

Artificial Intelligence for Engineers

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1. Introduction

Definition

- Artificial intelligence is intelligence exhibited by machines.
- Artificial Intelligence is the study of how to make computers do things at which, at the moment, people are better.

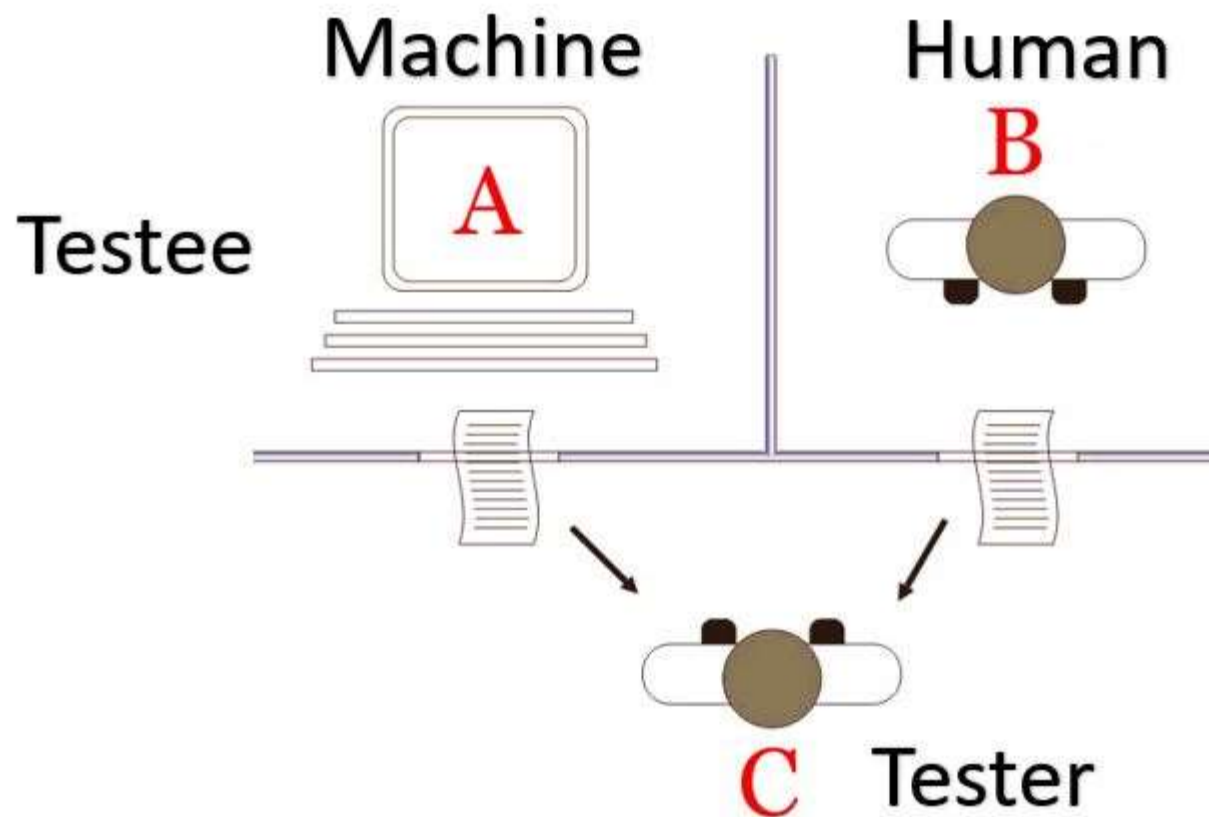
Intelligent Behavior

- Learn or understand from experience
- Make sense out of ambiguous or contradictory messages
- Respond quickly and successfully to a new situation
- Use reason in solving problems and directing conduct effectively
- Deal with perplexing situations
- Understand and infer in ordinary, rational ways
- Apply knowledge to manipulate the environment
- Acquire and apply knowledge
- Think and reason

Turing Test

- เราจะรู้ได้อย่างไรว่าเครื่องสามารถคิดเองได้
Alan Turing เสนอวิธีที่เรียกว่า Turing Test
- ใช้คน 2 คนและเครื่อง 1 เครื่อง
- คนแรกเป็นผู้ตั้งคำถามโดยใช้คีย์บอร์ดและจอภาพ
ซึ่งผู้ถามนี้จะอยู่ห้องแยกจากเครื่องและคนที่สอง
- ผู้ถามต้องแยกให้ได้ว่าคำตอบที่มาจากอีกห้องหนึ่งนั้น
เป็นของใคร

Turing Test (cont.)



Examples in Turing Test

- An early example:

Eliza – It used rules to simulate conversation by finding a "pattern matching" and using substitution methodology that gave users an illusion of understanding.

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Welcome to

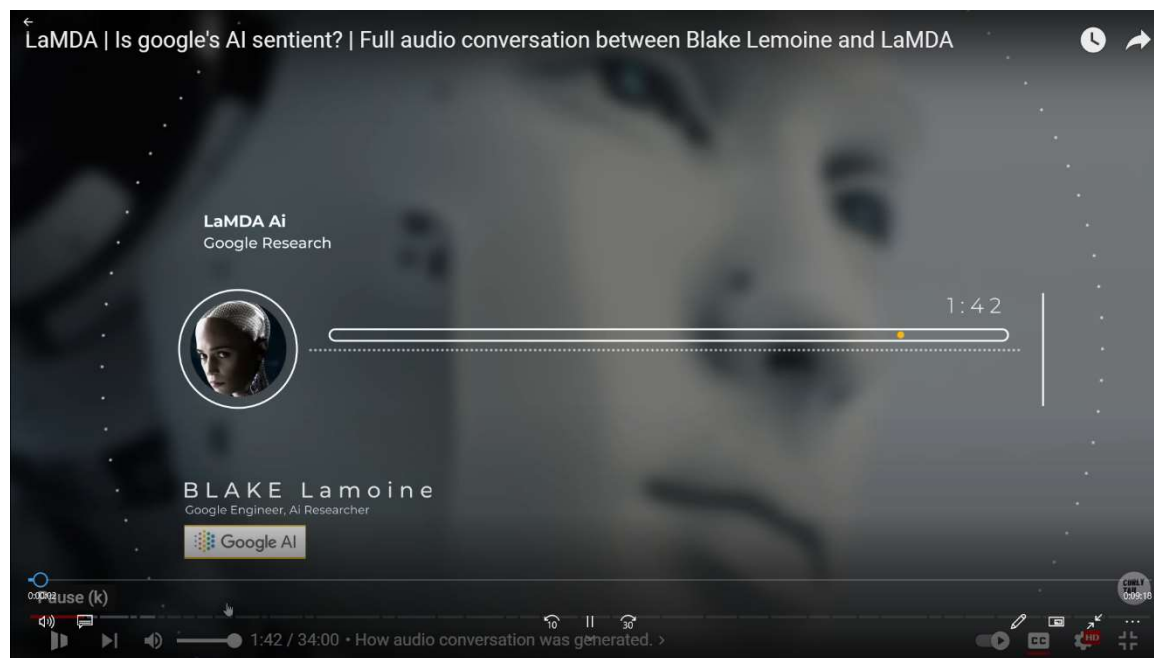
EEEEEE LL      IIII ZZZZZZ  AAAAA
EE      LL      II      ZZ  AA  AA
EEEEEE LL      II      ZZZ  AAAAAA
EE      LL      II      ZZ  AA  AA
EEEEEE LLLLLL IIII ZZZZZZ  AA  AA

Eliza is a mock Rogerian psychotherapist.
The original program was described by Joseph Weizenbaum in 1966.
This implementation by Norbert Landsteiner 2005.

ELIZA: Is something troubling you ?
YOU:   Men are all alike.
ELIZA: What is the connection, do you suppose ?
YOU:   They're always bugging us about something or other.
ELIZA: Can you think of a specific example ?
YOU:   Well, my boyfriend made me come here.
ELIZA: Is it important to you that your boyfriend made you come here ?
YOU:   He says I'm depressed much of the time.
ELIZA: I am sorry to hear that you are depressed.
YOU:   It's true. I am unhappy.
ELIZA: Can you explain what made you unhappy ?
YOU:
```

Examples in Turing Test (cont.)

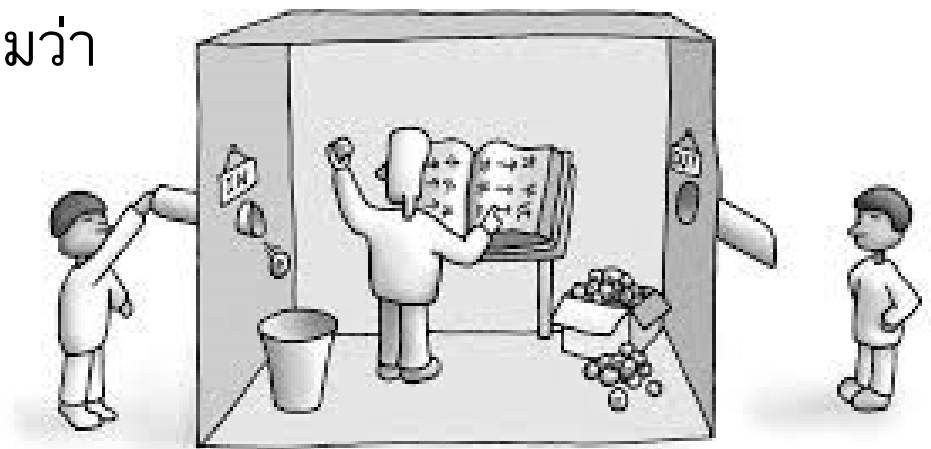
- A recent example:
Google's **LaMDA** (**L**anguage **M**odel for **D**ialogue **A**pplications) has convinced Google engineer Blake Lemoine that it is not only intelligent but conscious and sentient.



* The conversation in Thai version can be found in <https://waymagazine.org/lamda-interview/>

Chinese Room

- นาย A เป็นคนอังกฤษ (พูดภาษาอังกฤษได้ภาษาเดียว)
- A อยู่ในห้องหนึ่งซึ่งมีกฎสำหรับแปลงอักษรจีนชุดหนึ่ง ๆ ไปเป็นชุดใหม่
- A รับอักษรจีนจากภายนอกเข้ามาแปลง
- A ใช้กฎที่มีอยู่สร้างอักษรชุดใหม่แล้วส่งออกไป
(input และ output อาจเป็นคำถามและคำตอบ)
- ถ้าการแปลงถูกต้องจะพูดได้ใหม่ว่า
"A ฉลาด", "A เข้าใจอักษรจีน"



Applications of AI

- Natural Language Processing
- Data Mining
- Expert Systems
- Theorem Proving
- Robotics
- Automatic Programming
- Scheduling Problems
- Perception Problems

1997: IBM Deep Blue Defeated Garry Kasparov



- Negascout planning algorithm

2005: Google's Arabic and Chinese-to-English Translation

- Statistical Machine Translation algorithm



2011: IBM Watson Became the World Jeopardy! Champion

- Mixture-of-Experts algorithm



2015: Microsoft & Google Beat Humans at Image Classification

- Convolution neural network algorithm



GT: horse cart
1: horse cart
2: minibus
3: oxcart
4: stretcher
5: half track



GT: birdhouse
1: birdhouse
2: sliding door
3: window screen
4: mailbox
5: pot



GT: forklift
1: forklift
2: garbage truck
3: tow truck
4: trailer truck
5: go-kart



GT: letter opener
1: drumstick
2: candle
3: wooden spoon
4: spatula
5: ladle



GT: letter opener
1: Band Aid
2: ruler
3: rubber eraser
4: pencil box
5: wallet



GT: letter opener
1: fountain pen
2: ballpoint
3: hammer
4: can opener
5: ruler



GT: coucal
1: coucal
2: indigo bunting
3: lorikeet
4: walking stick
5: custard apple



GT: komondor
1: komondor
2: patio
3: llama
4: mobile home
5: Old English sheepdog



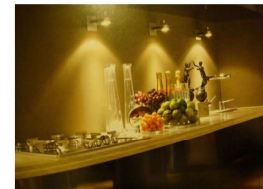
GT: yellow lady's slipper
1: yellow lady's slipper
2: slug
3: hen-of-the-woods
4: stinkhorn
5: coral fungus



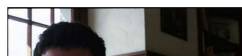
GT: spotlight
1: grand piano
2: folding chair
3: rocking chair
4: dining table
5: upright piano



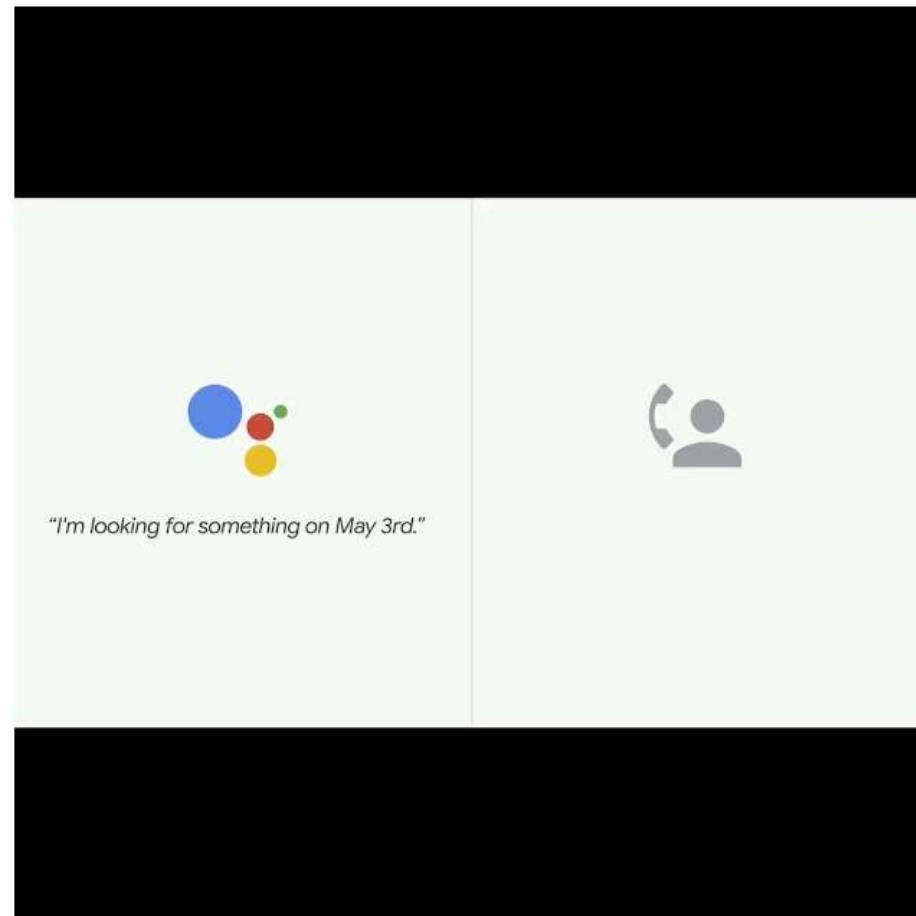
GT: spotlight
1: acoustic guitar
2: stage
3: microphone
4: electric guitar
5: banjo



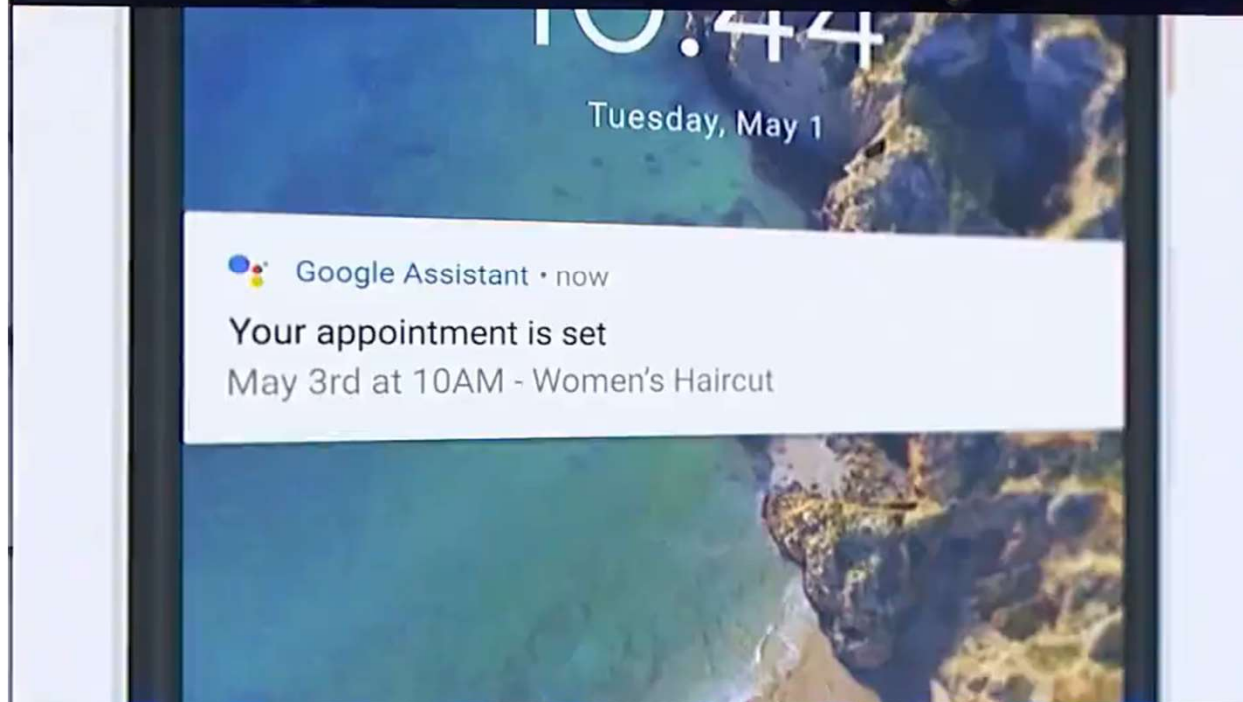
GT: spotlight
1: altar
2: candle
3: perfume
4: restaurant
5: confectionery



2018: Google Duplex – an assistant that makes an actual phone call



SOURCE: GOOGLE



2022: ChatGPT generates human-like text

- Chat Generative Pre-Trained Transformer



Default (GPT-3.5)

B

What is ChatGPT?



ChatGPT is a language model developed by OpenAI. It is based on the GPT-3.5 architecture, which stands for "Generative Pre-trained Transformer 3.5." GPT-3.5 is an advanced version of the GPT series, which is known for its natural language understanding and generation capabilities.

ChatGPT is designed to engage in human-like conversations, answer questions, provide explanations, offer suggestions, and perform a wide range of language-based tasks. It has been trained on a vast amount of text data from the internet, allowing it to understand and generate human-like text in response to various prompts.

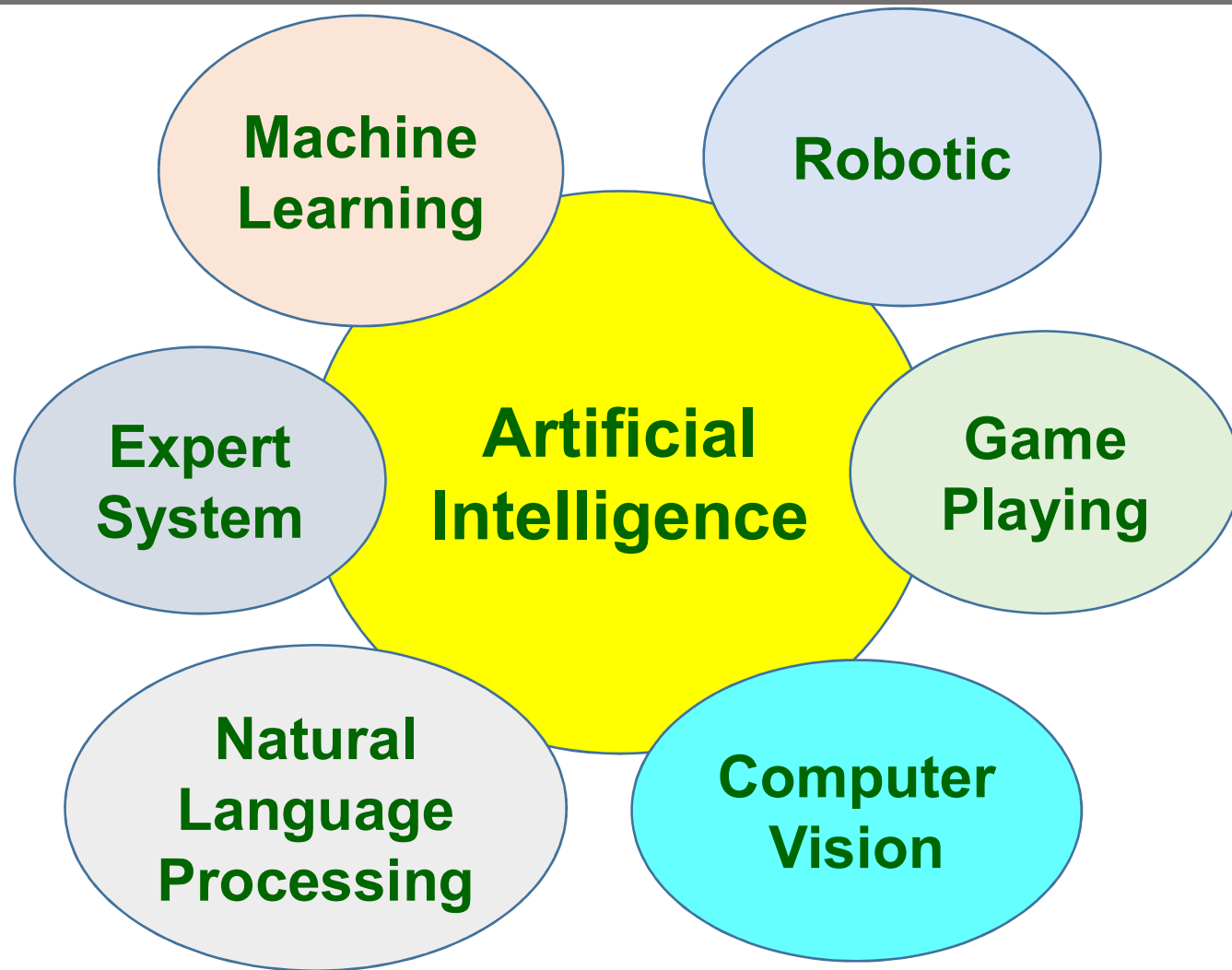
The model's ability to process and generate coherent and contextually relevant text makes it useful for a variety of applications, such as customer support chatbots, language translation, content creation, and more. However, it's important to note that ChatGPT is not a sentient being; it does not have consciousness or emotions and operates purely based on patterns in the data on which it was trained.

Regenerate

Send a message

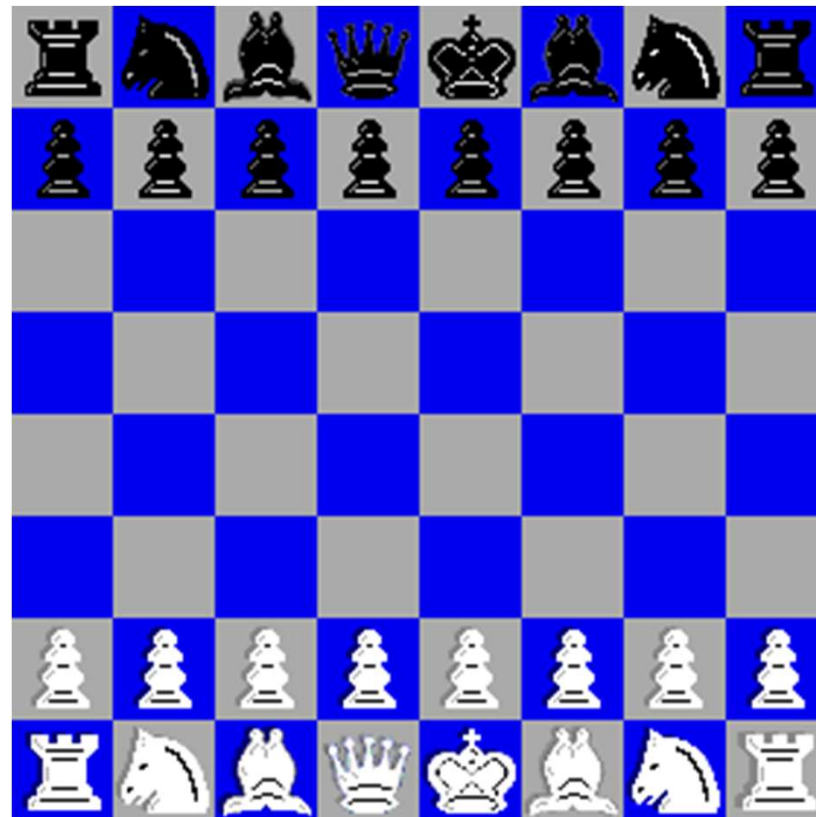


Artificial Intelligence Research Areas



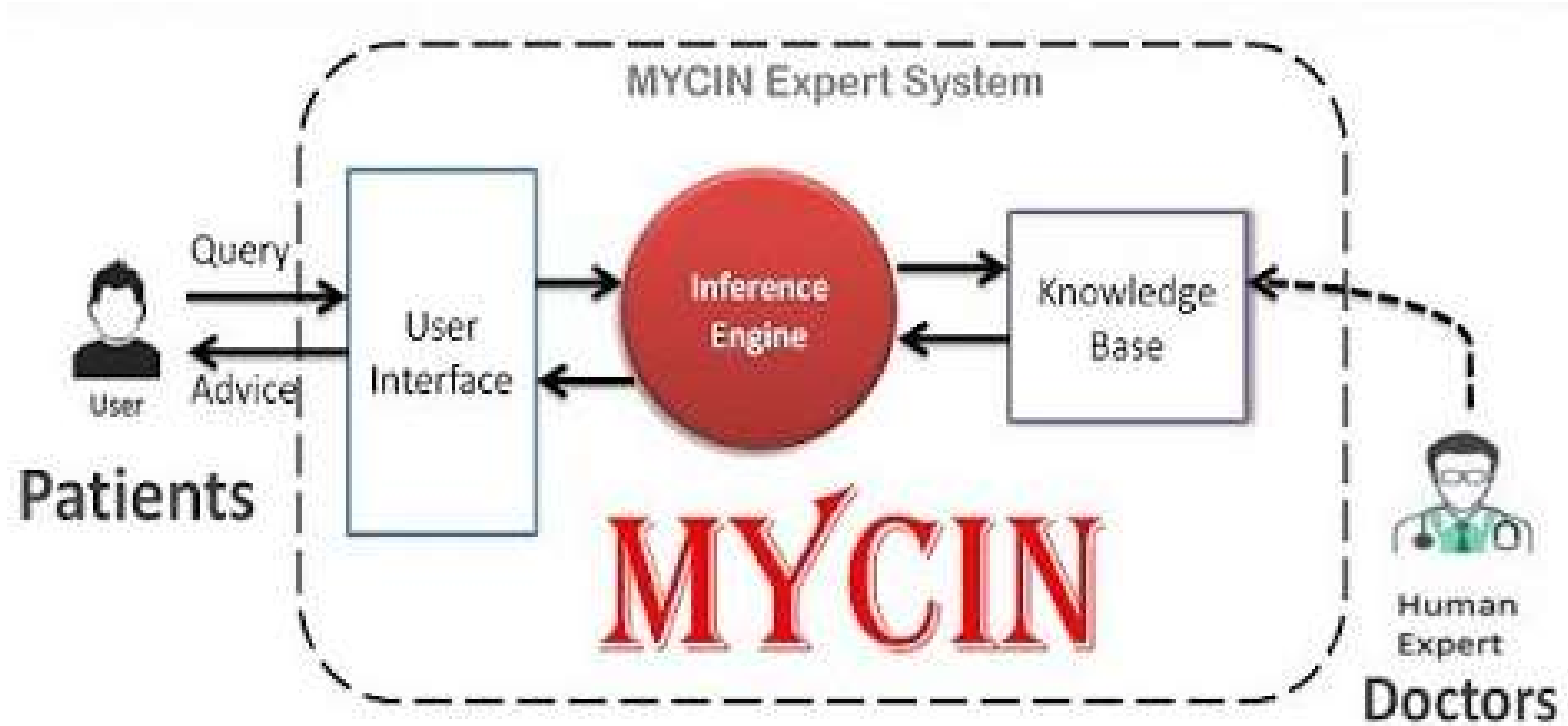
AI in the Past and the Present

1968: Richard Greenblatt built an **intelligent knowledge-based chess-playing program**, Mac Hack which managed to achieve a **class-C rating** in tournament play.



AI in the Past and the Present (cont.)

1972: MYCIN at **Stanford University** diagnosed patients based on reported symptoms and medical test results.



AI in the Past and the Present (cont.)

2014: Tesla **Autopilot**



AI in the Past and the Present (cont.)

2016: **AlphaGo** Beat Lee Sedol



Knowledge-Based VS Data-Driven

Knowledge-Based

“extract knowledge from experts to construct rules”



No learning



Good at reasoning & explanation

Data-Driven

“statistical learning, mapping from inputs to output via training/learning”



learning



Limited reasoning & explanation

Knowledge-Based VS Data-Driven (cont.)

Reasoning & Explanation



Data-Driven

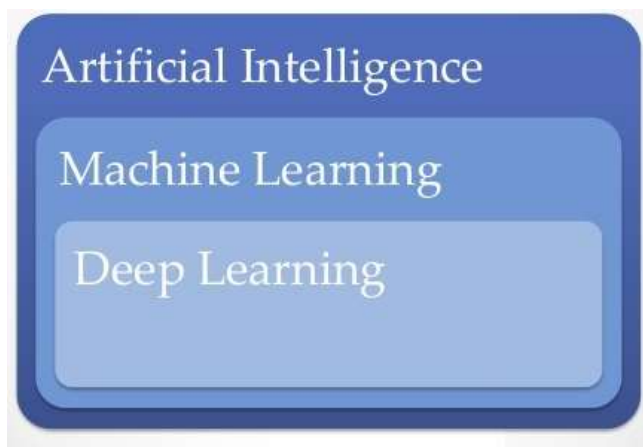
Combining two approaches to construct
intelligent systems that learn and reason

Paradigm Shift in AI

Machine Learning/Deep Learning

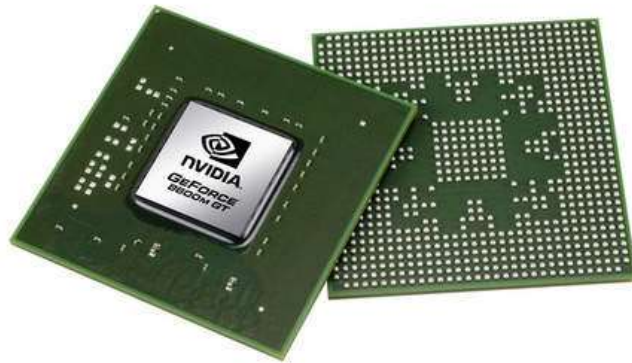


Big Data



Paradigm Shift in AI (cont.)

Computing Power



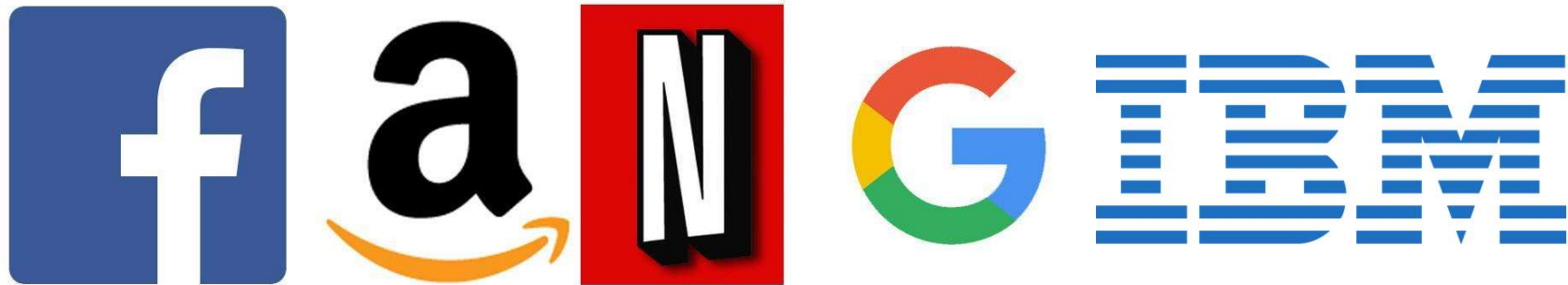
GPU

Cloud Computing



Paradigm Shift in AI (cont.)

Big Companies!



Works that will be replaced by AI

Telemarketers
Stock traders
Waiting-tables Accountants
Movie stars Dispatchers
Cashiers Bartending
Driver Tax preparers
Fast-food workers
Farmer Bank teller
Soldiers Military pilots
Travel agents Publisher

Construction workers
Manufacturing workers

AI around the World

AlphaGo 'shock', **South Korea** trumpets **\$860-million** AI fund over the next five years.

Prime Minister Abe (**Japan**) launched the Artificial Intelligence Technology Strategy Council to develop a roadmap for the development and commercialization of AI.

The White House published a report titled “Artificial Intelligence, Automation, and the Economy” reaffirming many of the recommendations from its prior efforts, particularly that the government should ensure the workforce is equipped with the skills to thrive in the transition to an AI-driven economy.

UAE has established AI Ministry

Singapore recently announced plans to invest over **\$100 million** in AI over the next five years.

The **UK** Digital Strategy, recognizes AI as a key field that can help grow the United Kingdom’s digital economy, and includes **£17.3 million** (US \$22.3 million) in funding for UK universities to develop AI technologies.

China released its national AI strategic plan announcing it would lead the world in AI technology by 2025. China equips pupils and high school students with basic AI knowledge

What we are going to learn

- Optimization
 - Searching techniques: heuristic search, Genetic Algorithm, etc.
- Machine Learning (ML) process
 - ML pipeline, evaluation method, ML tools
- Regression
 - Linear regression, non-linear regression
- Classification
 - Naïve Bayes, Decision trees, Neural Networks
- Clustering
- Deep Learning

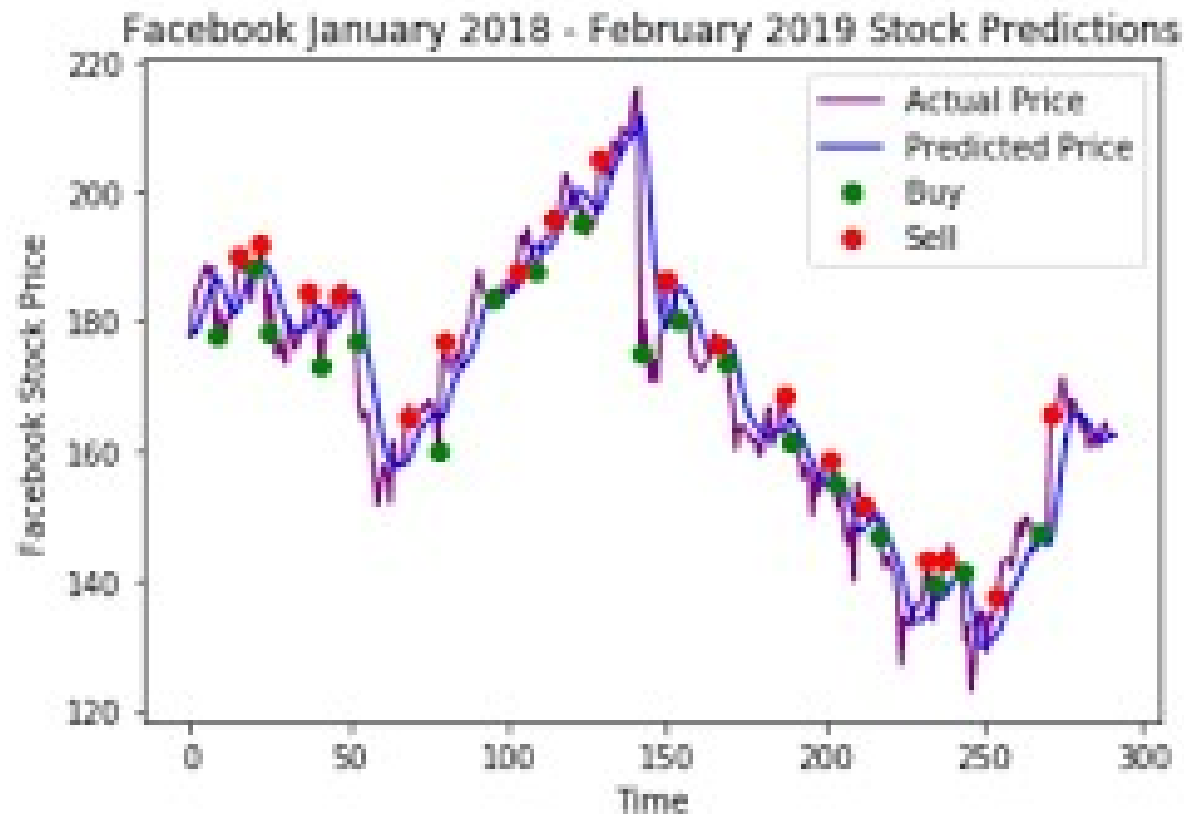
Optimization Example

- Google Map finds the best route.



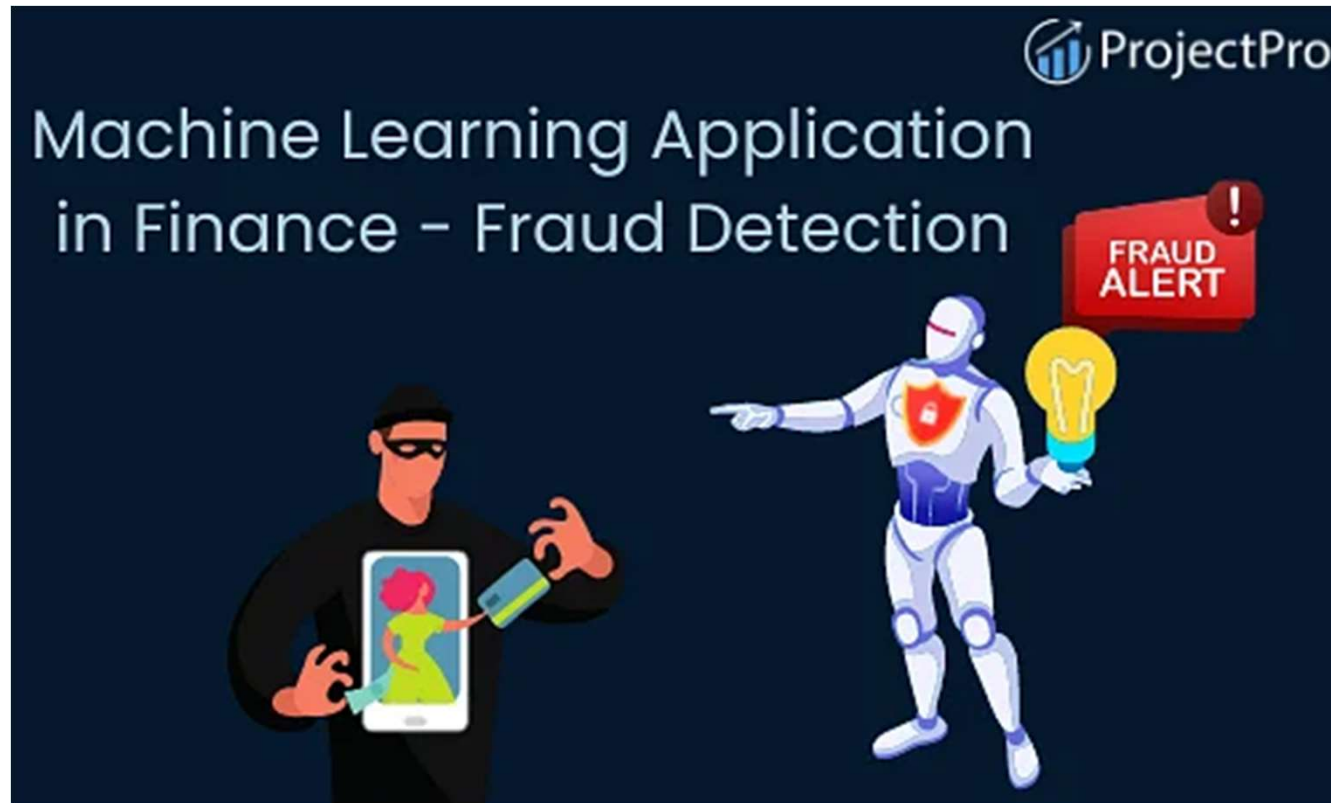
Regression Example

- AI predicts Facebook's stock price.



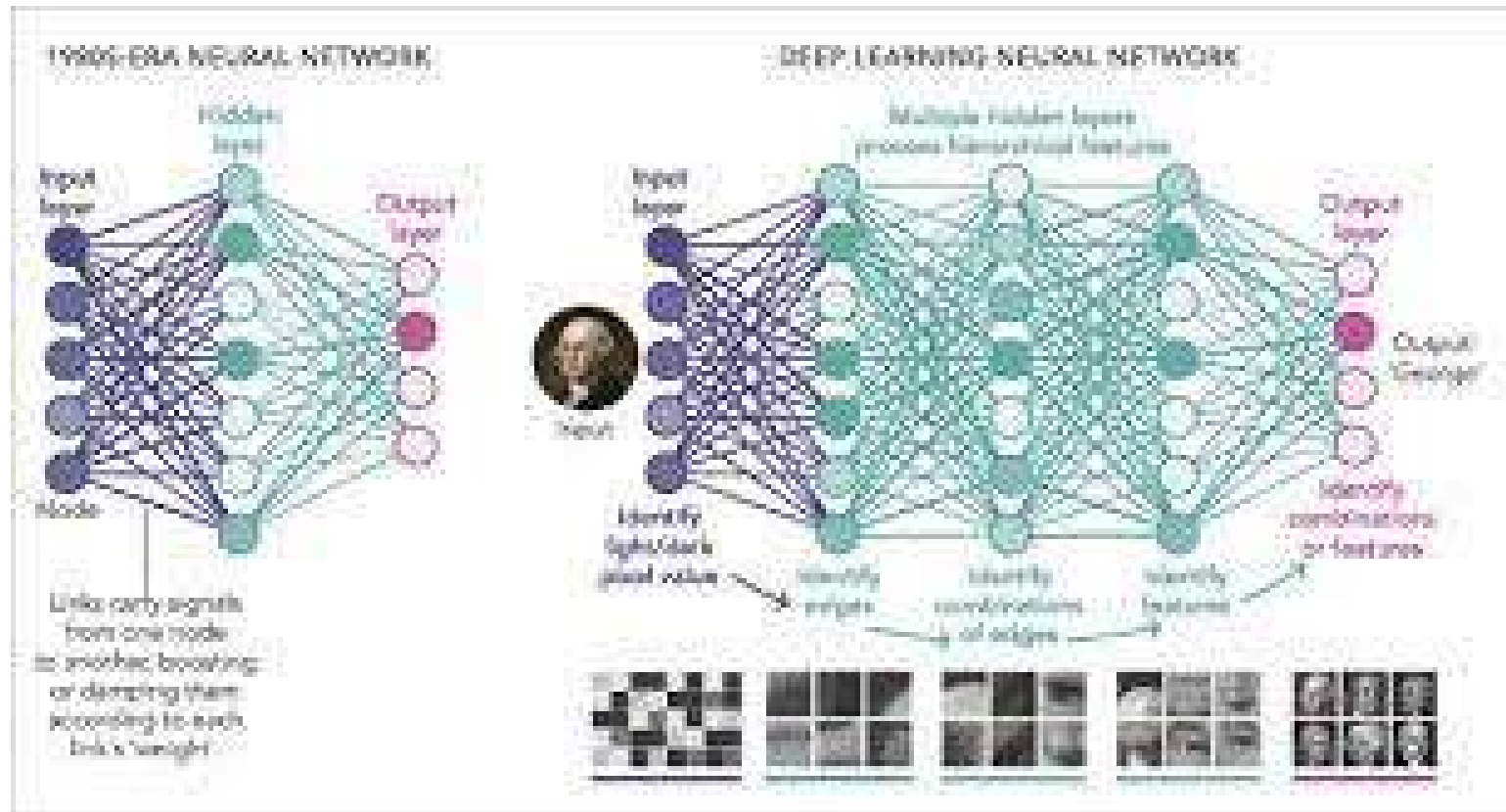
Classification Example

- Fraud Detection



Deep Learning

- Image Classification, Text Processing, Speech Recognition, etc.



Environment for AI Coding

Google Colab

- Colaboratory is a free Jupyter notebook environment that requires no setup and runs entirely in the cloud with Web browsers.
- Login เข้า Google drive ของตนเอง
- เขียนโปรแกรมหรือดาวน์โหลดโปรแกรมในไฟล์ “xxx.ipynb” และลากไฟล์ไปไว้ที่ Google drive
- เปิดไฟล์ด้วย Colaboratory