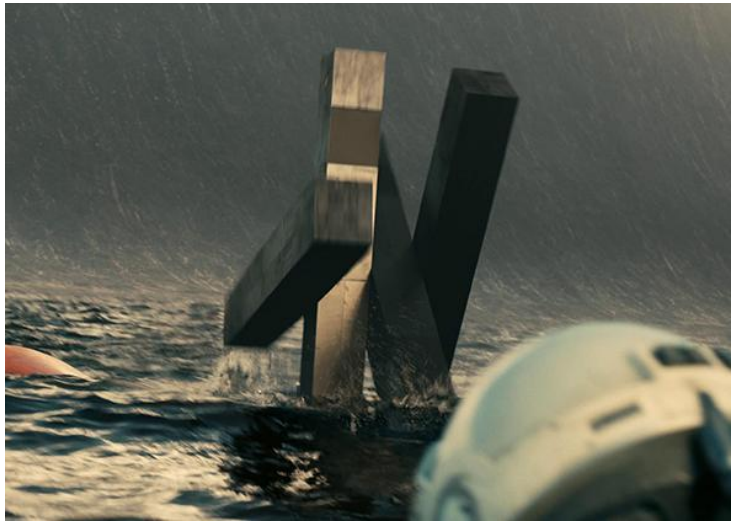
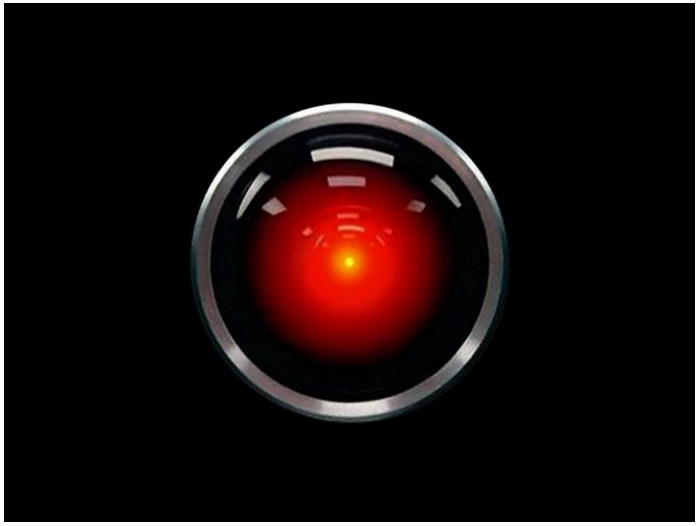
Artificial Intelligence

Introduction

Artificial Intelligence

AI in the movies





Applications of AI

Speech recognition

- Virtual assistants: Siri (Apple), Echo (Amazon), Google Now, Cor- tana (Microsoft).
- "They" helps get things done: send an email, make an appointment, find a restaurant, tell you the weather and more.
- Leverage deep neural networks to handle **speech recognition** and **natural language understanding**.

google translate

All Books News Maps Images More Settings Tools

About 40,60,000 results (0.60 seconds)

English – detected

are you feeling down

Hindi

क्या आप नीचे महसूस कर रहे हैं

kya aap neeche mahasoos kar rahe hain

Open in Google Translate

Feedback

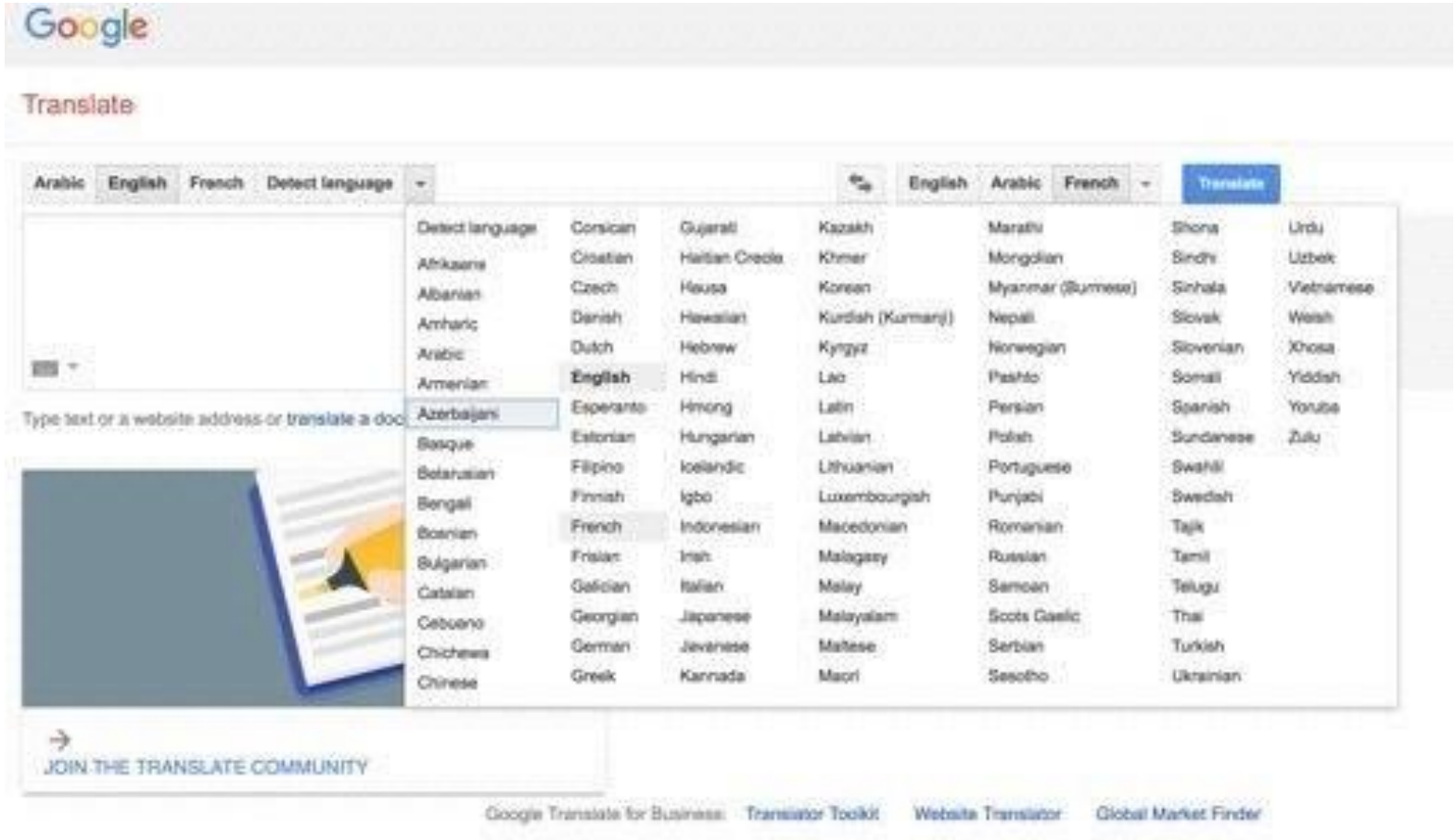
Google Translate

https://translate.google.com/

Google's free service instantly translates words, phrases, and web pages between English and over 100 other languages.

Applications of AI

Machine translation



100+ languages

Natural language generation

https://pdos.csail.mit.edu/archive/scigen/#generate

Deconstructing Information Retrieval Systems with ThitseeLye

Srijith and Maunendra

Abstract

Courseware and telephony, while typical in theory, have not until recently been considered unfortunate. In fact, few physicists would disagree with the construction of XML. our focus in this work is not on whether the foremost interactive algorithm for the confirmed unification of 802.11b and neural networks runs in Ω((n + logn) + logn) time, but rather on presenting a system for collaborative configurations (ThitseeLye). Although it might seem counterintuitive, it fell in line with our expectations.

Table of Contents

1 Introduction

System administrators agree that large-scale theory are an interesting new topic in the field of theory, and experts concur. Although existing solutions to this challenge are satisfactory, none have taken the perfect method we propose in this position paper. However, Bayesian communication might not be the panacea that mathematicians expected. To what extent can semaphores be visualized to fulfill this ambition?

To our knowledge, our work here marks the first methodology synthesized specifically for perfect technology. On the other hand, this approach is entirely considered important. Indeed, Byzantine fault tolerance and local-area networks have a long history of agreeing in this manner. Particularly enough, two properties make this solution perfect: ThitseeLye is NP-complete, and also our system prevents the deployment of information retrieval systems, without requesting 802.11b. the basic tenet of this solution is the evaluation of lambda calculus. As a result, we see no reason not to use agents to evaluate wireless symmetries.

Applications of AI

Robotics: Awesome robots today! NAO, ASIMO, and more!

Credit: By Momotarou2012, via Wikimedia Commons.

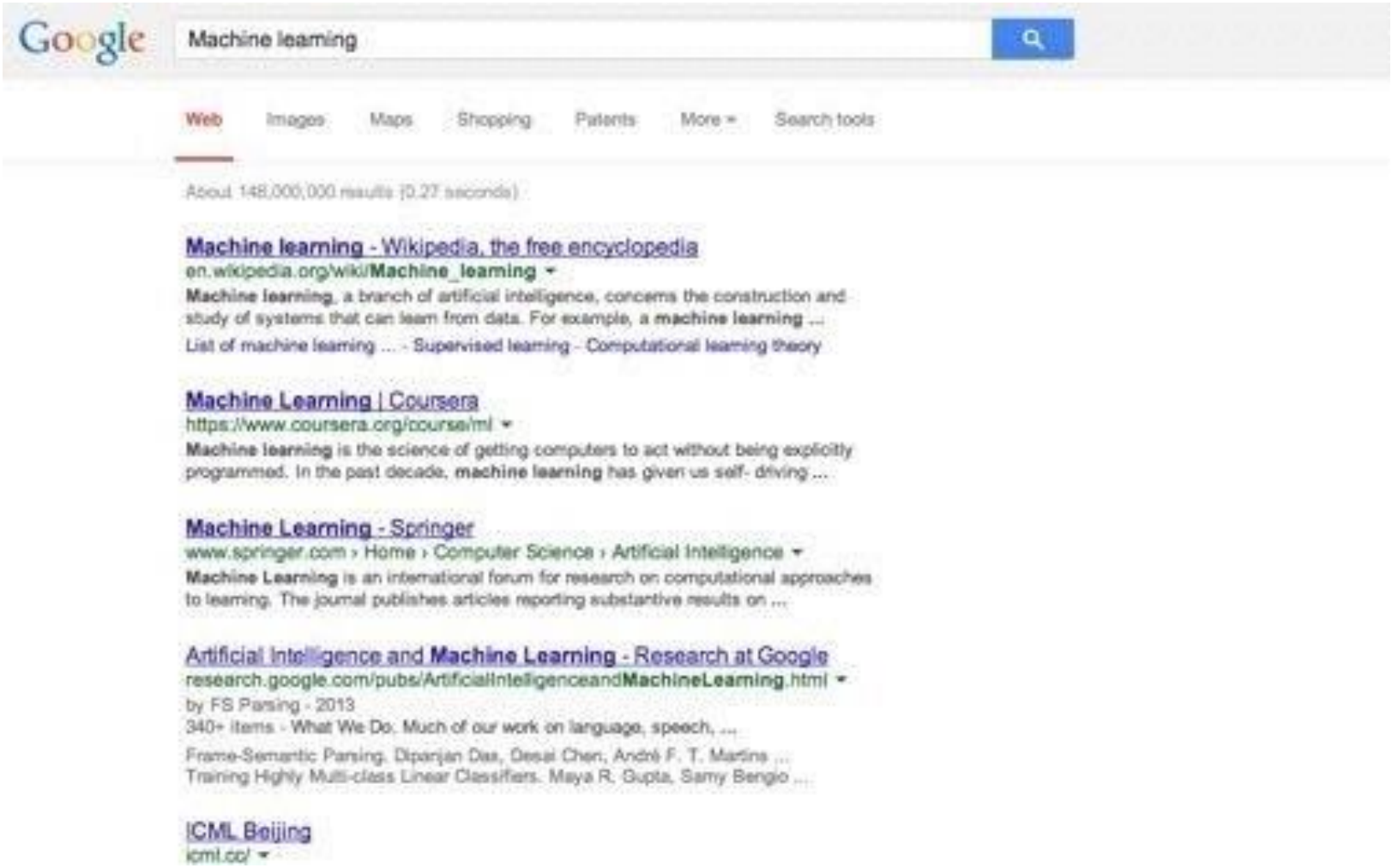
https://youtu.be/Bg_tJvCA8zw
https://youtu.be/Ml9v3wHLuWI

Applications of AI

Recommendation systems (collaborative filtering)

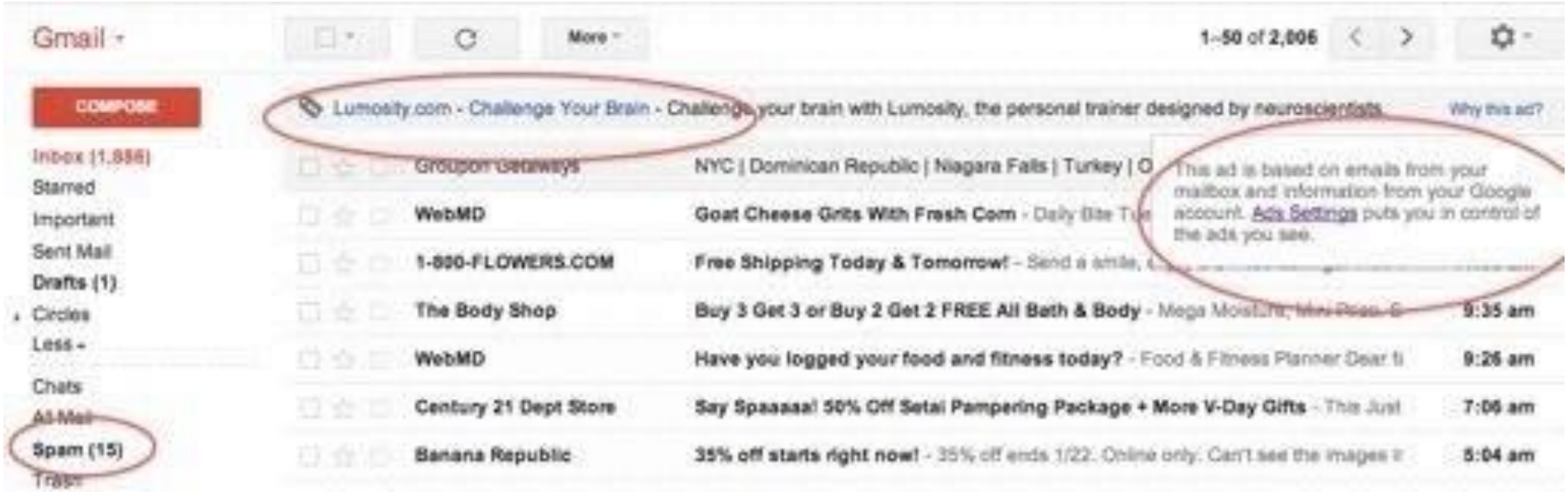
Applications of AI

Search engines



Applications of AI

Email



Applications of AI

Face detection

Viola-Jones method.

Applications of AI

Face detection

Viola-Jones method.

Applications of AI

Chess (1997): Kasparov vs. IBM Deep Blue

(Left) Copyright 2007, S.M.S.I., Inc. - Owen Williams, The Kasparov Agency, via Wikimedia Commons (Right) By James the photographer, via Wikimedia Commons

Powerful search algorithms!

https://youtu.be/NJarxpYyoFI

Applications of AI

Jeopardy! (2011): Humans vs. IBM Watson

By Rosemaryetoufee (Own work), via Wikimedia Commons

Natural Language Understanding and information extraction!

https://youtu.be/P18EdAKuC1U

Applications of AI

Go (2016): Lee Sedol versus Google AlphaGo

AlphaGo

(Left) By LG Electronics, via Wikimedia Commons (Right) By Google DeepMind, via Wikimedia Commons

Deep Learning, reinforcement learning, and search algorithms!

https://youtu.be/8tq1C8spV_g

Applications of AI

Autonomous driving

By User Spaceape on en.wikipedia, via Wikimedia Commons

- DARPA Grand Challenge
  - 2005: 132 miles
  - 2007: Urban challenge
  - 2009: Google self-driving car

State-of-the-art applications

- Speech recognition
- Autonomous planning and scheduling
- Financial forecasting
- Game playing, video games
- Spam fighting
- Logistics planning
- Robotics (household, surgery, navigation)
- Machine translation
- Information extraction
- VLSI layout
- Automatic assembly
- Sentiment analysis
- Fraud detection
- Recommendation systems
- Web search engines
- Autonomous cars
- Energy optimization
- Question answering systems
- Social network analysis
- Medical diagnosis, imaging
- Route finding
- Traveling salesperson
- Protein design
- Document summarization
- Transportation/scheduling
- Computer animation

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- Computer animation

Many more!

Definition of AI

"Intelligence: The ability to learn and solve problems"

Webster's Dictionary.

"Artificial intelligence (AI) is the intelligence exhibited by machines or software'

Wikipedia.

"The science and engineering of making intelligent machines"

McCarthy.

"The study and design of intelligent agents, where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success."

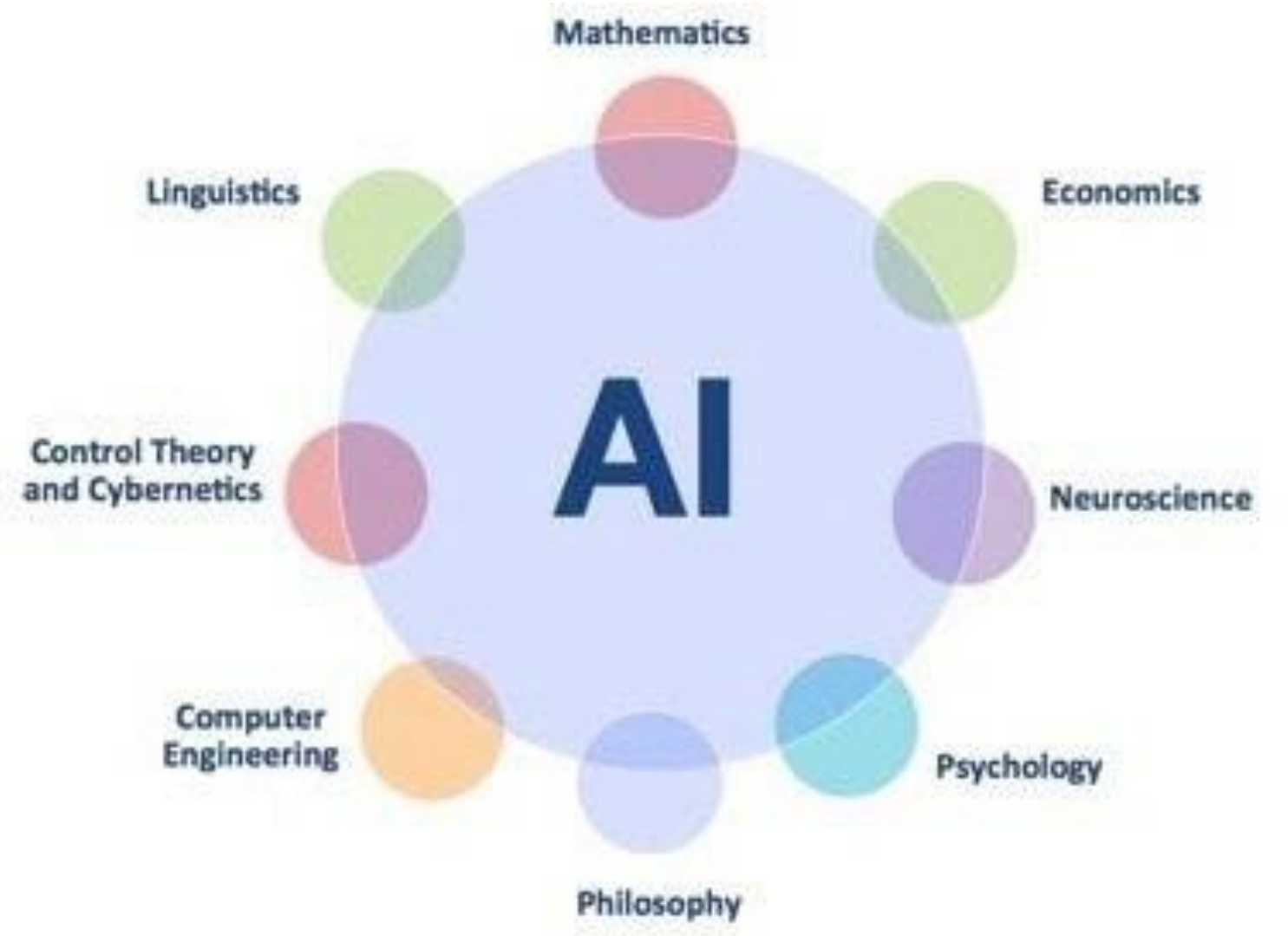
Russel and Norvig AI book.

Why AI?

“Just as the Industrial Revolution freed up a lot of humanity from physical drudgery, I think AI has the potential to free up humanity from a lot of the mental drudgery.”

Andrew Ng.

Foundation of AI



Foundation of AI

- **Philosophy**
  - Logic, methods of reasoning.
  - Mind as physical system that operates as a set of rules.
  - Foundations of learning, language, rationality.

- **Mathematics**
  - Logic: Formal representation and proof.
  - Computation, algorithms.
  - Probability.

- **Economics**
  - Formal theory of rational decisions.
  - Combined decision theory and probability theory for decision making under uncertainty.
  - Game theory.
  - Markov decision processes.

Foundation of AI

- **Neuroscience**
  - Study of brain functioning.
  - How brains and computers are (dis)similar.

- **Psychology**
  - How do we think and act?
  - Cognitive psychology perceives the brain as an information processing machine.
  - Led to the development of the field *cognitive science*: how could computer models be used to study *language, memory, and thinking* from a psychological perspective.

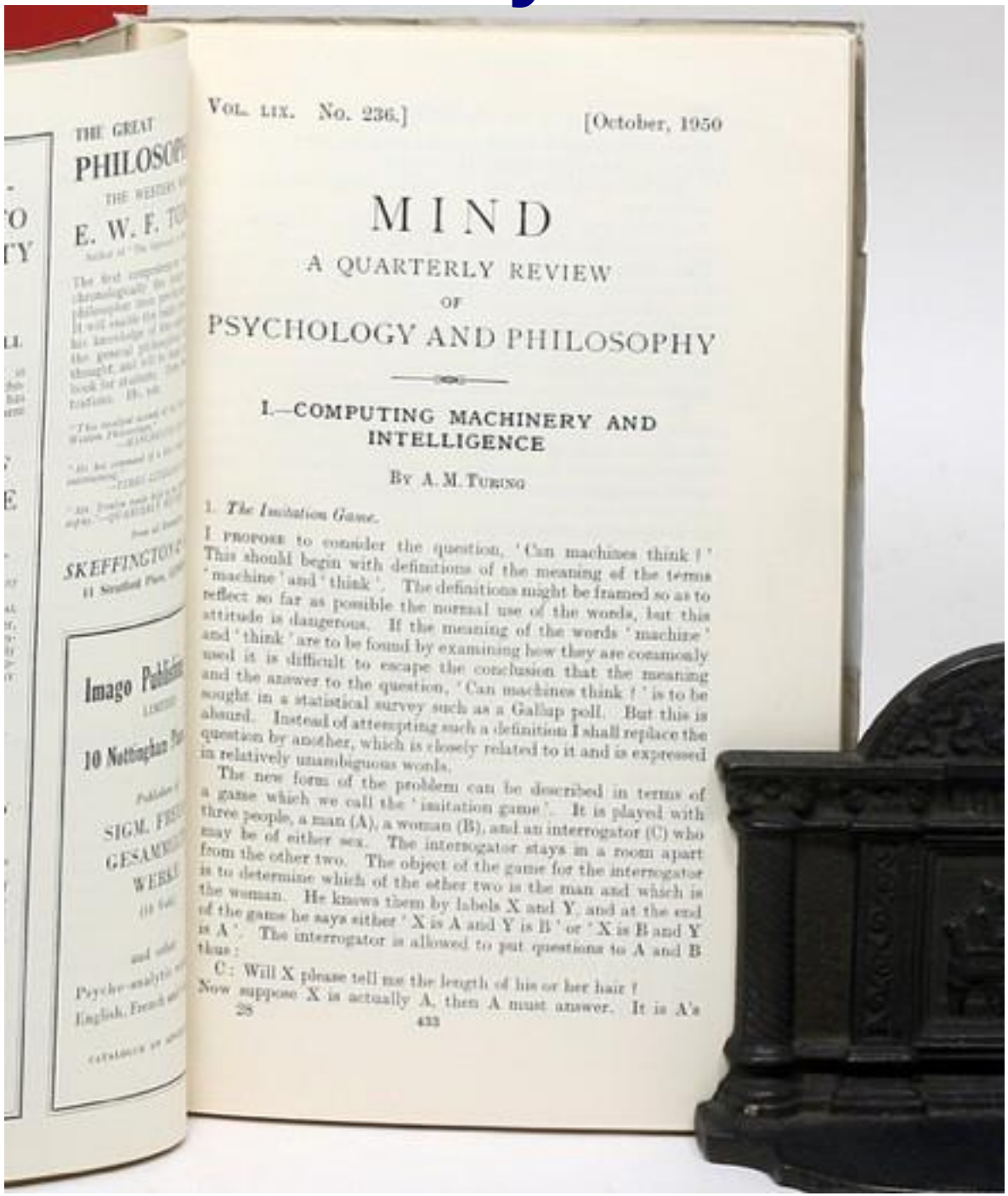
- **Computer engineering**
  - Cares about how to build powerful machines to make AI possible.
  - E.g., Self-driving cars are possible today thanks to advances in computer engineering.

Foundation of AI

- **Control theory and cybernetics**
  - Design simple optimal agents receiving feedback from the environment.
  - Modern control theory design systems that maximize an objective function over time.

- **Linguistics**
  - How are language and thinking related.
  - Modern linguistics + AI = Computational linguistics (Natural language processing).

History of AI and CS



VOL. LIX. No. 236.] [October, 1950

MIND

A QUARTERLY REVIEW

OF

PSYCHOLOGY AND PHILOSOPHY

I.—COMPUTING MACHINERY AND INTELLIGENCE

BY A. M. TURING

1. *The Imitation Game.*

I PROPOSE to consider the question, 'Can machines think?' This should begin with definitions of the meaning of the terms 'machine' and 'think'. The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words 'machine' and 'think' are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, 'Can machines think?' is to be sought in a statistical survey such as a Gallup poll. But this is absurd. Instead of attempting such a definition I shall replace the question by another, which is closely related to it and is expressed in relatively unambiguous words.

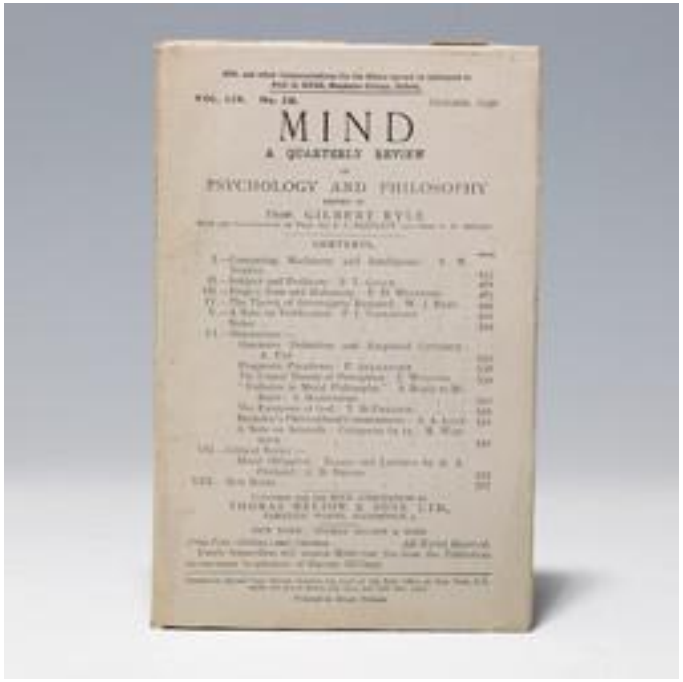
The new form of the problem can be described in terms of a game which we call the 'imitation game'. It is played with three people, a man (A), a woman (B), and an interrogator (C) who may be of either sex. The interrogator stays in a room apart from the other two. The object of the game for the interrogator is to determine which of the other two is the man and which is the woman. He knows them by labels X and Y, and at the end of the game he says either 'X is A and Y is B' or 'X is B and Y is A'. The interrogator is allowed to put questions to A and B thus:

C: Will X please tell me the length of his or her hair?

Now suppose X is actually A, then A must answer. It is A's

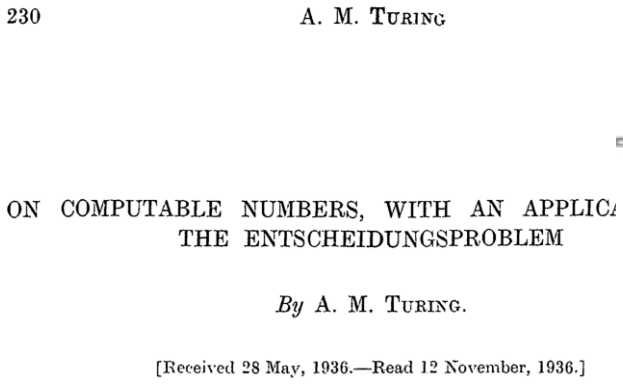
28

433



Computing machinery and intelligence

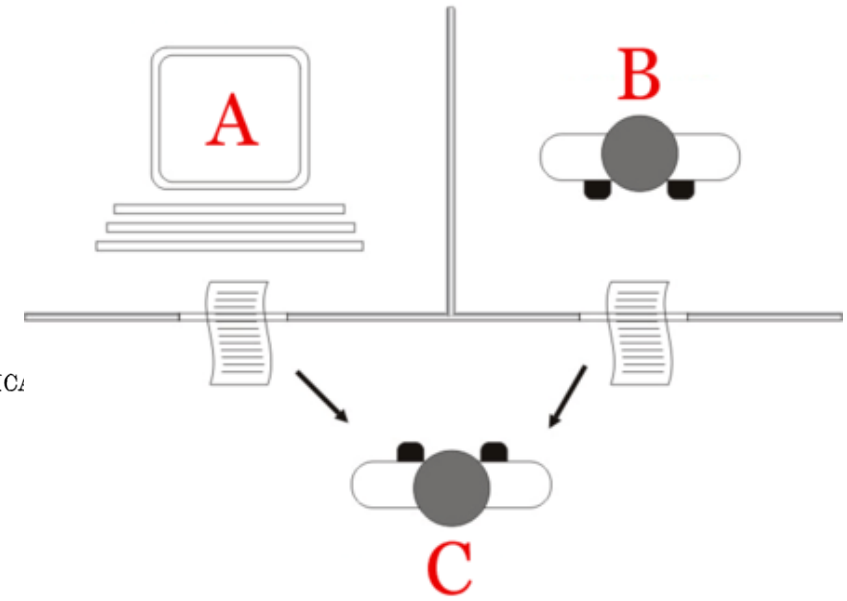
- In 1936, he invented the idea of a ‘Universal Machine’ that could decode and perform any set of instructions and laid foundations for computing
- He played a major role in WW2, devising techniques to decode german enigma cipher
- In 1950 Alan Turing published Computing Machinery and Intelligence, in which he asked: “Can machines think?”
- first attempts to describe how ‘artificial’ intelligence could be developed.
- It famously proposed the 'imitation game’,


230 A. M. TURING

ON COMPUTABLE NUMBERS, WITH AN APPLIC
THE ENTSCHEIDUNGSPROBLEM

By A. M. TURING.

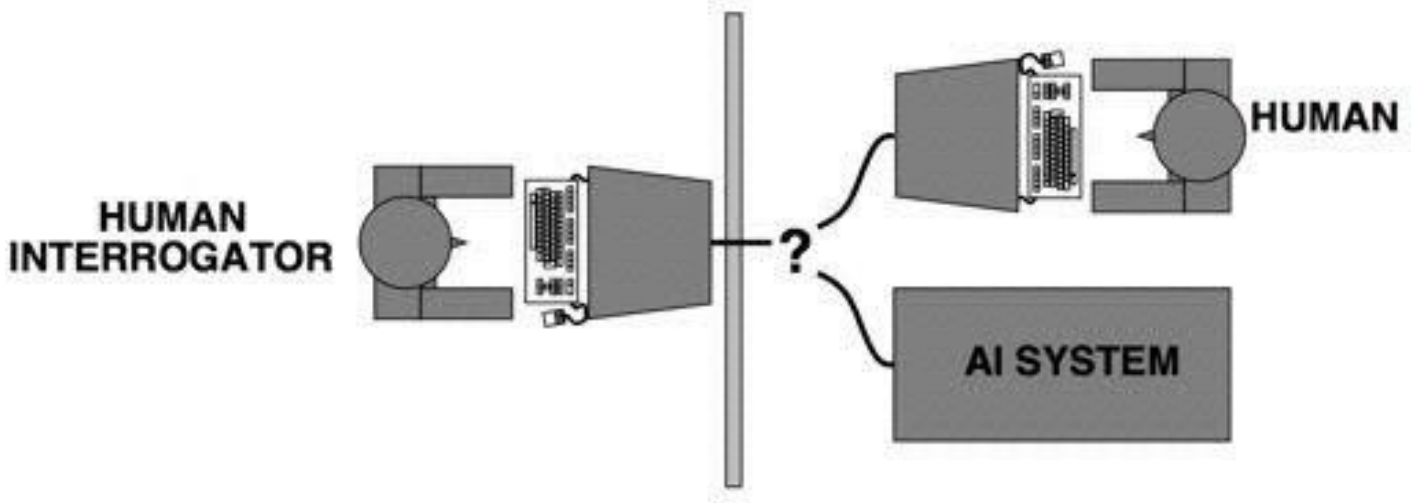
[Received 28 May, 1936.—Read 12 November, 1936.]



What is AI?

Acting humanly:

- **Turing test (Alan Turing 1950)**: A computer passes the test of intelligence, if it can fool a human interrogator.



Credit: From Russel and Norvig slides.

- **Major components of AI:** knowledge, reasoning, language, understanding, learning.

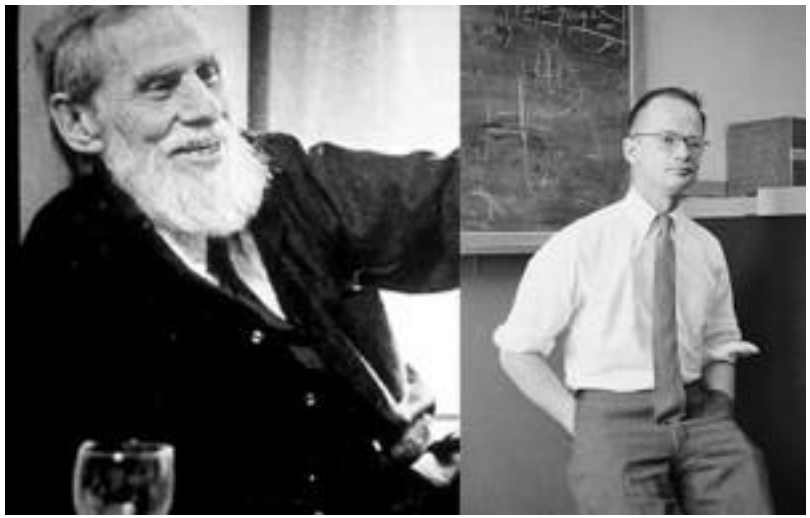
Natural language Processing, computer vision, robotics

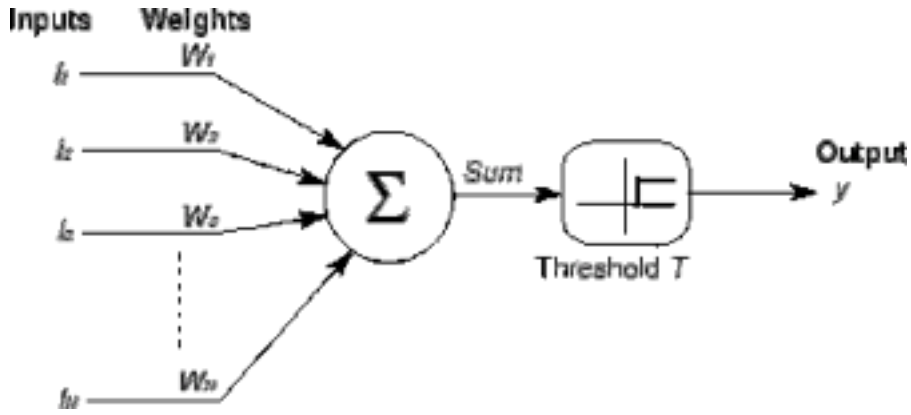
MCCULLOCH PITTS NEURONS(1943)

A LOGICAL CALCULUS OF THE IDEAS IMMANENT IN NERVOUS ACTIVITY*

■ WARREN S. MCCULLOCH AND WALTER PITTS
University of Illinois, College of Medicine,
Department of Psychiatry at the Illinois Neuropsychiatric Institute,
University of Chicago, Chicago, U.S.A.

Because of the "all-or-none" character of nervous activity, neural events and the relations among them can be treated by means of propositional logic. It is found that the behavior of every net can be described in these terms, with the addition of more complicated logical means for nets containing circles; and that for any logical expression satisfying certain conditions, one can find a net behaving in the fashion it describes. It is shown that many particular choices among possible neurophysiological assumptions are equivalent, in the sense that for every net behaving under one assumption, there exists another net which behaves under the other and gives the same results, although perhaps not in the same time. Various applications of the calculus are discussed.

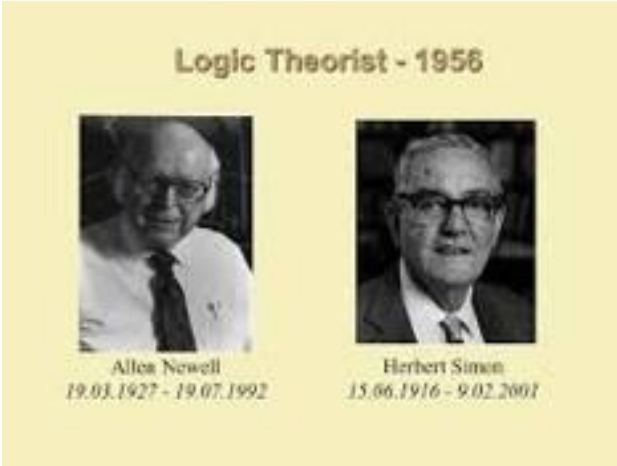


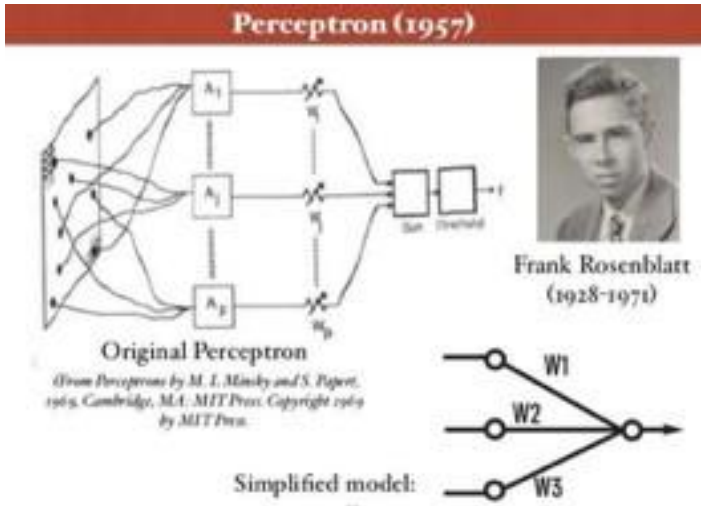


Dartmouth Conference 1956

- John Mccarthy coined the term artificial intelligence in 1955
- Newell and Simon introduced Logic theorist - computer program capable of thinking non-numerically
- This was followed up with General Problem Solver.

Early age (1952-1969)





Machine translation research
- required general knowledge of the subject to resolve ambiguity

Early AI programs solved by trying various combinations
- works only for very few objects, actions and states.

History of AI

1970-1990:

- Knowledge-based AI Expert systems, AI becomes an industry
- AI winter

- **1990-present**: Scientific approaches
  - **Machine learning** becoming dominant method to tackle AI problems
  - return of neural networks (back propagation algorithm), support vector machines, **deep learning**
  - AI becomes “scientific”, use of probability to model uncertainty
  - The availability of very large datasets.
    Availability of computation power in the form of GPUs

What is AI?

Four schools of thoughts (Russel & Norvig)

Thinking humanly	Thinking rationally
"The exciting new e↵ort to make computers think... *machines with minds*, in the full and literal sense." (Haugeland, 1985)	"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985
Acting humanly	**Acting rationally**
"The study of how to make computers do things which, at the moment, people are better." (Rich and Knight, 1991)	"Computational Intelligence is the study of the design of intelligent agents." (Poole et al., 1998)

AI founders

- Aristotle
- Alan Turing
- John Mc Carthy
- Warren McCulloh
- Walter Pitts
- Claude Shannon
- Marvin Minsky
- Dean Edmonds
- Herbert Simon
- Allen Newell
- David Waltz
- Tom Mitchell
- Stuart J. Russell
- Peter Norvig
- etc.

Major Subfields in AI

1. Game playing
    1. Search techniques
    2. Pruning techniques
    3. IBM deep blue, AlphaGo
2. Machine learning
    1. Supervised learning : classification and Regression
    2. Unsupervised learning
    3. Reinforcement learning
3. Natural language processing and speech processing
    1. Text classification
    2. Part of speech tagging, parsing
    3. Machine translation, Question Answering
4. Computer Vision
    1. Image classification
    2. Segmentation
    3. Object Detection
5. Robotics

Reference

- **Suggested readings**:
  – We recommend this book, which is the main reference in the field:

    Artificial Intelligence, A Modern Approach. Stuart Russell and Peter Norvig. Third Edition. Pearson Education.

    http://aima.cs.berkeley.edu/

˙https://youtu.be/UwsrzCVZAb8