Lecture 1. What is Artificial Intelligence?

CS 161: Fundamentals of AI

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Is this AI?

$$\begin{array}{r} 3921.56 \\ \times \quad 73.13 \\ \hline 286\,783.68 \end{array}$$

- For humans?
- For computers?
- In the year 1900?

The 1996 match

Game #	White	Black	Result	Comment
1	**Deep Blue**	Kasparov	1–0	
2	**Kasparov**	Deep Blue	1–0	
3	Deep Blue	Kasparov	½–½	Draw by mutual agreement
4	Kasparov	Deep Blue	½–½	Draw by mutual agreement
5	Deep Blue	**Kasparov**	0–1	Kasparov offered a draw after the 23rd move.
6	**Kasparov**	Deep Blue	1–0	
Result: **Kasparov–Deep Blue: 4–2**				

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

Exciting Times for AI

Facebook and CMU's 'superhuman' poker AI beats human pros

'It can bluff better than any human.'

By James Vincent | Jul 11, 2019, 2:00pm EDT

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Photo credit should read LIONEL BONAVENTURE/AFP/Getty Images

https://www.theverge.com/2019/7/11/20690078/ai-poker-pluribus-facebook-cmu-texas-hold-em-six-player-no-limit

DeepMind's StarCraft 2 AI is now better than 99.8 percent of all human players

AlphaStar is now grandmaster level in the real-time strategy game

By Nick Statt | @nickstatt | Oct 30, 2019, 2:00pm EDT

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Image: DeepMind

https://www.theverge.com/2019/10/30/20939147/deepmind-google-alphastar-starcraft-2-research-grandmaster-level

VIDEO: Tesla cruises down NC highway without a driver

A North Carolina man had some fun with his brand new Tesla Model X.

https://abc13.com/tag/self-driving-car/

What is AI?

- There are hundreds of definitions of **artificial intelligence**. Most contain a bias as to whether seeing AI as dealing with thinking versus acting, and seeing it as trying to model humans or capturing intelligence rationality.
  - Thinking or Acting?
  - Humanly or Rationally?

=> 2x2 = 4 possible definitions.

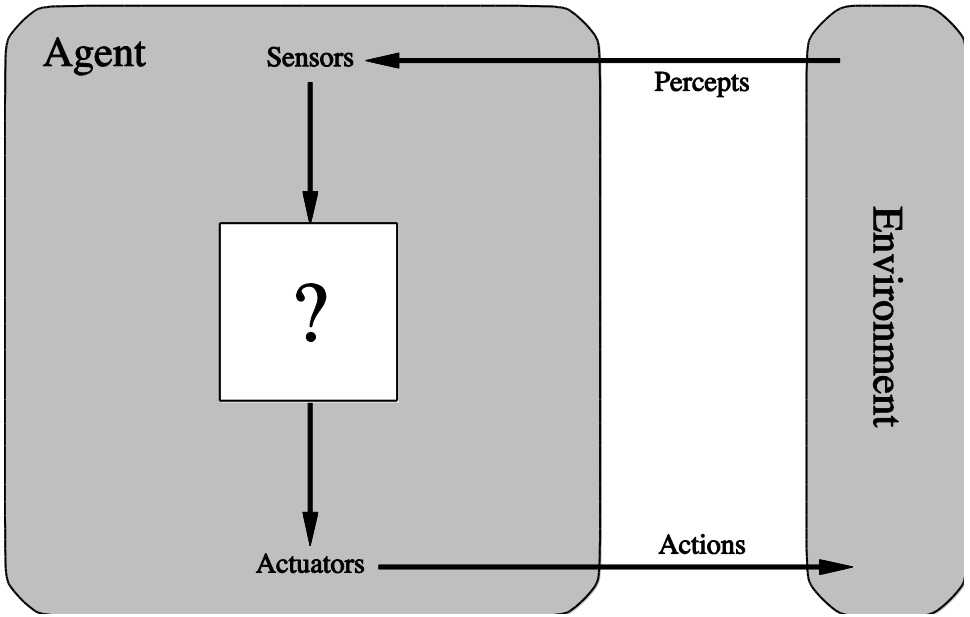
Definitions of AI

	Humanly	Rationally
Thinking	Thinking humanly — cognitive modeling. Systems should solve problems the same way humans do.	Thinking rationally — the use of logic. Need to worry about modeling uncertainty and dealing with complexity.
Acting	Acting humanly — the Turing Test approach.	Acting rationally — the study of rational agents: agents that maximize the expected value of their performance measure given what they currently know.

Current Consensus Definition

AI is the study of intelligent, rational agents

1. Perception/sensing
2. Thinking/reasoning/inference
3. Acting



Current Consensus Definition

AI is the study of intelligent, rational agents

*For each possible **percept** sequence, a rational agent should select an **action** that is **expected** to **maximize** its performance measure, given the evidence provided by the percept sequence and whatever built-in **knowledge** the agent has.*

Rational Agents

- *"Expected": not perfect*
- *No mention of humanly*
- *Which performance measure?*
  - *$1.01 now or "1 in a million" chance of $1 million*

The AI Pipeline

World

Observations
Data

User

Agent

Knowledge Representation
Machine Learning

Model

Is this new email spam?
Do these proteins interact?
Are Alice and Bob friends?
Will this patient react to the drug?

Emails

Cell

Social
Network

Healthcare

Inference
(Reasoning)

Action!

Strong vs Weak AI

- Weak AI: as if intelligent
- Strong AI: actually intelligent
  - Artificial General Intelligence (AGI): hypothetical intelligence of a machine that has the capacity to understand or learn any intellectual task that a human being can.

Most of current AI research is on Weak AI

Brief History

- 1940's — Interest in neurons, neural networks and their relationship to mathematics and learning
- 1950 — Turing's paper
- 1956 — Dartmouth conference
- 1950's and 1960's — enthusiasm and optimism; big promises
- Late 1960's and 1970's — Realization that further progress was really hard; disillusionment
- 1980's — Expert Systems, neural networks, etc.; AI now a little different; quiet successes
- 1990's to present — Intelligent agents
- 2000's — robot pets, self-driving cars

Area of Studies

- Computer Vision
- Speech recognition
- Robotics
- Problem Solving
- Searching a Solution Space
- Planning
- Learning
- Natural Language Processing
- Natural Language Understanding
- Knowledge Representation
- Automated Reasoning
- Inference, both in monotonic and non-monotonic logic
- Common Sense Reasoning
- Uncertainty and Probability
- Genetic Programming
- Artificial Life
- Ontology
- Epistemology
- Expert Systems
- Solving problems with no tractable deterministic algorithmic solutions
- Reinforcement Learning

Conclusions

This course: a reality check!

- Knowledge representation formalisms
- Automated reasoning and search algorithms
- Bayesian networks

"We can see only a short distance ahead, but we can see that much remains to be done."

[Turing]

Acknowlegment

- The slides are adapted from Stuart Russell, Danny De Schreye, Guy Van den Broeck et al.