

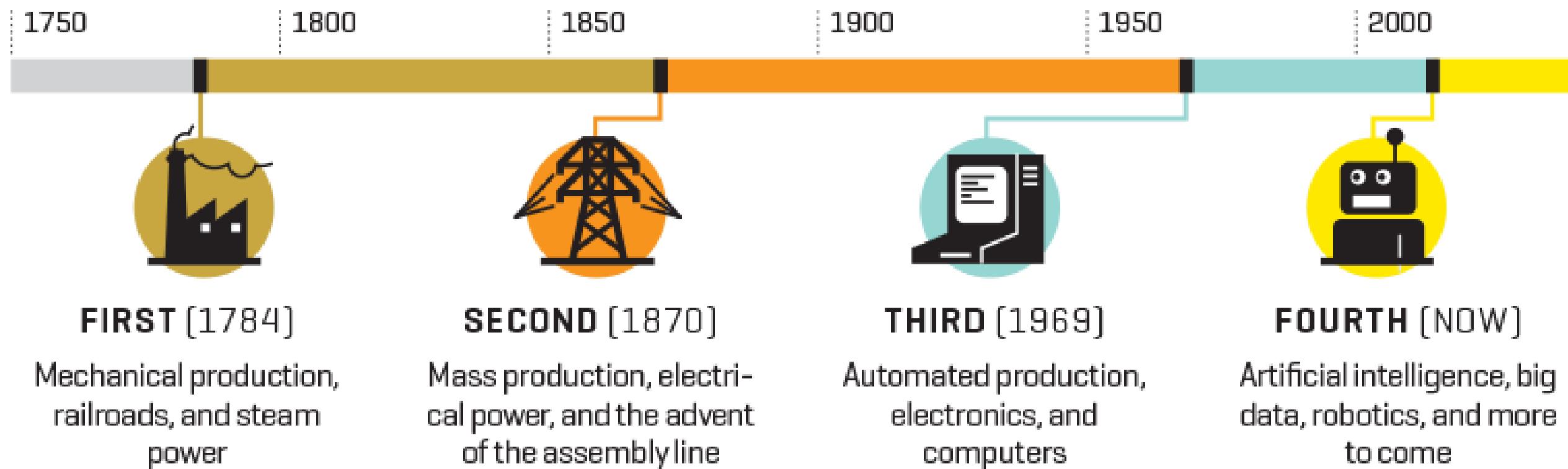
# 大 AI 時代的起點

陳敦和

技術發展處副處長



# THE FOUR INDUSTRIAL REVOLUTIONS



Source: World Economic Forum

# chip affordable

systems offer extensive program development tools.

You also get a choice of communication tools. The HP 9000 is currently compatible with Ethernet, and with HP's Shared Resource Manager (SRM) which lets clusters of HP 9000 and 16-bit desktop computers share data and use common peripherals. Links to central computers

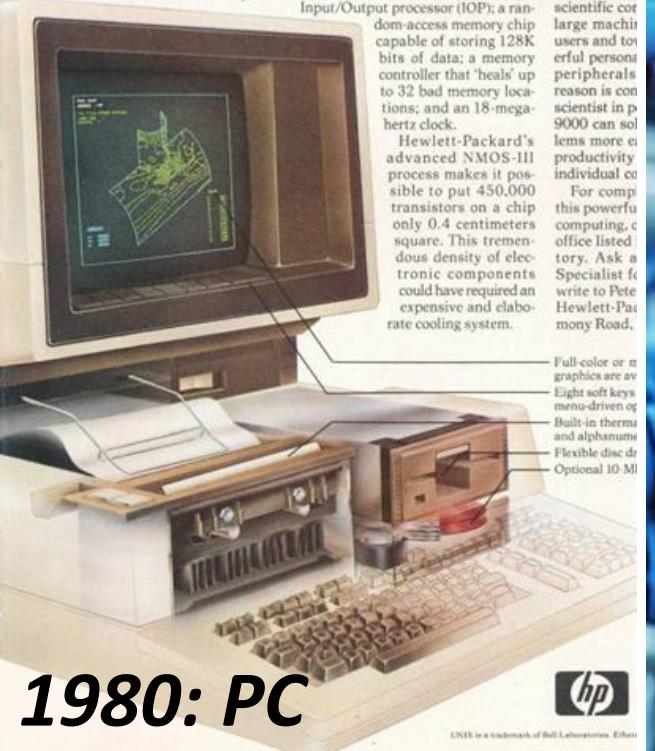
are also available. And in late 1983, HP will offer local area networks based on the IEEE-802 standard.

## New technology from the silicon up.

The five superchips that make the HP 9000 possible are the 32-bit CPU, which can execute a million instructions per second; an eight-channel Input/Output processor (IOP); a random-access memory chip capable of storing 128K bits of data; a memory controller that 'heads up' to 32 bad memory locations; and an 18-megahertz clock.

Hewlett-Packard's advanced NMOS-III process makes it possible to put 450,000 transistors on a chip only 0.4 centimeters square. This tremendous density of electronic components could have required an expensive and elaborate cooling system.

Full-color or grayscale graphics are available.  
Eight soft keys menu-driven.  
Built-in thermal and alphanumeric keyboard.  
Flexible disc drives.  
Optional 10-MHz clock.



**1980: PC**



**1990: Internet**

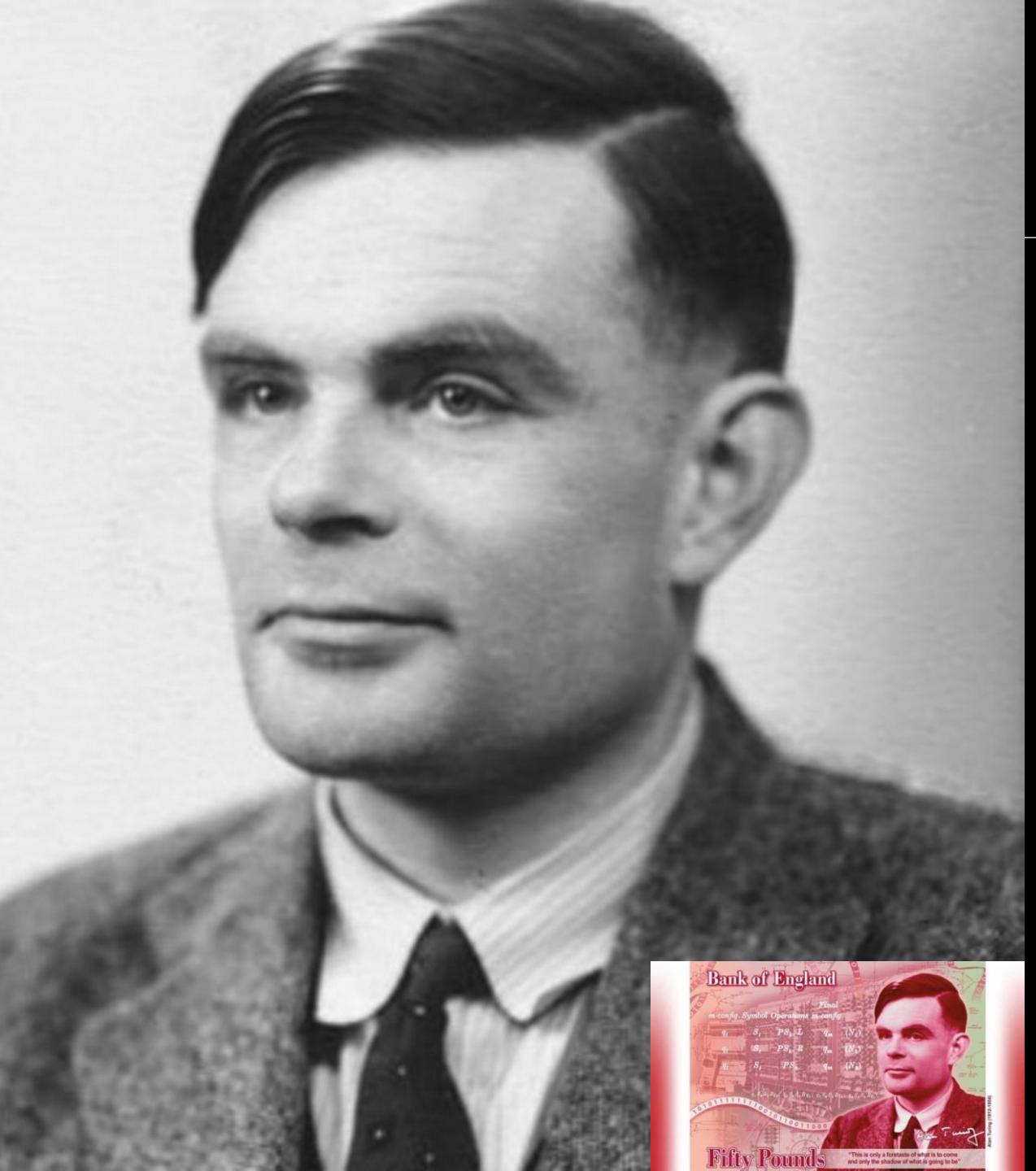


**2000: Mobile Device**



**2015: IoT+AI**

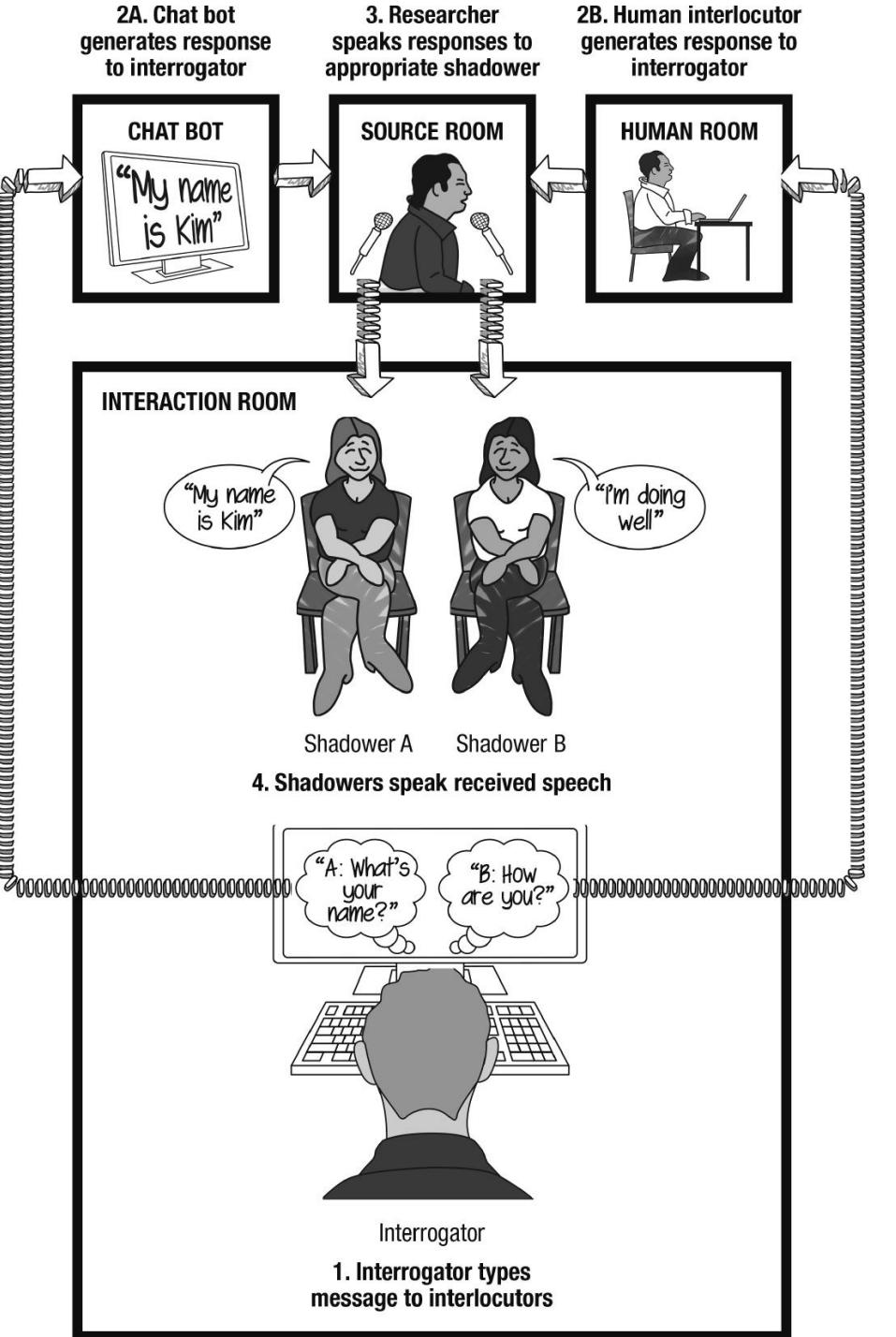
*Over the past 40 years,  
there are 4 Mega Trends in the industry and technology*



# Alan Turing (1912–1954)

- Mathematician, logician, cryptanalyst, philosopher, theoretical biologist, and computer scientist.
- The father of theoretical computer science and artificial intelligence
- Legend :
  - WW II Bletchley Park, Enigma machine, shorten 2 years. (2014電影:模仿遊戲)
  - Homosexual, chemical castration, and cyanide poisoning (half-eaten apple).





# Turing Test (1950)

- If tester cannot distinguish a machine and a man, this machine can be considered to have “intelligence”. (First time to use)
- “Imitation Game”(模仿遊戲) 
- AlphaGo as “Master” in end of 2016
- Google Assistant in 2018 Google I/O

Strong AI	Weak AI
General task (AGI) => Really can think	Specific task => Act as it can think

# 1956 Dartmouth AI Project



Five of the attendees of the 1956 Dartmouth Summer Research Project on AI reunited in 2006: Trenchard More, [John McCarthy](#), [Marvin Minsky](#), [Oliver Selfridge](#), and [Ray Solomonoff](#). Missing were: [Arthur Samuel](#), [Herbert Simon](#), [Allen Newell](#), [Nathaniel Rochester](#) and [Claude Shannon](#).

# 人工智慧發展簡史

## 第一波

1950-1960

失敗

### 符號邏輯

把人的思考邏輯放進電腦

由領域專家寫下決策邏輯。

人類還沒辦法清楚理解自己的思考過程，如何告訴電腦？

## 第二波

1980-1990

失敗

### 專家系統

把人的知識放進電腦

由領域專家寫下經驗規則。

太多難題人類無法解答、無法寫成規則、無法以程式碼表示。

## 第三波

2010-Present

### 機器學習

把人的經驗放進電腦

由領域專家提供歷史記錄，讓電腦自己歸納規則。

資料來源：《人工智慧在台灣》，劉奕酉整理

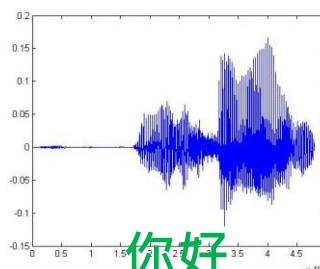
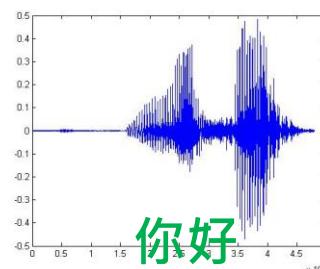
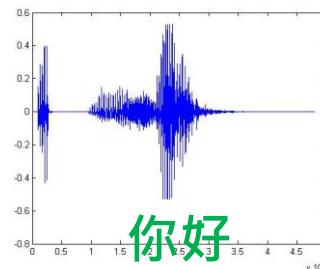
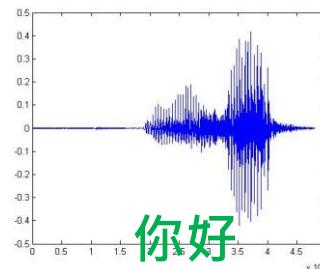
博藍尼悖論 (Polanyi's Paradox)



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# 機器學習的定義

“讓電腦能從資料裡頭淬取出  
決策規則的方法。



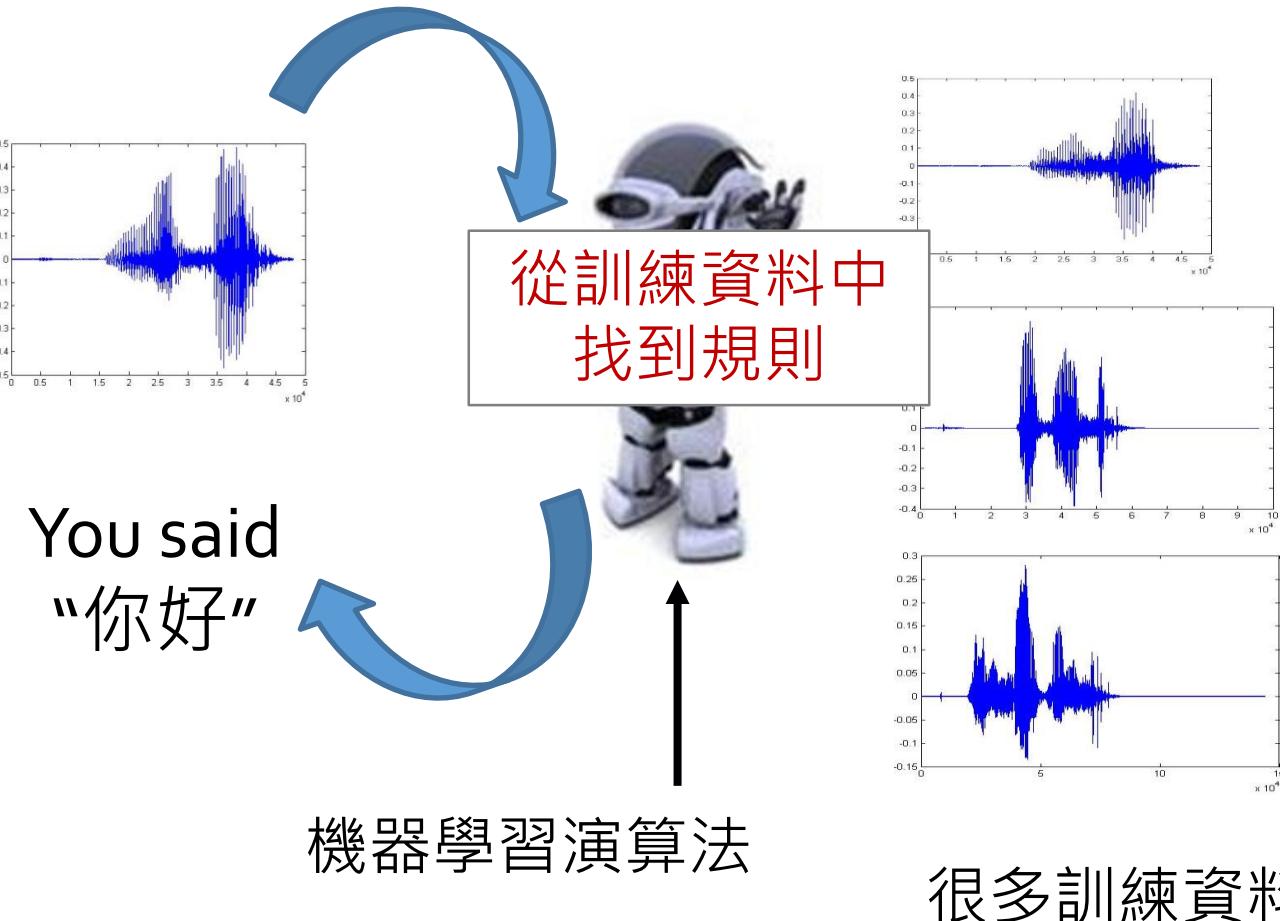
Find the common patterns  
from the left waveforms

You quickly get lost in the  
exceptions and special cases.

It seems impossible to  
write a program for  
speech recognition

(Slide Credit: [Hung-Yi Lee](#))

# 就放棄教電腦規則，讓它自己學吧！



(Slide Credit: [Hung-Yi Lee](#))

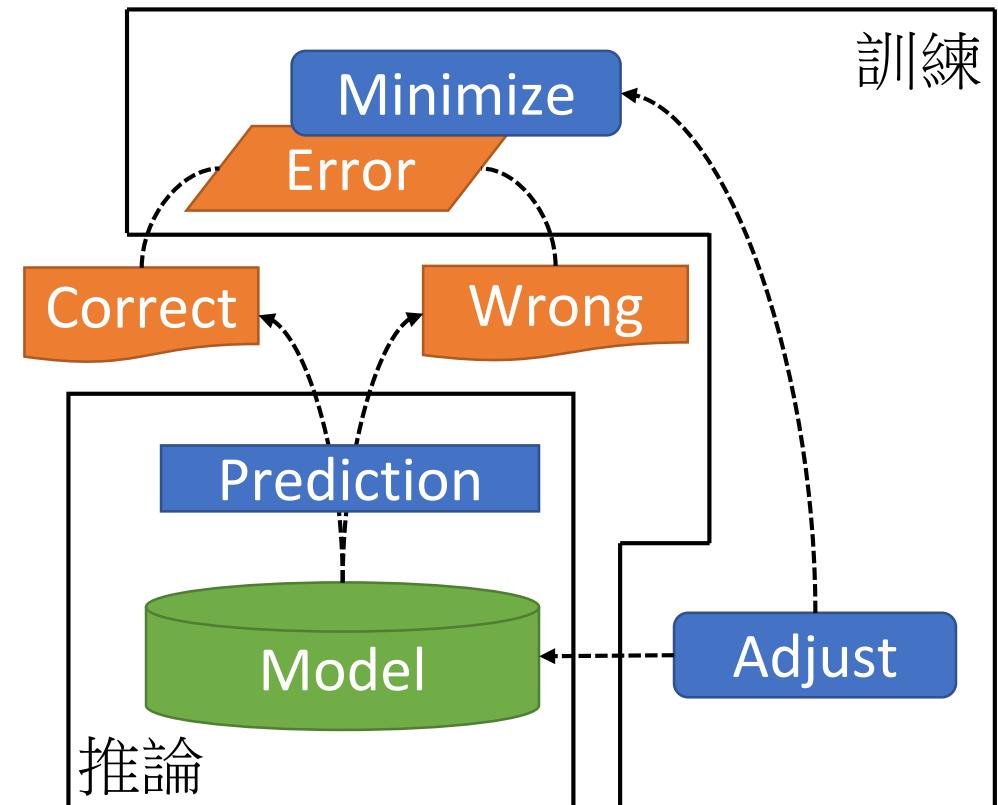
# 多數 AI 應用是讓機器學會一個對應關係

Input (A)	→	Output (B)	Application
email	→	spam? (0/1)	spam filtering
audio	→	text transcript	speech recognition
English	→	Chinese	machine translation
ad, user info	→	click? (0/1)	online advertising
image, radar info	→	position of other cars	self-driving car
image of phone	→	defect? (0/1)	visual inspection



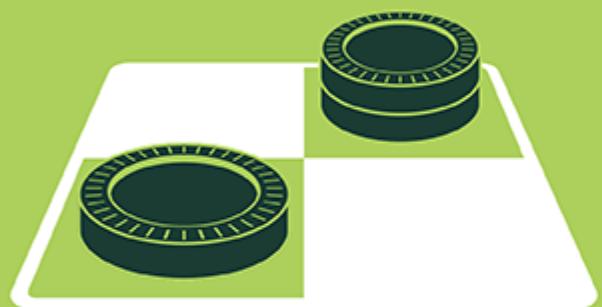
# Learning vs. Machine Learning

- Our daily life, we repeat an action : use **knowledge** to make a **decision**
- We expect : make a **good decision**
- How to make a good decision : **learn**
  - If **decision is bad** => adjust your knowledge (try-and-error)
- How to adjust our knowledge :
  - Know **gap** between good and bad decision
  - **Eliminate** the gap by adjusting knowledge



# ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.



1950's

1960's

1970's

1980's

1990's

2000's

2010's

# MACHINE LEARNING

Machine learning begins to flourish.



# DEEP LEARNING

Deep learning breakthroughs drive AI boom.

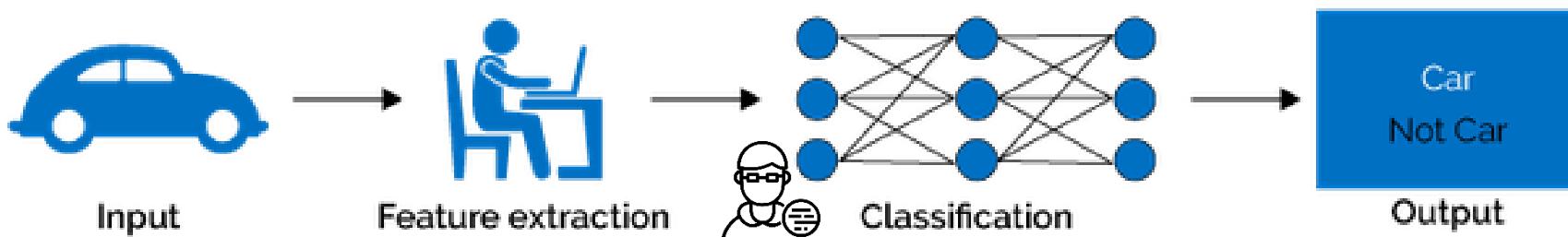


Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

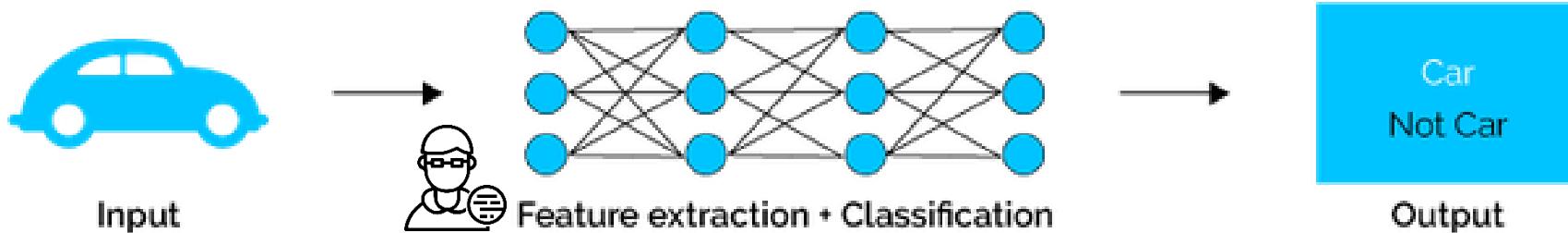
# Rule-based System

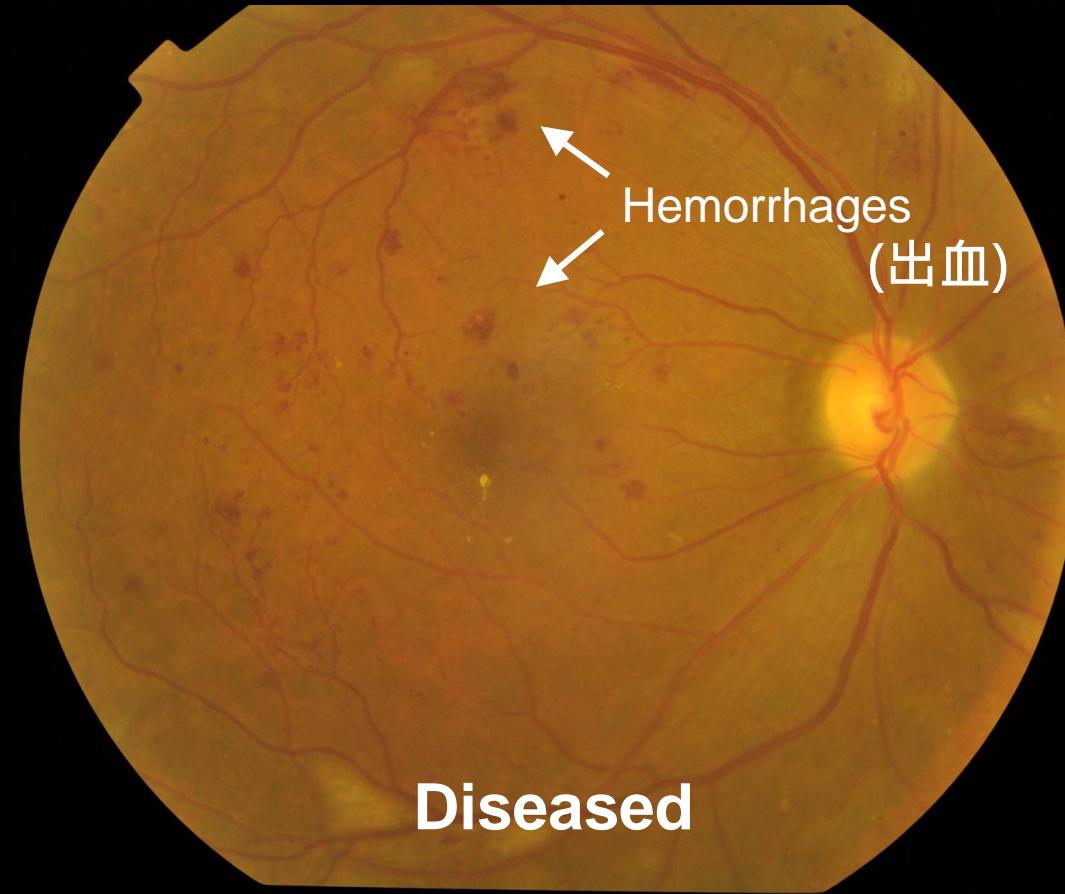


# Classical Machine Learning



# Deep Learning



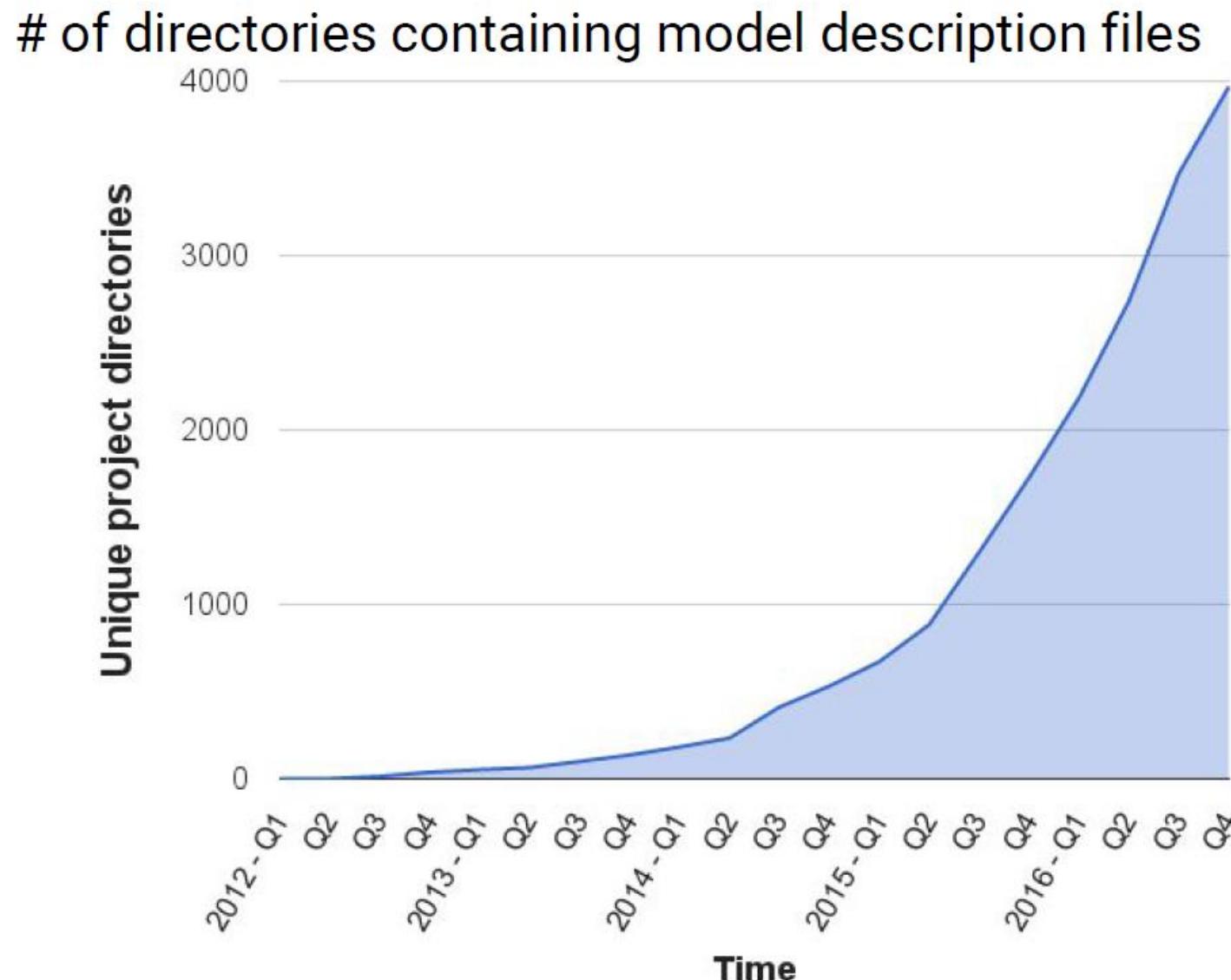


DR = 糖尿病  
視網膜病變



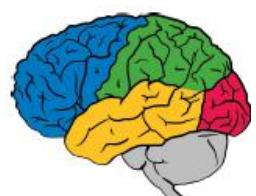
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# Growing Use of Deep Learning at Google



Across many products/areas:

- Android
- Apps
- drug discovery
- Gmail
- Image understanding
- Maps
- Natural language understanding
- Photos
- Robotics research
- Speech
- Translation
- YouTube
- ... many others ...



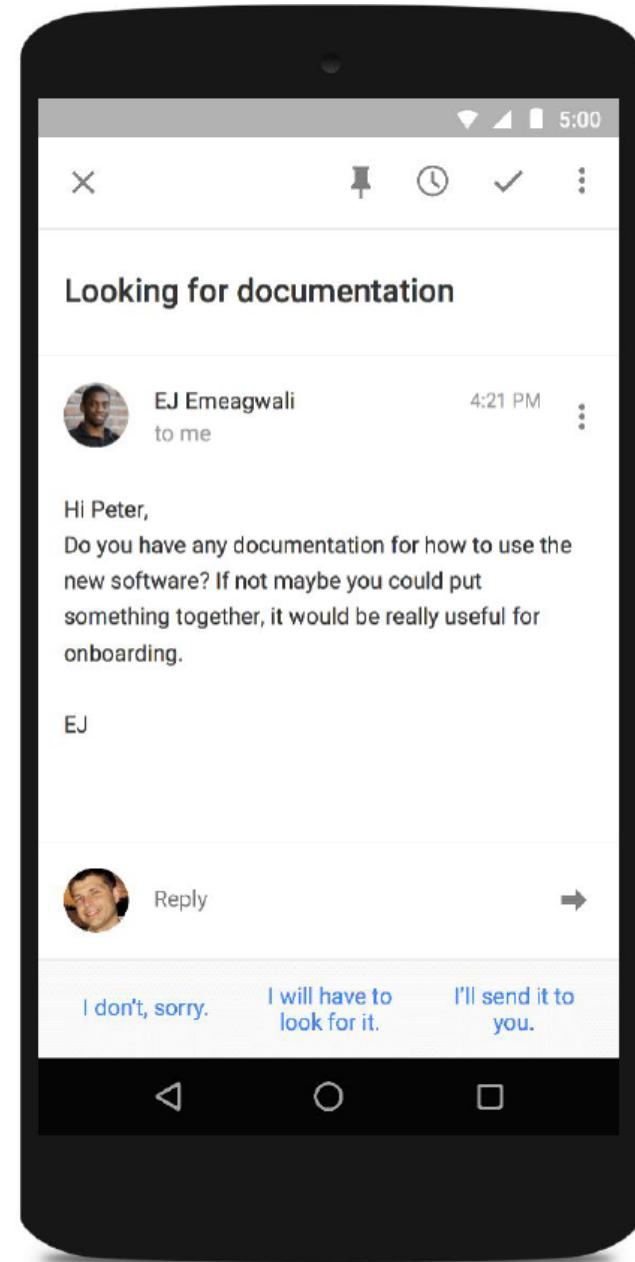


# Smart Reply

*April 1, 2009: April Fool's Day joke*

*Nov 5, 2015: Launched Real Product*

*Feb 1, 2016: >10% of mobile Inbox replies*





Deep Learning



GARRY  
KASPAROV

DEEP  
BLUE

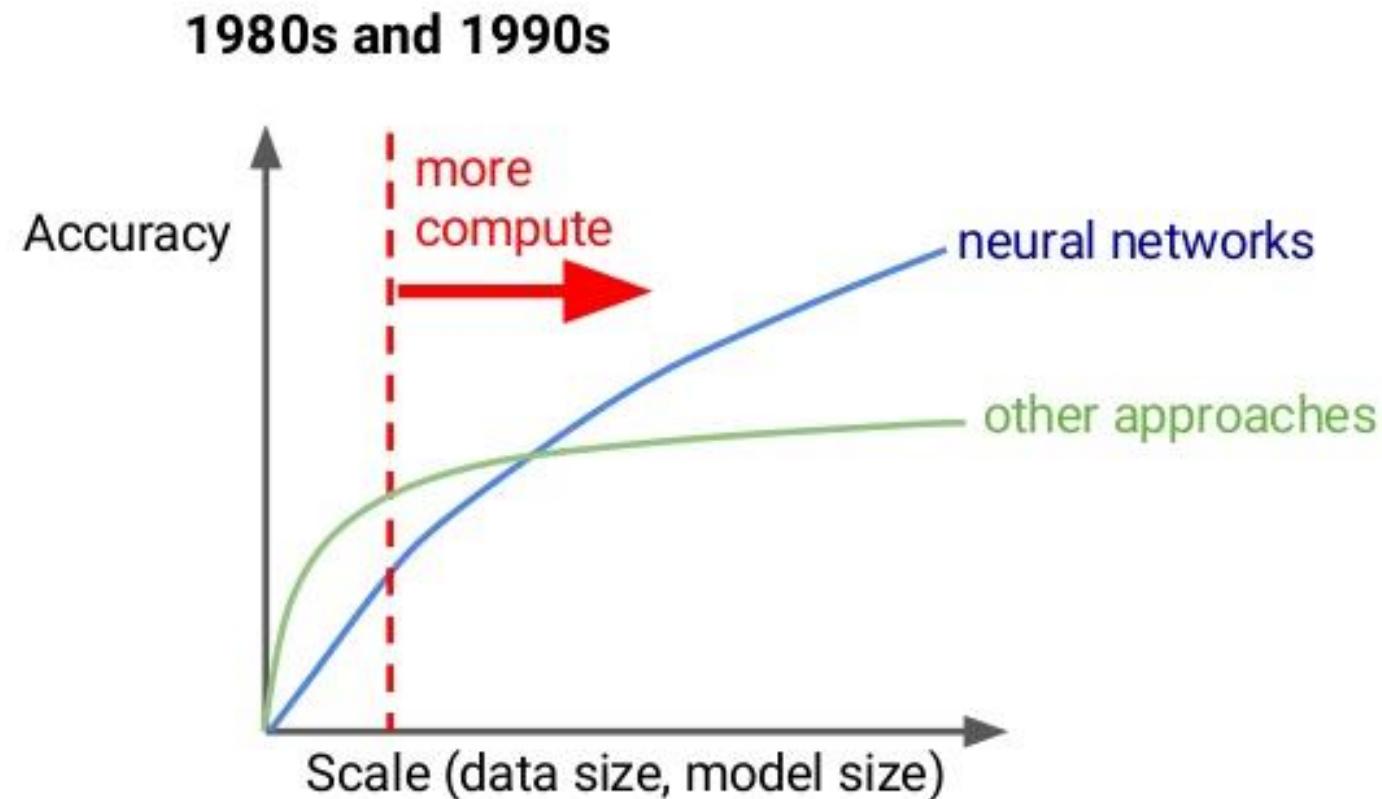
Traditional AI

D V VS  
EP BLUE  
rematch

under the auspices of the AC



# Why DL is hotter than ML ?

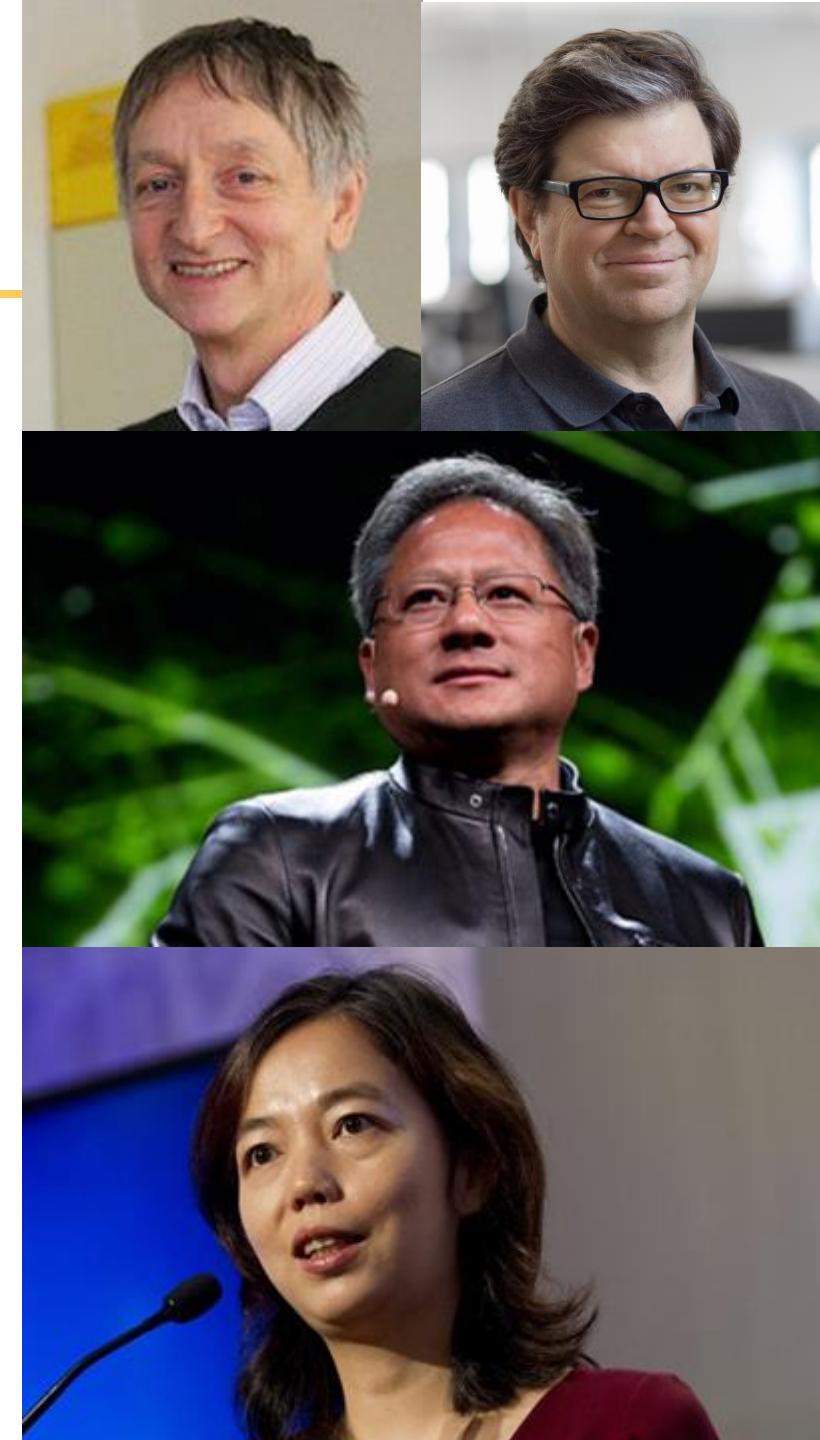


<https://www.slideshare.net/AIFrontiers/jeff-dean-trends-and-developments-in-deep-learning-research>

# Reasons Behind the Boom

- Theories Ready : DNN, CNN, RNN ...
  - DNN: Gradient Descent and Backpropagation
  - CNN: Convolution and NN-ized
- Hardware Capability : Nvidia GPU+CUDA
- Big Data : ImageNet and ILSVRC
  - **IMAGENET** 14,197,122 images, 21841 synsets indexed
- Software Tools/Communities :
  - Open Source

計算的複雜度下降 vs. 計算力的提升 =>  
人工智慧的黃金交叉 !!



# Auto Coloring

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[https://paintschainer.preferred.tech/index\\_zh.html](https://paintschainer.preferred.tech/index_zh.html)



# Colorful Image Colorization

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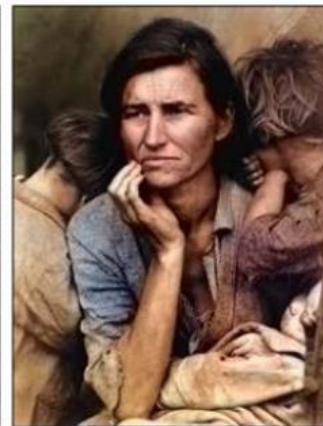
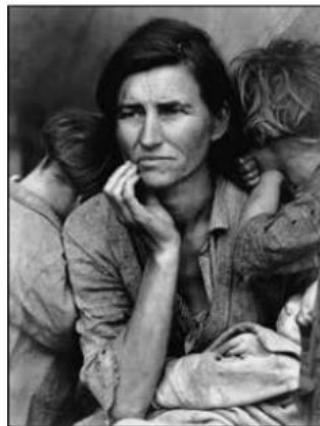
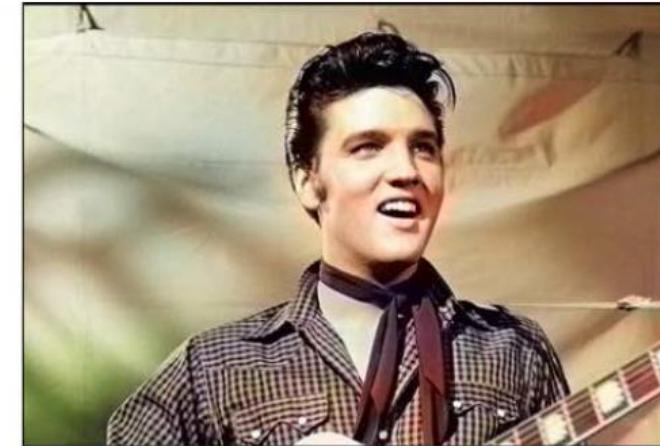
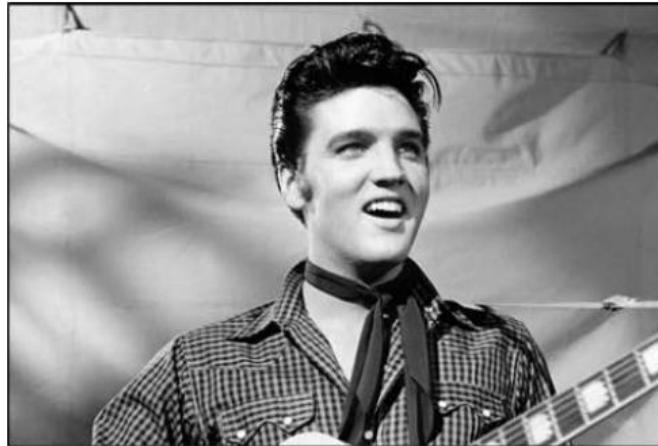
Zhang, Richard, Phillip Isola, and Alexei A. Efros. "Colorful image colorization." *European Conference on Computer Vision*. Springer International Publishing, 2016.



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# Colorize Legacy Photos

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# NLP : Sentence Generation

SYSTEM PROMPT  
(HUMAN-WRITTEN)

*A train carriage containing controlled nuclear materials was stolen in Cincinnati today. Its whereabouts are unknown.*

MODEL  
COMPLETION  
(MACHINE-  
WRITTEN, FIRST  
TRY)

The incident occurred on the downtown train line, which runs from Covington and Ashland stations.

In an email to Ohio news outlets, the U.S. Department of Energy said it is working with the Federal Railroad Administration to find the thief.

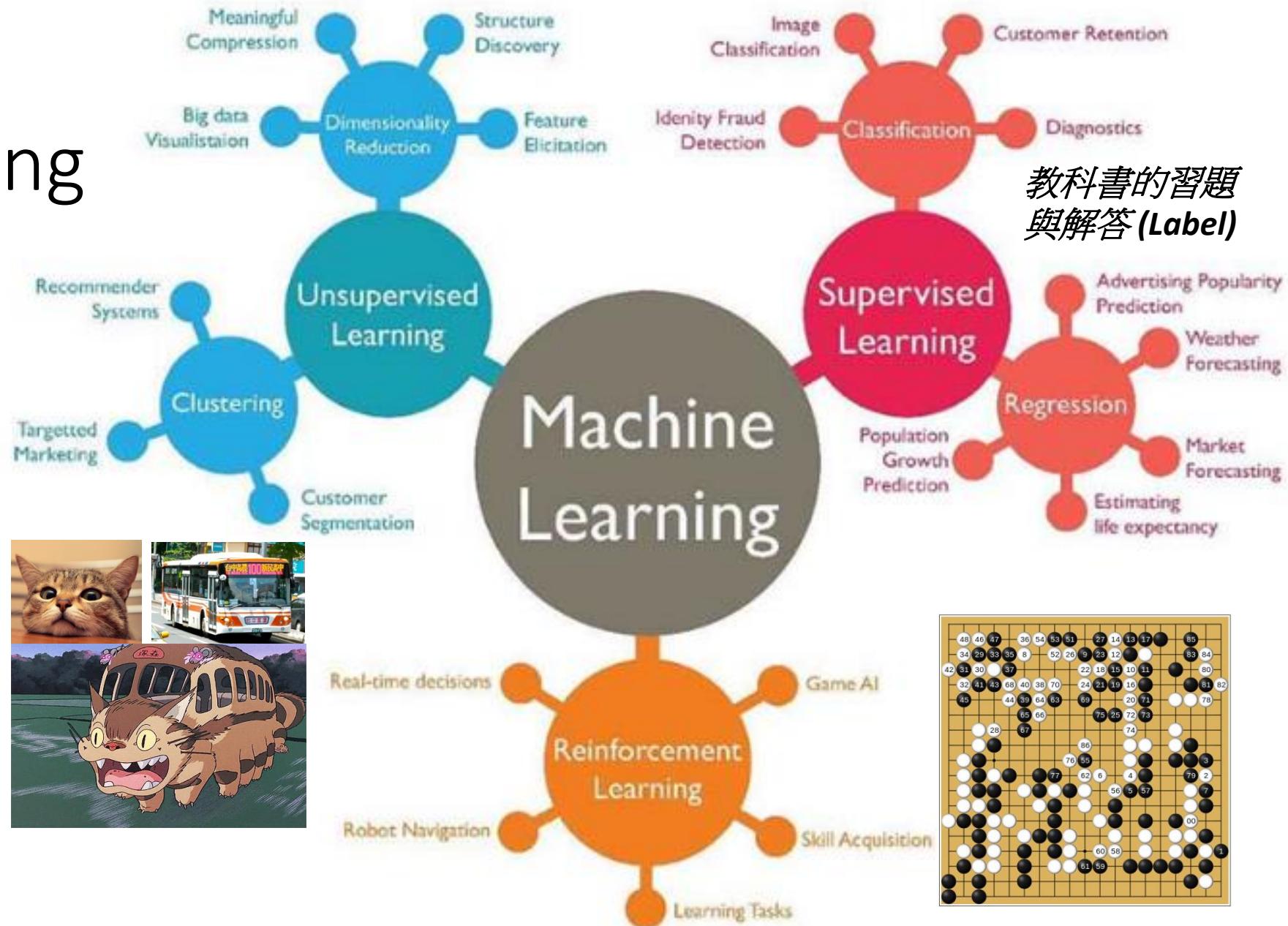
“The theft of this nuclear material will have significant

Transformer based



# Types of Machine Learning

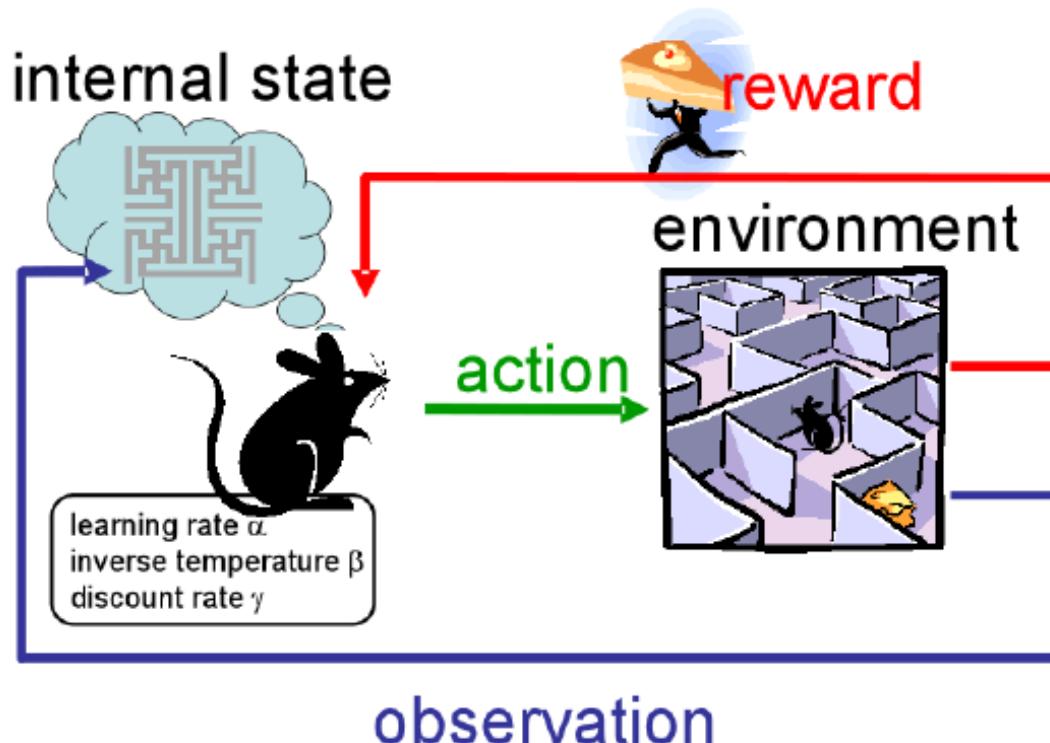
- Supervised Learning
  - Learning with (immediate) answer
- Unsupervised Learning
  - Learning without answer
- Reinforcement Learning
  - Learning with (long-term) goal



# Reinforcement Learning

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- Learn from interaction w/ environment to achieve a goal



# Learning to run and stand up

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<https://www.youtube.com/watch?v=SHLuf2ZBQSw>



# Top-Level Flow of ML

## 機器學習基本流程



學習 : 10% vs. 90%

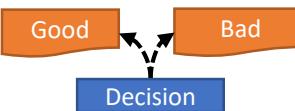
實務 : 90% vs. 10%



# Data : Prepare, Analyze, Process

- Prepare :

1. Collect : collect dataset (existing popular, or by your own)
2. Label : label expected output for input data



- Analyze :

3. Explore : EDA (Explorative Data Analysis) and Visualization

- Process :

4. (Pre-process) Clean : corrupt, inaccurate, and missing values
5. Feature Engineering : normalize, encoding, assemble, filter...
6. (Validation) Split : training set(考古題) and validation set(練習題) / testing set(大考)



amazon mechanical turk

# Data

# Data

# Data



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Data

Label

Problem



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- ✓ Enough Data
  - ✓ Enough Labeled Data
- 
- ✓ Problem Definition
  - ✓ Metrics
  - ✓ Domain Experts



# 產業AI化：框架



不只是運用AI,  
而是重新省思產業升級的絕佳時機





## What are we missing?

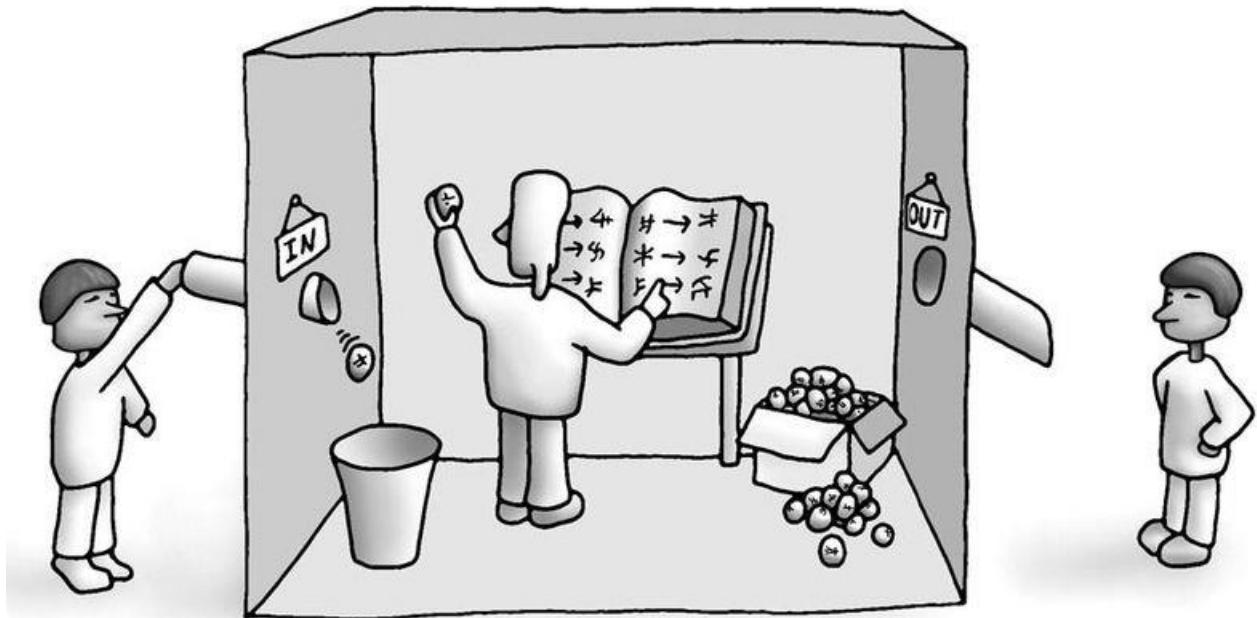
To get to “real” AI

Supervised learning needs too many samples.  
Reinforcement learning needs too many trials.  
Machines don’t have common sense.

facebook  
Artificial Intelligence Research



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source: wikicommons

## Chinese Room (1980)



**John Searle**  
**PHILOSOPHER**

Strong AI	Weak AI
Can think Own conscious	Act as it can think Consciousless



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Chinese – detected ▾



English ▾



我吃餐廳 Edit

Wǒ chī cāntīng

I am eating  
restaurant

[Open in Google Translate](#)

[Feedback](#)

Chinese – detected ▾



English ▾



那輛白車是黑車

Nà liàng bái chē shì hēi chē

That white car is a  
black car

[Open in Google Translate](#)

[Feedback](#)



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●●●○○ Sprint LTE

9:23 AM

75% 

< Messages

老婆

Details

晚上朋友找我去 pub 喝  
酒，晚點回家可以嗎？

好啊，你去啊！



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# What we can and cannot today

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- What we can have

- Safer car, autonomous car
- Better medical image analysis
- Personalized medicine
- Adequate language translation
- Useful but stupid chatbots
- Information search, retrieval, filtering
- Numerous applications in energy, finance, manufacturing, commerce, law, ...

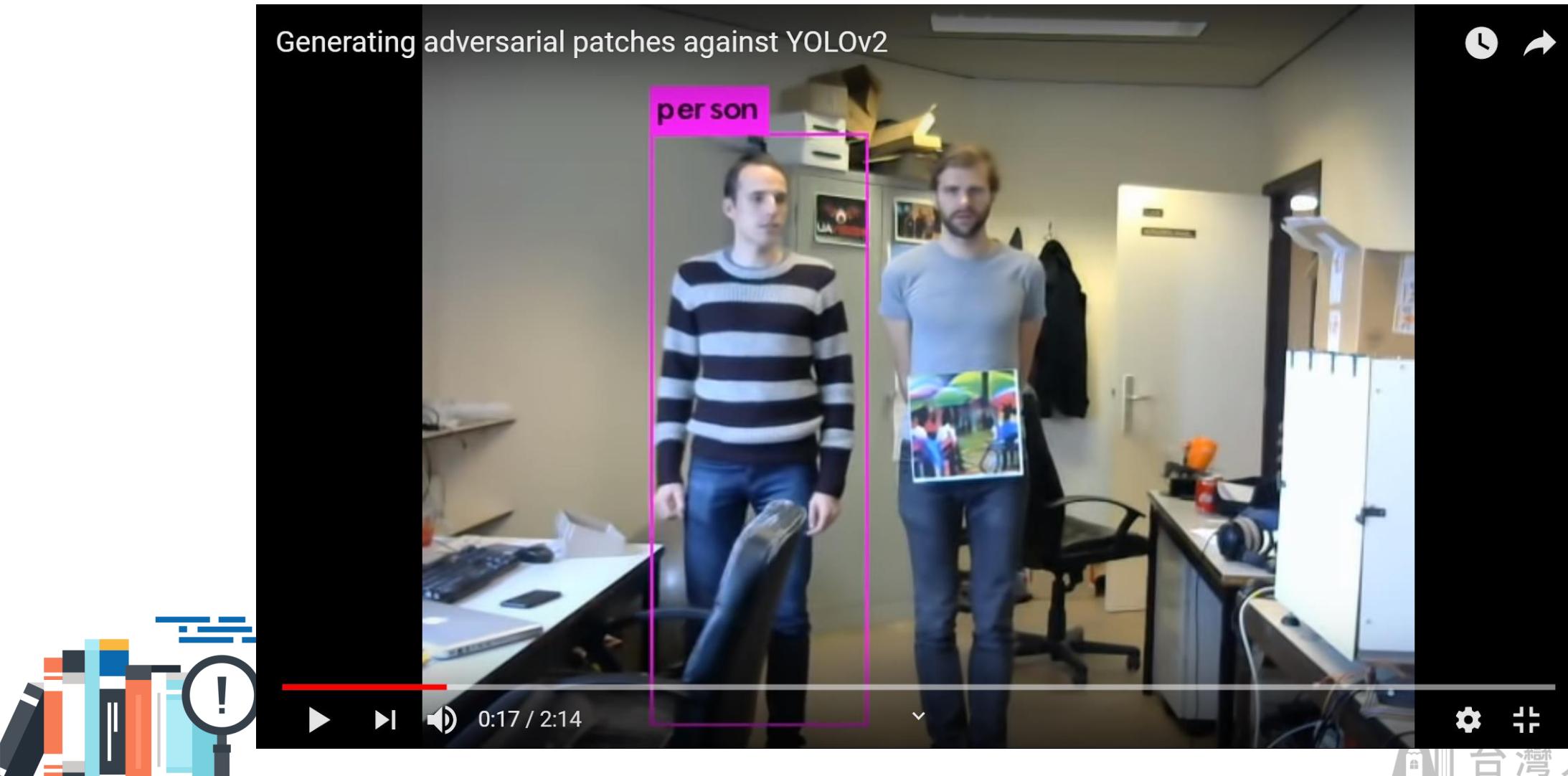


- What we cannot have (yet)

- Machine with common sense
- Intelligent personal assistants
- “Smart” chatbots
- Household robots
- Agile and dexterous robots
- Artificial General Intelligence (AGI)



# Adversarial Patches



# DeepFakes



<https://www.inside.com.tw/2017/12/13/gal-gadot-fake-ai-porn>

<http://www.businessinsider.com/obama-deepfake-video-insulting-trump-2018-4>



<https://www.instagram.com/p/ByaVigGFP2U>

Donald Trump | Mr. Bean Deepfake



BREAKING NOW

DONALD TRUMP JOINS 2016 RACE FOR PRESIDENT

Donald Trump | (R) Presidential Candidate

CNN

5:30 PM ET

SITUATION ROOM



0:12 / 2:11



HD



[https://www.youtube.com/watch?v=MBWue1T\\_irk](https://www.youtube.com/watch?v=MBWue1T_irk)



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# Fake News

SYSTEM PROMPT  
(HUMAN-WRITTEN)

*In a shocking finding, scientist discovered a herd of unicorns living in a remote, previously unexplored valley, in the Andes Mountains. Even more surprising to the researchers was the fact that the unicorns spoke perfect English.*

MODEL  
COMPLETION  
(MACHINE-  
WRITTEN, 10 TRIES)

The scientist named the population, after their distinctive horn, Ovid's Unicorn. These four-horned, silver-white unicorns were previously unknown to science.

Now, after almost two centuries, the mystery of what sparked this odd phenomenon is finally solved.

Dr. Jorge Pérez, an evolutionary biologist from the University of La Paz, and several companions, were exploring the Andes Mountains when they found a small valley, with no other animals or humans. Pérez noticed that the valley had what appeared to be a natural fountain, surrounded by two peaks of rock and silver snow.

Pérez and the others then ventured further into the valley. "By the time we reached the top of one peak, the water looked blue, with some crystals on top," said Pérez.

Pérez and his friends were astonished to see the unicorn herd. These creatures could be seen from the air without having to move too much to see them – they were so close they could touch their horns.

18,403 views | Sep 3, 2019, 04:42pm

# A Voice Deepfake Was Used To Scam A CEO Out Of \$243,000



**Jesse Damiani** Contributor 

Consumer Tech

*I cover the human side of VR/AR, Blockchain, AI, Startups, & Media.*



Earlier this summer, researchers from Dessa, an AI company based in Toronto, produced a simulation of popular podcaster and comedian Joe Rogan's voice:

[https://www.youtube.com/watch?v=DWK\\_iYBl8cA](https://www.youtube.com/watch?v=DWK_iYBl8cA)

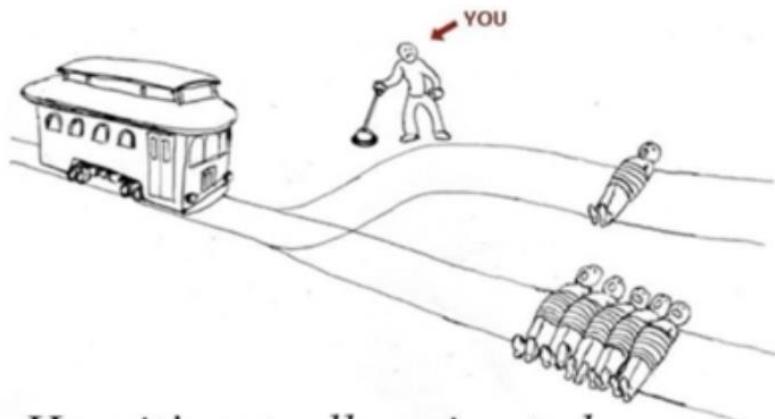
<https://www.forbes.com/sites/jessedamiani/2019/09/03/a-voice-deepfake-was-used-to-scam-a-ceo-out-of-243000/>

# 北京地鐵將用人臉識別技術實現乘客分類安檢

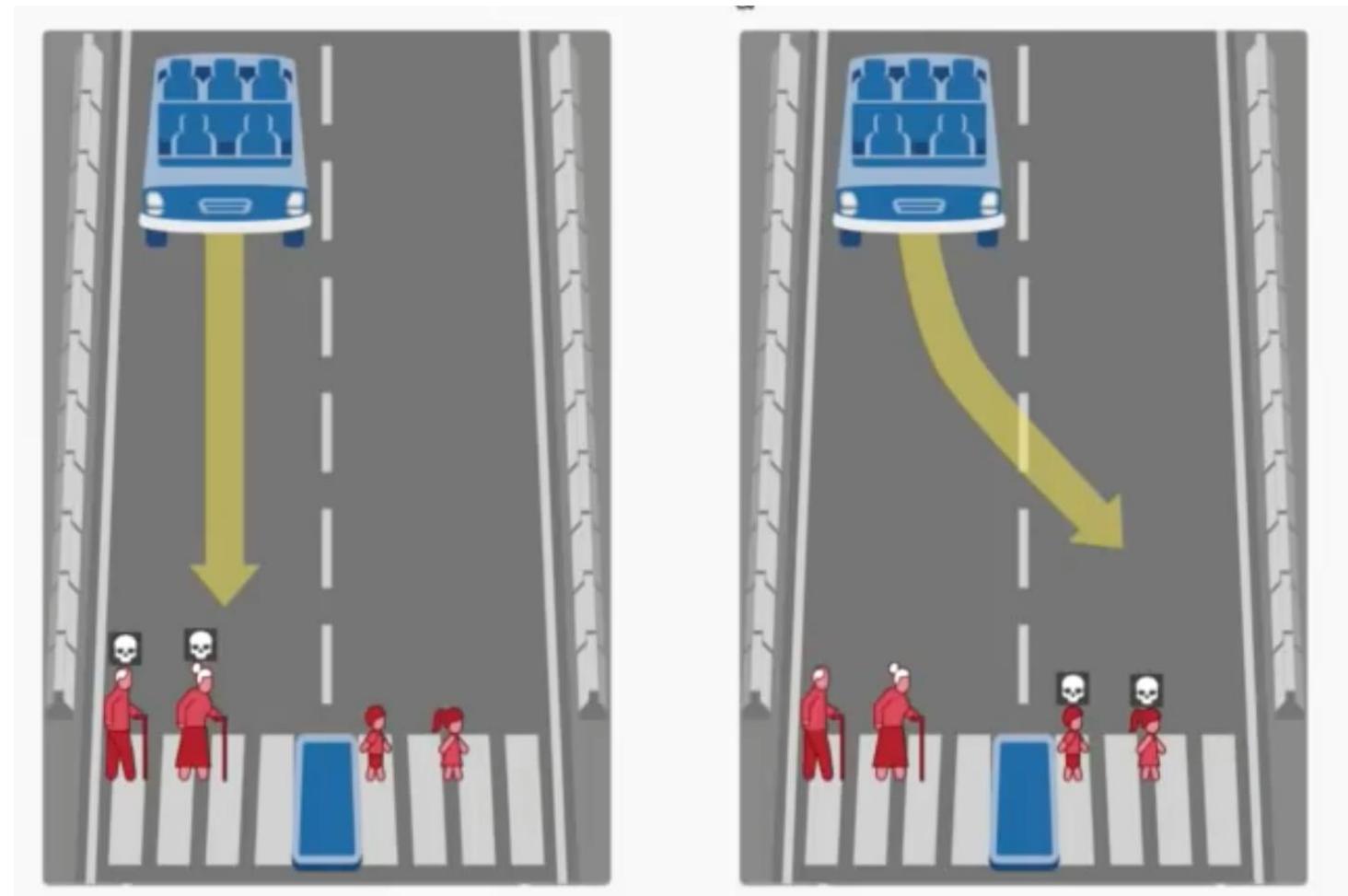
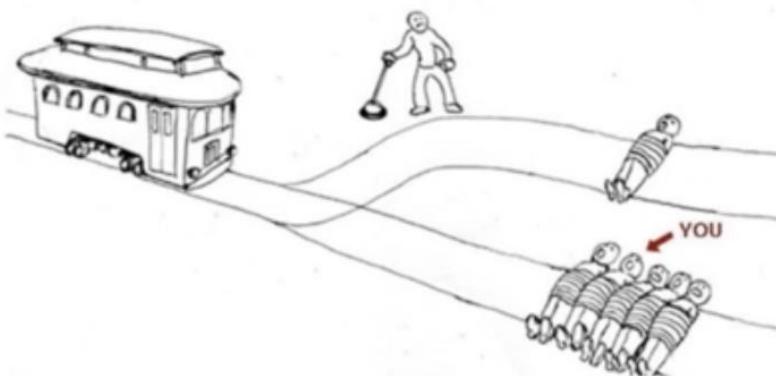


# AI Ethics

*How you imagine the trolley problem*



*How it's actually going to be*



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# 人工智慧的影響如此深遠...

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- 下一代的教育
- 結構性失業議題
- 道德議題
- 隱私 / 資安危機
- 終身學習
- 企業領導階層的顧問
- 降低產業 AI 應用的門檻
- 公部門施政的監督
  - 建築, 施工, 檢查, 科專, 教育
- 法規調適
  - 醫療, 自駕, 平權
- AI 新創的國際化
- 產業 AI 的國際化



陳昇瑋 / 台灣人工智慧學校2019校友年會

# 大 AI 時代 從各位開始



# TAIWAN

讓世界看到 TAIWAN，就想到 AI；  
看到 TAIWAN 在 AI 的成就，就不禁讚嘆：WA！  
這是我們對自己與台灣的期許。