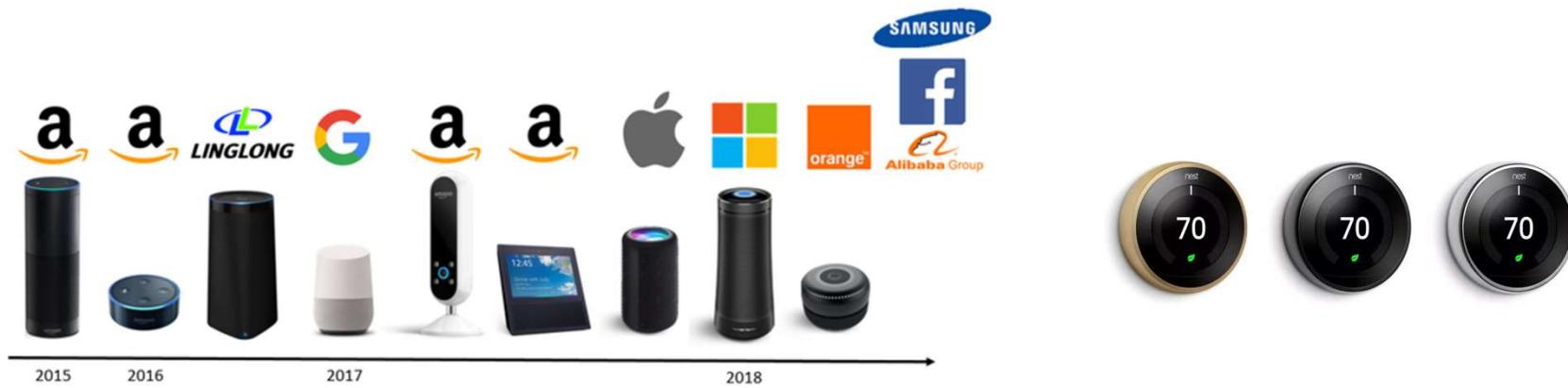
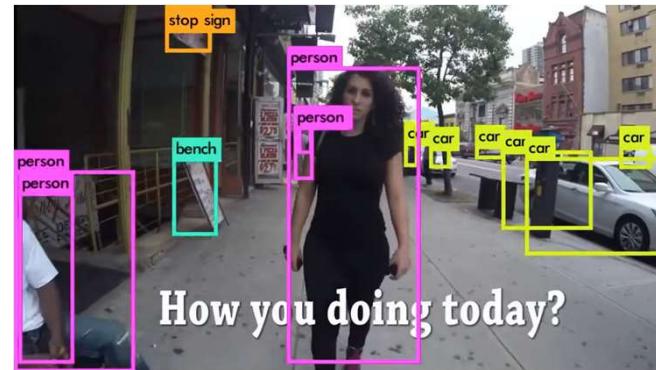


Image sources: <https://www.ansys.com/blog/challenges-level-5-autonomous-vehicles>
<https://www.uber.com/blog/pennsylvania/new-wheels/>
<https://www.pocket-lint.com/phones/buyers-guides/120309-best-smartphones-and-flagship-mobile-phones-to-buy>
<https://www.smartly.ai/blog/tag/smart-speakers/>
<https://9to5google.com/guides/nest/>

STATE OF THE ART

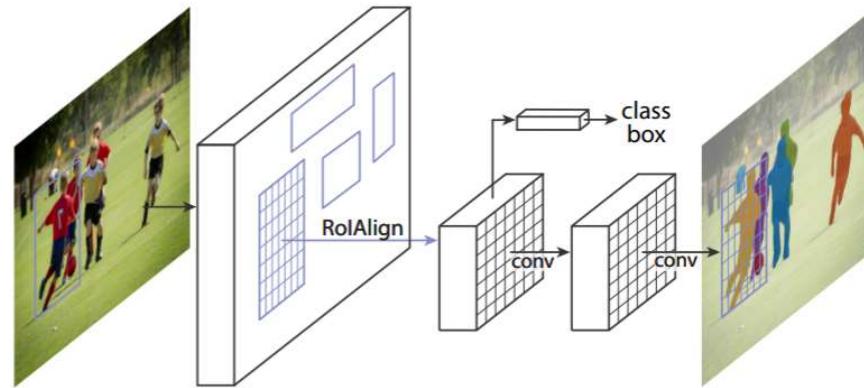


Multi-person Pose Estimation
<https://github.com/CMU-Perceptual-Computing-Lab/openpose>



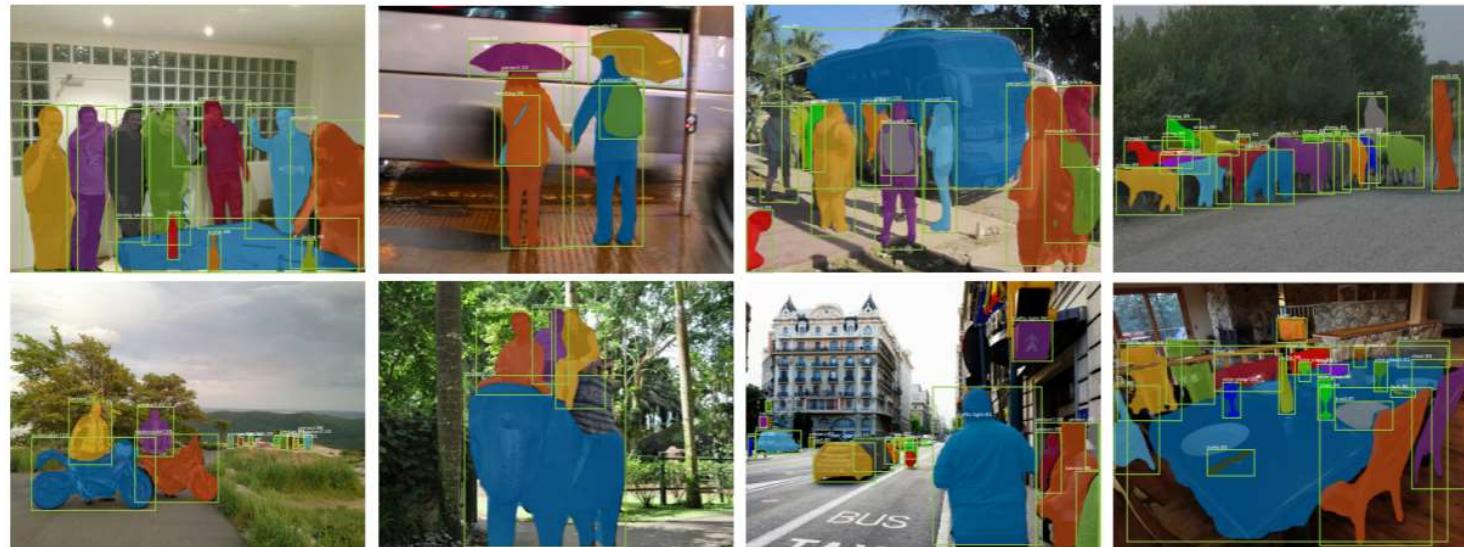
Object Recognition
<https://youtu.be/Qwui-fXCUYA>

AI in our life



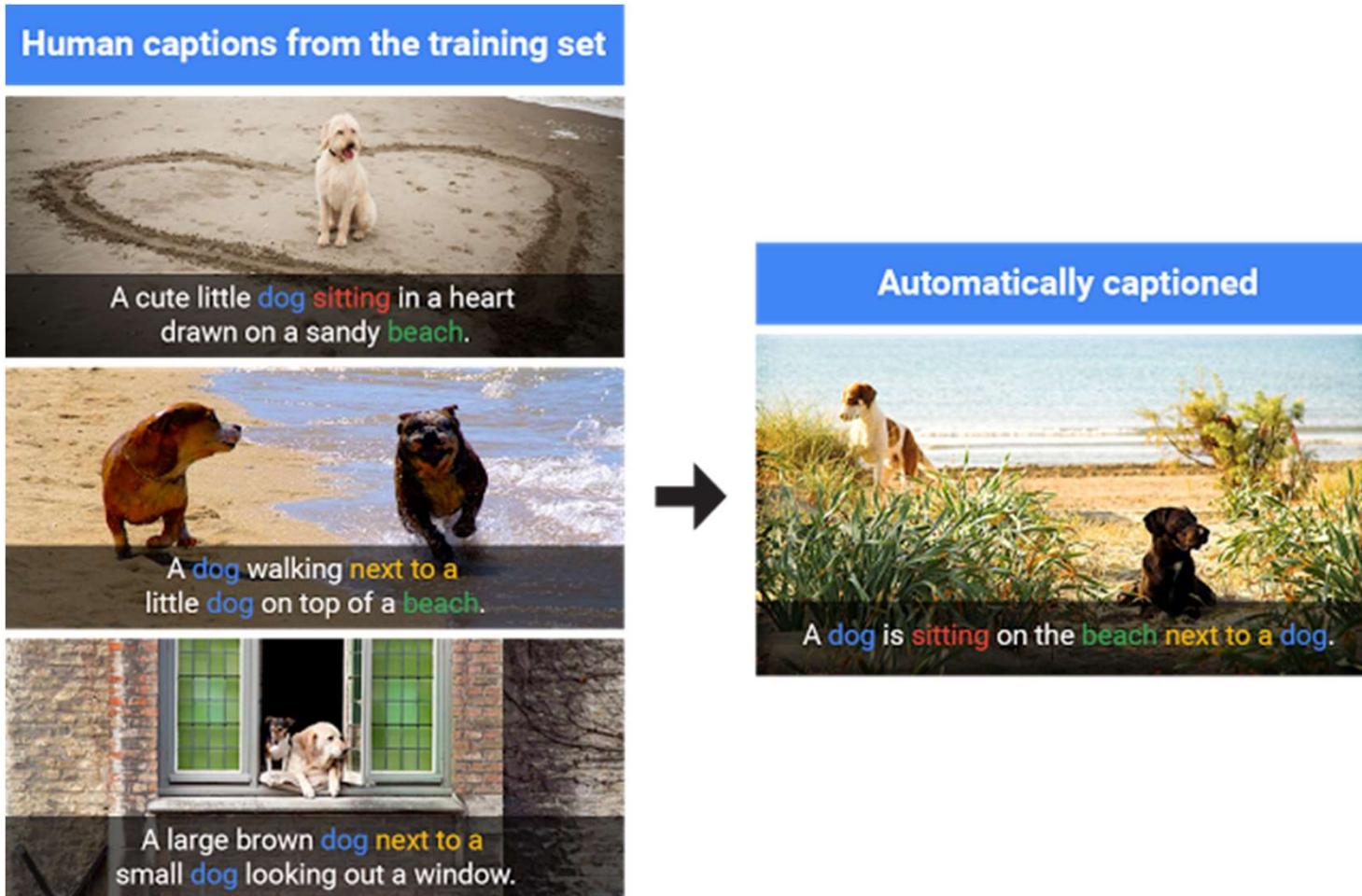
He, et.al., "Mask R-CNN," 2017

Figure 1. The **Mask R-CNN** framework for instance segmentation.



AI in our life

- Image Caption Generation



AI in our life

- Image-to-Image Translation

<https://affinelayer.com/pixsrv/>

Image-to-Image Translation with Conditional Adversarial Nets

Phillip Isola

Jun-Yan Zhu

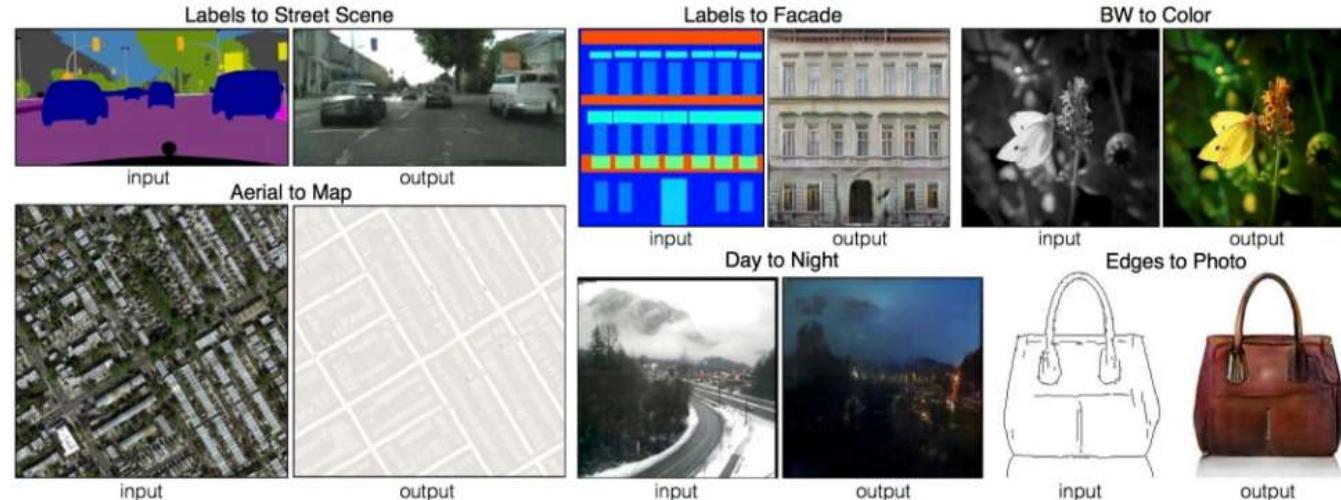
Tinghui Zhou

Alexei A. Efros

University of California, Berkeley
In CVPR 2017

[Paper]

[GitHub]



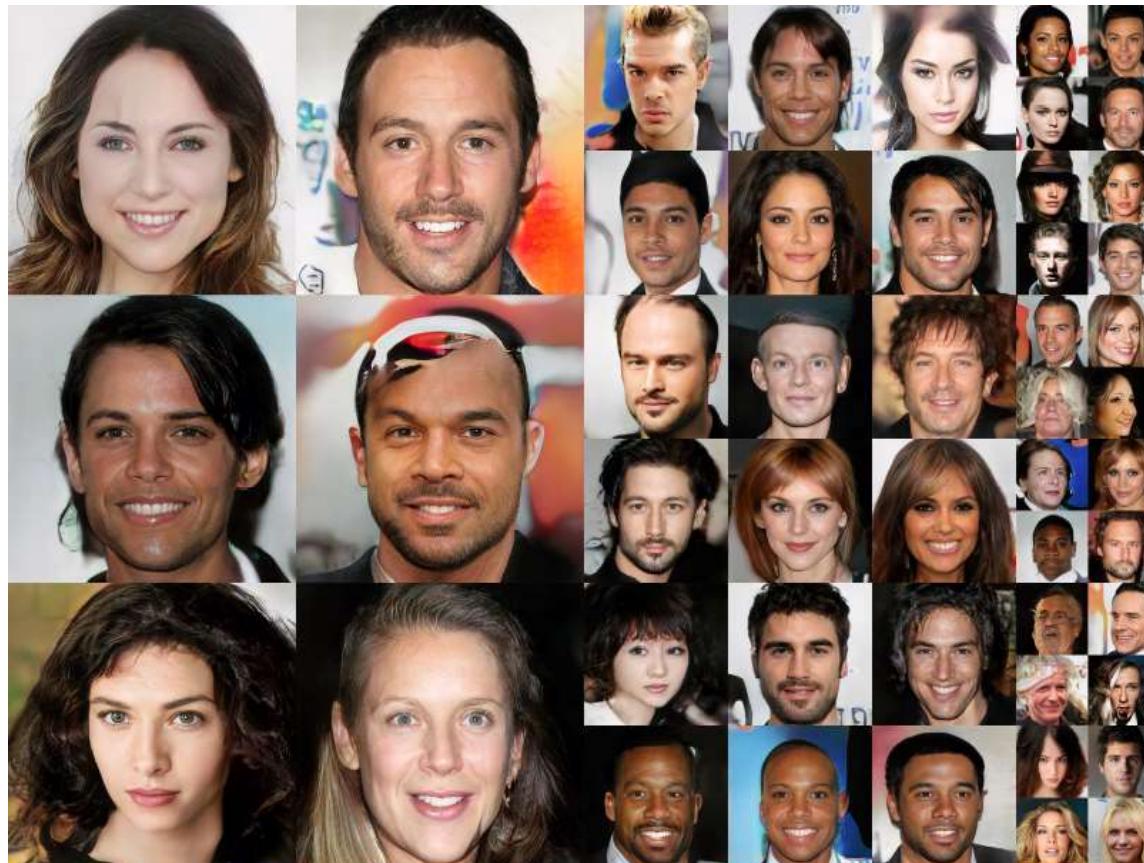
Example results on several image-to-image translation problems. In each case we use the same architecture and objective, simply training on different data.



ECE30007 Intro to AI Project

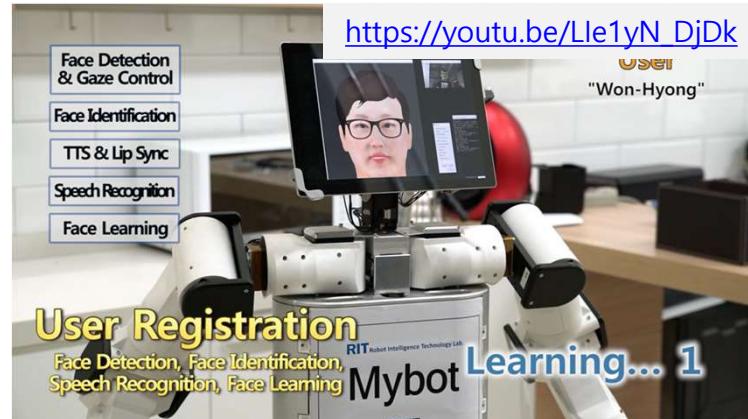
AI in our life

- Image Synthesis



AI in our life

- Robot interaction



AI in our life

Brain-Computer Interface: Drone control



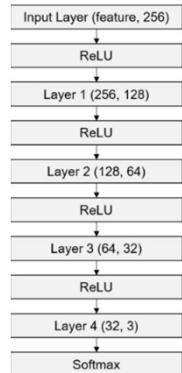
https://www.youtube.com/watch?v=_OoKIE38nhs



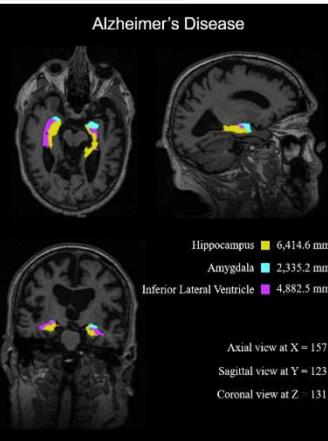
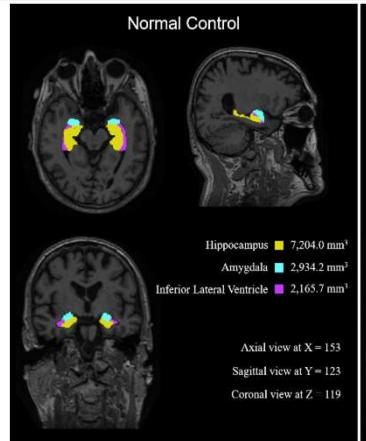
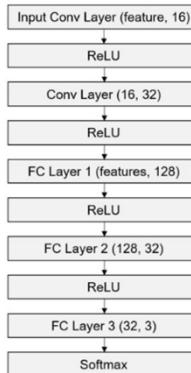
Brain-Computer Interface: Robot arm control

Medical AI for Dementia Diagnosis and Biomarker Detection

MLP

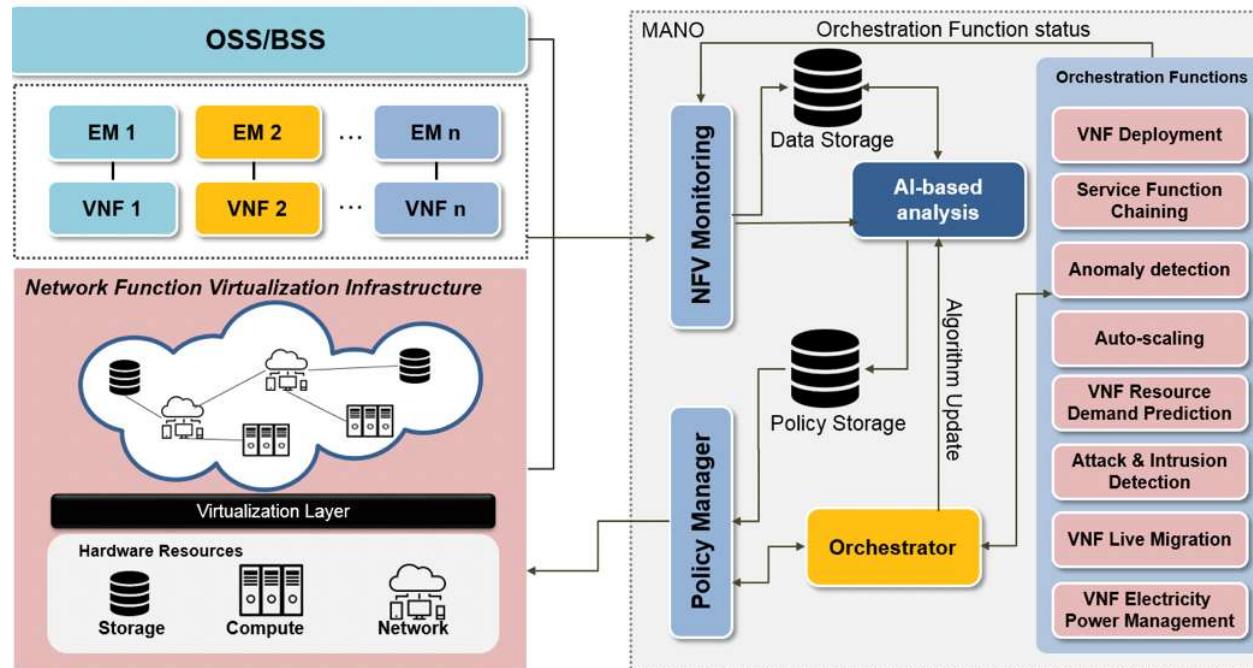


CNN

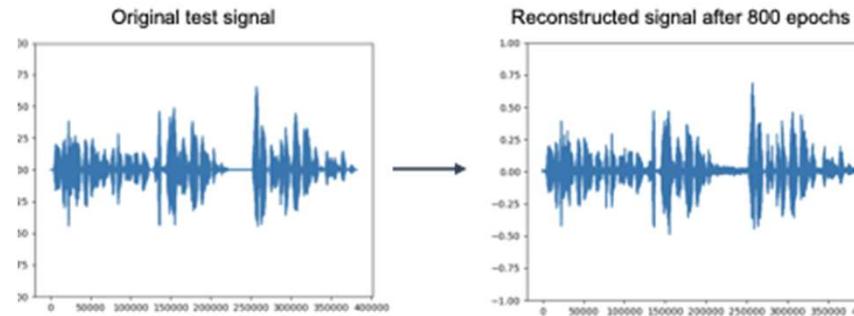


AI in our life

Artificial intelligence to manage virtual network functions



Audio Compression with Recurrent Neural Networks



Limitation of recent AI

- Possible errors and bias
 - As human makes errors, AI can make errors too.
 - Usually, it is evaluated based on public data (which may be biased).
 - Real world is huge, complex and changes.
 - Limited data, label and knowledge.
- Challenges
 - Massive data, computational resource and energy
 - Good experience and insights to domains
 - Understanding of a given problem, phenomena, environment
 - How to design and model domains and problems.
 - How to generalize AI.
 - How to explain results, performance, learning mechanism etc.

Artificial Intelligence vs. Human Intelligence

- Human
 - Learning from even small examples or experiences
 - Good generalization, transferring experience/internal model
 - Relatively human decision can be explained or understandable.
- Current AI is not a strong AI or AGI
 - It is just pretending as if it thinks.
 - No thought, mind, consciousness, emotion, ego in it.
- But AI is a very useful tool
 - Cost-effective, and good for huge data, service, system.
 - Can make up for traditional systems(or service).
 - Thus, Human with AI than Human vs. AI.

HW1

❖ Task

- ✓ 인공지능 관련 뉴스, 논문, 유튜브 등의 자료를 스크랩할 수 있는 블로그나 GitHub 또는 비슷한 종류의 웹페이지를 하나 만든다.
- ✓ 최근 2년 이내의 자료 두개를 스크랩 한다.
- ✓ 스크랩을 할 때는 다음을 반드시 작성한다.
 - 1) 출처 링크
 - 2) 소스의 날짜
 - 3) 간단한 요약
- ✓ 본인의 스크랩 웹페이지 링크를 HDLMS Assignments 란에 작성하여 제출한다.

❖ Due Time

- ✓ 3/6(월) 밤 11시 59분

IGU

Thank you!