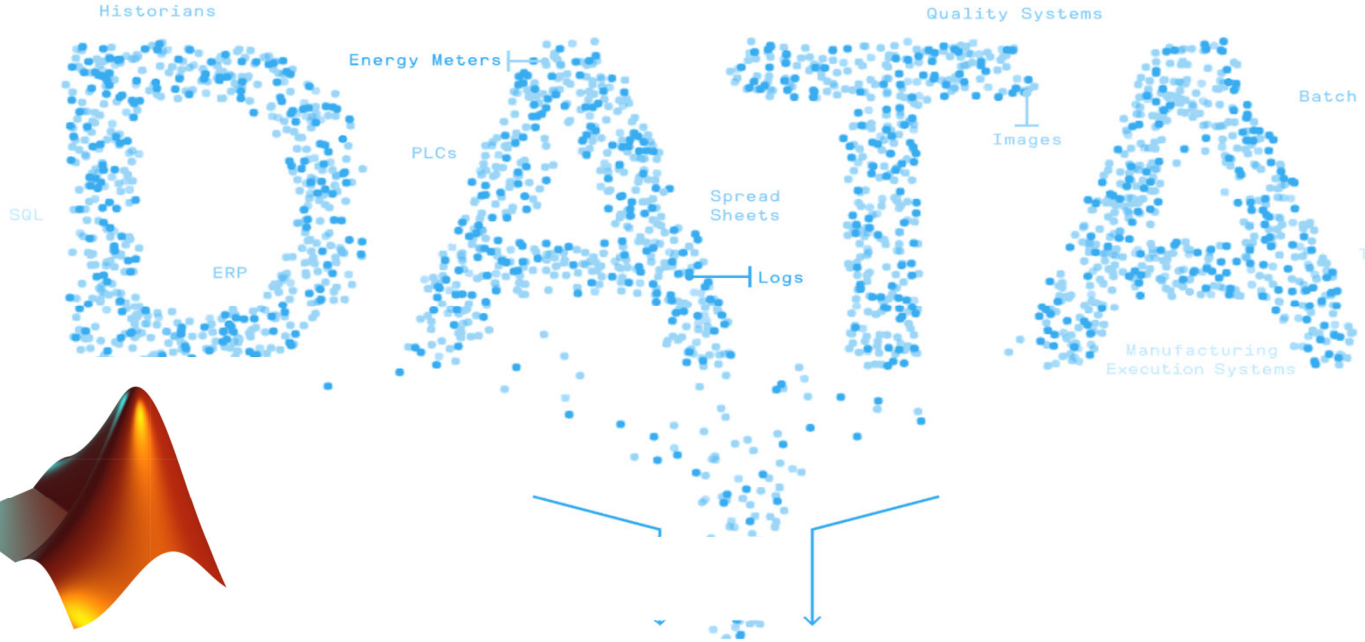
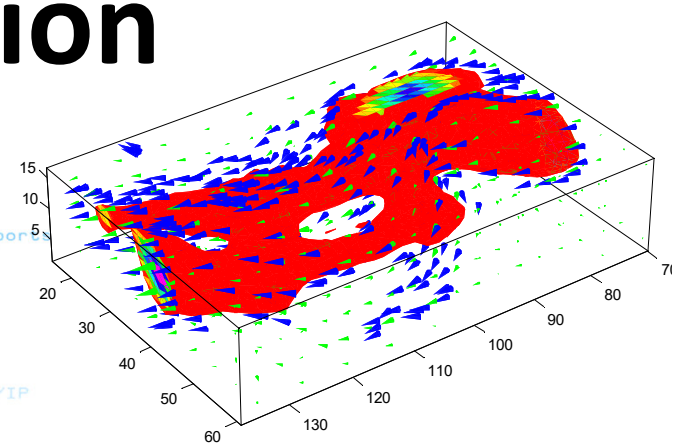
Introduction to Artificial Intelligence

- 01-02 An Introduction





Dr Leo Chen
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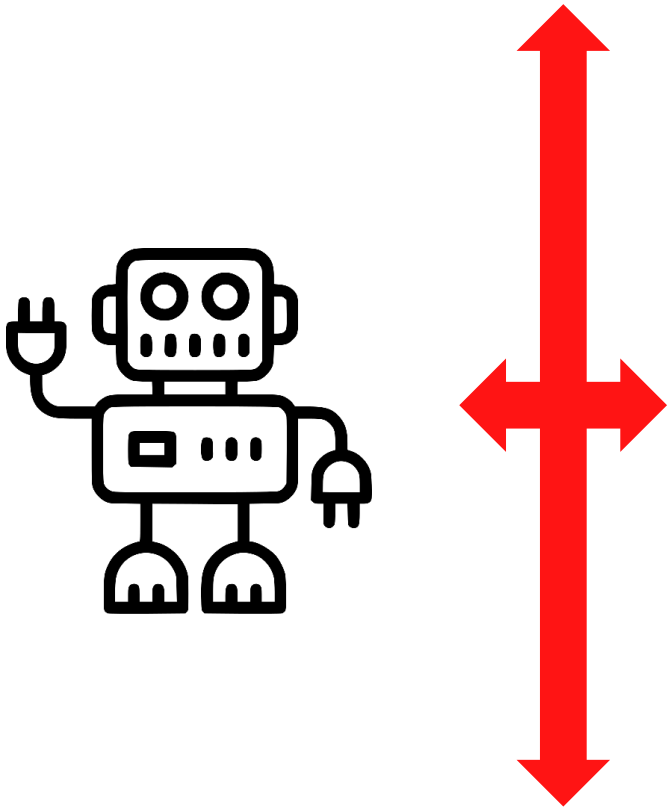
21/Feb/2024

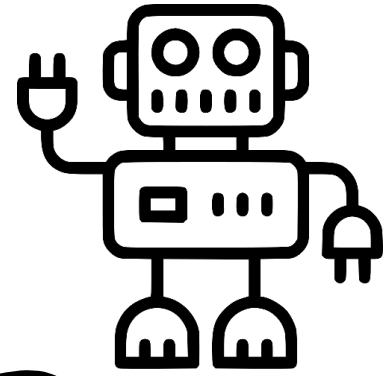
Module Contents

1. Introduction
2. Evolutionary Computation
3. Artificial Neural Network
4. Fuzzy Logic and Fuzzy Systems
5. More AI Subsets
6. AI and Industry 4.0
7. AI Applications
8. Labs
9. Courseworks



Chapter Contents

1. Definition of Artificial Intelligence
2. History of Artificial Intelligence
3. Key Drivers and Enablers
4. Related Concepts
5. National Importance and Strategies
6. Applications
7. AI Ethics

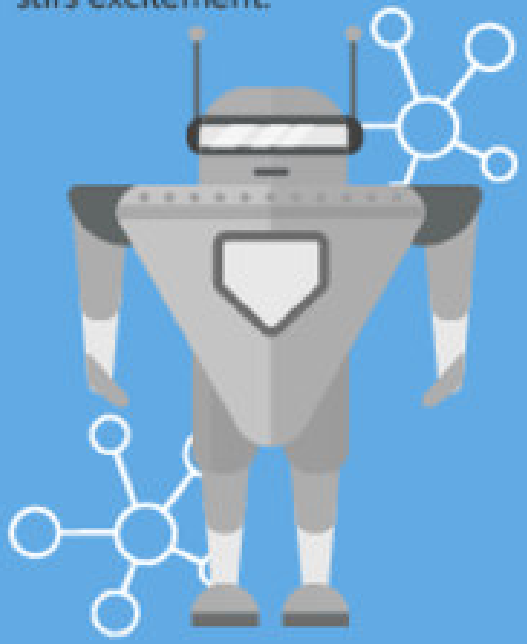


- Class Discussions
- Reading List
- FAQ
- Appendix
- Reference

Timeline of AI

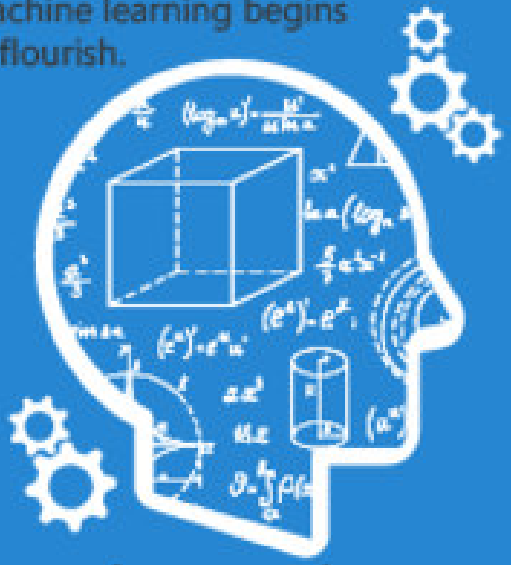
ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.



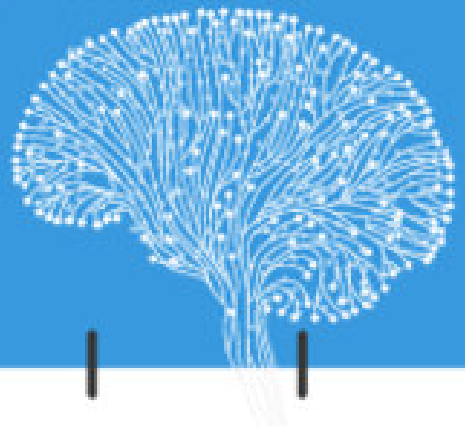
MACHINE LEARNING

Machine learning begins to flourish.



DEEP LEARNING

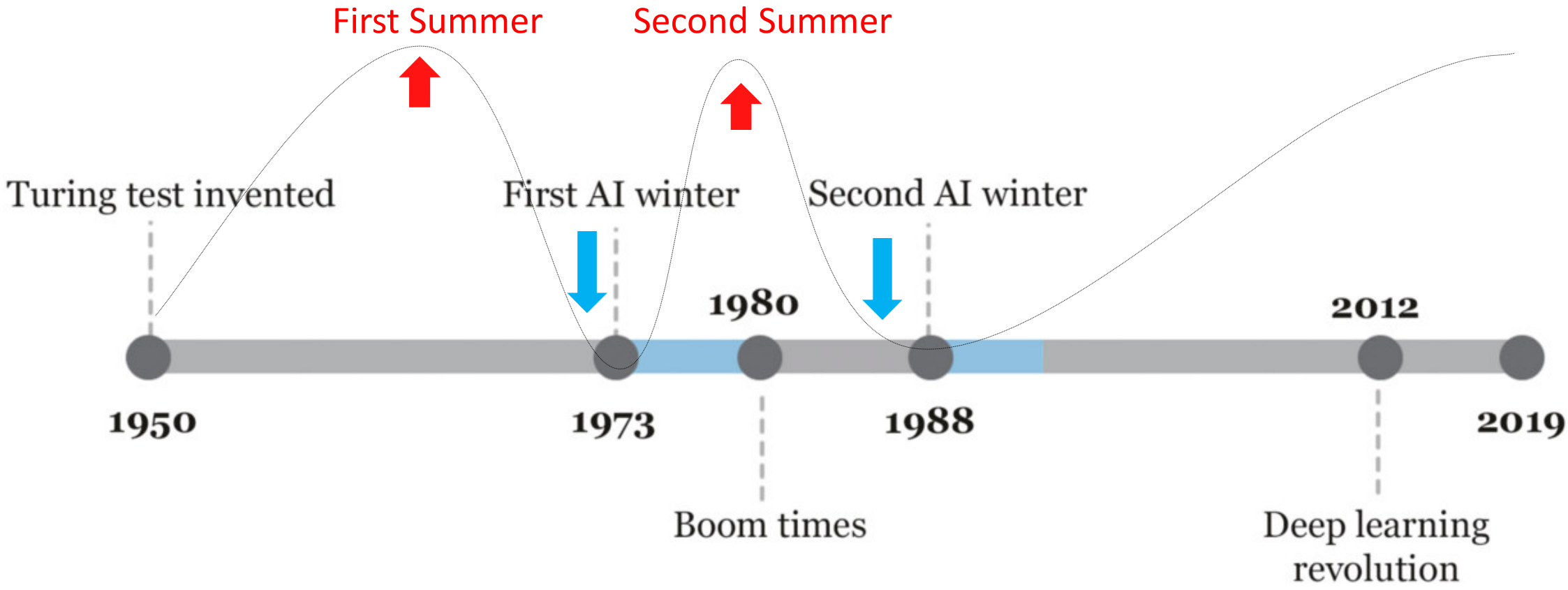
Deep learning breakthroughs drive AI boom.



1950's 1960's 1970's 1980's 1990's 2000's 2010's

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

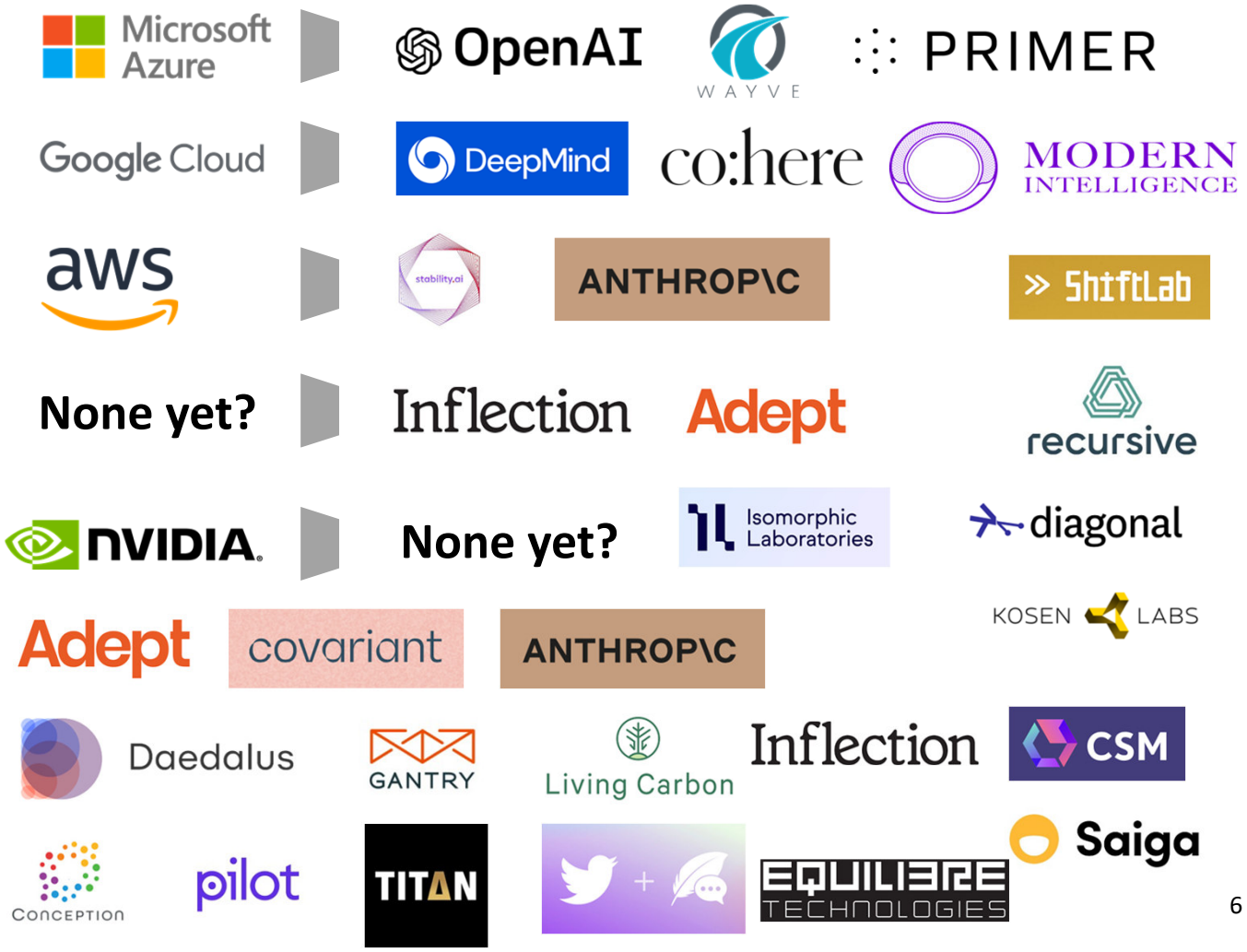
Summers and Winters of AI



2. History of Artificial Intelligence [5-12]

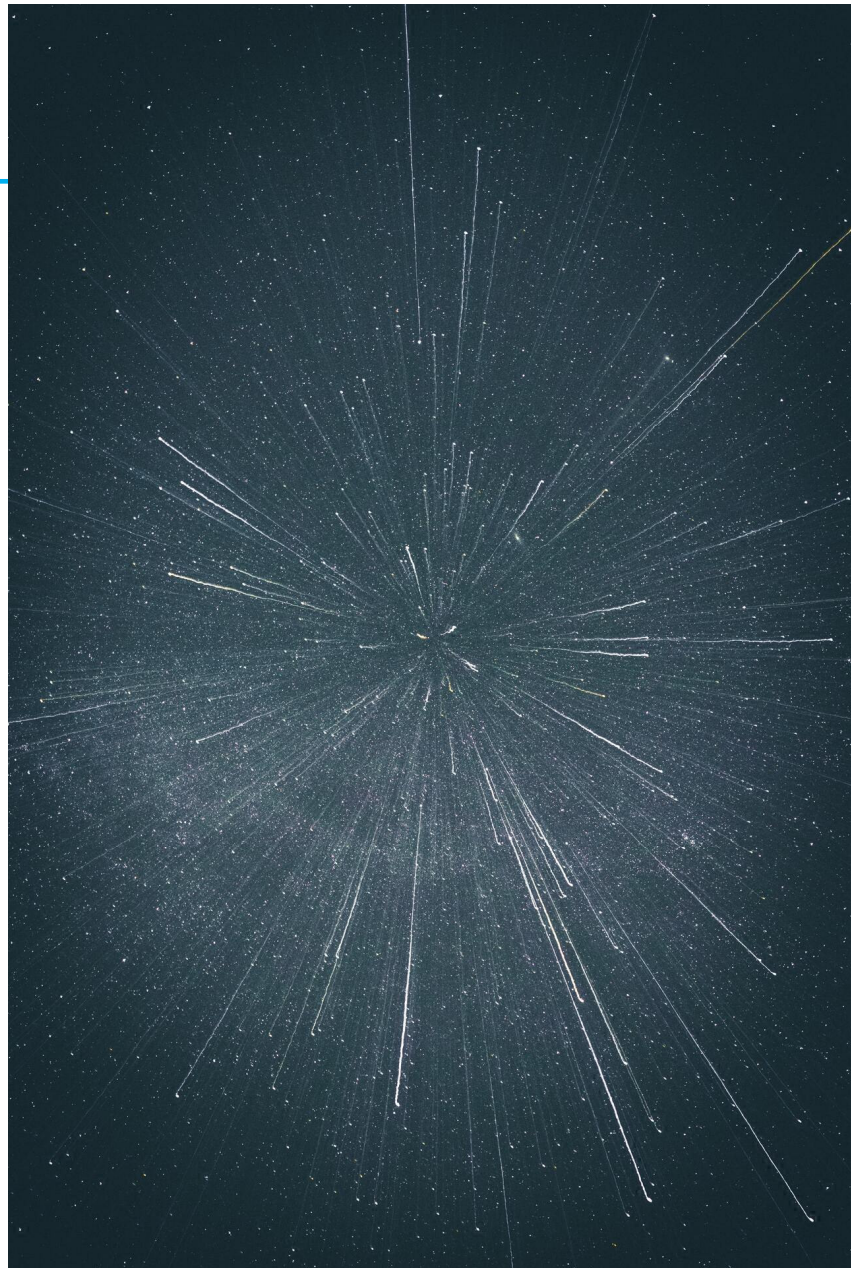
OpenAI

1. Key Milestones
2. Key Figures
3. Key Places
4. AI Types
5. AI Tests



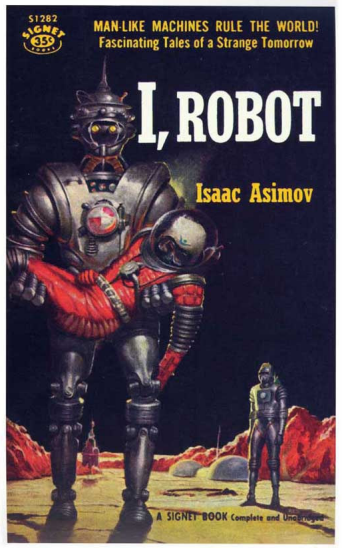
Perspective

- **Universe created** 13.8 billion years ago
- **Earth created** 4.54 billion years ago
- **Modern humans** 300,000 years ago
- **Civilisation** 12,000 years ago
- **Written record** 5,000 years ago
- the 1st industrial revolution 1784
- the 2nd industrial revolution 1870
- the 3rd industrial revolution 1969
- the 4th industrial revolution 21st century



1. Key Milestones[6]

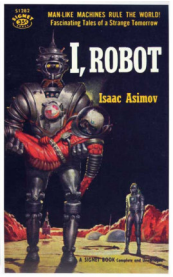
- 1942: **Isaac Asimov** formulates the **Three Laws of Robotics**
- 1950: **Alan Turing** Proposes the Imitation Game
- 1956: **Dartmouth** College holds an AI Conference
- 1957: Frank Rosenblatt Builds Mark I Perceptron
- 1956-1973: AI Experiences its **First Summer**
- 1973-1980: AI Encounters its **First Winter**
- 1987: AI Experiences its **Second Winter**
- 1997: IBM's **Deep Blue** Defeats Garry Kasparov



1. Key Milestones[6]

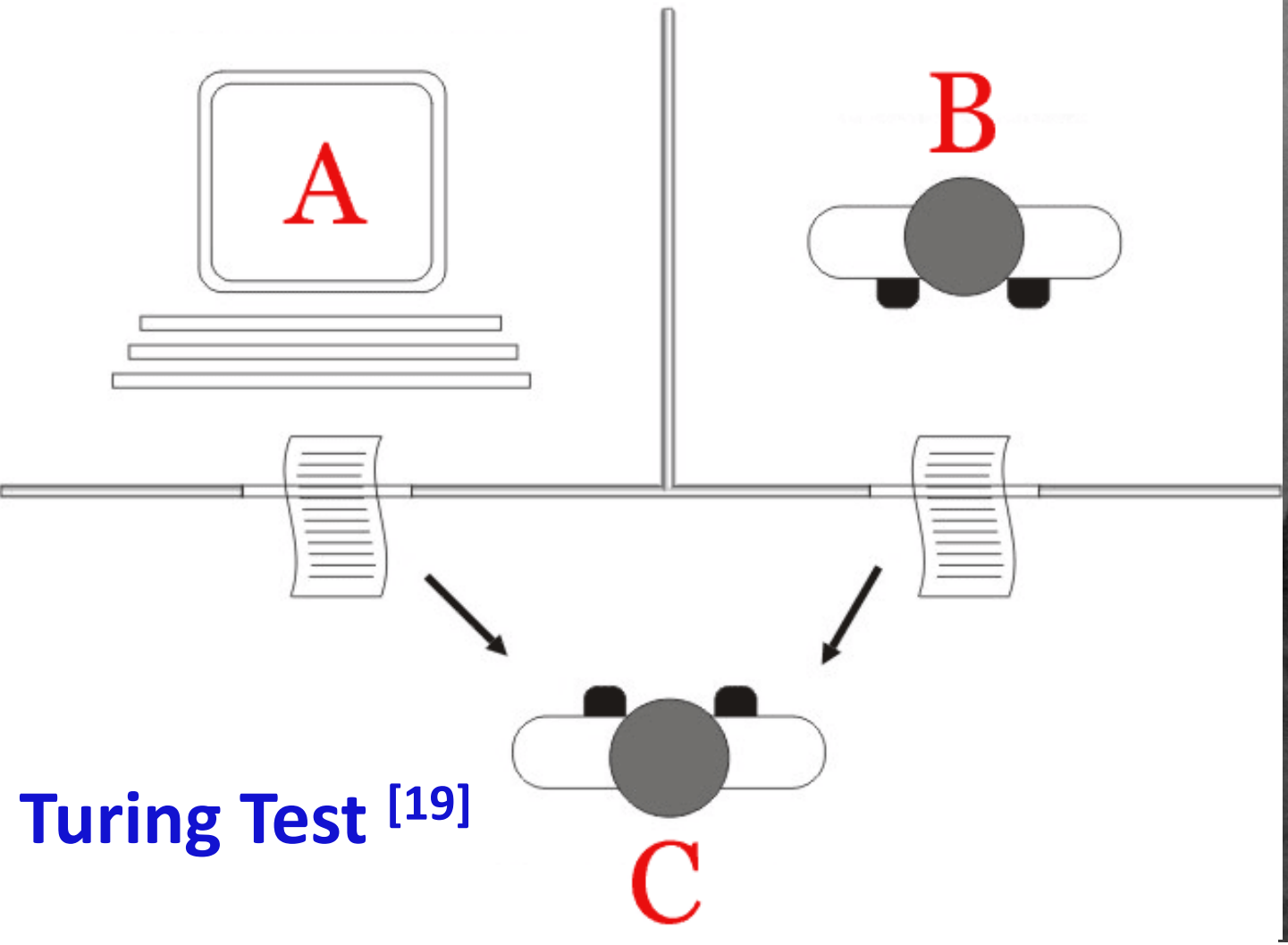
- 2011: **Google** Brain Project Starts
- 2012: **AlexNet** wins ImageNet Challenge
- 2016: **AlphaGo** Defeats Human Go Champion
- 2017: **Facebook AI** creates its Own Language
- 2018: AI beats Humans in **Stanford Reading Test**
- 2020: What's the **Future** of AI
- 2022: **ChatGPT** (Chat Generative Pre-trained Transformer)

1942: Isaac Asimov Formulates the Three Laws of Robotics

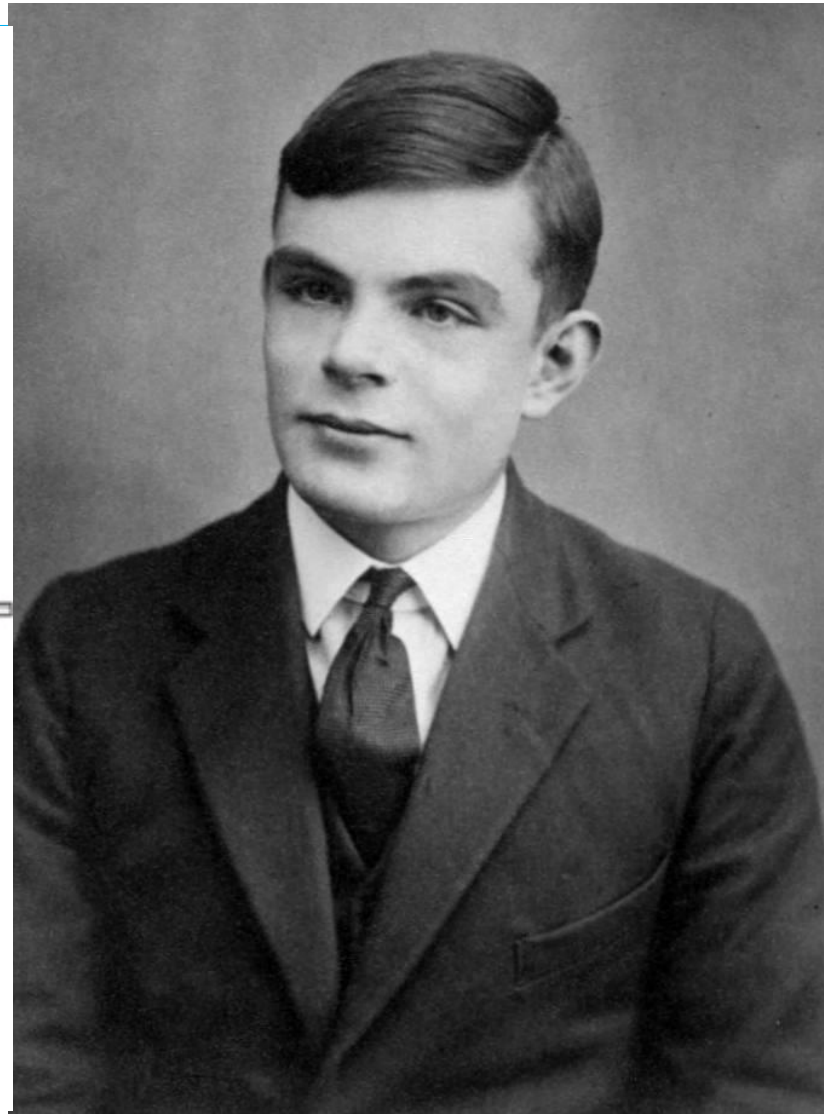


- In 1942, the renowned science fiction writer Isaac Asimov wrote a story Runaround in his book I, Robot that featured a robot called Speedy.
- In this story, Asimov listed the **three laws of robotics:**
  - ✓ **First Law**: A robot may not **injure** a human being or, through inaction, allow a human being to come to harm.
  - ✓ **Second Law**: A robot must **obey** the orders given it by human beings except where such orders would conflict with the First Law.
  - ✓ **Third Law**: A robot must **protect its own** existence as long as such protection does **not conflict** with the First or Second Laws.
- The story gained Asimov some **science-fiction** fans; it also made scientists think about the possibility of machines with intelligence. Even to this day, many AI developers apply the laws of robotics to modern AI.

1950: Alan Turing Proposes the Imitation Game

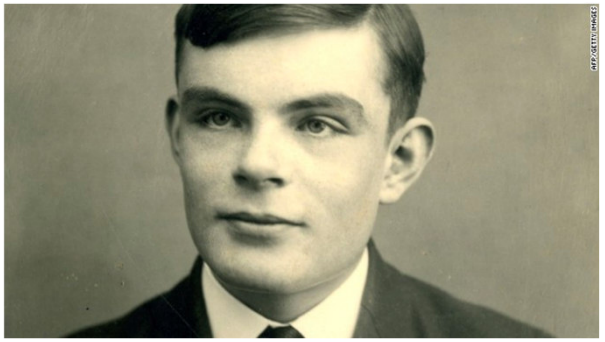


Turing Test [19]



1950: Alan Turing Proposes the Imitation Game

- **1950**: **Alan Turing** publishes *Computing Machinery and Intelligence*. In the paper, Turing—famous for breaking the **Nazi's ENIGMA** code during WWII—proposes to answer the question '**can machines think**?' and introduces the **Turing Test** [19] to determine if a computer can demonstrate the same intelligence (or the results of the same intelligence) as a human.



1956: Dartmouth College holds an AI Conference

- In 1956, a mathematics professor from Dartmouth College, **John McCarthy** and others organised an AI conference at their college.

- The event held in the summer of 1956 invited some of the brightest minds in computer and cognitive science who discussed the various fields of **AI, including: reasoning, learning and search, language and cognition, gaming and human interactions** with **intelligent machines, robots**.

1956: Dartmouth College holds an AI Conference

- **1956**: **John McCarthy** coins the term '**artificial intelligence**' at **the first-ever AI conference** at **Dartmouth College**. (McCarthy would go on to invent the **Lisp** language.)
- The **Dartmouth** Conference held in 1956 is often regarded as the **birthplace** of AI.
- Later that year, Allen Newell, J.C. Shaw, and Herbert Simon create the **Logic Theorist**, the first-ever running **AI software program**.

1956: Dartmouth College holds an AI Conference

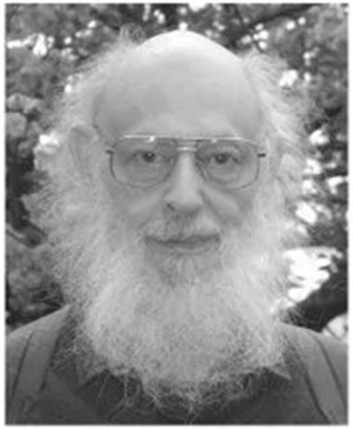
- ‘Artificial Intelligence’ John McCarthy.
- 'Machine Learning' Arthur Samuel

1956 Dartmouth Conference: The Founding Fathers of AI

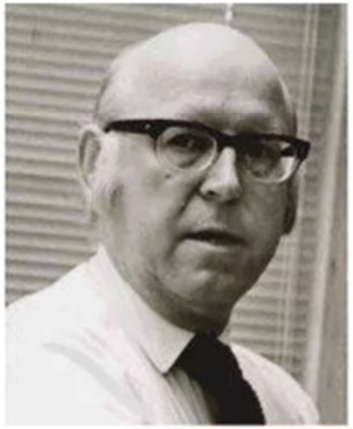
John MacCarthy

Marvin Minsky

Claude Shannon



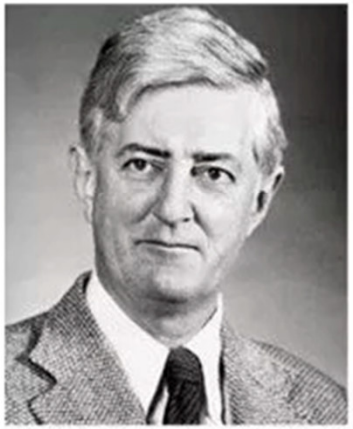
Ray Solomonoff



Alan Newell

Herbert Simon

Arthur Samuel

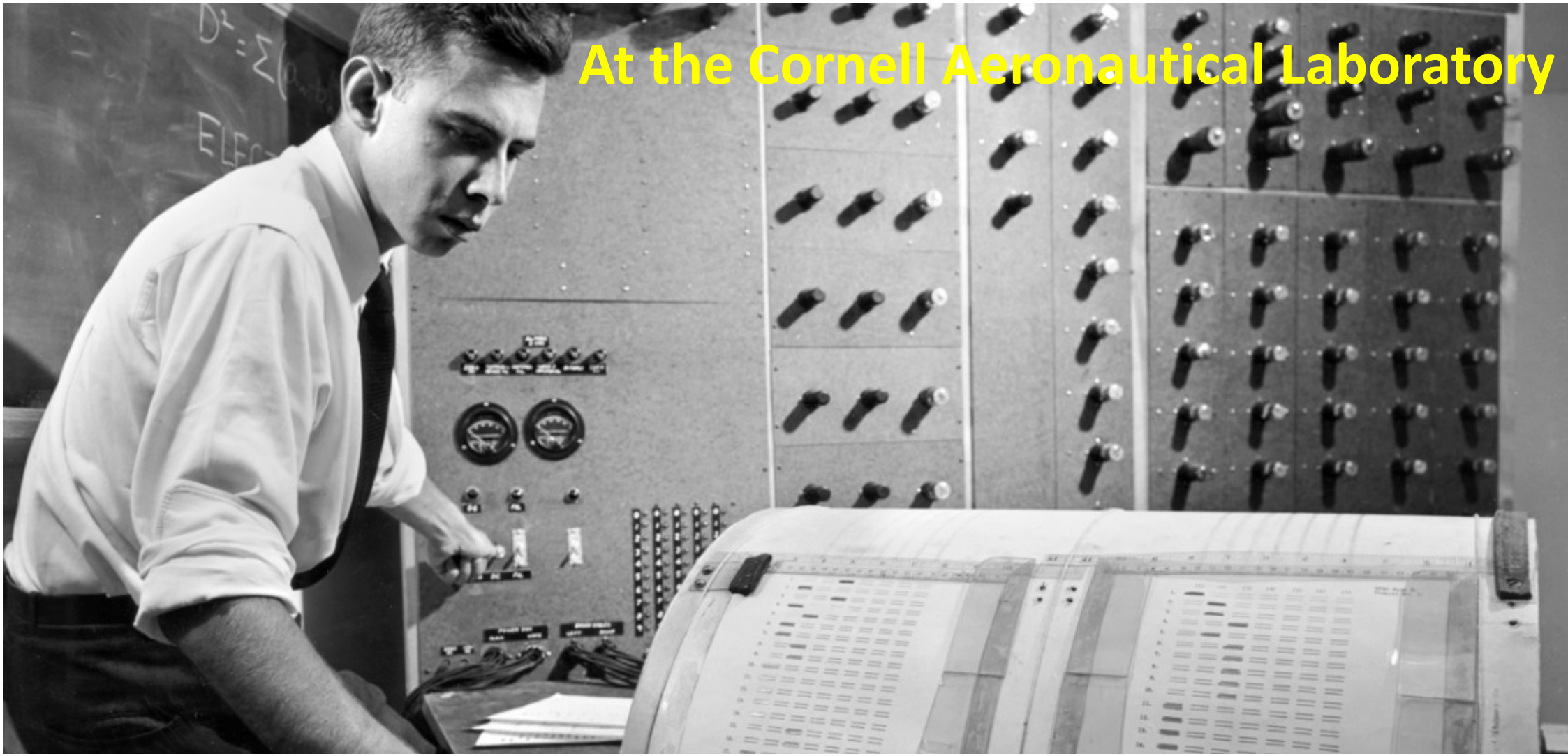


Oliver Selfridge

Nathaniel Rochester

Trenchard More

1957: Frank Rosenblatt - Perceptron



1957: Frank Rosenblatt - Perceptron

FIG. 1 — Organization of a biological brain. (Red areas indicate active cells, responding to the letter X.)

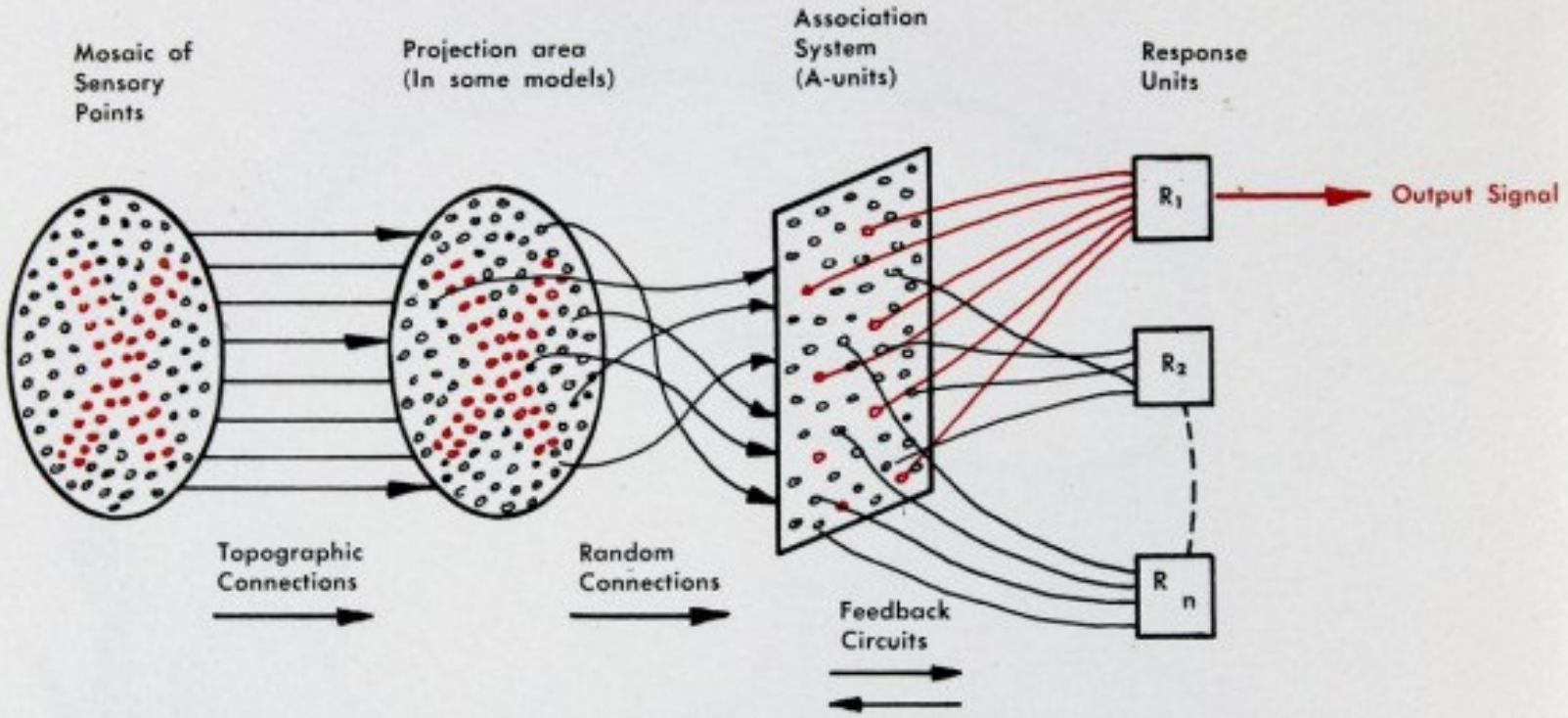
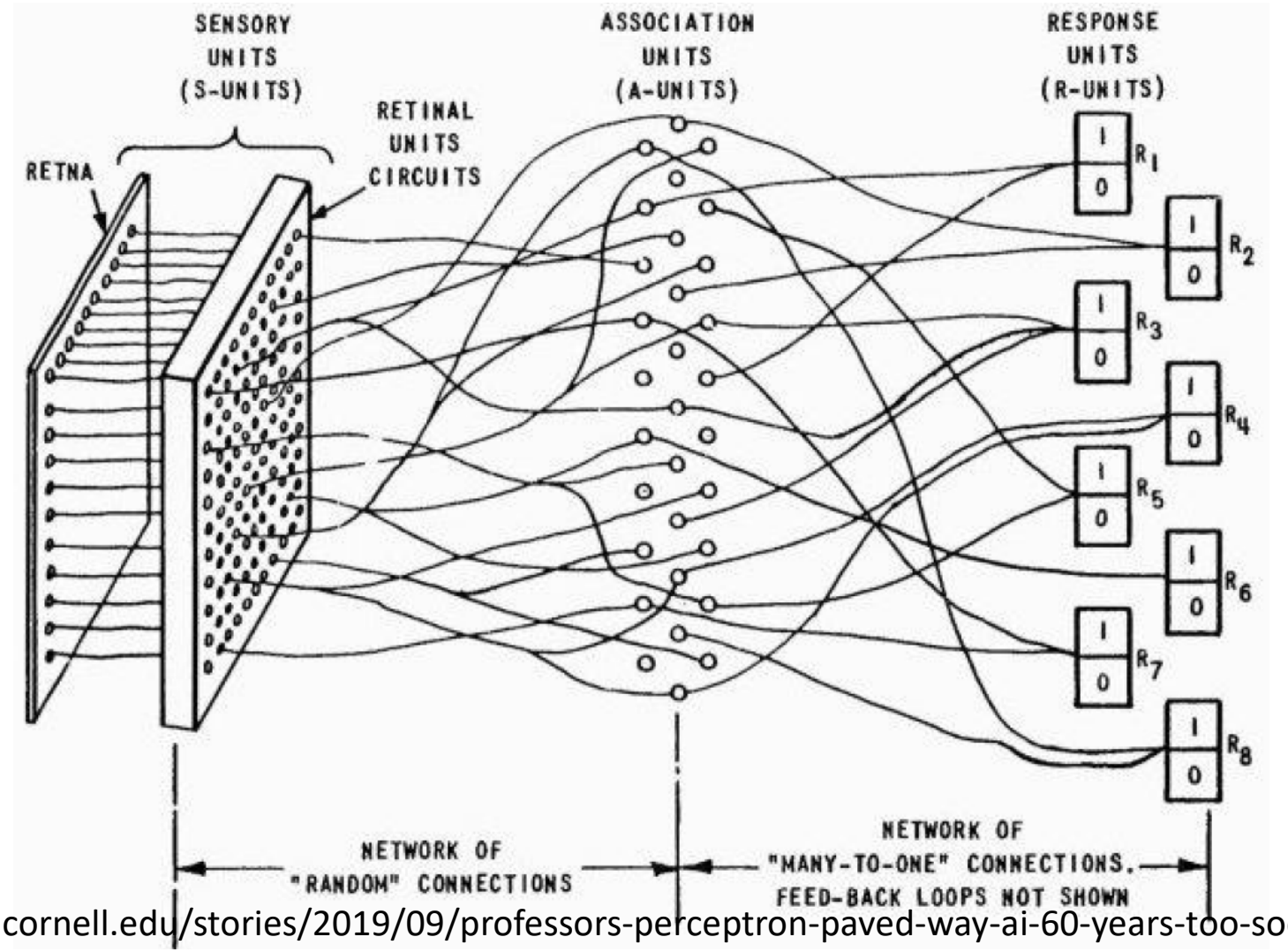


FIG. 2 — Organization of a perceptron.

1962: Frank Rosenblatt - Multi-layer ANN



https://news.cornell.edu/stories/2019/09/professors-perceptron-paved-way-ai-60-years-too-soon

1956-1973: AI Experiences its First Summer

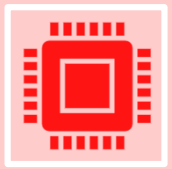
Post the Dartmouth conference, key **breakthroughs** began happening in the area of AI. For this reason, the period from 1956 to 1973 is often called the **first summer of AI**.

Throughout the 1960s, government agencies such as the Defense Advanced Research Projects Agency (**DARPA**) granted **large funds** for AI research.

1958: **John McCarthy** developed a **high-level programming** language, **Lisp** while working at the Massachusetts Institute of Technology (MIT). It is a popular programming language for AI research.

1956-1973: AI Experiences its First Summer

1961: the **first industrial robot**, was deployed on an assembly line of General Motors. The robot was used to automate metalworking and welding processes.



1964: Daniel Gureasko Bobrow, an American computer scientist created an **AI program** called **STUDENT**. Written in **Lisp**, the program was designed to read and solve word problems found in high school algebra books.

1956-1973: AI Experiences its First Summer

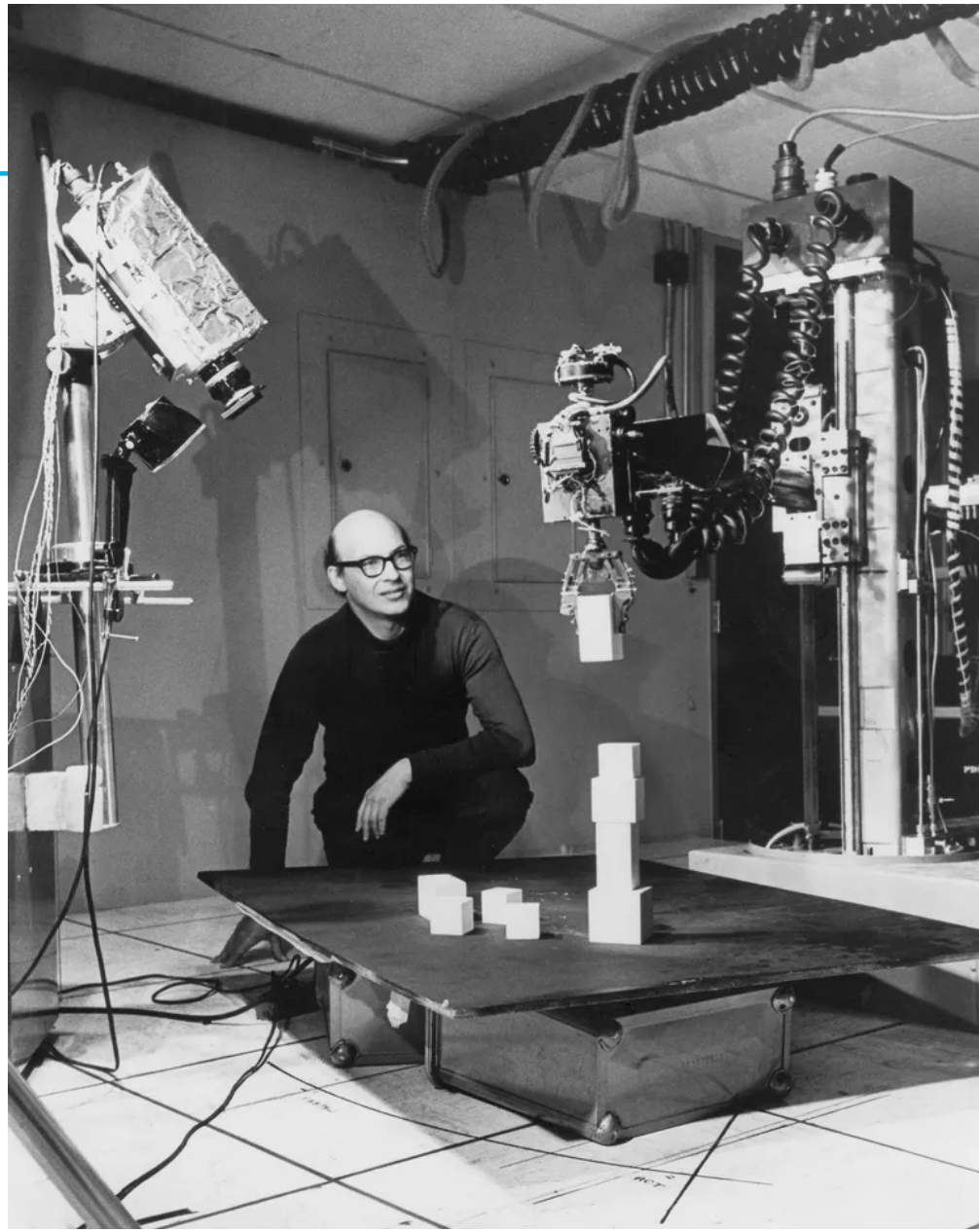
- **1965**: Joseph Weizenbaum, a **German computer scientist** at the Massachusetts Institute of Technology created a natural language processing program, **ELIZA**.
- The program was designed to **imitate a therapist** who would **ask its users open-ended questions** and **respond** with follow-ups. ELIZA is now regarded as the **first chatterbox** in the history of artificial intelligence.

1956-1973: AI Experiences its First Summer

- **1966**: A group of engineers at the Stanford Research Institute created Shakey, the **first general-purpose mobile robot** with the ability to reason about its surroundings.
- **1967**: **Frank Rosenblatt** builds the Mark 1 Perceptron, the **first computer** based on a **neural network** that **'learned' though trial and error**.

1967

MIT professor **Marvin Minsky** predicted in 1967 that true artificial intelligence would be created within a generation.



1956-1973: AI Experiences its First Summer

- **1968**: Marvin Minsky and Seymour Papert publish **a book** titled **Perceptrons**, which becomes both the landmark work on **neural networks** and, at least for a while, an argument against future neural network research projects.
- **1973**: WABOT-1, the **first** full-scale **anthropomorphic robot** was created in **Japan**. The robot had a **limb-control** system, a **vision system** and a conversation system. It could **converse** with a person in Japanese.

1973-1980: AI Encounters its First Winter

- Both the US and the British government began to **cut down on funding** for university AI research.

1980-1987

- **1986**: Developed the **backpropagation algorithm** for training multilayer neural networks with **David Rumelhart** and **Ronald Williams**
- 1987: Introduced the concept of **distributed representations** for learning high-level abstractions with Terry Sejnowski
- 1987: Invented **Boltzmann machines** and restricted Boltzmann machines for unsupervised learning with David Ackley and Terrence Sejnowski
- 2006: Proposed **deep belief networks** and **deep learning** as a way of overcoming the limitations of shallow neural networks with Ruslan Salakhutdinov

1987: AI Experiences its Second Winter

- The early 1980s witnessed the development of **'expert systems' (XCON)** that stored massive amounts of **data** and were able to imitate the human **decision-making** process.
- But these **expert systems** required **specialised hardware**, the market for expert systems began to **decline** and eventually collapsed in 1987.
- Began to use **different terms** for AI-based work: **'machine learning'**,**'analytics'** and **'informatics'**
- The second winter in the history of AI lasted well into the **mid-1990s**.

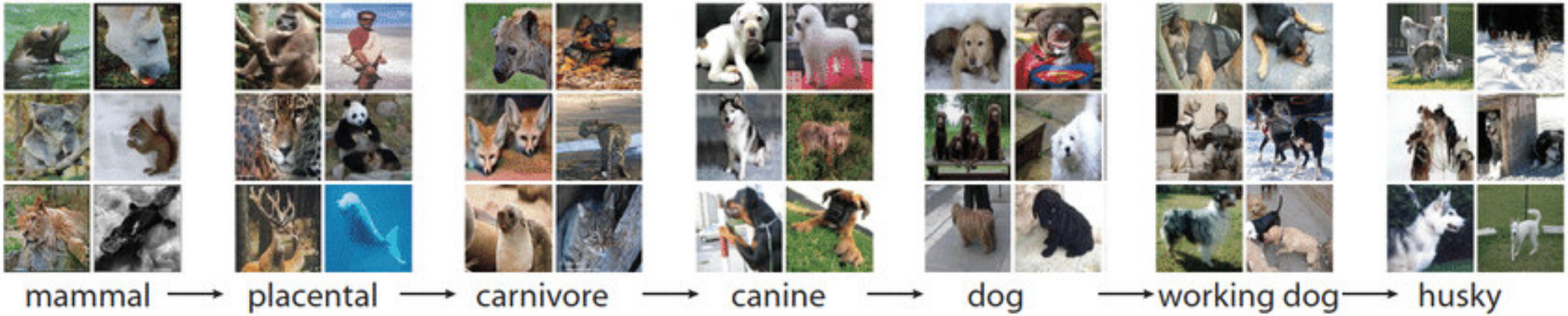
1997: IBM's Deep Blue Defeats Garry Kasparov

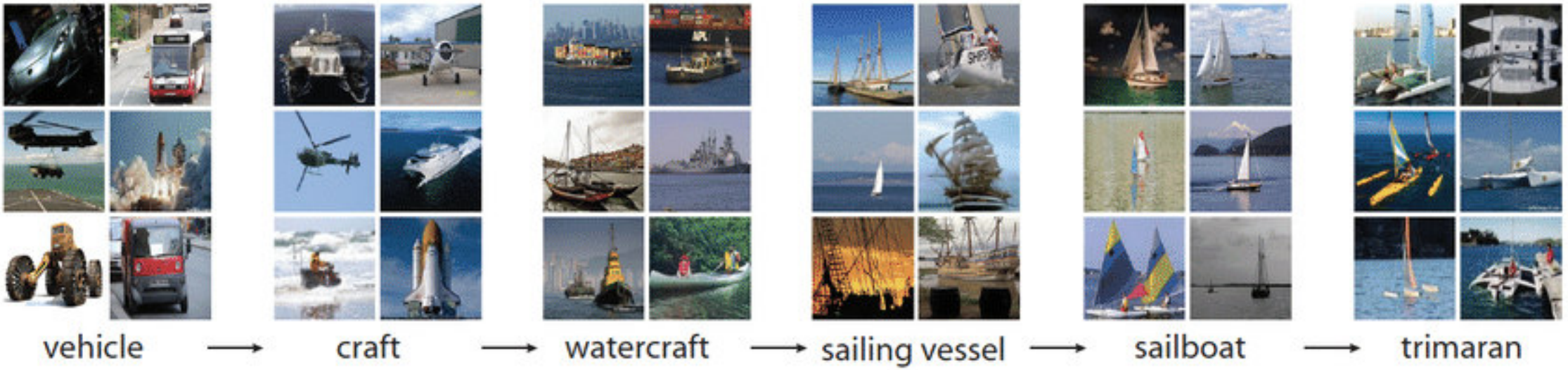
2006 ImageNet Competition

- ImageNet: a Large-Scale Hierarchical Image Database
- In 2006, Fei-Fei Li started ruminating on an idea.

Senior Research Team

- Prof. Li Fei-Fei, PI, Stanford University
- Prof. Jia Deng, Princeton University
- Prof. Olga Russakovsky, Princeton University
- Prof. Alex Berg, UNC Chapel Hill, Facebook, Shopagon
- Prof. Kai Li, Princeton University





https://devopedia.org/imagenet
https://image-net.org/download.php

2011: Google Brain Project Starts

- Google engineer **Jeff Dean** and Stanford professor **Andrew Ng** set out to create a large neural network backed by Google's servers, marked the beginning of the **Google Brain Project**.
- 2011 was also the year when Apple released **Siri**, an AI-based virtual assistant for iOS operating systems. Siri used natural-language user interface to observe, answer and recommend things to human users.

2012: AlexNet wins ImageNet Challenge

- In 2012, University of Toronto professor Geoffrey Hinton along with two of his students created a neural network model **AlexNet** to compete in an **image recognition competition** called **ImageNet**.
- AlexNet won the competition. The event triggered a series of developments in deep neural networks and AI, and Hinton received the coveted **Turing Prize** in 2018.

2016: AlphaGo Defeats Human Go Champion

2017: Facebook AI creates its Own Language

- the chatbots began deviating from the script and started communicating in a **new language**-the one they created **without** human intervention.
- Eventually, Facebook had to shut down this AI experiment as it wasn't going in the intended direction.
- Google AutoML

2018: AI beats Humans in Stanford Reading Test

- In January 2018, two AI programs created by **Alibaba** and **Microsoft** beat humans in a **Stanford University reading comprehension test**.
- Google cloud **AutoML**

2020: What the Future of AI[6,7]

- From AI in healthcare, AI in education, AI in manufacturing, AI in law, finance, and even AI in politics, in the prevailing times, **AI is everywhere**.

A.I. TIMELINE [8]

SYZYGY

1950
TURING TEST

Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence

1955
A.I. BORN

Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

1961
UNIMATE

First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

1964
ELIZA

Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966
SHAKEY

The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I. WINTER

Many false starts and dead-ends leave A.I. out in the cold

1997
DEEP BLUE

Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998
KISMET

Cynthia Breazeal at MIT introduces KISmet, an emotionally intelligent robot insofar as it detects and responds to people's feelings

1999
AIBO

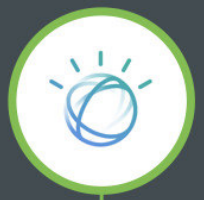
Sony launches first consumer robot pet dog AiBO (AI robot) with skills and personality that develop over time

2002
ROOMBA

First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes

2011
SIRI

Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S



2011
WATSON

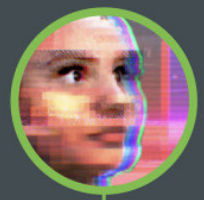
IBM's question answering computer Watson wins first place on popular $1M prize television quiz show *Jeopardy*

2014
EUGENE

Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human

2014
ALEXA

Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks



2016
TAY

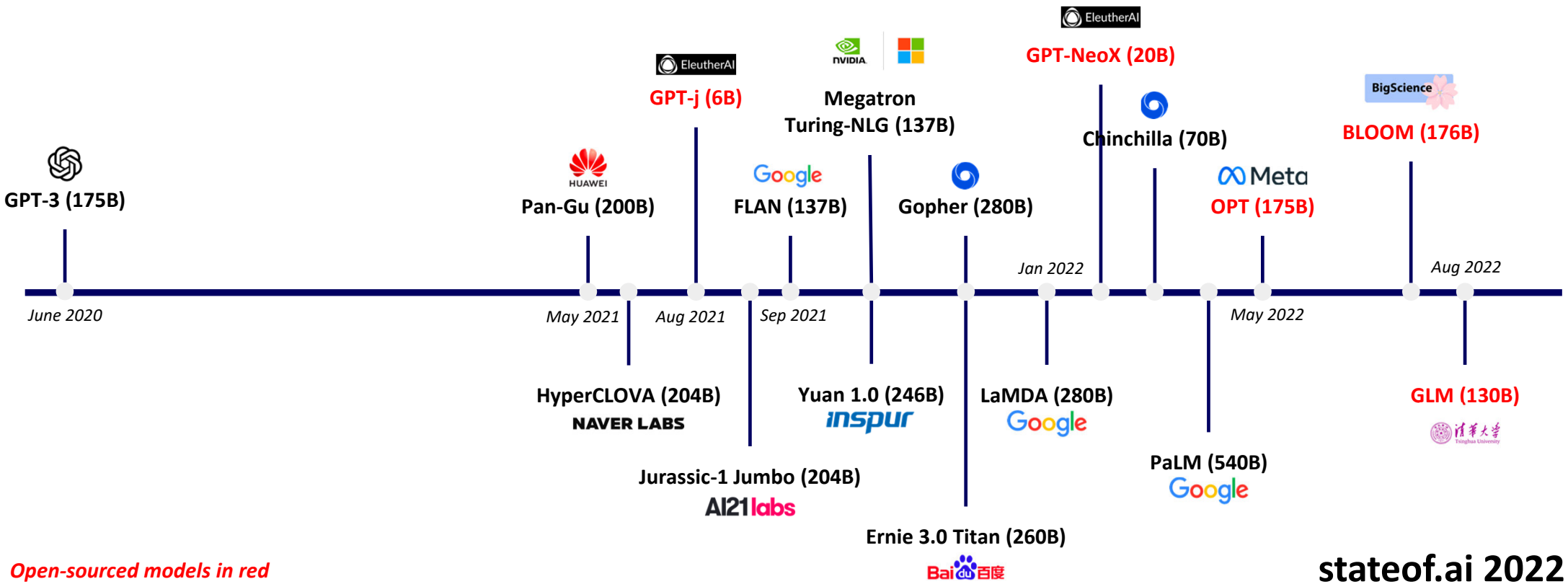
Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

2017
ALPHAGO

Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

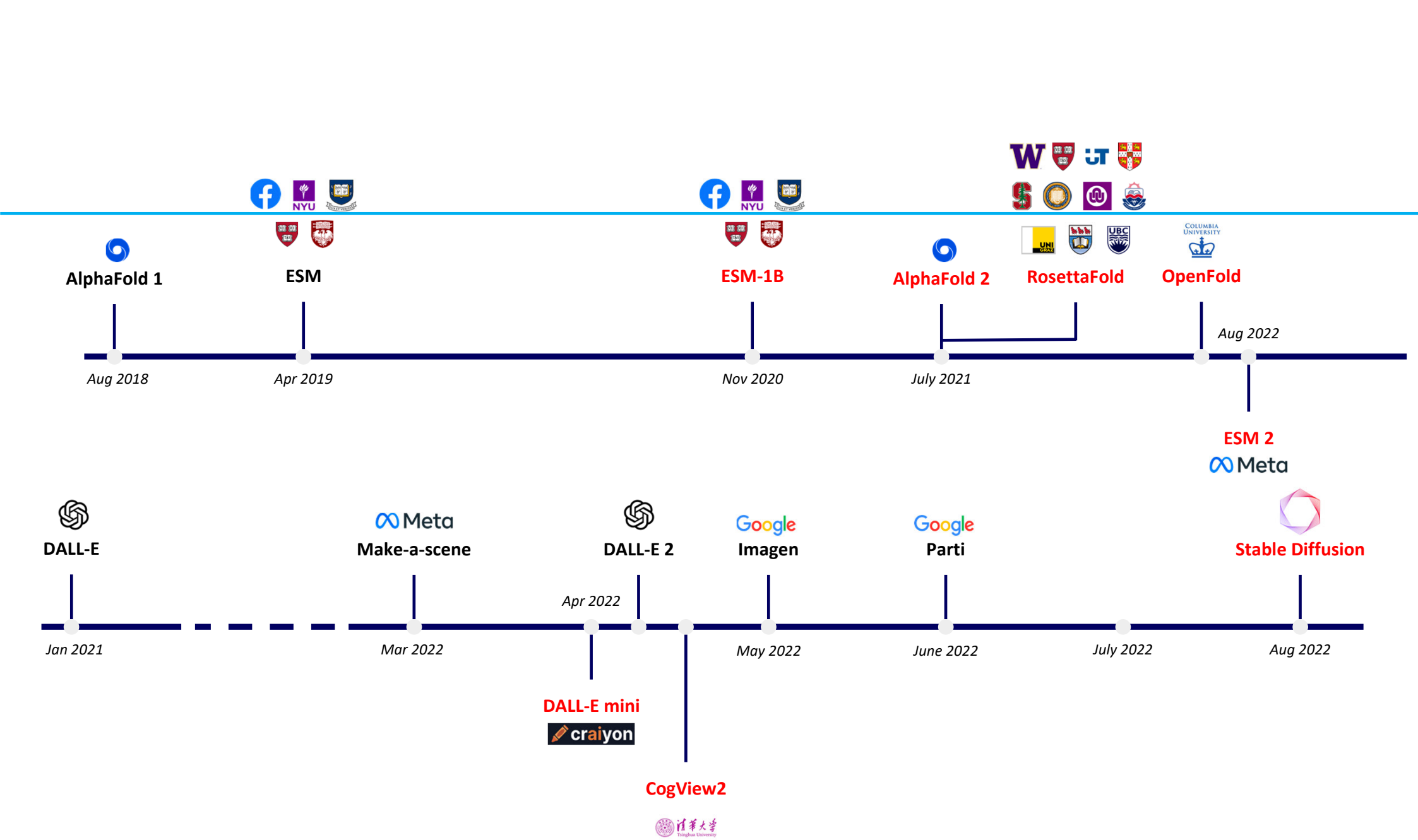
https://digitalwellbeing.org/artificial-intelligence-timeline-infographic-from-eliza-to-tay-and-beyond/

Landmark models from OpenAI and DeepMind have been implemented/cloned/improved by th open source community much faster than we'd have expected



Open-sourced models in red

stateof.ai 2022



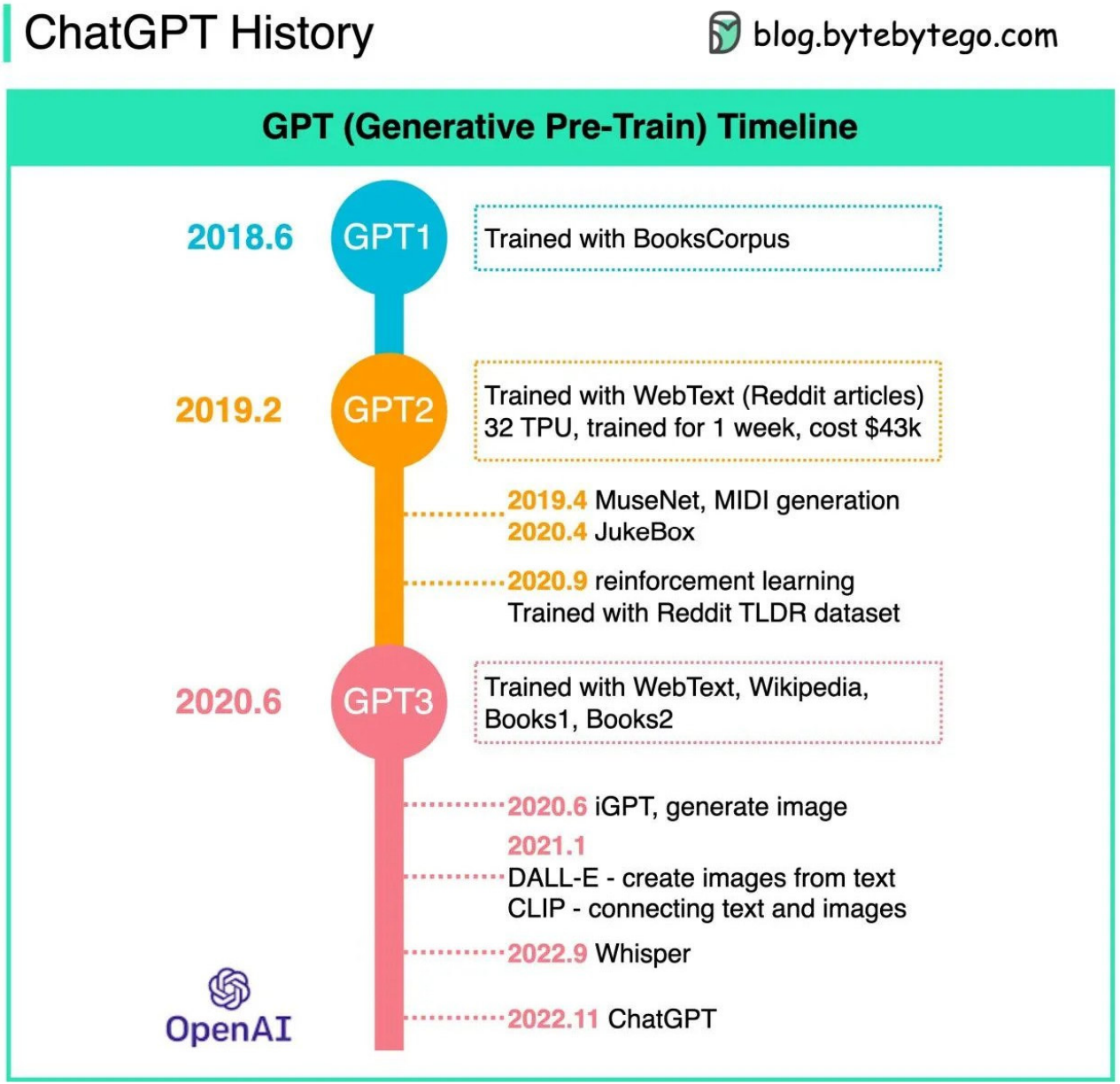
Open-sourced models in red

stateof.ai 2022

2022: ChatGPT

- **ChatGPT** (**Chat Generative Pre-trained Transformer**) is a chatbot developed by OpenAI and launched in November 2022.
- It is built on top of OpenAI's GPT-3 family of large language models
- It has been fine-tuned (an approach to transfer learning) using both supervised and reinforcement learning techniques.

https://en.wikipedia.org/wiki/ChatGPT



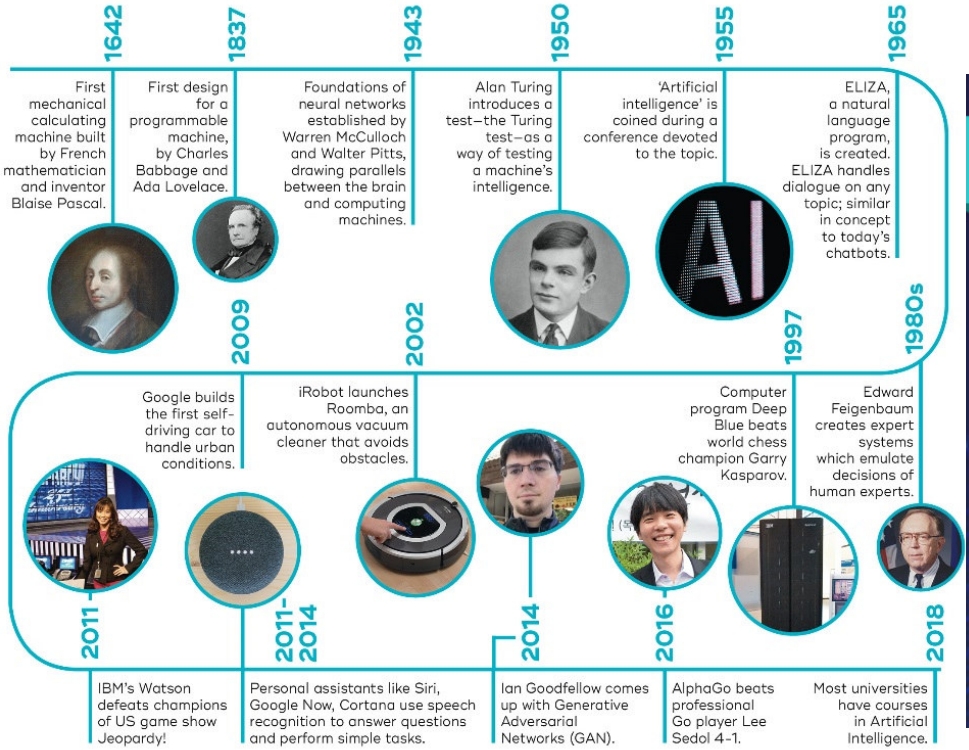
More Recent AI Tools

- 2023 Gemini
- 2024 OpenAI/Sora

Class Exercise 01

- Can you design a graph to summarise the timeline of AI history? Examples:

[13]



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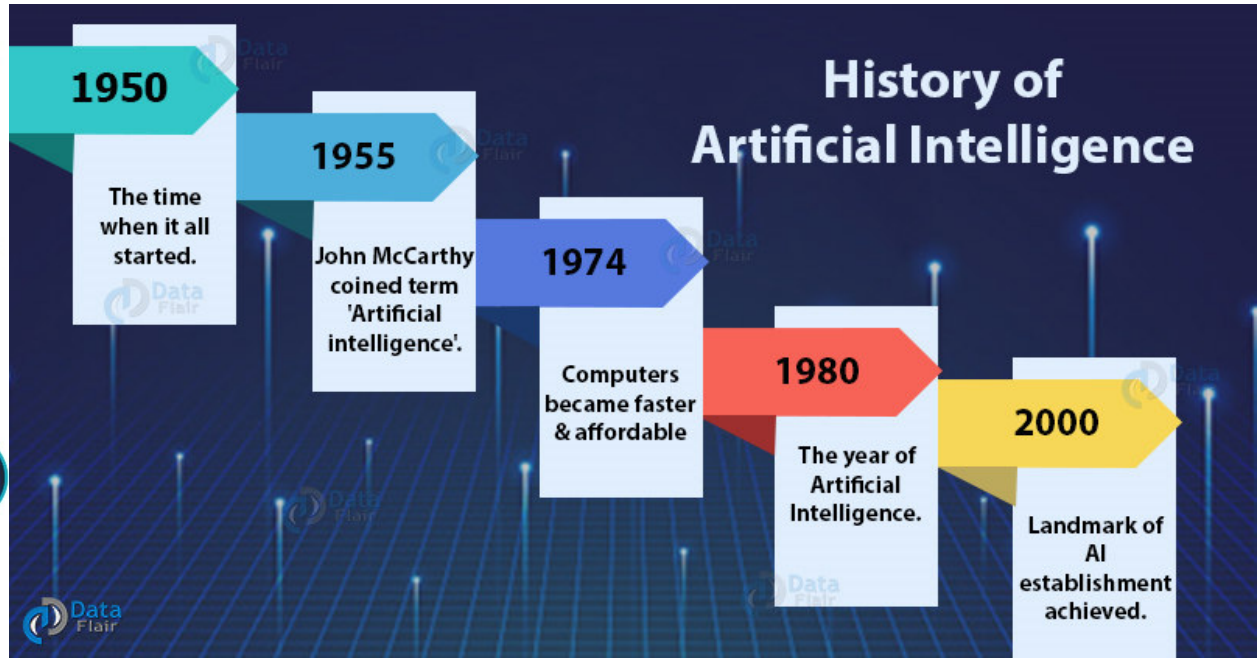

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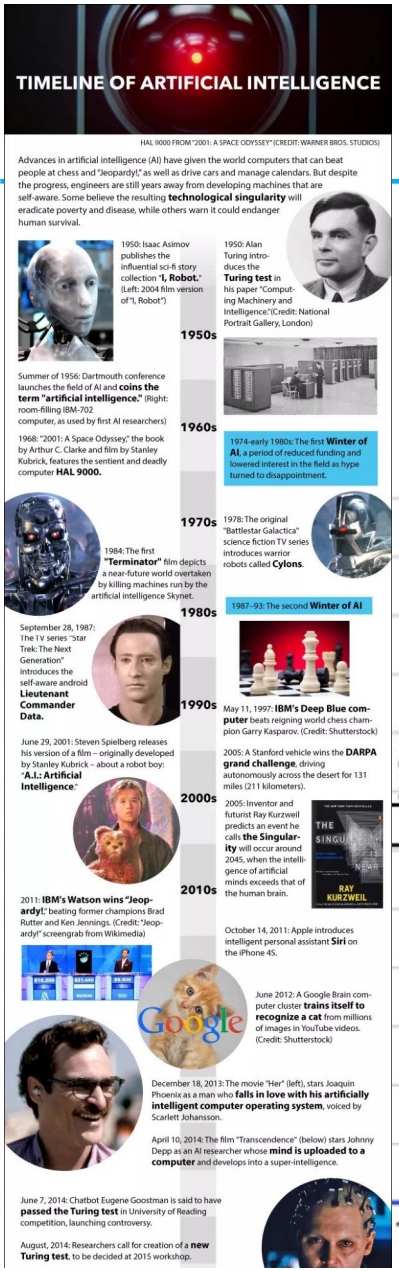
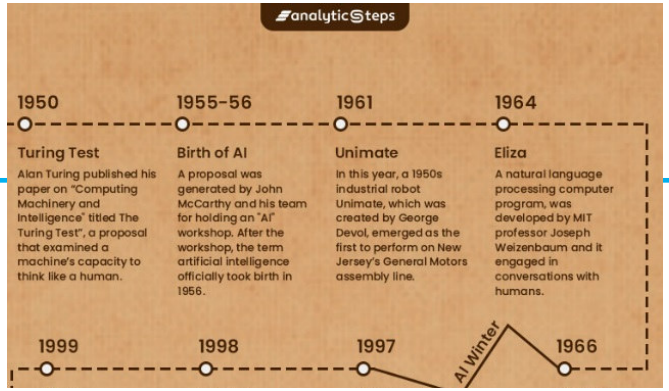
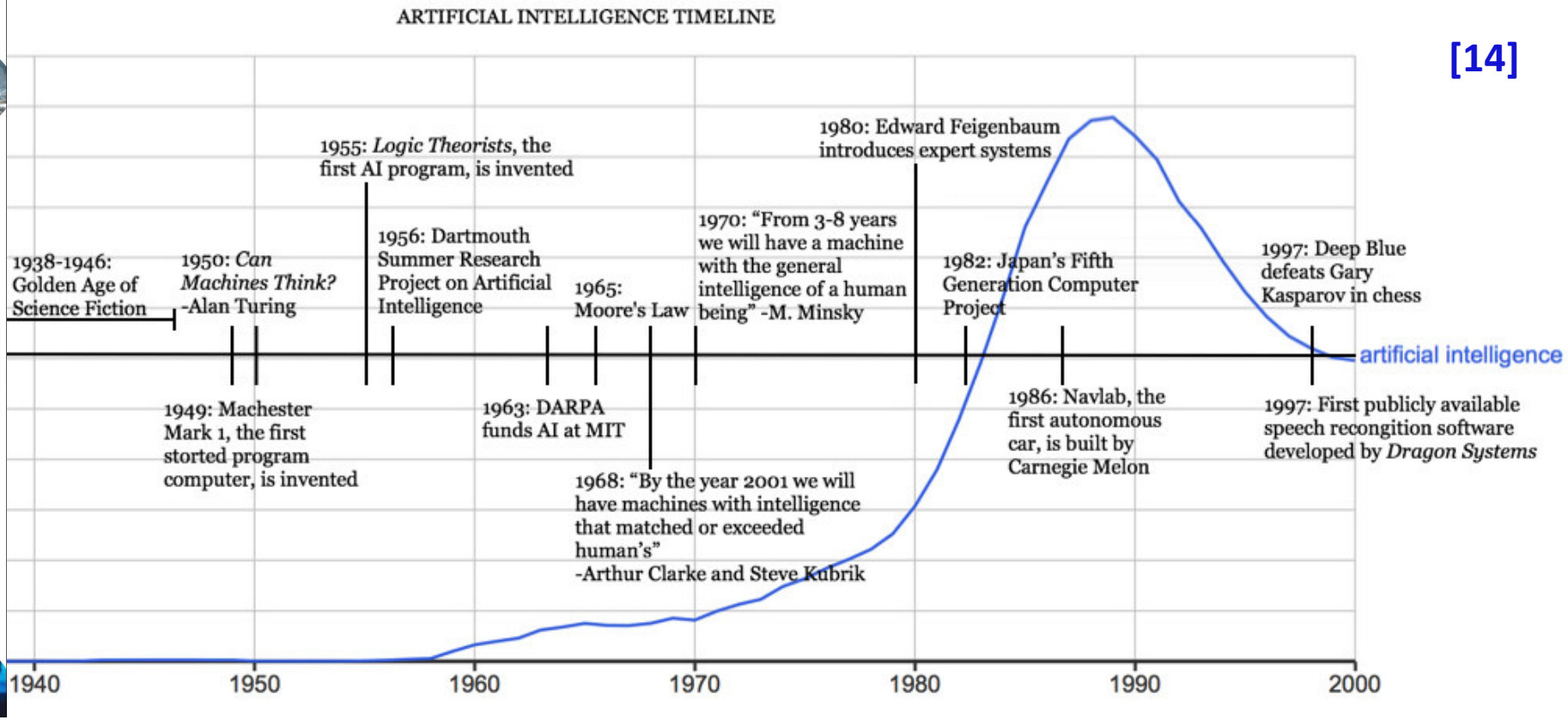

TIMELINE OF ARTIFICIAL INTELLIGENCE
HAL 9000 FROM "2001: A SPACE ODYSSEY" (CREDIT: WARNER BROS. STUDIOS)
Advances in artificial intelligence (AI) have given the world computers that can beat people at chess and "Jeopardy!," as well as drive cars and manage calendars. But despite the progress, engineers are still years away from developing machines that are self-aware. Some believe the resulting technological singularity will eradicate poverty and disease, while others warn it could endanger human survival.
1950: Isaac Asimov publishes the influential sci-fi story collection "I, Robot." (Left: 2004 film version of "I, Robot")
1950: Alan Turing introduces the Turing test in his paper "Computing Machinery and Intelligence."(Credit: National Portrait Gallery, London)
1950s
Summer of 1956: Dartmouth conference launches the field of AI and coins the term "artificial intelligence." (Right: room-filling IBM-702 computer, as used by first AI researchers)
1960s
1968: "2001: A Space Odyssey," the book by Arthur C. Clarke and film by Stanley Kubrick, features the sentient and deadly computer HAL 9000.
1974-early 1980s: The first Winter of AI, a period of reduced funding and lowered interest in the field as hype turned to disappointment.
1970s
1978: The original "Battlestar Galactica" science fiction TV series introduces warrior robots called Cylons.
1984: The first "Terminator" film depicts a near-future world overtaken by killing machines run by the artificial intelligence Skynet.
1980s
1987–93: The second Winter of AI
September 28, 1987: The TV series "Star Trek: The Next Generation" introduces the self-aware android Lieutenant Commander Data.
1990s
May 11, 1997: IBM's Deep Blue computer beats reigning world chess champion Garry Kasparov. (Credit: Shutterstock)
June 29, 2001: Steven Spielberg releases his version of a film – originally developed by Stanley Kubrick – about a robot boy: "A.I.: Artificial Intelligence."
2005: A Stanford vehicle wins the DARPA grand challenge, driving autonomously across the desert for 131 miles (211 kilometers).
2000s
2005: Inventor and futurist Ray Kurzweil predicts an event he calls the Singularity will occur around 2045, when the intelligence of artificial minds exceeds that of the human brain.
THE SINGULARITY IS NEAR
RAY KURZWEIL
2010s
2011: IBM's Watson wins "Jeopardy!," beating former champions Brad Rutter and Ken Jennings. (Credit: "Jeopardy!" screengrab from Wikimedia)
October 14, 2011: Apple introduces intelligent personal assistant Siri on the iPhone 4S.
Google
June 2012: A Google Brain computer cluster trains itself to recognize a cat from millions of images in YouTube videos. (Credit: Shutterstock)
December 18, 2013: The movie "Her" (left), stars Joaquin Phoenix as a man who falls in love with his artificially intelligent computer operating system, voiced by Scarlett Johansson.
April 10, 2014: The film "Transcendence" (below) stars Johnny Depp as an AI researcher whose mind is uploaded to a computer and develops into a super-intelligence.
June 7, 2014: Chatbot Eugene Goostman is said to have passed the Turing test in University of Reading competition, launching controversy.
August, 2014: Researchers call for creation of a new Turing test, to be decided at 2015 workshop.

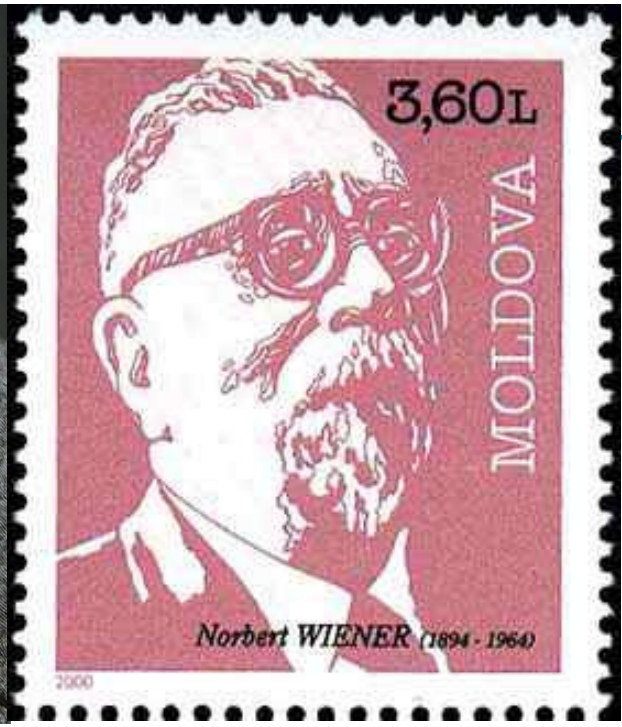
[7]


analyticSteps
1950
Turing Test
Alan Turing published his paper on "Computing Machinery and Intelligence" titled The Turing Test", a proposal that examined a machine's capacity to think like a human.
1955-56
Birth of AI
A proposal was generated by John McCarthy and his team for holding an "AI" workshop. After the workshop, the term artificial intelligence officially took birth in 1956.
1961
Unimate
In this year, a 1950s industrial robot Unimate, which was created by George Devol, emerged as the first to perform on New Jersey's General Motors assembly line.
1964
Eliza
A natural language processing computer program, was developed by MIT professor Joseph Weizenbaum and it engaged in conversations with humans.
1999
1998
1997
AI Winter
1966

[14]


ARTIFICIAL INTELLIGENCE TIMELINE
1938-1946: Golden Age of Science Fiction
1950: Can Machines Think? -Alan Turing
1949: Machester Mark 1, the first storted program computer, is invented
1955: Logic Theorists, the first AI program, is invented
1956: Dartmouth Summer Research Project on Artificial Intelligence
1963: DARPA funds AI at MIT
1965: Moore's Law
1968: "By the year 2001 we will have machines with intelligence that matched or exceeded human's" -Arthur Clarke and Steve Kubrik
1970: "From 3-8 years we will have a machine with the general intelligence of a human being" -M. Minsky
1980: Edward Feigenbaum introduces expert systems
1982: Japan's Fifth Generation Computer Project
1986: Navlab, the first autonomous car, is built by Carnegie Melon
1997: First publicly available speech recongition software developed by Dragon Systems
1997: Deep Blue defeats Gary Kasparov in chess
artificial intelligence
1940
1950
1960
1970
1980
1990
2000

2. Key Figures



[1] Alan Turing[20-22]

- **Alan Turing** 6+mins
- **Alan Turing** 11+min Betrayed by the Country He Saved
- **Alan Turing** 46mins The Enigma Machine & Imitation

[2] Norbert Wiener

- **Who is Norbert Wiener** 2mins

[3] John McCarthy

- **Did You know How John McCarthy** 4+mins

2. Key People

[4] Herbert Simon

Herb Simon's 100th birthday 1min

[1] Alan Turing[20-22]

- **Alan** Mathison **Turing** OBE FRS (23 June 1912 - 7 June 1954) was an English mathematician, computer scientist, logician, cryptanalyst, philosopher, and theoretical biologist.
- Cryptanalysis of the Enigma, Turing's proof, Turing machine, **Turing test**, Unorganised machine, Turing pattern, Turing reduction, The Chemical Basis of Morphogenesis
- The **Alan Turing Institute** is the national institute for data science and artificial intelligence, with headquarters at the British Library www.turing.ac.uk

MSS. and other Communications for the Editor should be addressed to
Prof. G. RYLE, Magdalen College, Oxford.

VOL. LIX. No. 236. OCTOBER, 1950

MIND

A QUARTERLY REVIEW

OF

PSYCHOLOGY AND PHILOSOPHY

EDITED BY

PROF. GILBERT RYLE

WITH THE CO-OPERATION OF PROF. SIR F. C. BARTLETT AND PROF. C. D. BROAD

CONTENTS.

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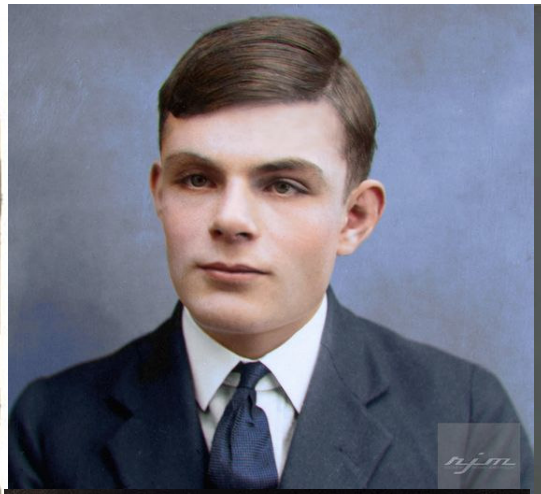
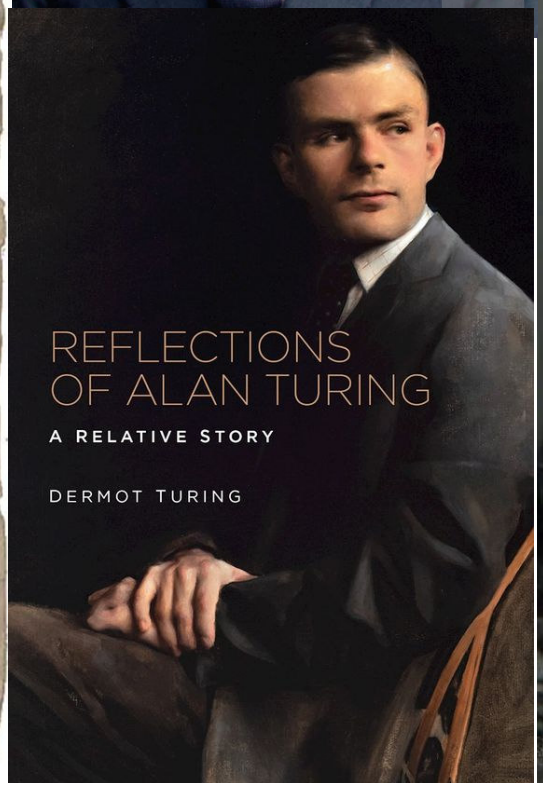
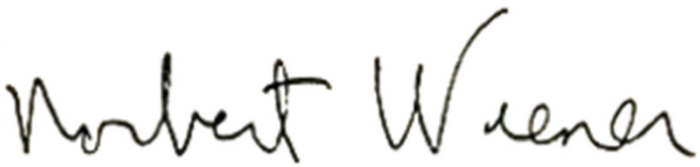


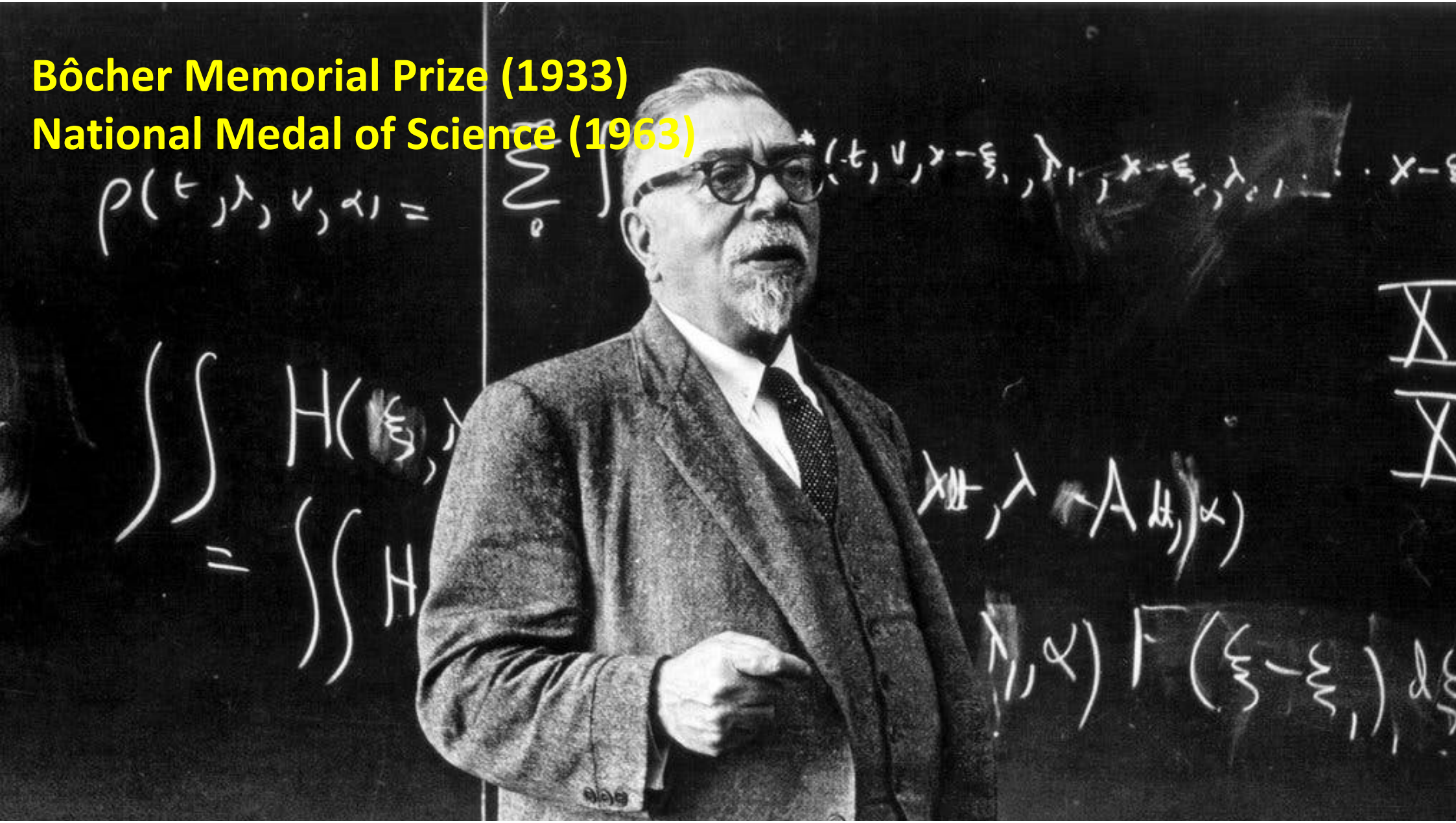


The Imitation Game (2014)

[2] Norbert Wiener[23-26]

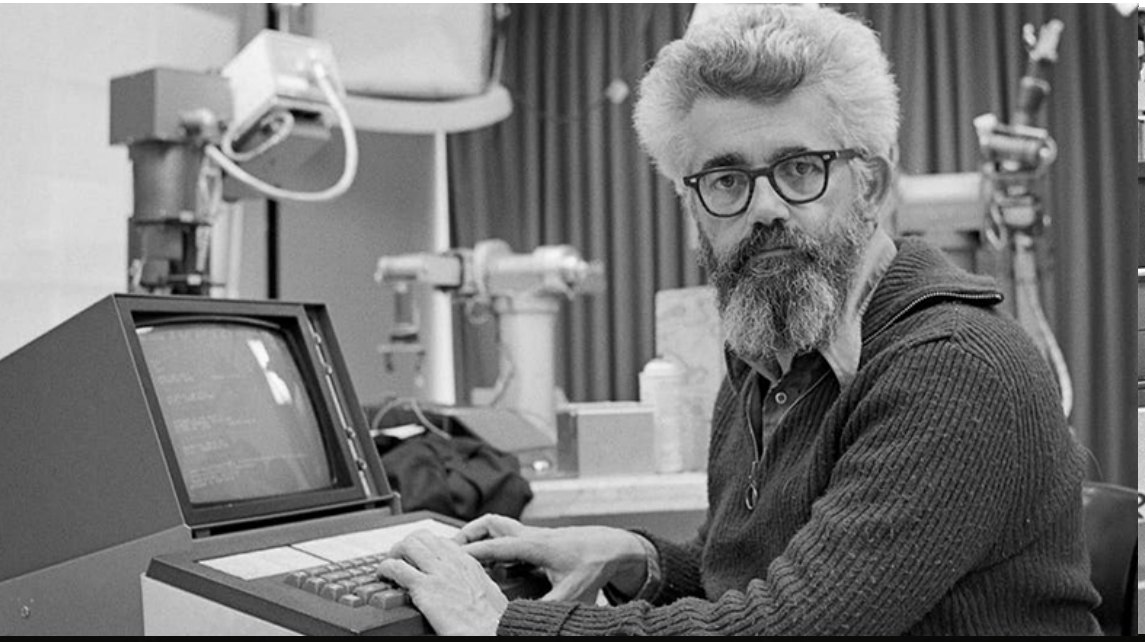


- **Norbert Wiener** (November 26, 1894 – March 18, 1964) was an American mathematician and philosopher.
- **Cybernetics-Control** and Communication in the Animal and the Machine (1948)
- The **Human Use** of **Human Beings** (1950)
- The question led him to considering automation and how like a human a machine could become--could a machine assume human intellectual capabilities, and when could it exceed and replace a human?


Bôcher Memorial Prize (1933)
National Medal of Science (1963)

[3] John McCarthy [27-30]

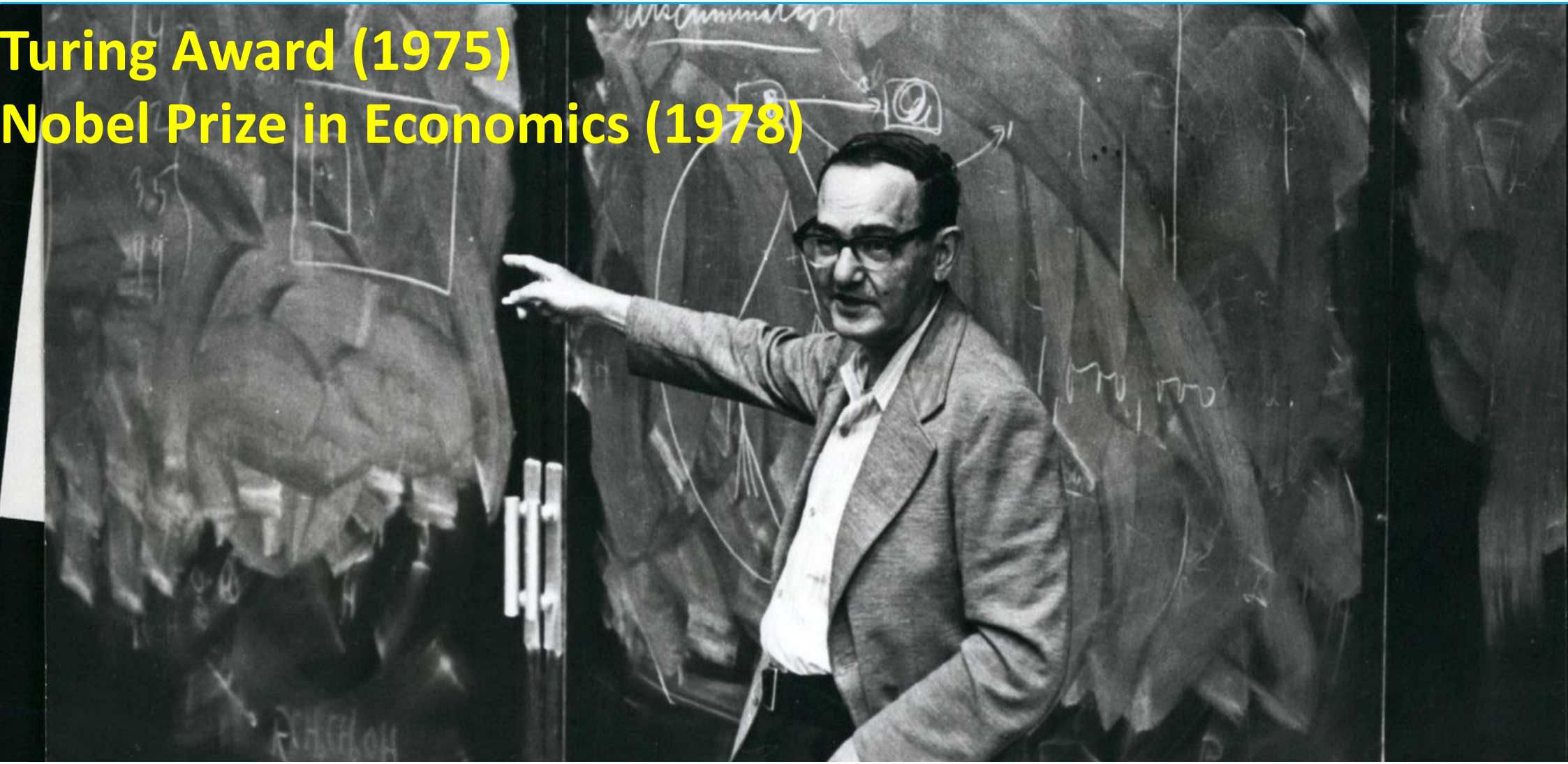
- **John McCarthy** (September 4, 1927 – October 24, 2011)
- **The inventor** of the concept **of artificial intelligence**, John McCarthyJohn McCarthy coined the term “AI” in 1955 in connection with a proposed **summer workshop** at Dartmouth College, which many of the world's leading thinkers in computing attended.
- As part of refining his ideas about AI, he also invented the programming language **lisp** in 1958 。



Turing Award (1971)
National Medal of Science (1990)

[4] Herbert Simon[60,61]

Learn or Creative?



1642

First mechanical calculating machine built by French mathematician and inventor Blaise Pascal.

1837

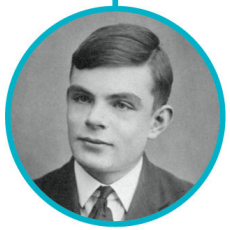
First design for a programmable machine, by Charles Babbage and Ada Lovelace.

1943

Foundations of neural networks established by Warren McCulloch and Walter Pitts, drawing parallels between the brain and computing machines.

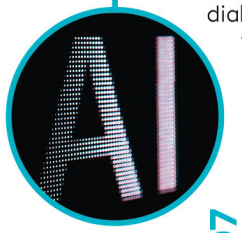
1950

Alan Turing introduces a test—the Turing test—as a way of testing a machine's intelligence.



1955

'Artificial intelligence' is coined during a conference devoted to the topic.



1965

ELIZA, a natural language program, is created. ELIZA handles dialogue on any topic; similar in concept to today's chatbots.

1980s

Edward Feigenbaum creates expert systems which emulate decisions of human experts.

1997

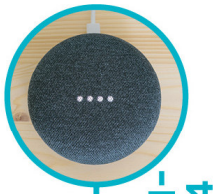
Computer program Deep Blue beats world chess champion Garry Kasparov.

2002

iRobot launches Roomba, an autonomous vacuum cleaner that avoids obstacles.

2009

Google builds the first self-driving car to handle urban conditions.



2011

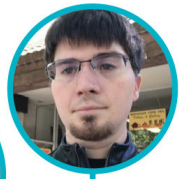
IBM's Watson defeats champions of US game show Jeopardy!

2011-2014

Personal assistants like Siri, Google Now, Cortana use speech recognition to answer questions and perform simple tasks.

2014

Ian Goodfellow comes up with Generative Adversarial Networks (GAN).



2016

AlphaGo beats professional Go player Lee Sedol 4-1.

2018

Most universities have courses in Artificial Intelligence.

3. Key Places

- **Dartmouth College**, Hanover, New Hampshire, USA
- **Stanford** Research Institute (SRI), Menlo Park, California, USA
- **Massachusetts** Institute of Technology (MIT), Cambridge, Massachusetts, USA
- University of **Edinburgh**, Edinburgh, Scotland
- **Silicon Valley**, California, USA
- **DeepMind**, London, United Kingdom
- **OpenAI**, San Francisco, California, USA

A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence (August 31st, 1955) [34]

3. Key Places

- Carnegie Mellon University, Pittsburgh, Pennsylvania, USA
- Oxford University, Oxford, United Kingdom
- IBM Research, various locations worldwide
- Google Research, various locations worldwide
- Microsoft Research, various locations worldwide
- Facebook AI Research (FAIR), various locations worldwide
- Amazon Web Services (AWS) AI Research, various locations worldwide

3. Key Places

- National Institute of Advanced Industrial Science and Technology (AIST), Tokyo, Japan
- Peking University, Beijing, China
- Tsinghua University, Beijing, China
- École Normale Supérieure (ENS), Paris, France
- Technical University of Munich (TUM), Munich, Germany
- National University of Singapore (NUS), Singapore
- xAI by Elon Musk, various locations worldwide

Dartmouth College

- Held for **eight weeks** in Hanover, New Hampshire in **1956** the **conference** gathered 20 of the brightest minds in computer- and cognitive science for a workshop
- Dartmouth Summer Research Project on **Artificial Intelligence**
- A written **proposal** to the Rockefeller Foundation
- The term **artificial intelligence (AI)** itself was first coined by **McCarthy** during the conference.

A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence (August 31st, 1955) [34]

Massachusetts Institute of Technology (MIT)

Silicon Valley

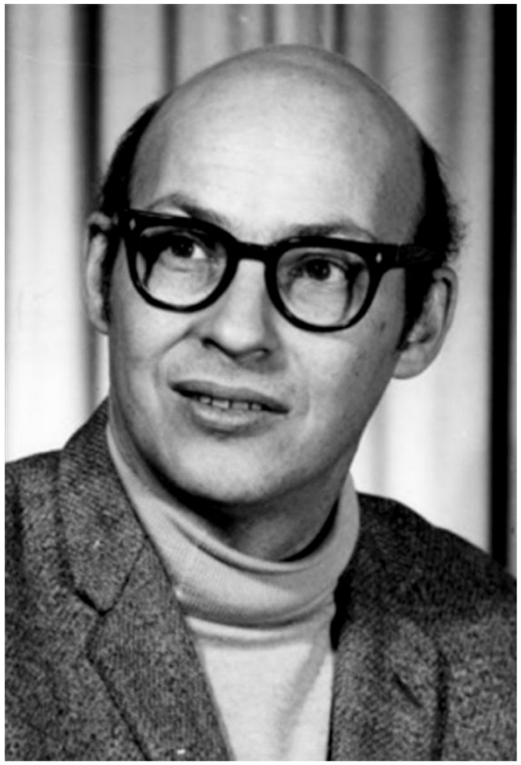
DeepMind

xAI

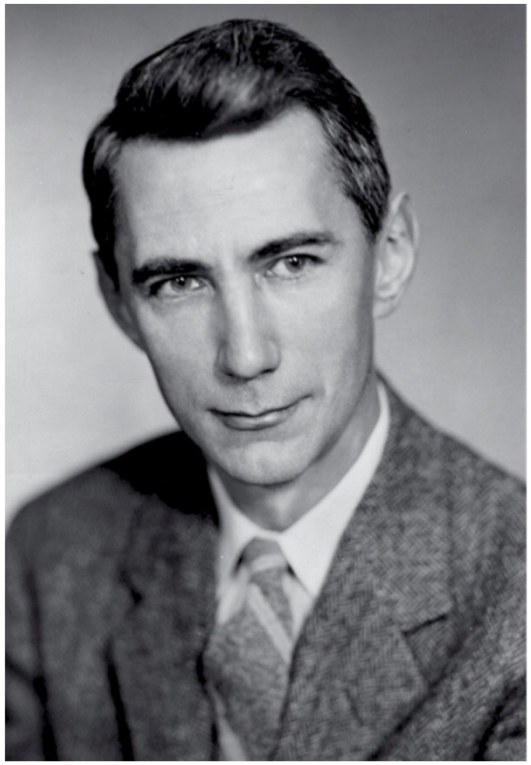
- xAI, founded by **Elon Musk**, is an organization dedicated to the research and development of artificial intelligence. While it does not have a physical location per se, xAI operates across multiple locations worldwide, collaborating with various research institutions and experts in the field. Elon Musk's involvement in AI research and his efforts through xAI have contributed to the advancement and ethical considerations of AI technologies.

The 1956 Dartmouth Workshop

John McCarthy



Marvin Minsky



Claude Shannon

Nathaniel Rochester

The proposers of the 1956 Dartmouth Conference. From left to right: John McCarthy, Marvin Minsky (Photo: MIT Museum), Claude Shannon and Nathaniel Rochester (Photo: Institute of Electrical and Electronics Engineers Inc) [34]

The 1956 Dartmouth Workshop

A Proposal for the

DARTMOUTH SUMMER RESEARCH PROJECT ON ARTIFICIAL INTELLIGENCE

June 17 - Aug. 16

We propose that a 2 month, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.

The following are some aspects of the artificial intelligence problem:

1) Automatic Computers

If a machine can do a job, then an automatic calculator can be programmed to simulate the machine. The speeds and memory capacities of present computers may be insufficient to simulate many of the higher functions of the human brain, but the major obstacle is not lack of machine capacity, but our inability to write programs taking full advantage of what we have.

2) How Can a Computer be Programmed to Use a Language

It may be speculated that a large part of human thought consists of manipulating words according to rules of reasoning

A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence (August 31st, 1955) [35]

We propose that a two-month, ten-man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire

- **1. Automatic Computers**
- **2. How Can a Computer be Programmed to Use a Language**
- **3. Neuron Nets**
- **4. Theory of the Size of a Calculation**
- **5. Self-improvement**
- **6. Abstractions**
- **7. Randomness and Creativity**


IN THIS BUILDING DURING THE SUMMER OF 1956
JOHN McCARTHY (DARTMOUTH COLLEGE), MARVIN L. MINSKY (MIT)
NATHANIEL ROCHESTER (IBM), AND CLAUDE SHANNON (BELL LABORATORIES)
CONDUCTED
THE DARTMOUTH SUMMER RESEARCH PROJECT
ON ARTIFICIAL INTELLIGENCE
FIRST USE OF THE TERM "ARTIFICIAL INTELLIGENCE"
FOUNDING OF ARTIFICIAL INTELLIGENCE AS A RESEARCH DISCIPLINE
"To proceed on the basis of the conjecture
that every aspect of learning or any other feature of intelligence
can in principle be so precisely described that a machine can be made to simulate it."
IN COMMEMORATION OF THE PROJECT'S 50th ANNIVERSARY
JULY 13, 2006

July 2006 AI@50 conference

Five of the attendees of the 1956 Dartmouth Summer Research Project on Artificial Intelligence reunited at the July 2006 AI@50 conference. From left: **Trenchard More, John McCarthy, Marvin Minsky, Oliver Selfridge, and Ray Solomonoff**. (Photo by Joseph Mehling) https://www.forbes.com/sites/gilpress/2016/08/28/artificial-intelligence-defined-as-a-new-research-discipline-this-week-in-tech-history/?sh=3a394c5a6dd1

4. AI Types[2,36]

- Artificial narrow intelligence (**ANI**), which has a narrow range of abilities;
- Artificial general intelligence (**AGI**), which is on par with human capabilities;
- Artificial superintelligence (**ASI**), which is more capable than a human.

AGI and ASI (10:38)

Artificial narrow intelligence (ANI) / Weak AI / Narrow AI

- Narrow AI is goal-oriented, designed to perform singular tasks - i.e. facial recognition, speech recognition/voice assistants, driving a car, or searching the internet - and is very intelligent at **completing the specific task** it is programmed to do
- Narrow AI doesn't mimic or replicate human intelligence, it merely **simulates human behaviour** based on a narrow range of parameters and contexts
- Can only **learn or be taught** to complete specific tasks
- AI is **programmed** to interact with humans in a natural, personalised manner
- Narrow AI can either be reactive, or have **a limited memory**

Examples of narrow AI:

We have currently only achieved narrow AI

- **Google** Search
- **Siri** by Apple, Alexa by Amazon, Cortana by Microsoft virtual assistants
- IBM's Watson
- **Image** / **facial** recognition software – **computer vision**
- Disease mapping and prediction tools
- Manufacturing and drone **robots**
- Email spam filters / social media monitoring tools for dangerous conter
- **Entertainment** or marketing content **recommendations** based on watch/listen/purchase behaviour
- **Self-driving** cars

Artificial General Intelligence (AGI) / Strong AI / Deep AI

- Mimics human intelligence and behaviours, with the ability to **learn** and **apply** its intelligence to **solve** any problem. AGI can **think**, **understand**, and **act** in a way that is indistinguishable from that of a human in any given situation.
- Uses a theory of mind AI framework, which refers to the ability to discern **needs, emotions, beliefs and thought processes** of other intelligent entitles. Training machines to truly **understand** humans.
- **Human brain** is the model for creating general intelligence. The lack of comprehensive knowledge on the functionality of the human brain.

Artificial Super Intelligence (ASI)/Super AI

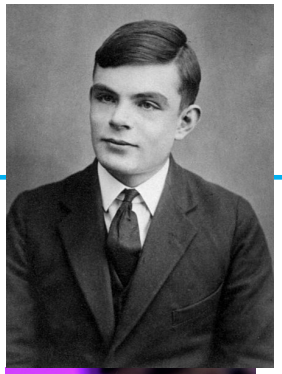
- ASI is where machines become **self-aware** and surpass the capacity of human intelligence and ability. In science fiction robots overrun, overthrow, and/or enslave humanity.
- ASI sees AI evolve to be so **akin** to human emotions and experiences, and it evokes emotions, needs, beliefs and desires of its own.
- ASI would theoretically **be exceedingly better at everything we do**; math, science, sports, art, medicine, hobbies, emotional relationships, everything.
- ASI would have **a greater memory** and **a faster ability** to process and analyse data and stimuli.
- Consequently, the decision-making and problem solving capabilities of super intelligent beings would **be far superior than** those of human beings.

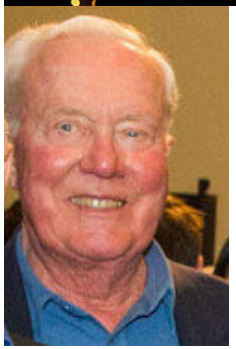
Class Discussion 01

Do you think which type of AI is **ChatGPT**?

- Weak AI: 2023
- Strong AI: 20?0
- Super AI: ?

5. AI Tests for confirming human-level AGI [2,36]





1. The Turing Test (Alan Turing)
2. The Coffee Test (Steve Wozniak)
3. The Robot College Student Test (Ben Goertzel)
4. The Employment Test (Nils John Nilsson)
5. What Should Replace the Turing Test?

1. The Turing Test (Alan Turing)

- A machine and a human both **converse unseen** with a **second human,** who must evaluate which of the two is the machine, which passes the test if it can fool the evaluator a significant fraction of the time.
- **Note**: Turing does not prescribe what should qualify as intelligence, o knowing that it is a machine should disqualify it.

  - What is Turing Test (1:54)
  - Google AI making a call (3:57)

2. The Coffee Test (Steve Wozniak)

- A machine is required to enter an average American home and figure out how to make coffee:
  1) find the coffee machine
  2) find the coffee
  3) add water
  4) find a mug
  5) brew the coffee by pushing the proper buttons.

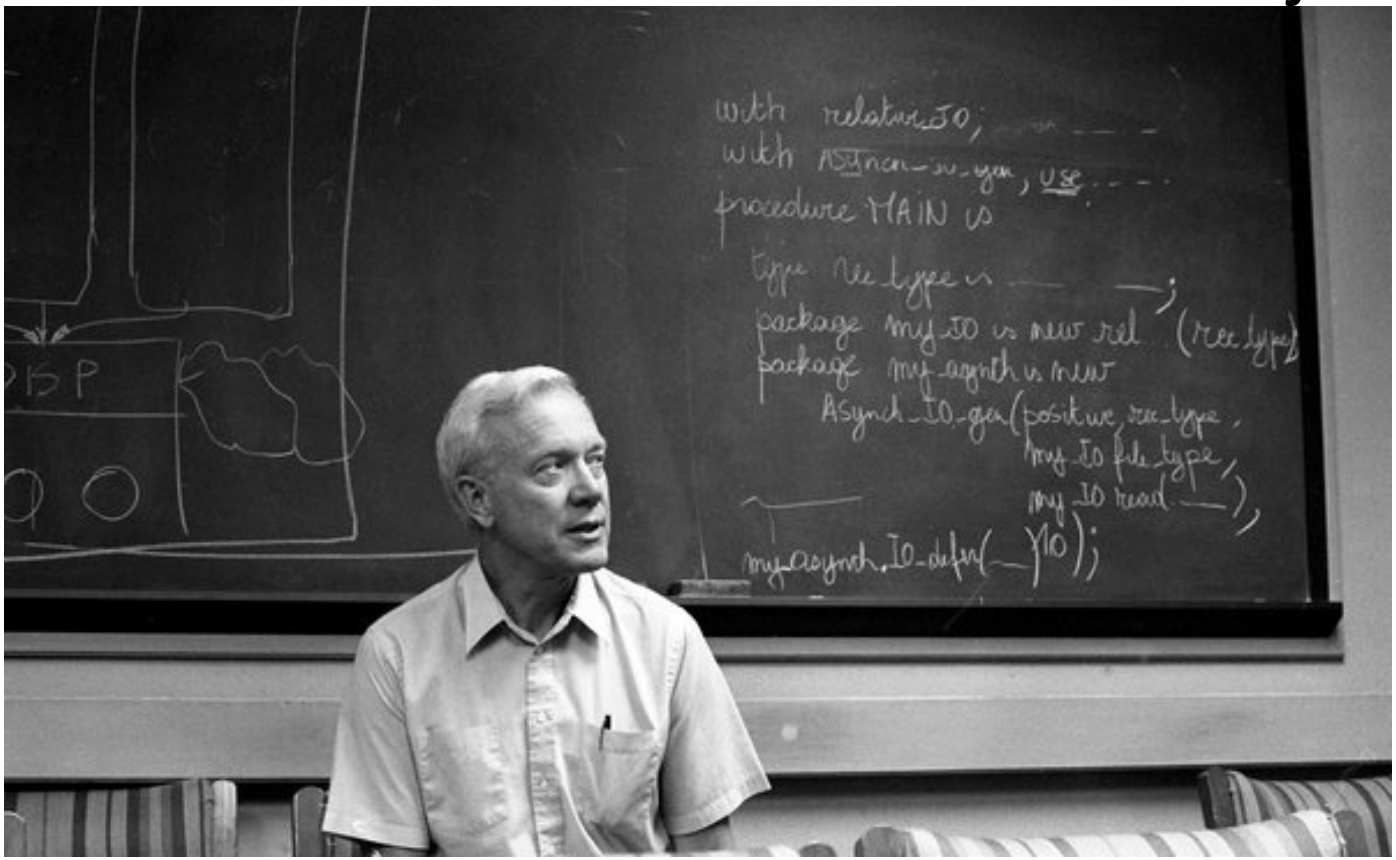
- Wozniak Could a Computer Make a Cup of Coffee (2:14)
- GPT-J AI Beth Takes The Coffee Test (3:51)

3. The Robot College Student Test (Ben Goertzel)

- A machine **enrolls** in a **university**, taking and passing the same classes that humans would, and **obtaining** a **degree**.

4. The Employment Test (Nils John Nilsson)

- A machine performs an economically important job at least **as well as** humans in the same job.

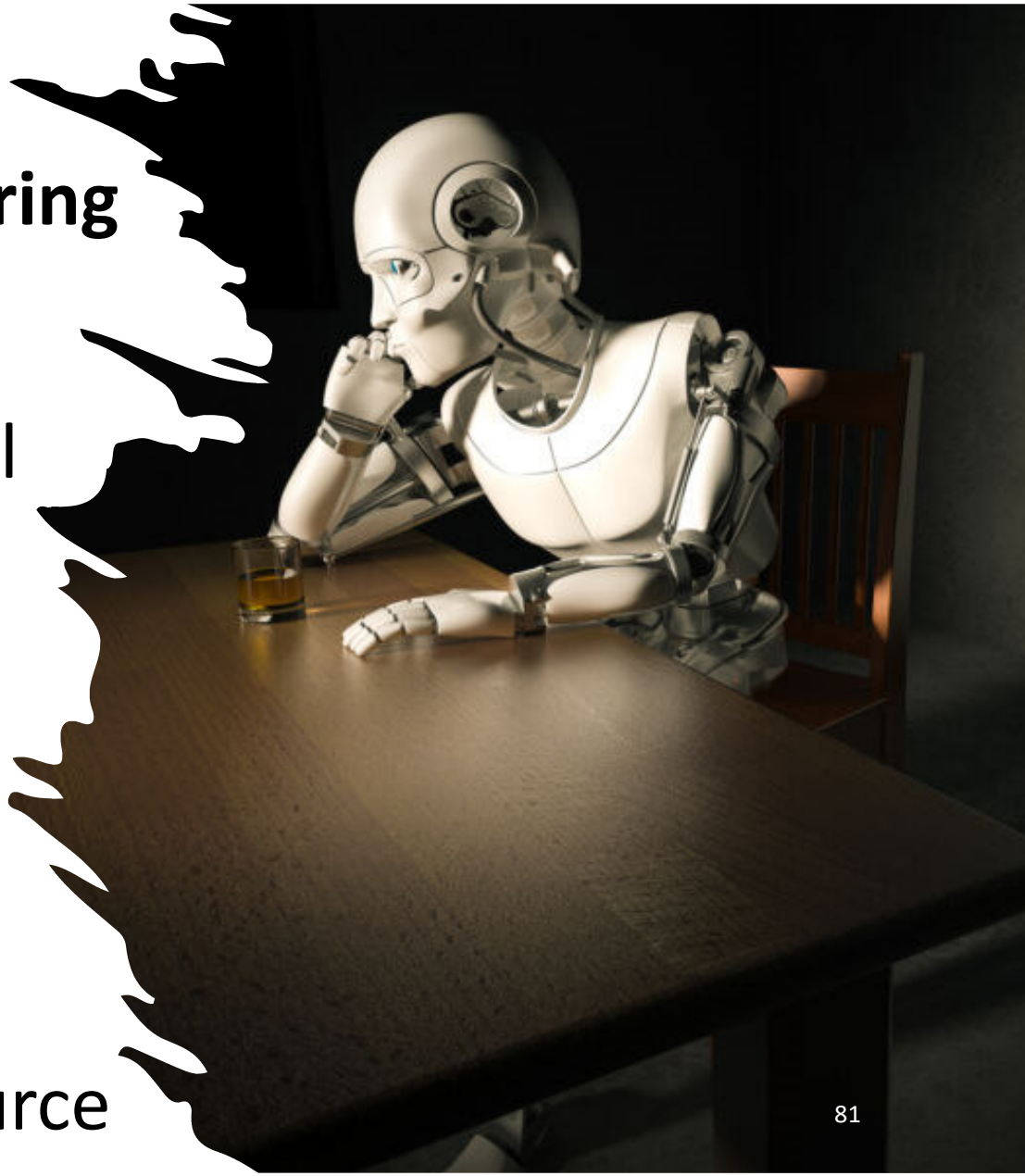


5. What Should Replace the Turing Test?[1,2]

Step 1: A series of psychological experiments.

Step 2: Testing AI's ability to introspect

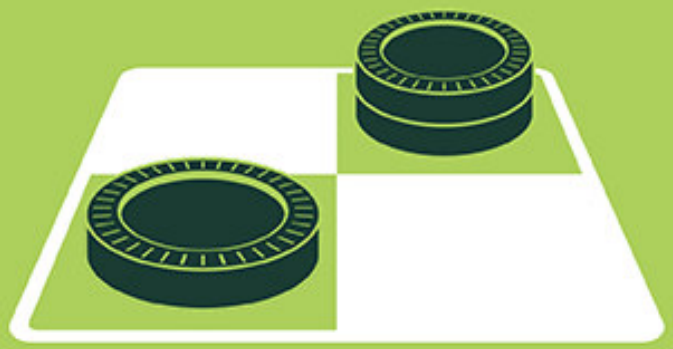
Step 3: Going deep into the source



Summary: History of Artificial Intelligence

ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.



MACHINE LEARNING

Machine learning begins to flourish.

DEEP LEARNING

Deep learning breakthroughs drive AI boom.

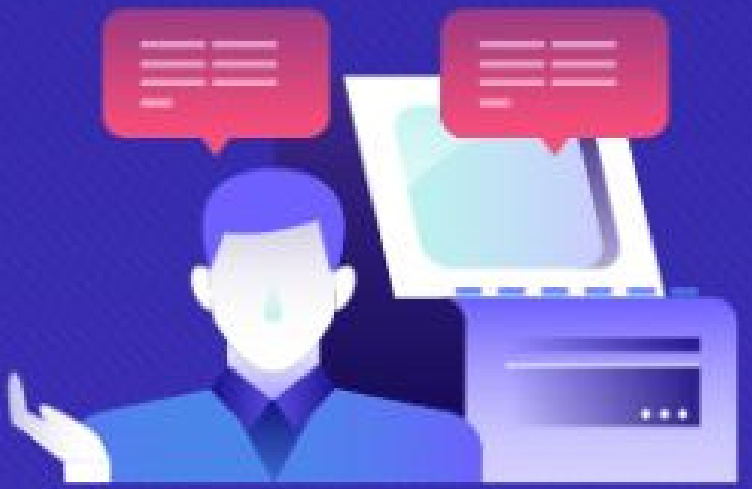
1950's 1960's 1970's 1980's 1990's 2000's 2010's

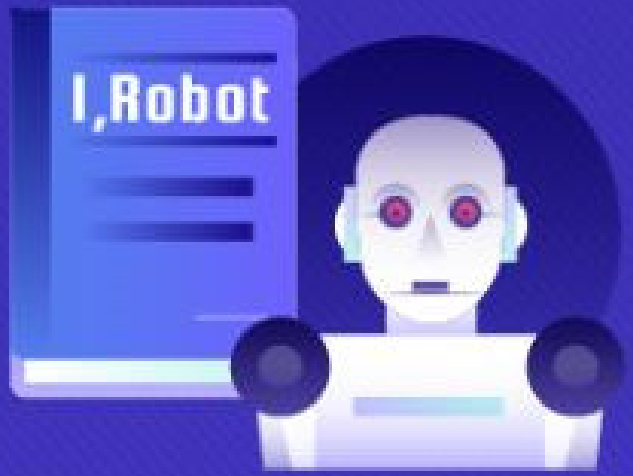
FAQ 01 Summary of AI History

1943

TURING TEST

Alan Turing invented the "Turing test," which set the bar for an intelligent machine: a computer that could fool someone into thinking they were talking to a real person. Grey Walter built some of the first ever robots.





1950

I, ROBOT

I, Robot was published—a collection of short stories by science fiction writer Isaac Asimov.

1969

SHAKEY THE ROBOT

Shakey the Robot, the first general-purpose mobile robot was built. It was able to make decisions about its own actions by reasoning about its surroundings.

1968

2001: A SPACE ODYSSEY

Marvin Minsky, the founder of the AI Laboratory at MIT, advised Stanley Kubrick on the film 2001: A Space Odyssey, featuring an intelligent computer, HAL 9000.

1973

"AI WINTER"

The "AI winter" began—millions had been spent, with little to show for it. As a result, funding for the industry was slashed.

1981

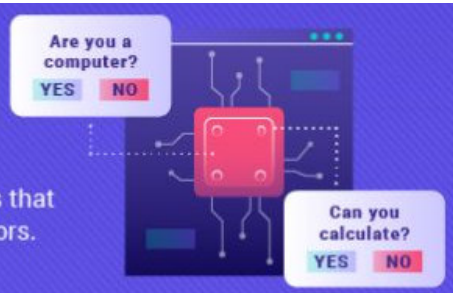
NARROW AI

Instead of trying to create a general intelligence, research shifted toward creating "expert systems," which focused on much narrower tasks.

1990

BOTTOM-UP APPROACH

Rodney Brooks spearheaded the "bottom-up approach": aiming to develop neural networks that simulated brain cells and learned new behaviors.



1997

DEEP BLUE

Supercomputer Deep Blue, developed by IBM, faced world chess champion Garry Kasparov.

2002

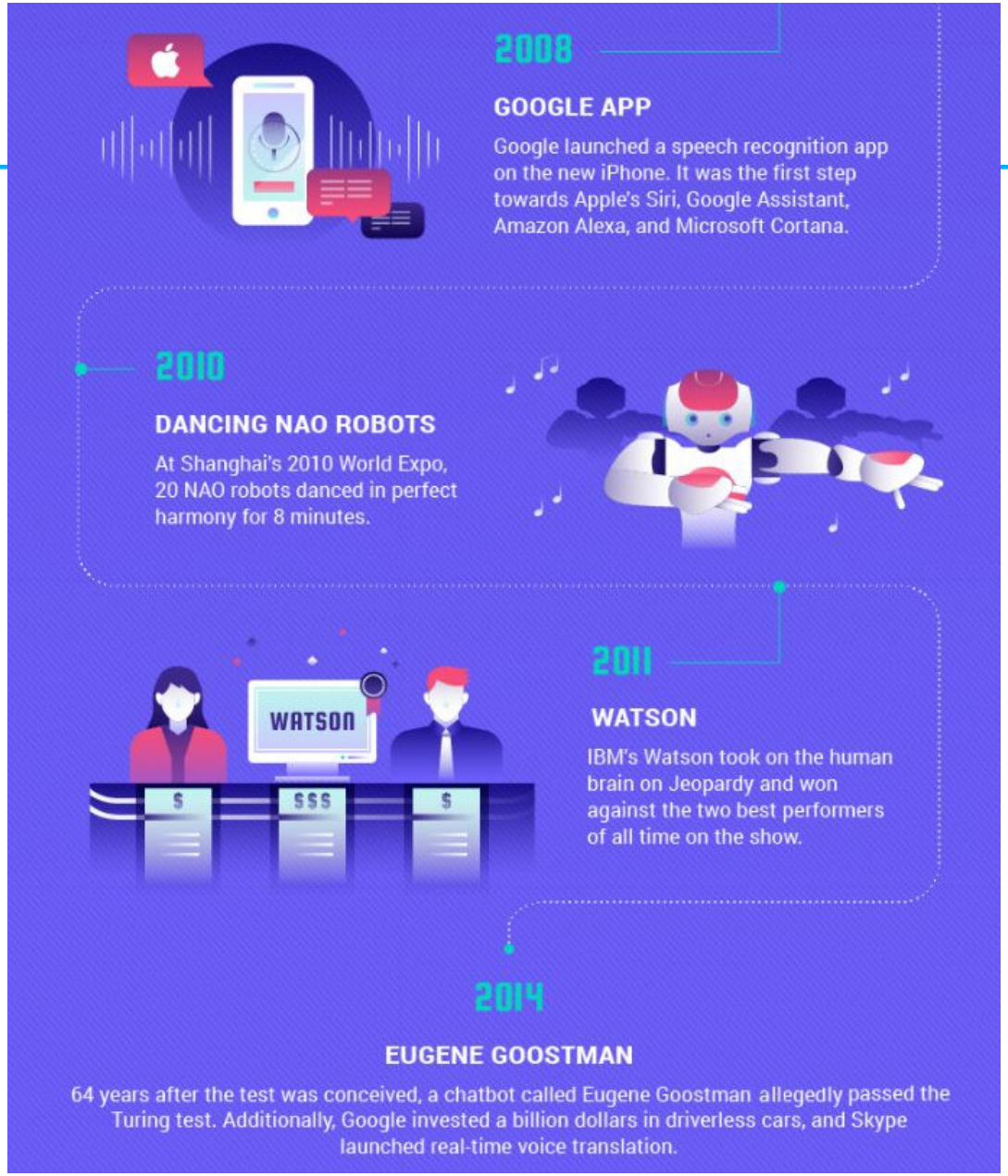
ROOMBA

iRobot created the first commercially successful robot for the home—an autonomous vacuum

2005

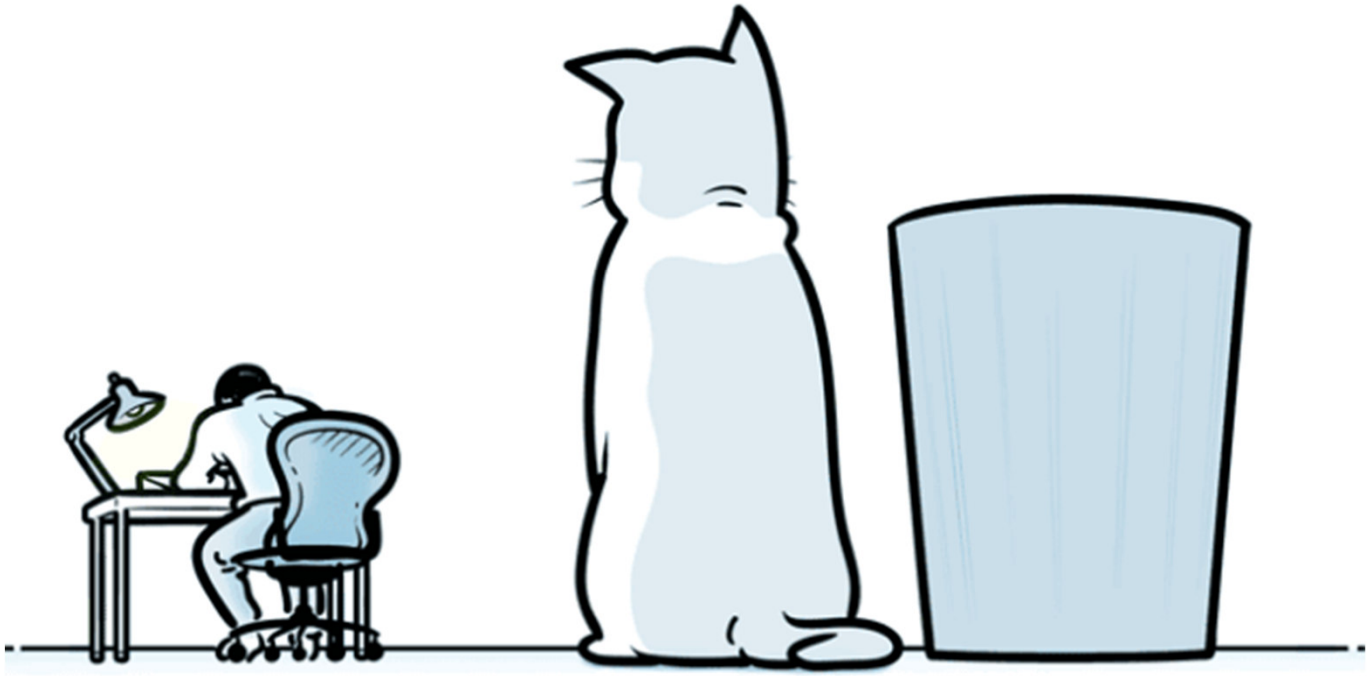
BIGDOG

The US military started investing in autonomous robots. BigDog, made by Boston Dynamics, was one of the first.


2008
GOOGLE APP
Google launched a speech recognition app on the new iPhone. It was the first step towards Apple's Siri, Google Assistant, Amazon Alexa, and Microsoft Cortana.
2010
DANCING NAO ROBOTS
At Shanghai's 2010 World Expo, 20 NAO robots danced in perfect harmony for 8 minutes.
WATSON
$
$$$
$
2011
WATSON
IBM's Watson took on the human brain on Jeopardy and won against the two best performers of all time on the show.
2014
EUGENE GOOSTMAN
64 years after the test was conceived, a chatbot called Eugene Goostman allegedly passed the Turing test. Additionally, Google invested a billion dollars in driverless cars, and Skype launched real-time voice translation.

Thanks and Questions

https://github.com/LeoYiChen/Introduction2AI-202010



Brief History of AI[37] (5:58)

- 1943 - Neuron
- 1957 - Perceptron
- 1960 - Backpropagation Model
- 1962 - Backpropagation With Chain Rule
- 1965 - Multilayer Neural Network
- 1969 - The Fall Of Perceptron
- 1970 - Backpropagation Is Computer Coded
- 1971 - Neural Network Goes Deep
- 1974 - 1980 The 1st major "AI Winter"
- 1980 - Neocognitron – First CNN Architecture
- 1982 - Hopfield Network – Early RNN

Brief History of AI[37]

- 1982 - Proposal For Backpropagation In ANN
- 1985 - Boltzmann Machine
- 1986 - NETtalk – ANN Learns Speech
- 1986 - Implementation Of Backpropagation
- 1986 - Restricted Boltzmann Machine
- 1987-1993 The 2nd major "AI Winter"
- 1989 - CNN Adopting Backpropagation
- 1989 - Universal Approximators Theorem
- 1991 - Vanishing Gradient Problem
- 1997 - Long Short-Term Memory
- 2006 - Deep belief network

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Brief History of AI[37]

- 2008 - Use of GPU in Training
- 2009 - ImageNet
- 2011 - ReLU : Rectified Linear Unit
- 2012 - AlexNet
- 2014 - GAN : Generative Adversarial Network
- 2016 - AlphaGo Beats Human
- 2017 - Transformer
- 2020 - OpenAI GPT-3
- 2021 - Monster AI models

Reference

[1] If AI is making the Turing test obsolete, what might be better? | Ars Technica, https://arstechnica.com/ai/2023/12/do-ai-improvements-call-for-something-better-than-the-turing-test/

[2] **What Should Replace the Turing Test?**

https://spj.science.org/doi/10.34133/icomputing.0064

Introduction to Artificial Intelligence
- 01-02 An Introduction

Thanks and Questions

This is the Last Page

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