AI + Gender Data Lab Capacity Building Program

Unlocking AI

Concepts, History, and a new Tool for Governance

Shanghai Jiao Tong University

Aug 5–7, 2025

Kigali, Rwanda

Two Scenarios…

EICV7	Population who attended school in the past 12 months (%)				Population aged between 6 and 30 (000s)		
	Male	Female	Total	Gender Parity index	Male	Female	Total
Rwanda	60.3	59.0	59.7	0.98	3,386	3,587	6,973
Residence area							
Urban	58.1	53.9	55.9	0.93	956	1,079	2,036
Rural	61.2	61.2	61.2	1.00	2,430	2,508	4,938
Province							
City of Kigali	53.7	49.3	51.4	0.92	467	521	989
Southern	61.5	62.7	62.1	1.02	744	755	1,499
Western	63.2	60.9	62.0	0.96	734	786	1,520
Northern	61.1	59.2	60.2	0.97	521	551	1,072
Eastern	60.0	59.8	59.9	1.00	920	974	1,894
Quintile							
Q1	59.5	61.8	60.6	1.04	737	715	1,452
Q2	64.4	61.4	62.9	0.95	690	717	1,407
Q3	60.7	60.4	60.5	0.99	665	713	1,378
Q4	60.0	58.8	59.4	0.98	660	699	1,359
Q5	56.7	53.1	54.8	0.94	634	743	1,377
5 year age group							
6-9	95.8	96.6	96.2	1.01	696	697	1,392
10-14	94.9	96.5	95.7	1.02	805	814	1,619
15-19	58.6	62.4	60.5	1.06	785	815	1,600
20-24	22.5	19.7	21.0	0.88	581	660	1,241
25-30	4.2	3.6	3.9	0.84	519	602	1,122
Disability status							
Without disability	60.6	59.2	59.9	0.98	3,344	3,548	6,891
With disability	39.5	41.6	40.5	1.05	42.75	39	82

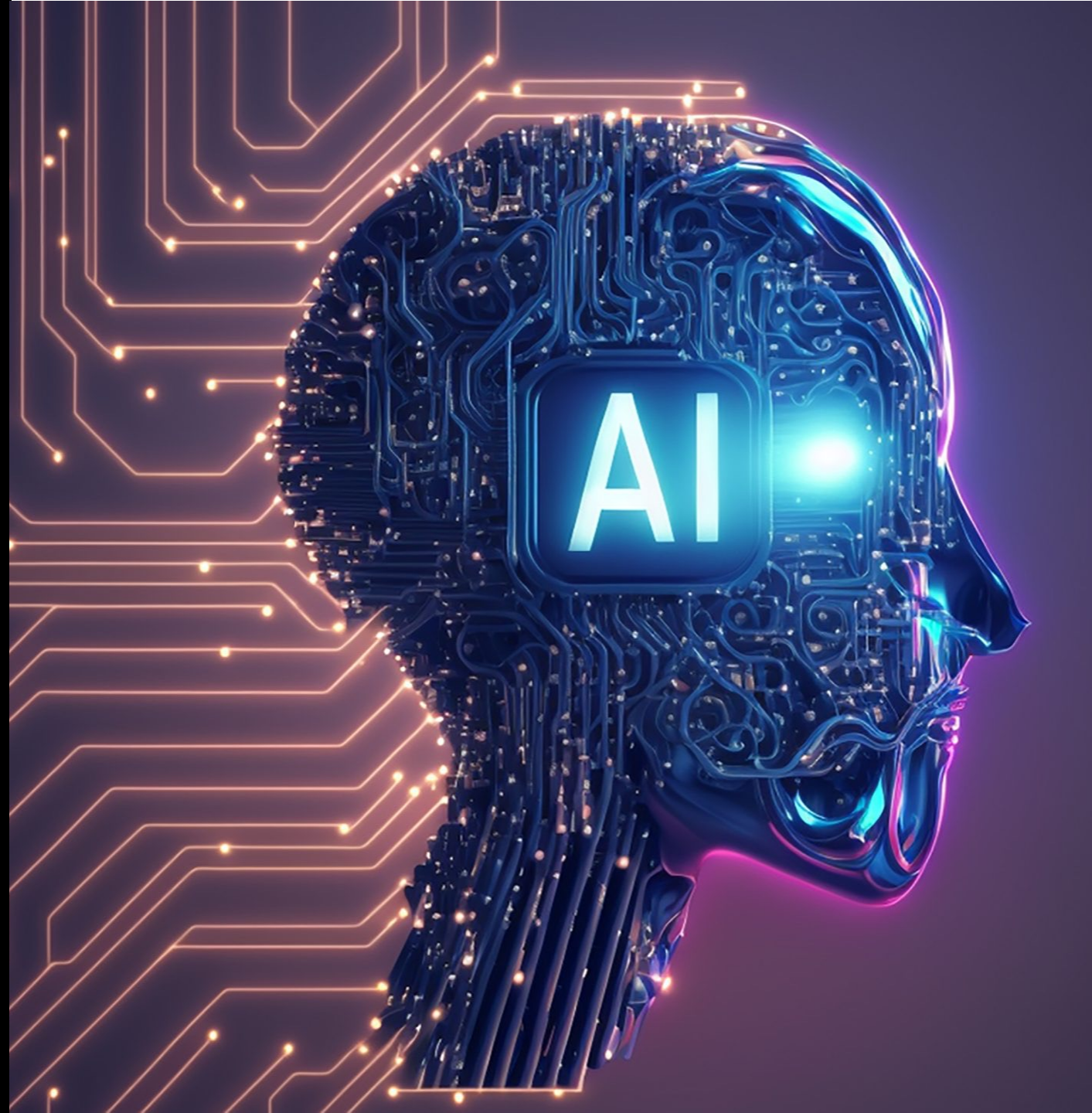
Source: NISR, EICV7

What We Will Explore

- What is Artificial Intelligence (AI)?
- A Brief History of AI
- The State of the Art
- Discussion

What is AI?

- Concepts and Definitions
- The Foundations of AI

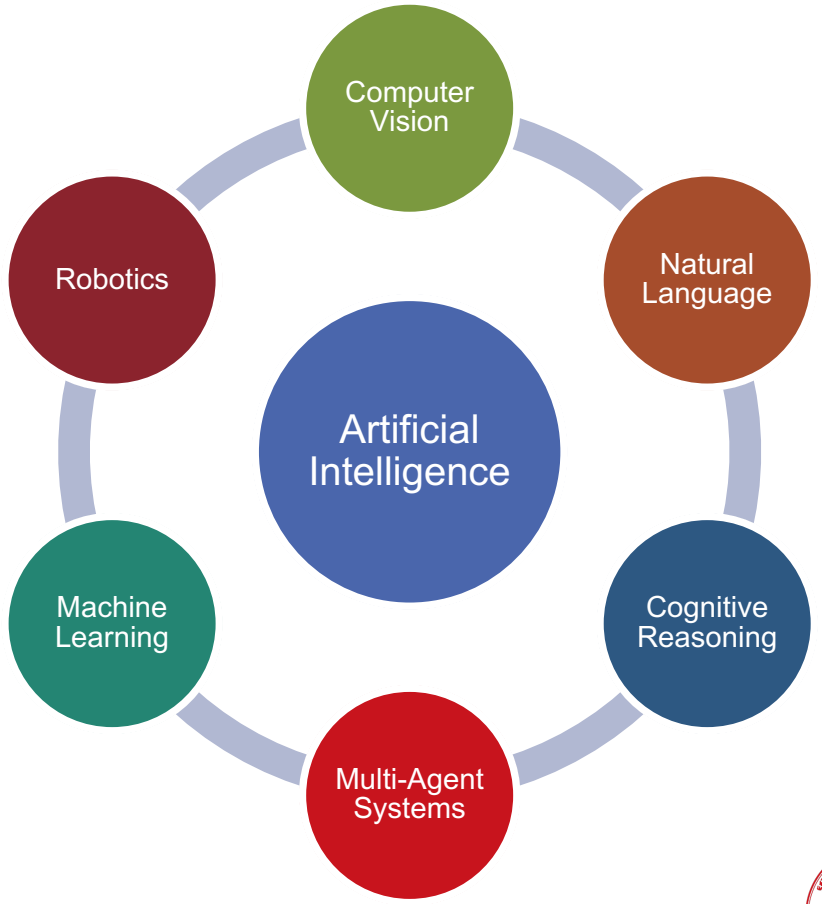


Starting with Human Intelligence

- Human intelligence
- *Homo sapiens* -- “Man the wise”
- Gardner's Theory: Multiple Intelligences

Starting with Human Intelligence

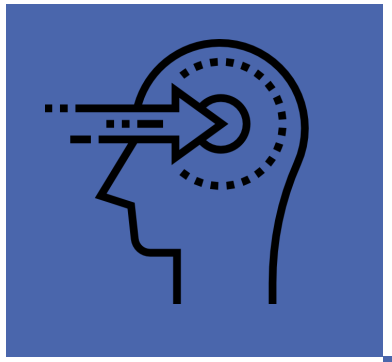
- AI can be seen as the scientific endeavor to **simulate**, **extend**, and **expand** some of these human intellectual capabilities using machines.

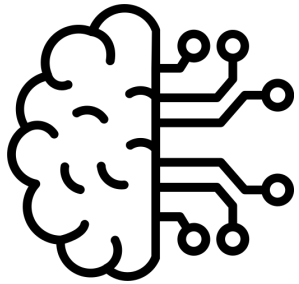


A Simple Definition of AI

- A simple way to think about AI is as the study of **agents** that receive percepts from the environment and perform actions.

Perception





Learning

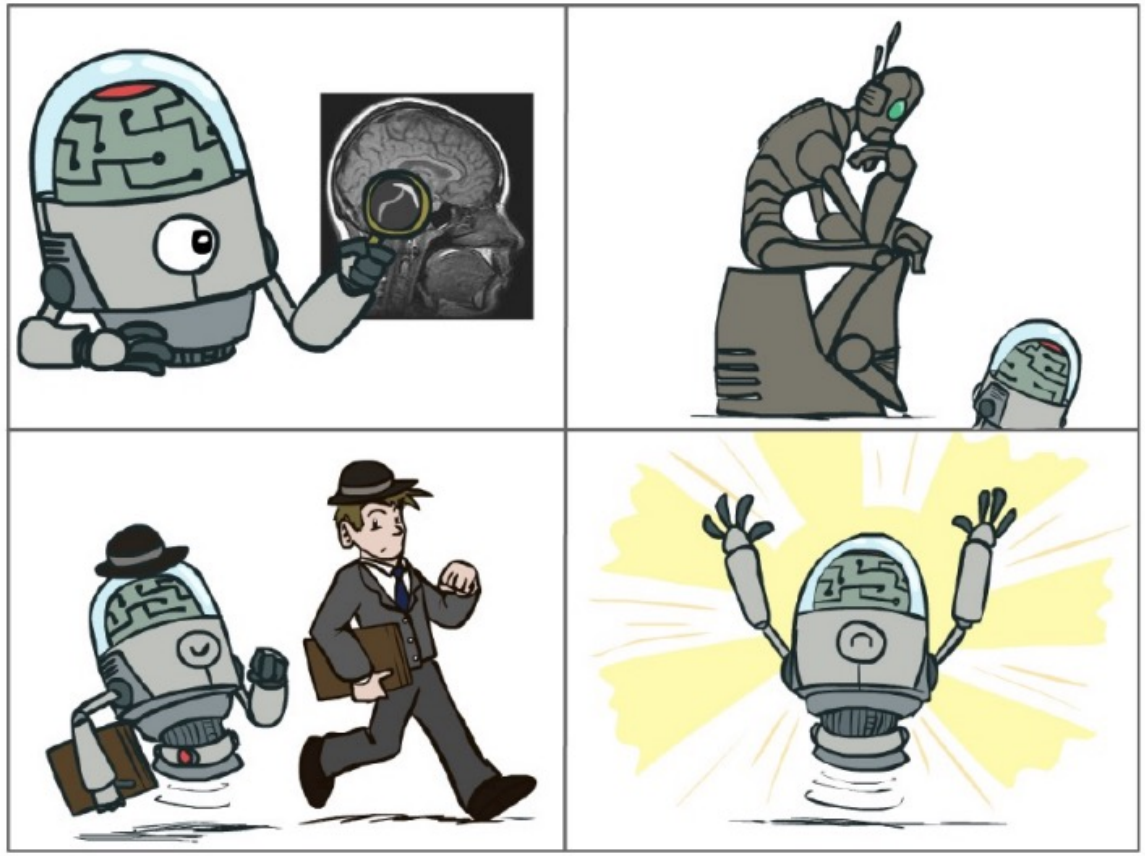
Reasoning

Action

Four Approaches of AI

- Historically, researchers have pursued several different versions of AI.
- Human vs. Rational; Thought vs. Behavior

Thinking humanly
(cognitive modeling)



Thinking rationally
(logic and probability)

Acting humanly
(Turing test)

Acting rationally
(rational agent)

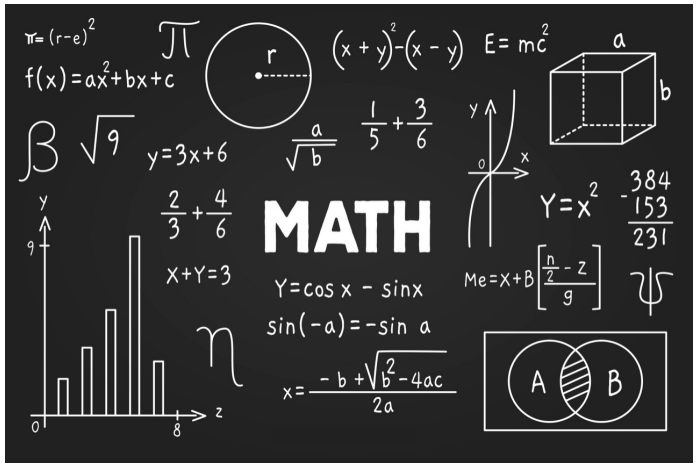
The Foundations of AI

Philosophy (since ~400 BCE)

- Made AI conceivable by suggesting that the mind is in some ways like a machine.
- Knowledge is encoded in some internal language

Mathematics (since ~800 CE)

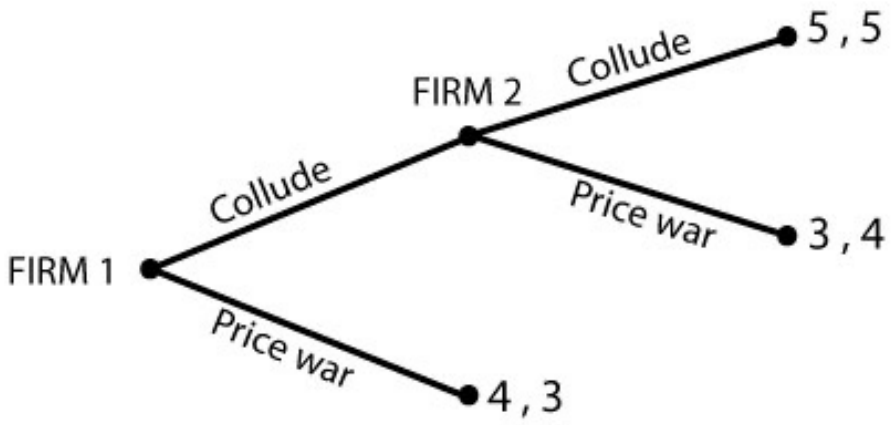
- Provided the tools to understand logical certainty and uncertainty
- Probabilistic statements
- Set the groundwork for computation



The Foundations of AI

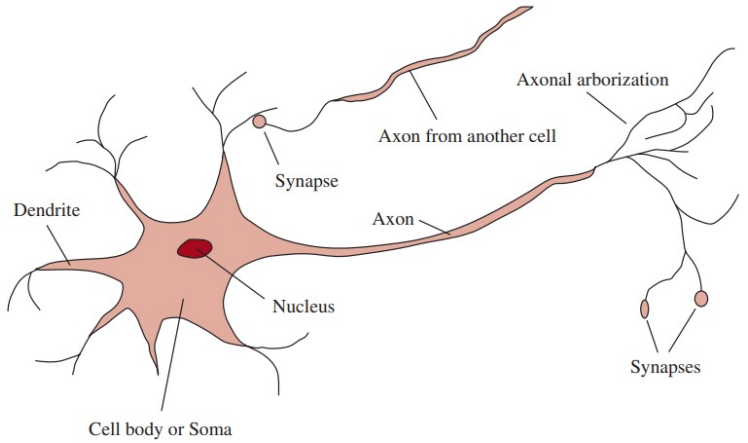
Economics (since ~1776)

- Formalized the problem of making decisions
- To maximize the expected utility



Neuroscience (since ~1861)

- Discovered facts about how brain works
- Similarity between human brain and computers.



The Foundations of AI

	Supercomputer	Personal Computer	Human Brain
Cycle time	10^{-9} sec	10^{-9} sec	10^{-3} sec
Storage Units	10^{16} byte RAM	10^{10} byte RAM	10^{11} nuerons

Even with a computer of virtually unlimited capacity, we still require further conceptual breakthroughs in our understanding of intelligence.

Crudely put, without the right theory, faster machines just give you the wrong answer faster!

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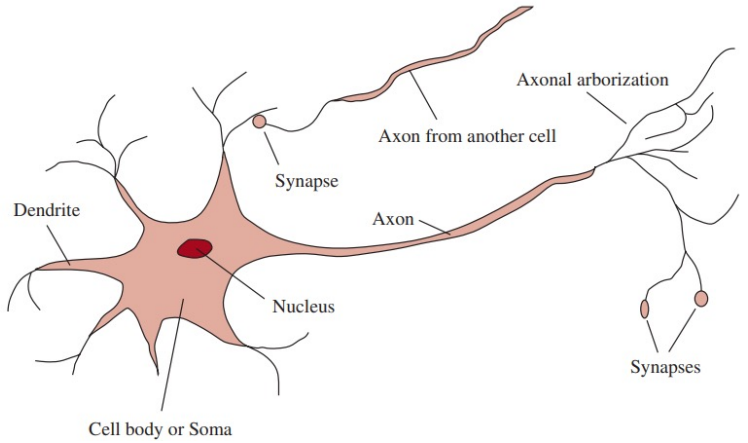
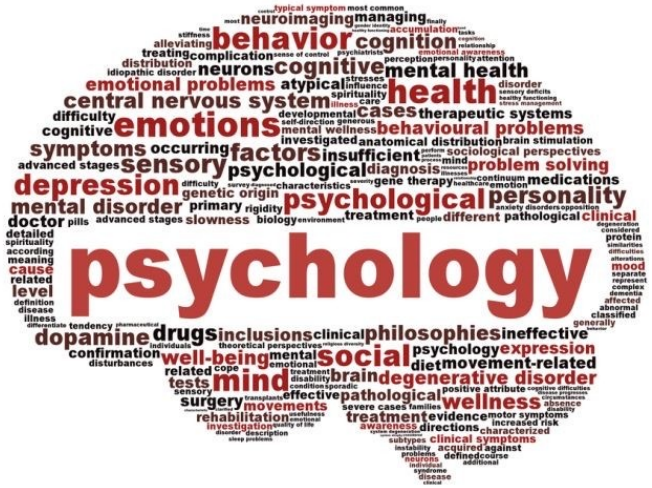


The Foundations of AI

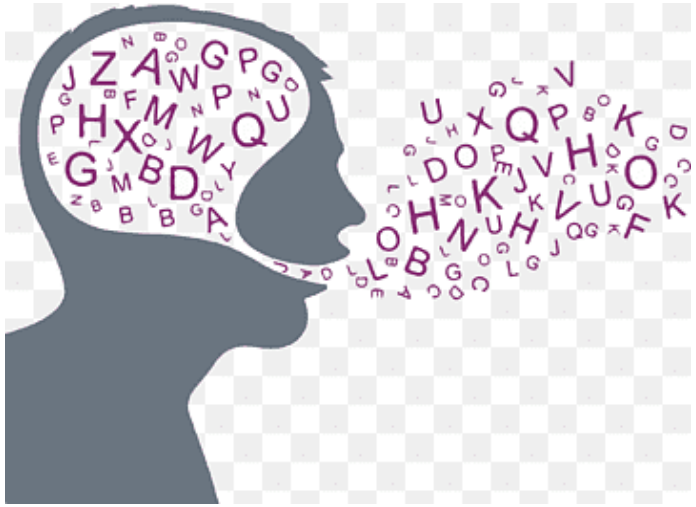
Psychology (since ~1879)

- Adopted the idea that humans can be considered information processing machines



Linguistics (since ~1957)

- Natural Language Processing



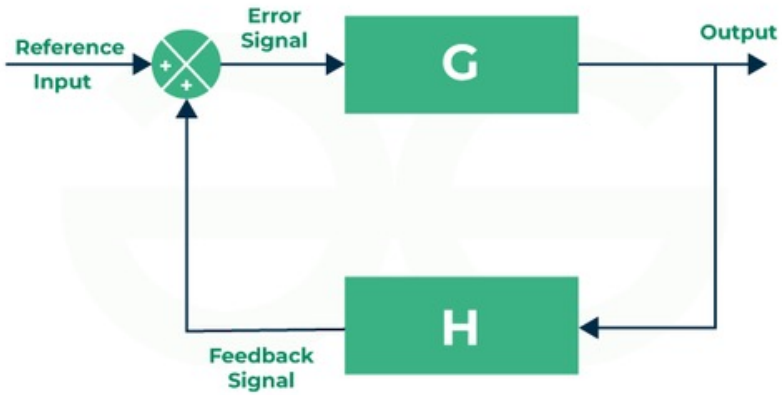
The Foundations of AI

Computer Engineering (since ~1940)

- Provided ever-more-powerful machines (Hardware)
- Made AI applications possible (Software)

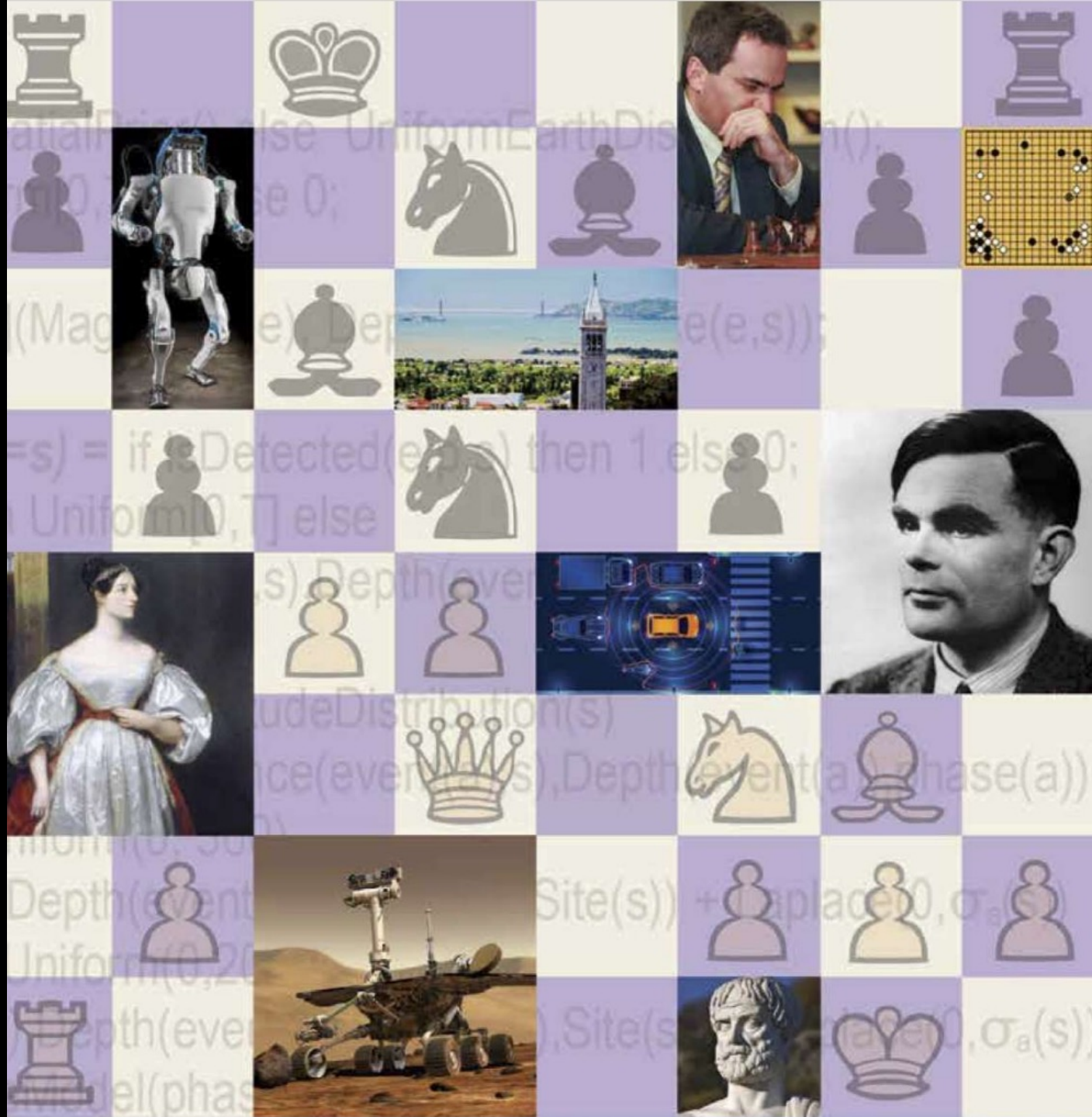
Control Theory (since ~1948)

- Act optimally on the **feedback** from the environment
- Positive feedback vs negative feedback

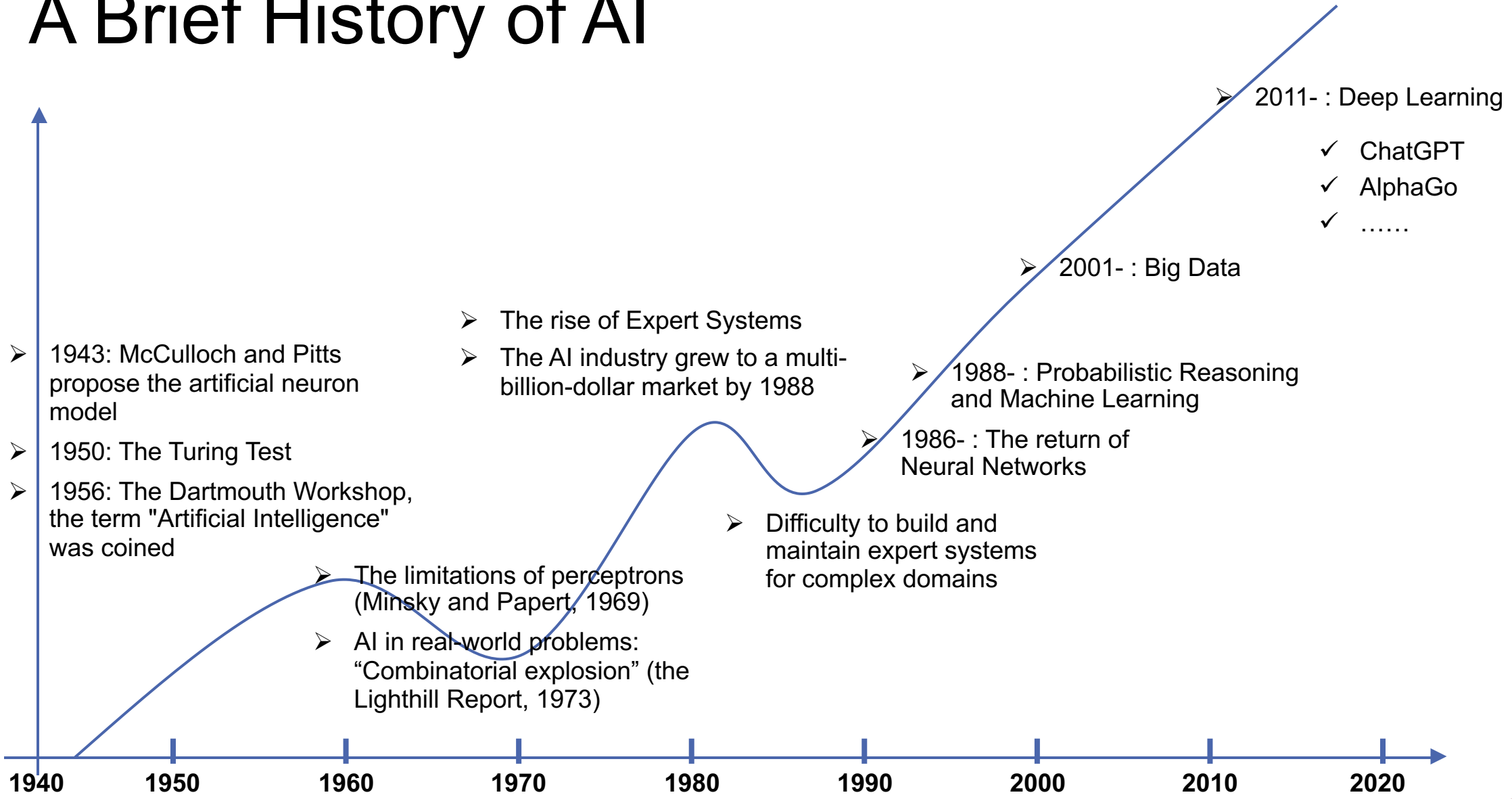


A Brief History of AI

- The Inception of AI & Early Enthusiasm
- From Expert Systems to Machine Learning
- The Deep Learning Revolution
- AI in China



A Brief History of AI



AI in China

Chinese Tech Firms Vie for Dominance in Large AI Models

Company	Large Model	Company	Large Model
Baidu	Wenxin Yiyan	NetEase	Fuxi
Alibaba	Tongyi Qianwen, M6	JD.com	ChatJD
Tencent	Hunyuan	CloudWalk	Hangye Jingling
Huawei	Pangu	Langboat	MChat
SenseTime	SenseNova, SenseChat	Inspur	Yuan 1.0
Kunlun Tech	Tiangong 3.5	Haomo.AI	DriveGPT
Zhihu	Zhihaitu AI	Data Grand	Cao Zhi
Iflytek	Iflytek Spark	Mobvoi	Xulie Houzi
360	360 Zhinao		

Note: Information accurate as of May 2
Source: Public information compiled by Caixin

Caixin

The State of the Art

- NLP & How it works
- Computer Vision
- Multimodality
- Cognitive Reasoning
- AI + X

The State of Art

Standard University's One Hundred Year Study of AI (a.k.a. AI100)

- **Publications**: AI papers increased 20-fold between 2010 and 2019 to about 20,000 a year. The most popular category was machine learning.
- **Sentiment**: About 70% of news articles on AI are neutral, but articles with positive tone increased from 12% in 2016 to 30% in 2018.
- **Students**: Course enrollment increased 5-fold in the U.S. and 16-fold internationally from a 2010 baseline. AI is the most popular specialization in Computer Science.
- **Diversity**: AI Professors worldwide are about 80% male, 20% female. Similar numbers hold for Ph.D. students and industry hires.
- …

Natural Language Processing (NLP)

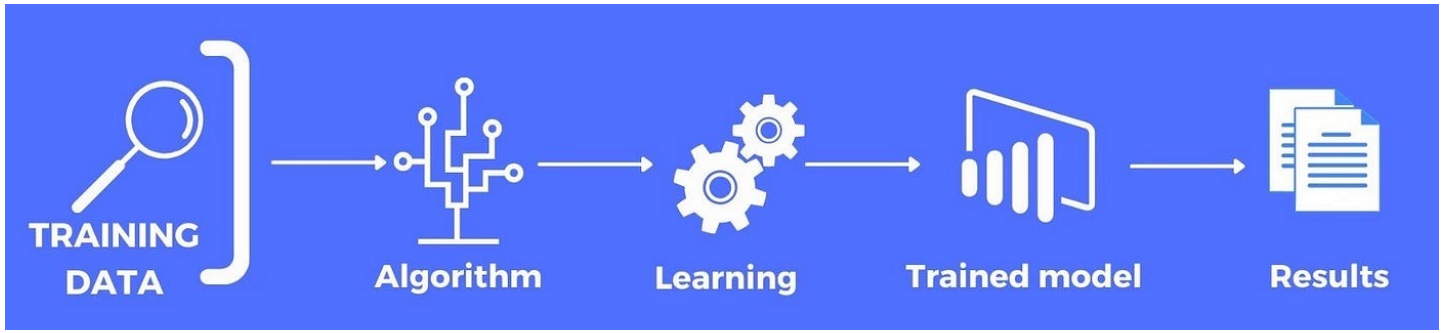
- Natural Language Processing, or NLP, is the capability of a computer program to understand, interpret, and generate human language.
- The **core** technology behind the generative AI tools
- Perhaps, the most directly applicable technology for your daily work

HOW does NLP work?

Natural Language Processing (NLP): How it works

How does a machine “understand” and “write” language?

- The Core Principle: A Super-Powered **“Next-Word Predictor”**
- An incredibly powerful system for predicting the next most likely word in a sentence.
- TRAINING: It has been **trained** on a vast library of text and books from the internet.
  - The training set is of utmost importance!



Natural Language Processing (NLP): How it works

- How it learns: “You Shall Know a Word by the Company It Keeps”.
  - Linguistics: meaning that words with *similar* meanings tend to appear in similar sentences and contexts.
  - Calculate the distance of similarity

- The Generation Process
  - e.g., The most important export product for Rwanda is ... ?
  - Based on countless economic reports, news articles, and websites it has read, the word “coffee” might have a very high probability.

Natural Language Processing (NLP): How it works

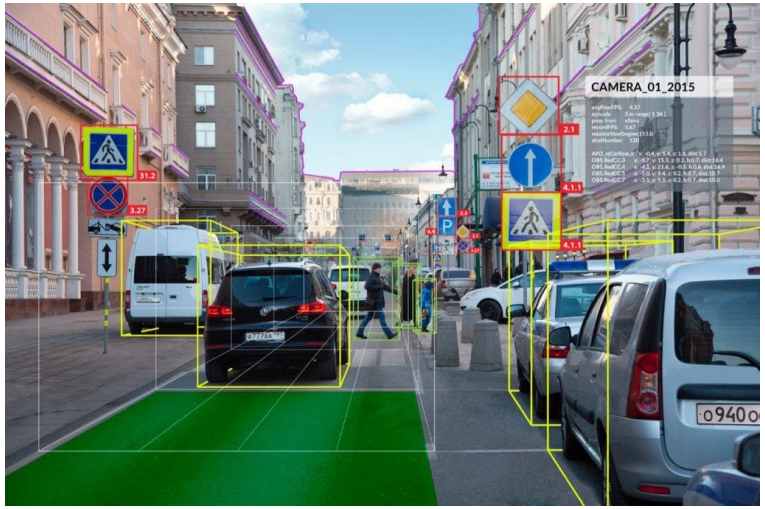
- Plausible, Not Necessarily Factual
  - This is the most critical takeaway!
  - AI's goal is to create a statistically probable sequence of words >> plausible
  - It is designed to *sound* correct and fluent.

However, the AI has no internal database of facts!

Hallucinate: AI can invent facts, figures, and sources that are completely false

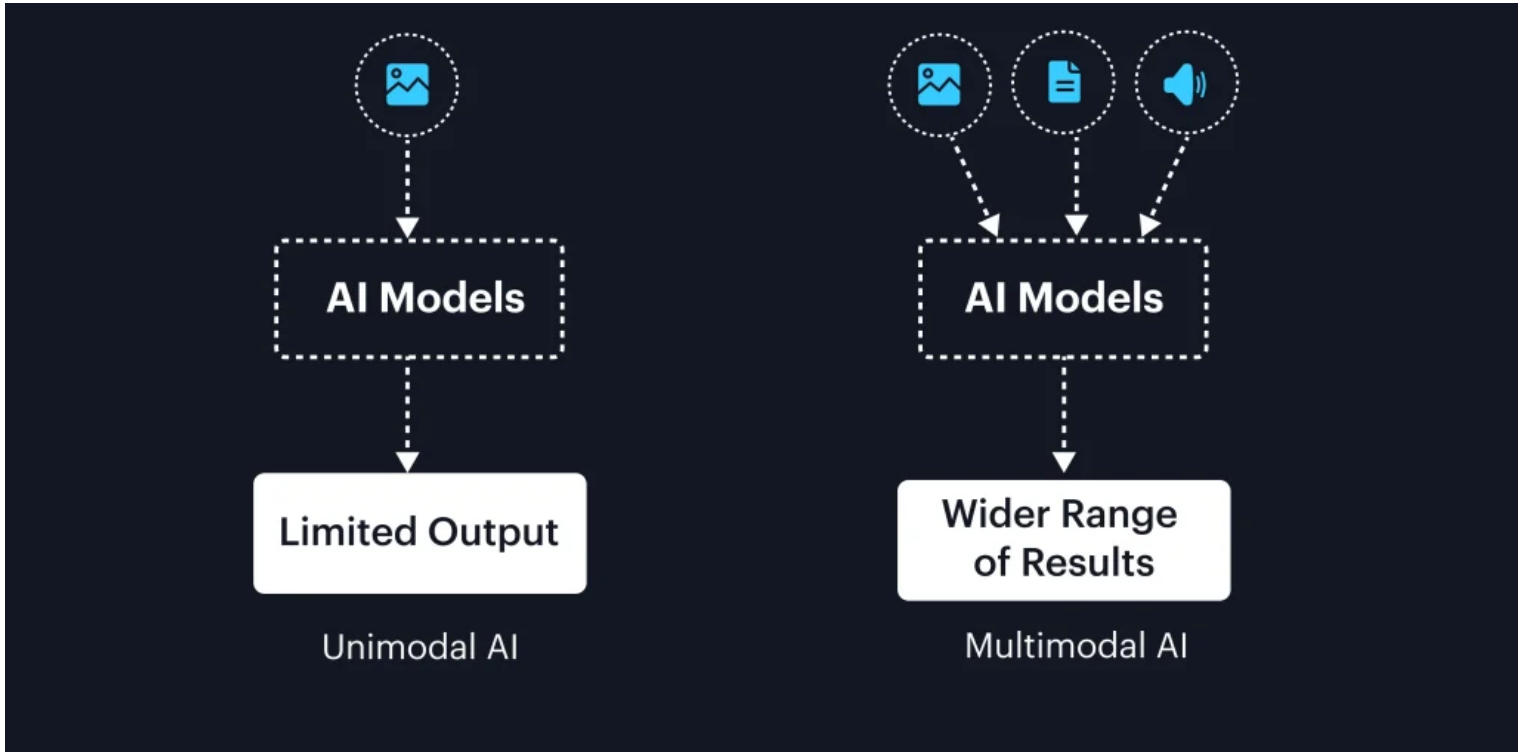
Computer Vision

- Computer Vision is the field of AI that trains computers to interpret and understand the visual world.
- Using digital images from **cameras** and **videos**, machines can accurately identify and classify objects — and then react.
- Automated Driving



Multimodality

- The most advanced AI systems are now multimodal, meaning they can understand and process information from multiple types of data at once.
- Including **text**, **images**, **audio**, and **video**.



Cognitive Reasoning & Strategy

- AI has achieved superhuman performance in games of complex strategy, like Chess and Go.
- DeepMind's **AlphaGo** defeated the world's best Chess player in 2016.
- This showed that AI could master tasks requiring deep, intuitive, and strategic reasoning.

Discussion

- Based on the AI capabilities we just discussed, what is ONE specific, time-consuming, or difficult task in your work with the EICV7 data, and how could an AI tool assist you?

Thank you!

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