Introduction to Artificial Intelligence

DA 221

Jan - May 2023

IIT Guwahati

Instructors: Neeraj Sharma & Arghyadip Roy

About Us

Your Instructors

Arghyadip Roy

Neeraj Sharma

Teaching Assistants

Shania H

Let’s get an idea why this course

What going on Earth?

About Google Books
• Overview

Google Books Library Project – An enhanced card catalog of the world's books

Google books

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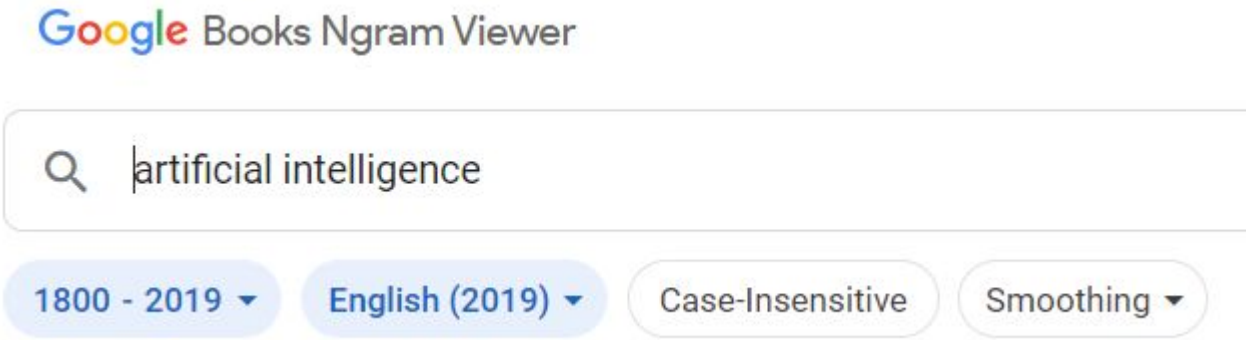
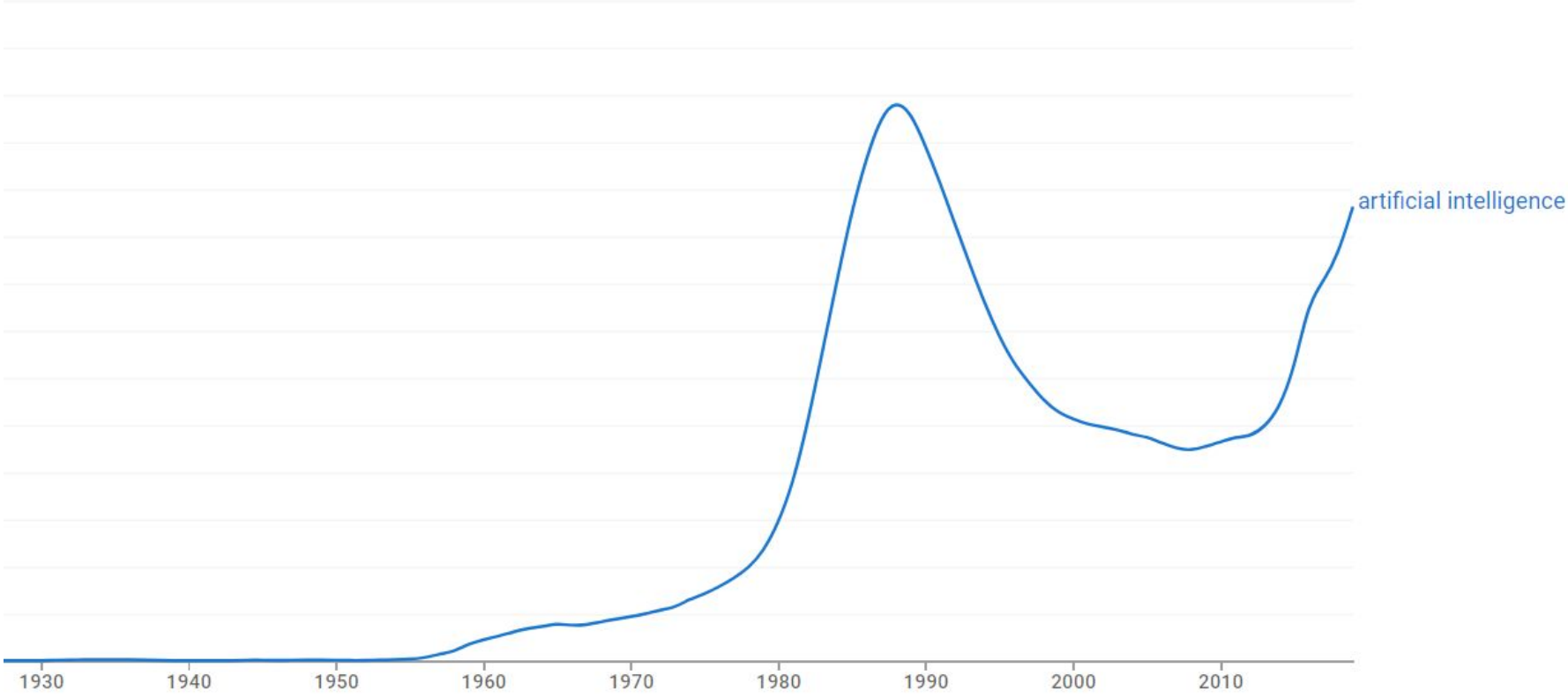
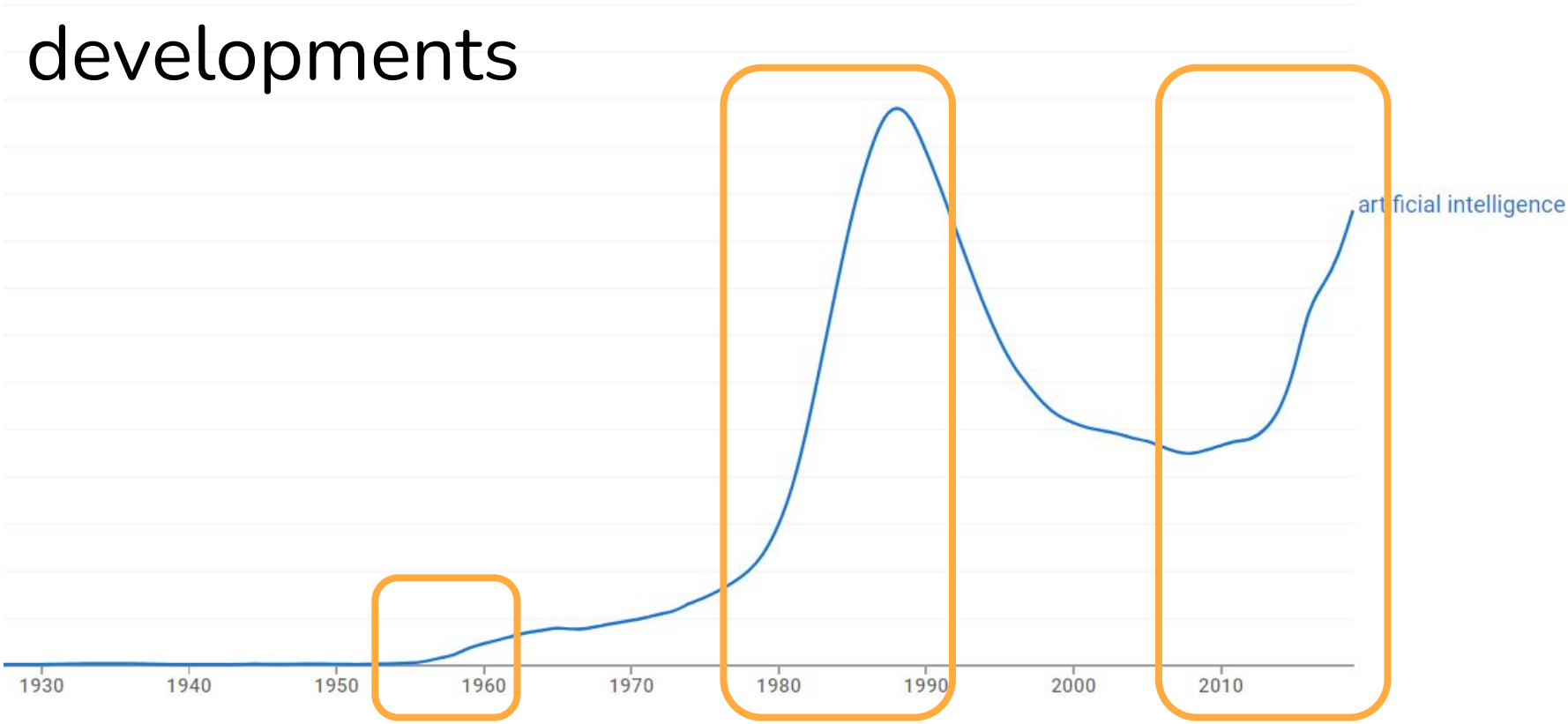


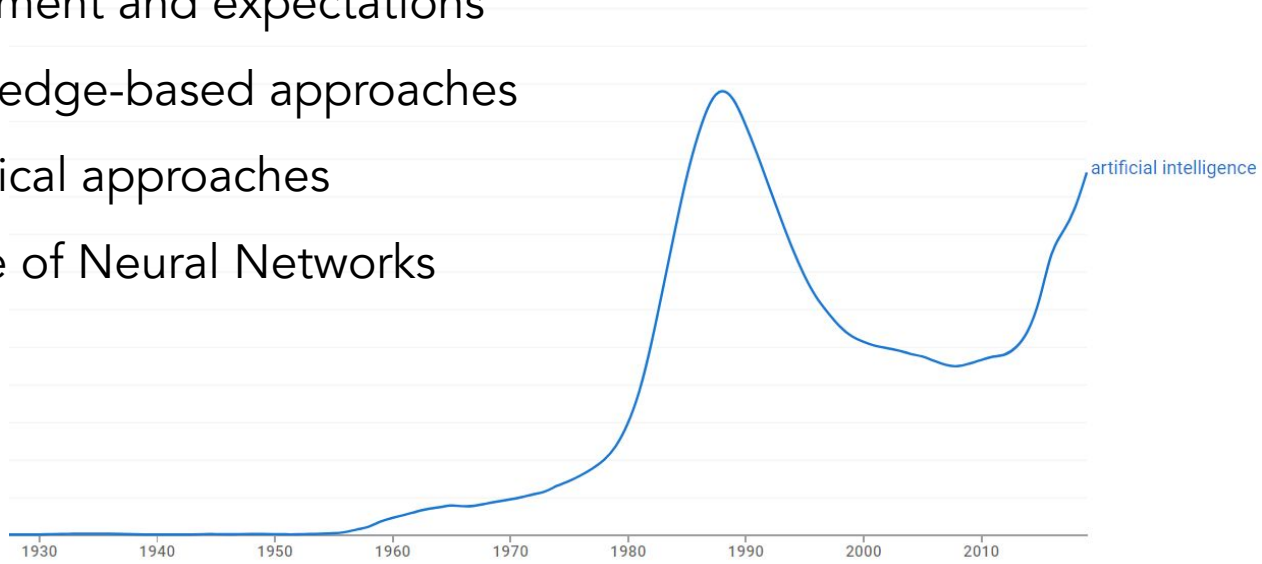

artificial intelligence
1930
1940
1950
1960
1970
1980
1990
2000
2010

Phases of AI developments



AI History

- 1940 - 1950: Early days
- 1950 - 1970: Excitement and expectations
- 1970 - 1990: Knowledge-based approaches
- 1990 - 2005: Statistical approaches
- 2005 - Present: Rise of Neural Networks



Course Philosophy

- Understand the AI landscape
- Be able to write and implement (some) AI algorithms
  - Focus on how to compute intelligently
  - Well-established algorithms
  - Review (when possible) recent methods
- Train us to think and formulate AI approach for a problem

Course Syllabus

Sl. No.	Broad Title / Topics
1	Introduction to AI and Intelligent agents
2	Problem solving by Searching
3	Logical Agents
4	Knowledge representation and Automated planning
5	Uncertain Knowledge and Reasoning
6	Introduction to Reinforcement Learning
7	Multi-armed Bandit & Applications
8	TD Learning & Application
9	Q Learning, Application & Policy Gradient

Course Syllabus

Neeraj

Arghyadip

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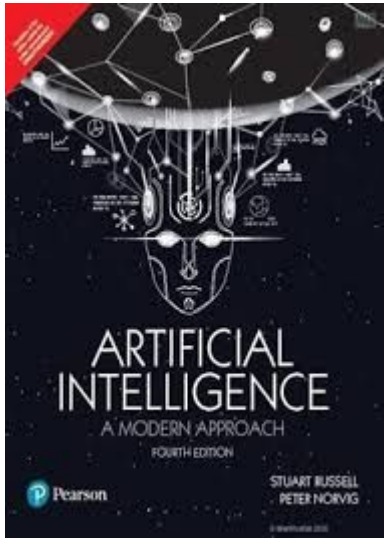
Course Material



Textbook

Artificial Intelligence: A Modern Approach

- Stuart Russell
- Peter Norvig

- CS188: Introduction to AI, Berkeley
- An Introduction to AI, by Mausam, IIT Delhi (NPTEL)
- CS221: AI: Principles and techniques, Stanford
- Introduction to Artificial Intelligence, ULiège, Fall 2022.

Reference Materials

- Shared through a common space: Teams/Website

Our Material

Course Logistics

- Mid-sem = 30%
- Final Sem = 50%
- 2 Quiz = 1 pre-mid-sem and one post-mid-sem, 10% + 10%
- Assignments
    - Programming assignments
    - Paper Discussions
    - Exercises

Code of Conduct

- Institute policies for code of conduct will be followed
  - Attendance >= 75 %
  - Please cite collaborators if you have them
  - Academic dishonesty policies ▪ Reported to Institute ▪ Negative points (and more)
- Goal is to learn
  - Differently people learn differently
  - Important to share what you learn
- Let us know if you get confused or need any help

Code of Conduct

- To contact via e-mail:

```
Dear/Hey <Neeraj>,

<Short description>I am doing so and so however, this happened. Is there a way
out for this? Lorem Ipsum is simply dummy text of the printing and typesetting
industry. Lorem Ipsum has been the industry's standard dummy text ever since the
1500s, when an unknown printer took a galley of type and scrambled it to make a
type specimen book.

<One line> What you need or how an I help?

Best regards,
<Your name>
```

Code of Conduct

Avoid saying “sir”, especially in lower case

- To contact me via e-mail:

Notice the newline

Left aligned

```
Dear/Hey <Neeraj>,

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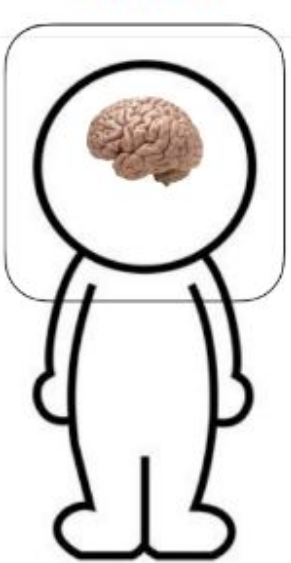
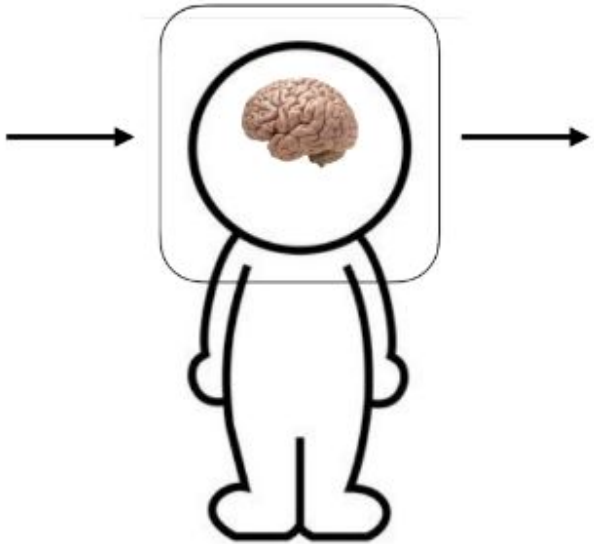
Intelligence

- Let’s share our thoughts on this

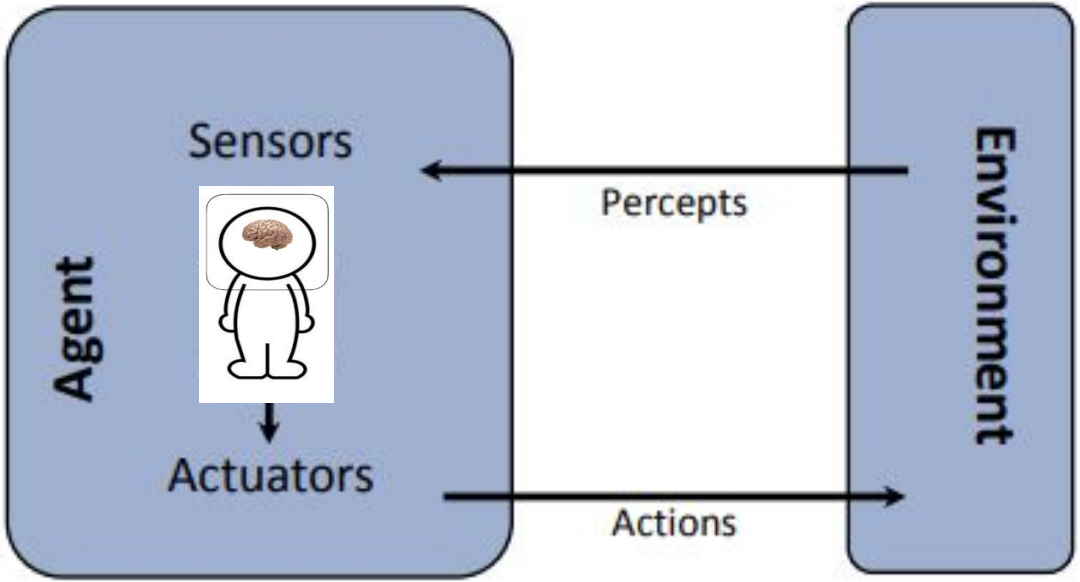
Intelligence



Intelligence



Intelligence



What can help?

Philosophy: logic, methods of reasoning, mind as physical system, foundations of learning, language, rationality.

Mathematics: formal representation and proof, algorithms, computation

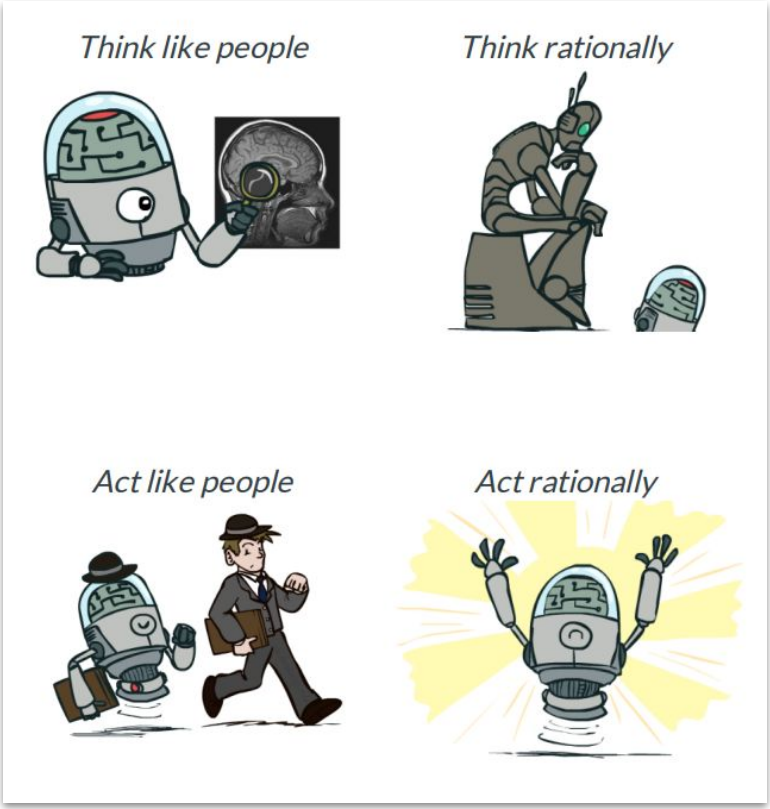
Psychology: adaptation, phenomena of perception and motor control, psychophysics.

Neuroscience: plastic physical substrate for mental activity.

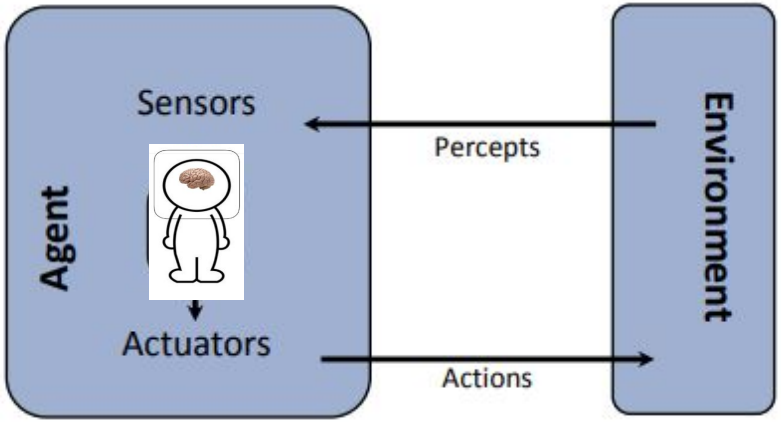
Linguistics: knowledge representation, grammar.

Control theory and Robotics: homeostatic systems, stability, simple optimal agent designs

and more!



Intelligence



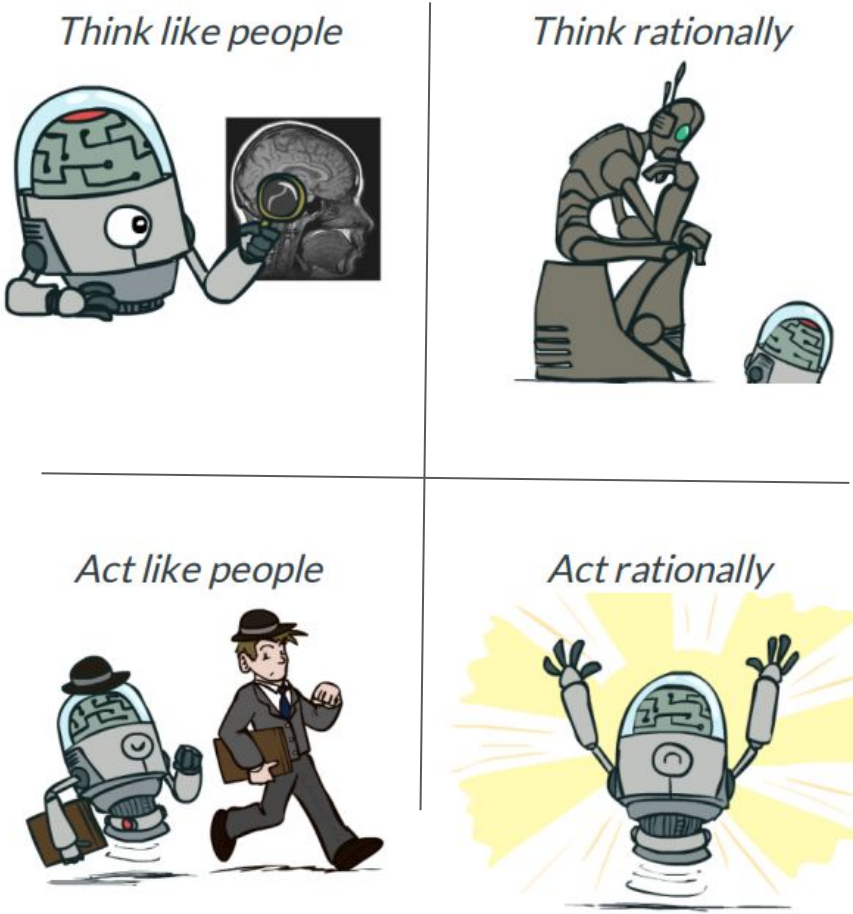
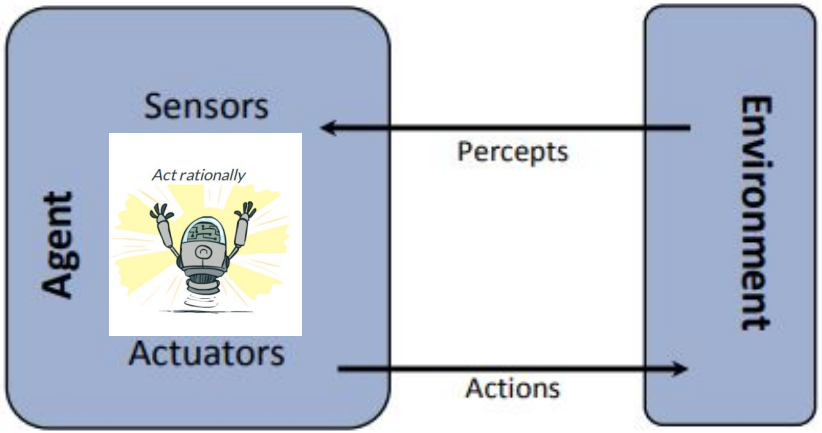


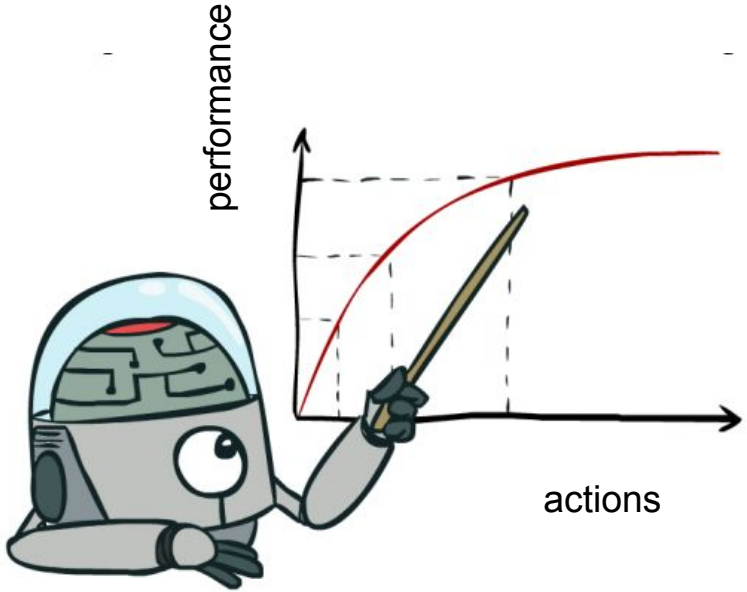
Image credits: CS188, UC Berkeley

Act Rationally

- Rationality only concerns what decisions are made (not the thought process behind them, human-like or not)
- Goals are expressed in terms of the performance or utility of outcomes
- Being rational means maximizing its expected performance.
- The standard of rationality is general and mathematically well defined.

Artificial Intelligence





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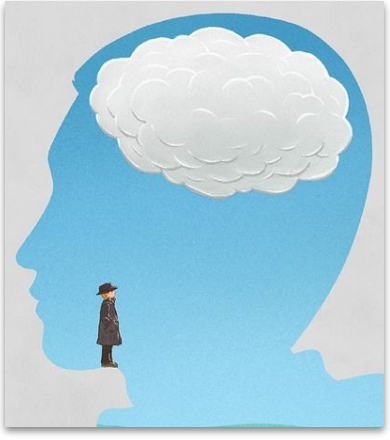
1940-1950: Early days



1940-1950: Early days

- McCulloh and Pitts: Boolean circuit model of brain
- Turing's work on computing machines and defining intelligence

1950-1969: Excitement

- 1950s: Early AI programs demonstrating success in games like checkers program
- 1956: Dartmouth meeting:"Artificial Intelligence" term used
- 1958: Rosenblatt invents the perceptron
    - Lot of hype and excitement!
- 1965: Robinson's complete algorithm for logical reasoning
- 1966-1974: AI discovers computational complexity

By the 1970s, however, AI research ran into some strong headwinds. In the United States, Defense Advanced Research Projects Agency (DARPA) funding had been substantially reduced from its 1960s levels.[5] And in 1973, the United Kingdom saw the publication of the Lighthill report, in which Sir James Lighthill, Lucasian Professor of Mathematics at Cambridge University, argued that AI's "grandiose objectives" remained largely unmet, and called for a virtual halt to all AI research in Britain.[6]

1970-1990: Knowledge-based approaches

- 1969: Neural network research almost disappears after a paper by Minsky and Papert
- 1969-1979: Early development of knowledge-based systems
- 1980-1988: Expert systems industrial boom

1990-2005: Statistical Approaches

- 1985 - 1995: Neural networks continue crawling
- 1988 - 2000: Probability, analysis, theoretical bounds, VC dimensions, SVMs
- 1988-: Bayesian approach continues to crawl

another, led to uncannily capable behavior. Writing for *Time* magazine in 1996, Kasparov observed: "I had played a lot of computers but had never experienced anything like this. I could feel – I could smell – a new kind of intelligence across the table."[11] Our attribution of intelligence to the machine is a recurrent feature

2000 - : Data, Compute, Open-source revolution

- 2000 - : Training multi-layer neural networks (GPUs)
- 2000 - : Internet boom - lots of data
- 2010 - : Open source code, develop and share

Forms of doing AI

Symbolic AI Rule first -"Learning or any other feature of intelligence can be so precisely described in terms of rules (and logic) that a machine can be made to simulate it"

Statistical AI Math first - Probability and everything around it

Neural Networks AI Results first

Future direction of AI

sibilities. We need to continue to interrogate our understanding of the concept of intelligence. For the foreseeable future, no variety of AI will have a reasonable claim to a sufficient range of attributes for us to ascribe them general intelligence. But this cannot be an in-principle embargo.

"From So Simple a Beginning": Species of Artificial Intelligence

Nigel Shadbolt

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This course will focus on problem solving using intelligent algorithms

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