

COMP3608 - Intelligent Systems

Lecture #1: Course Administration and Introduction to Intelligence



HAPPY NEW YEAR!

WELCOME BACK :D

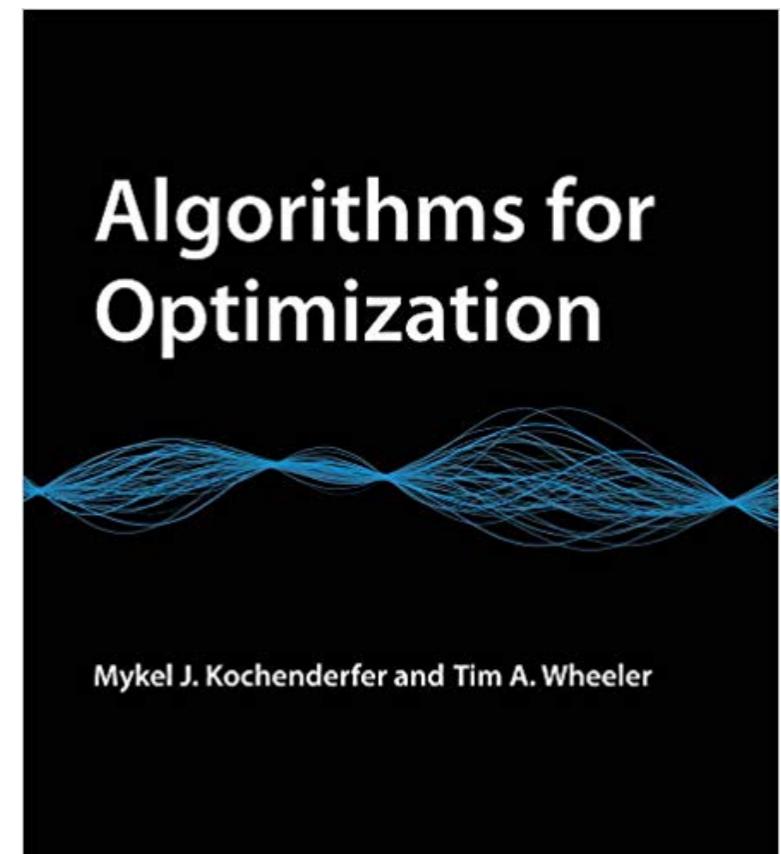
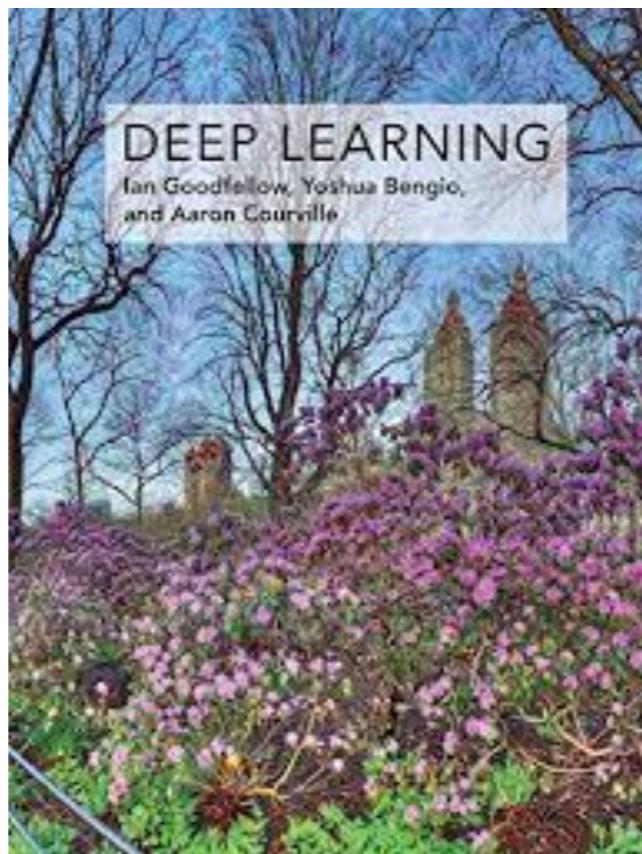
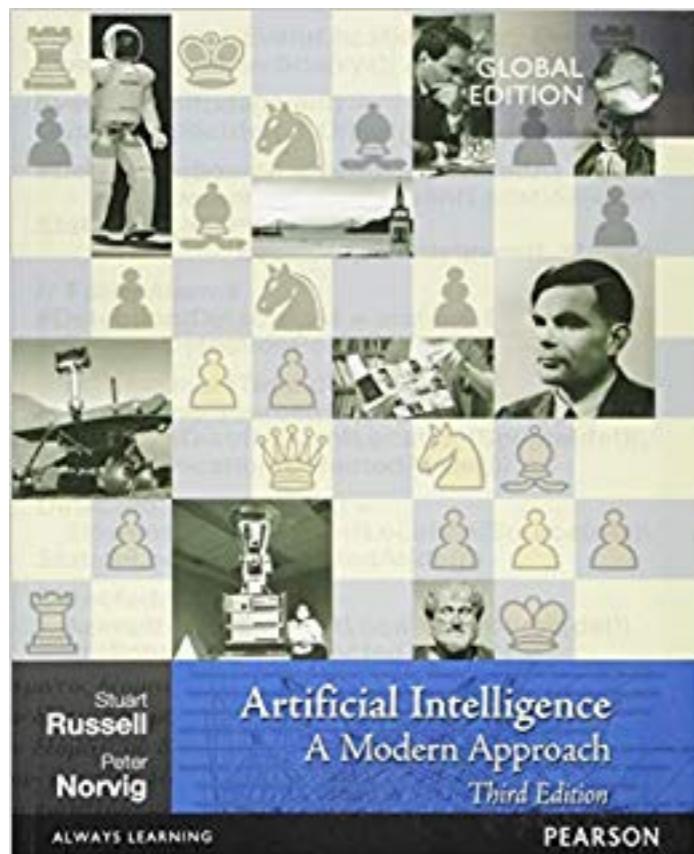
Outline

- Course Administration
 - Evaluation Structure
 - Programming language etc...
- Course Outline
- What is AI?
- Symbolism vs Connectionism
- Some philosophical issues

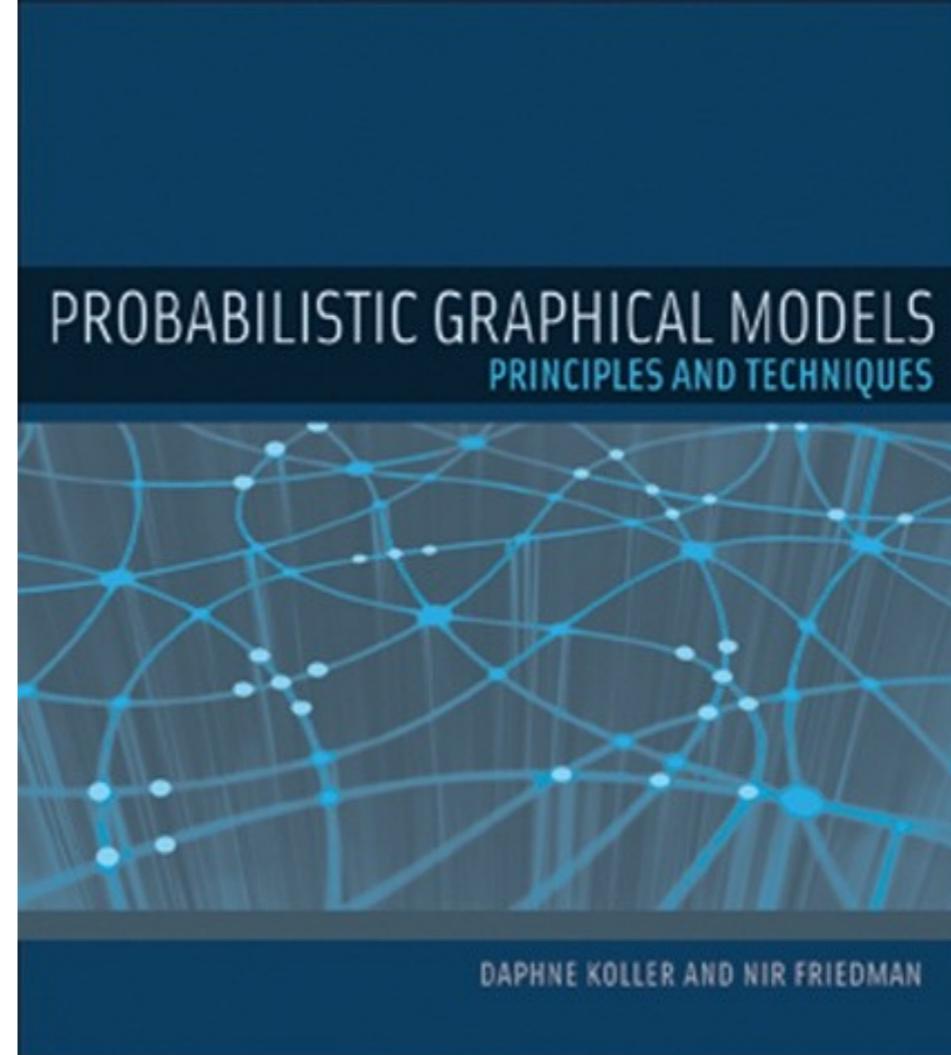
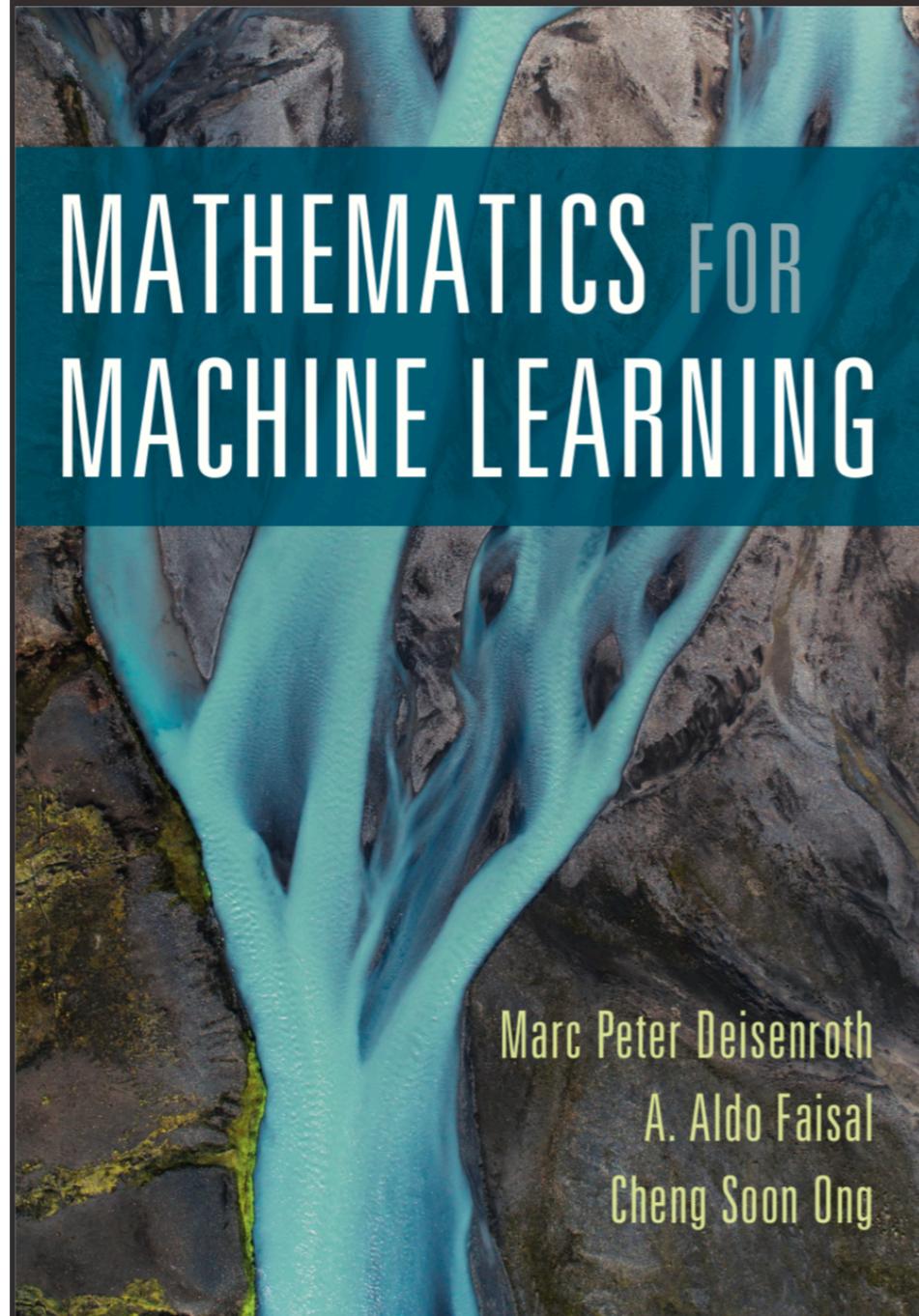
Course Administration

- Course Instructor: Mr. Inzamam Rahaman
 - inzamam.rahaman@sta.uwi.edu
- Course Tutor/Marker: Mr. Shiva Ramoudith
 - shivarmx@gmail.com
- Course site: TBD
- Programming Languages for the course: Python or Julia, MiniZinc

Textbooks



Textbooks



Expectations

- AI is very young field
 - Much of the basics are still in flux
 - TONS of unsolved problems
 - Chance for great impact!
- Doing well in this course and field requires effort
 - A lot of reading coupled with practice
 - Will curate of course...
 - But expect a fair bit of self-study

Course Outline

- 1. Intro to Intelligence (this lecture)**
2. Optimisation Concepts
 1. Constraint Satisfaction Problems
3. Population Meta-heuristics (SA, GA, GP, and PSO)
4. Machine Learning Concepts
5. Linear Regression and Logistic Regression
6. Feed-forward Neural Networks
7. Convolutional Neural Networks
8. Bayes Theorem and Naive Bayes
9. Bayesian Networks

Course Evaluation

- Course Work (50%)
 - Two Exams (10% each)
 - February 14th 2020 - Topics 1 - 4
 - March 27th 2020 - Topics 5 - 8
 - Three Assignments (10% each)
 - A1 - Meta-heuristics and CSP
 - A2 - Logistic Regression and Linear Regression
 - A3 - Neural Networks
 - To be in groups of 2 - 3 people
- Final Exam (50%)

A close-up photograph of a young man with curly brown hair, smiling warmly at the camera. He is wearing a dark t-shirt and holding a light-colored acoustic guitar. In the background, a large electronic keyboard or synthesizer is visible, its keys glowing with blue and green light. The lighting is dramatic, with strong highlights on his face and the instrument.

This is where the fun begins.

What is this course about?

- In a nutshell, how to build agents that are artificially intelligent
- Raises two questions
 - What is an agent?
 - What would it mean for agent to be artificially intelligent?

What is Intelligence?

- If we want to build Intelligent Systems or find ways of developing Artificial Intelligence we need to know what Intelligence means!
- Unfortunately there is no universally accepted definition...

What is AI?

- Need to adopt some notion of what constitutes artificial intelligence if we are to construct such systems
- Fundamental assumption: The brain is a computer
- Different perspectives on what constitutes AI
 - Four main perspectives
 - Split across two dimensions:
 - Thinking vs Acting
 - Humanly vs Rationally

Thinking Humanly

“The exciting new effort to make computers think . . . *machines with minds*, in the full and literal sense.” (Haugeland, 1985)

“[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . .” (Bellman, 1978)

Acting Humanly

“The art of creating machines that perform functions that require intelligence when performed by people.” (Kurzweil, 1990)

“The study of how to make computers do things at which, at the moment, people are better.” (Rich and Knight, 1991)

Thinking Rationally

“The study of mental faculties through the use of computational models.” (Charniak and McDermott, 1985)

“The study of the computations that make it possible to perceive, reason, and act.” (Winston, 1992)

Acting Rationally

“Computational Intelligence is the study of the design of intelligent agents.” (Poole *et al.*, 1998)

“AI . . . is concerned with intelligent behavior in artifacts.” (Nilsson, 1998)

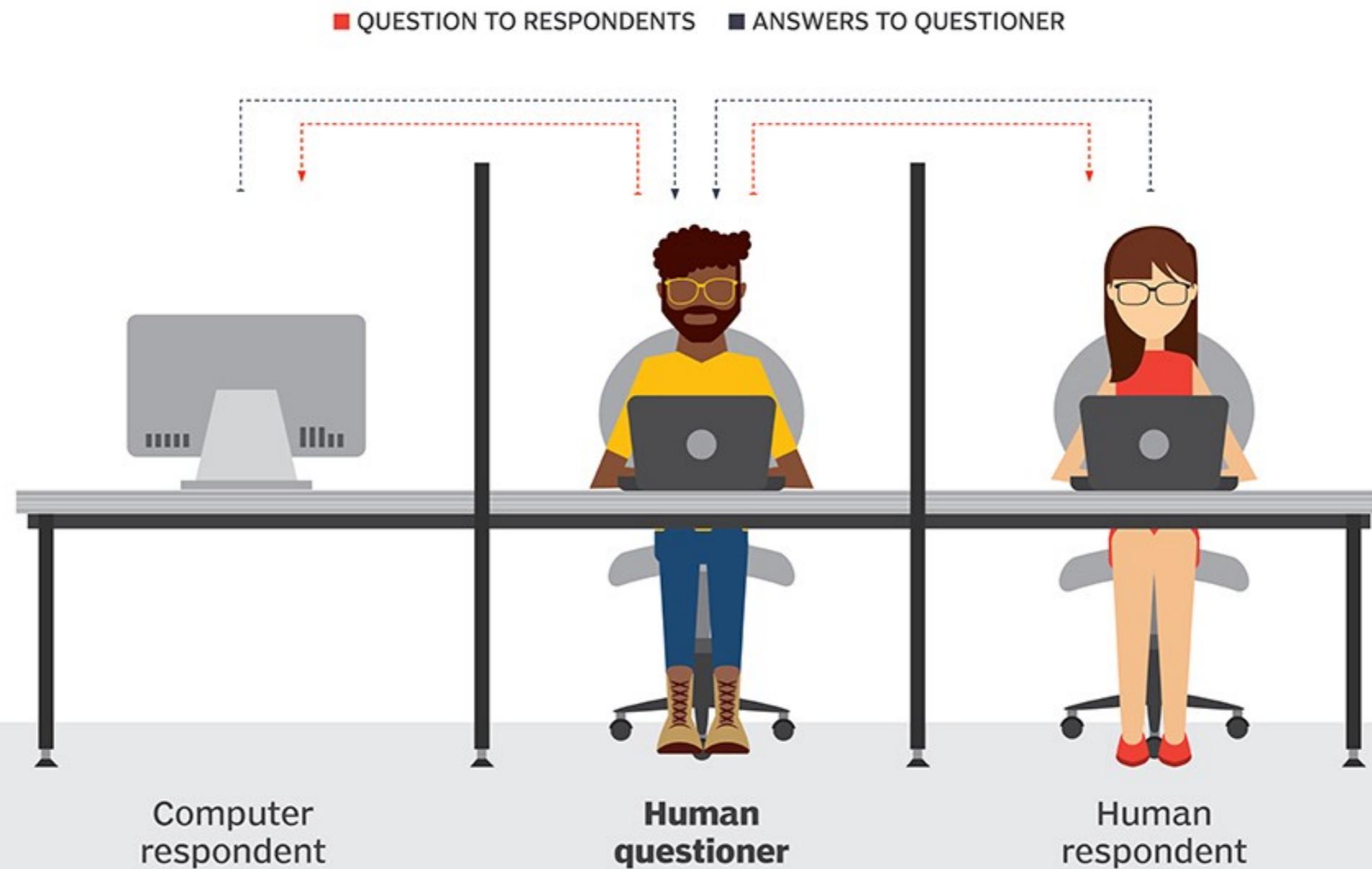
Acting Humanly - Emulation

- Turing Test!
- Can a computer successfully fool a person into believing that it is a computer and not a machine?
 - If so, then it behaves humanly enough to be considered intelligent

Turing test

During the Turing test, the human questioner asks a series of questions to both respondents.

After the specified time, the questioner tries to decide which terminal is operated by the human respondent and which terminal is operated by the computer.



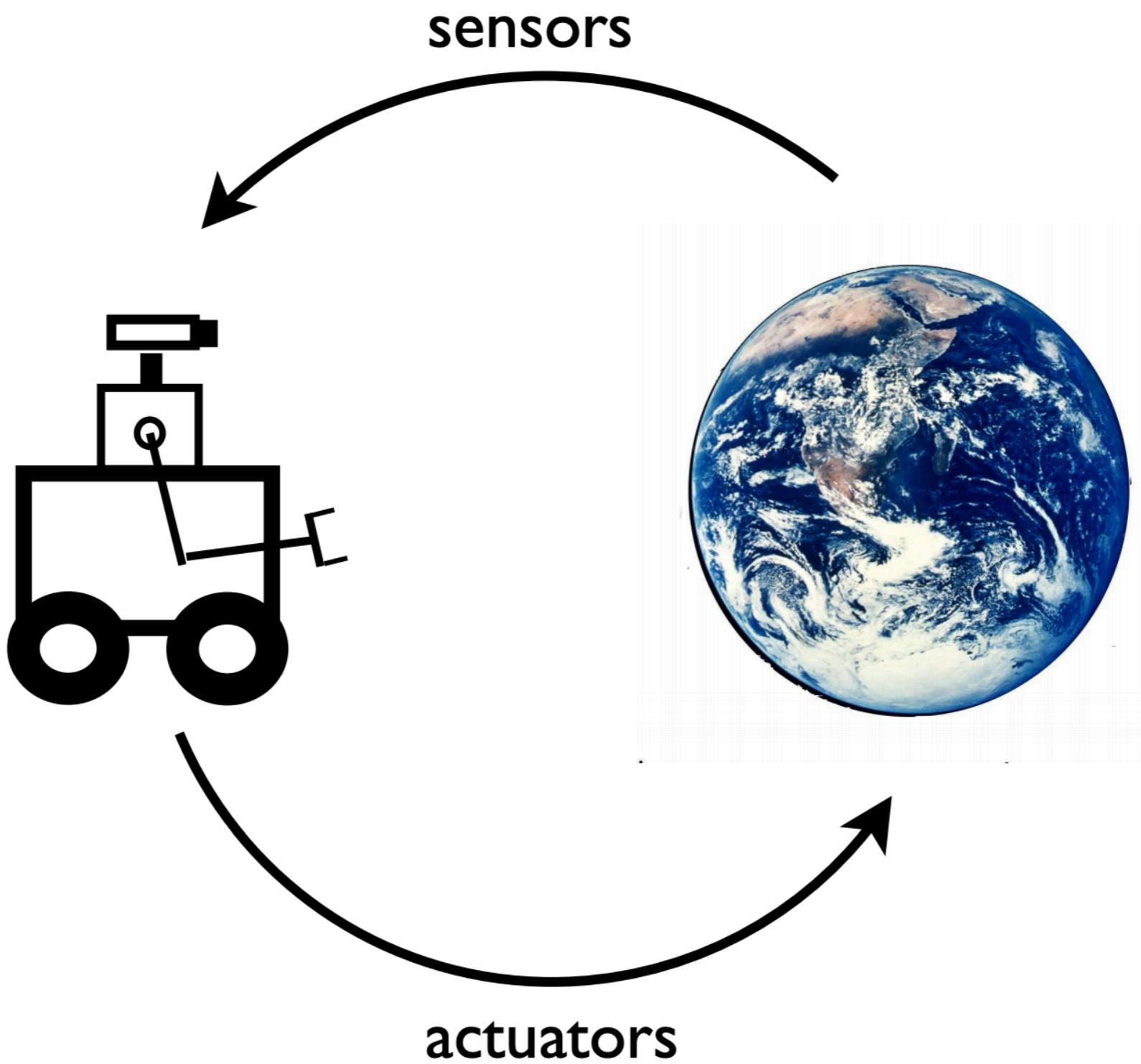
Thinking Humanly - Cognitive Science

- Sometimes called the Cognitive Science approach
- A system is intelligent if it simulates the cognition of human beings

Thinking Rationally - Logic

- A system is intelligent if it follows directly uses logic to reason about the world
- Different types of logic, each with different assumptions, axioms, and connectives:
 - Predicate Logic
 - Modal Logic(s)
 - etc ...

Acting Rationally



Rational Agents

- A rational agent is one that:
 - “acts” on an “environment”
 - according to what it has “perceived”
 - in order to maximise or minimise some performance measure

Rational Agents

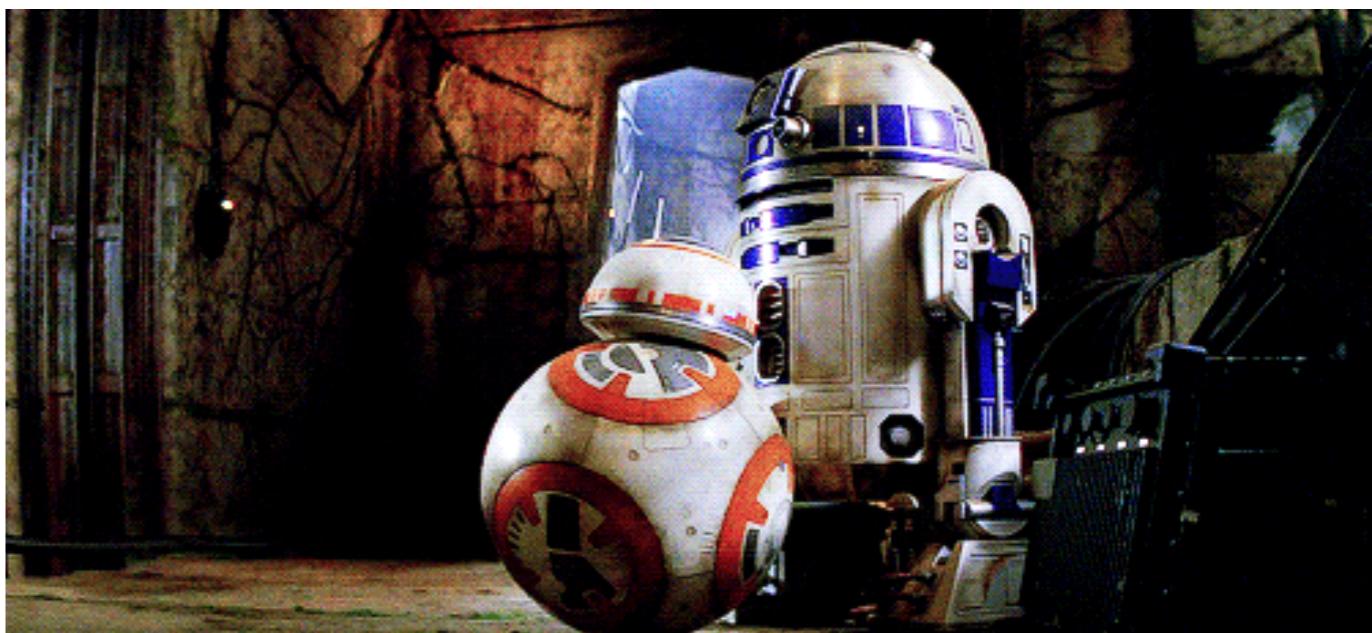
- A rational agent is one that:
 - “acts” on an “environment” (takes **action**)
 - according to what it has “perceived” (based on **state**)
 - in order to maximise or minimise some performance measure (**objective function or cost function**)
- Our definition of these components are broad
 - We will be focusing primarily on the thinking rationally and acting rationally approaches

Views on AI

- Two views on the “role” of AI:
 - AI “Agents”
 - AI “Products”

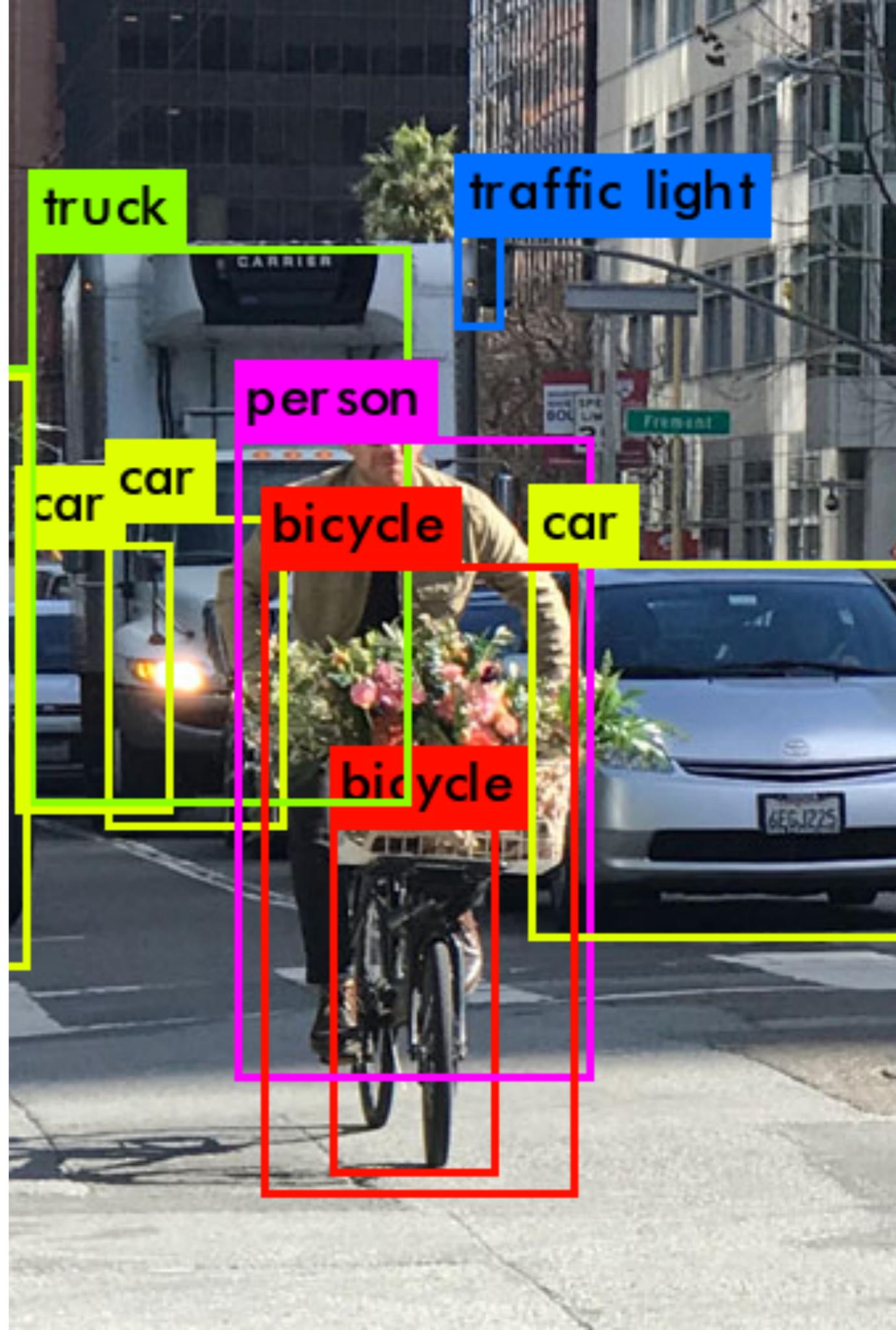
AI Agents

- Goal: construct agents that can perceive, contemplate, plan, and act in the world autonomously
- In a sense, an attempt to “replicate” humanity
- Not very successful in its goals so far....
 - Some question if even achievable
 - More on that in a bit



AI products

- AI as a tool for the benefit of humanity
- No need to replicate humanity
- Just make our lives, easier, longer, better, etc ...
- Arguably more successful in its goal



Views on AI

- Two views on the “role” of AI:
 - AI Agents
 - AI products
- Underlying methods differ very little
- How we approach problems differs though
- Conflating the two views can cause a great deal of confusion
 - Will adopt the AI products view more often than not in the course
 - But both are scientifically important!

Fragmentation of AI

- AI has several (intersecting) sub-fields:
 - Machine Learning
 - Planning
 - Vision
 - Language
 - Knowledge Reasoning and Representation
 - Search

Fragmentation of AI

- AI has several (intersecting) sub-fields:
 - **Machine Learning**
 - Planning
 - Vision
 - Language
 - **Knowledge Reasoning and Representation**
 - **Search**

Fragmentation of AI

- AI has several (intersecting) sub-fields:
 - **Machine Learning** (Neural Networks, Regression)
 - Planning
 - Vision
 - Language
 - **Knowledge Reasoning and Representation** (Bayes)
 - **Search** (GA, GP, SA, PSO)

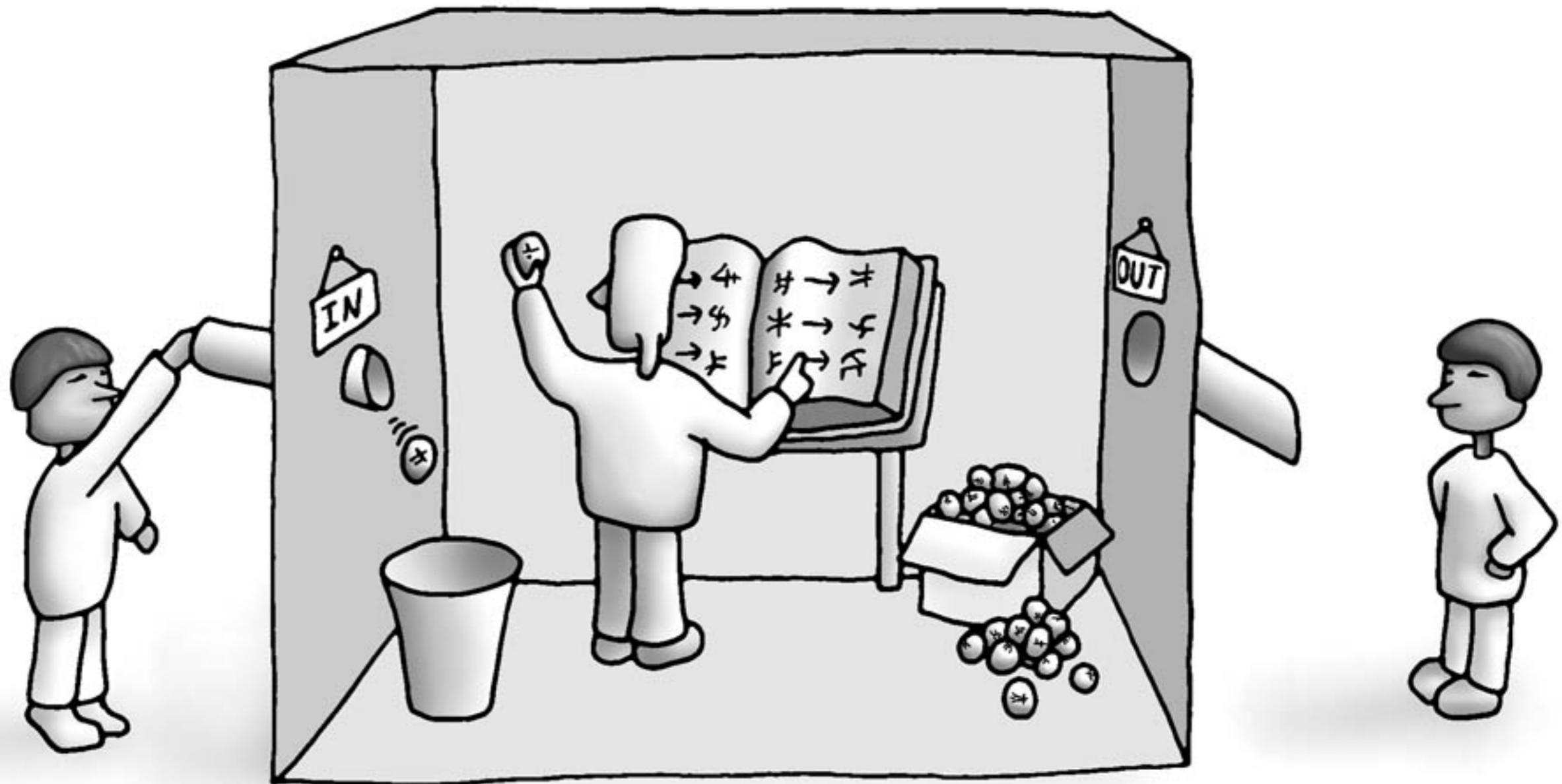
Symbolism vs Connectionism

- Two general methodological approaches towards achieving AI
- Symbolism - AI is best achieved using algorithms and tools that manipulate symbols
- Connectionism - AI is best achieved using algorithms that leverage linear algebra, calculus, probability and statistics
 - We will focus more on a Connectionism oriented approach

Philosophical Issues

- As you can imagine, AI introduces a number of philosophical/ethical questions and problems
- Philosophy of AI is a huge sub-area of philosophy
 - An entire course onto itself
 - Would not dare to give even a remotely comprehensive treatment here
 - But some food for thought

Searle's Chinese Room Argument

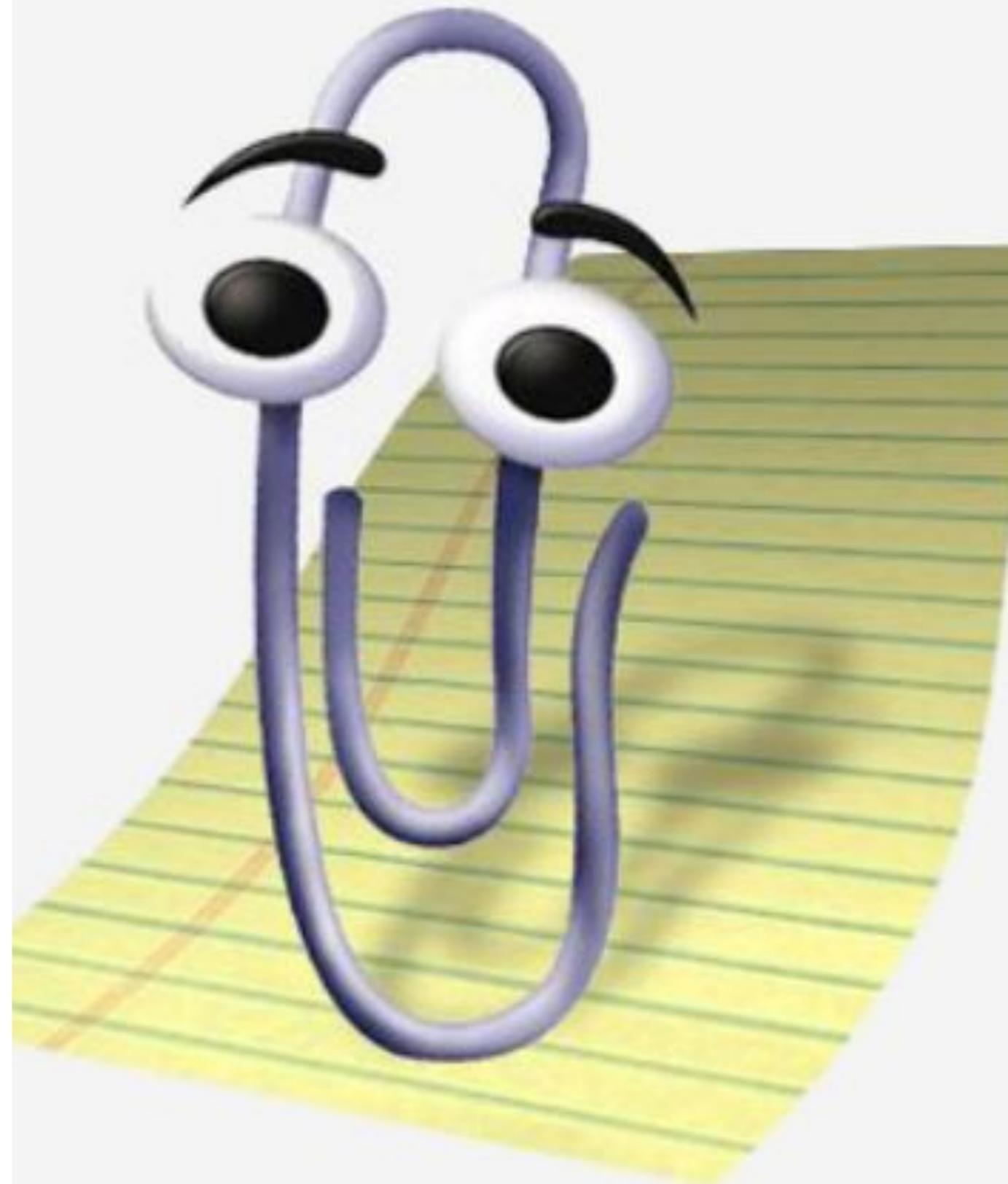


Searle's Chinese Room Argument

- Thought experiment on the validity of “AI”
- Synopsis:
 - A man is locked in a room with a book
 - Book describes how to respond to Chinese symbols
 - Room has two slits: input and output
 - Chinese symbols go into the input slot
 - A sensible string of Chinese symbols come back out
 - To outsiders, the room “understands” Chinese
 - However, this flies in the face of our conventional understanding of understanding

Paper-Clip Optimiser

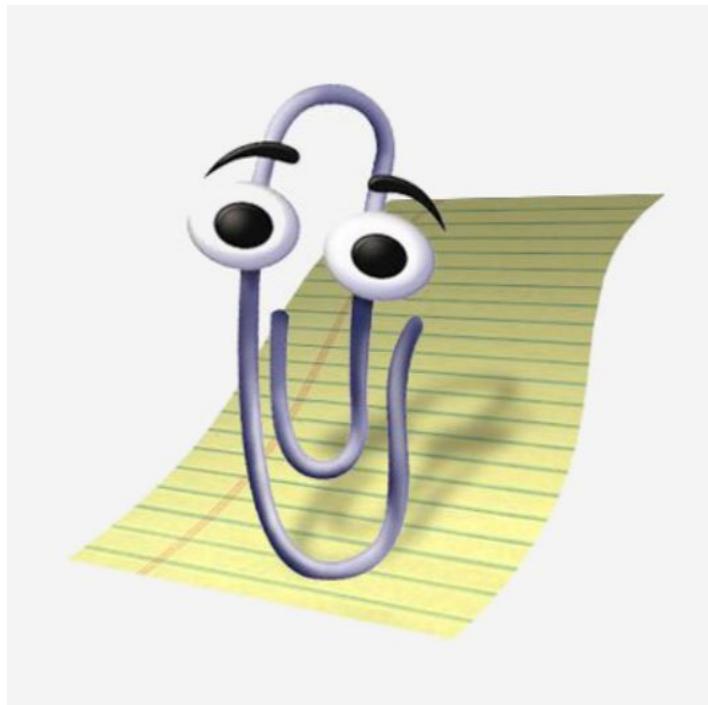
On the dangers of runaway AI



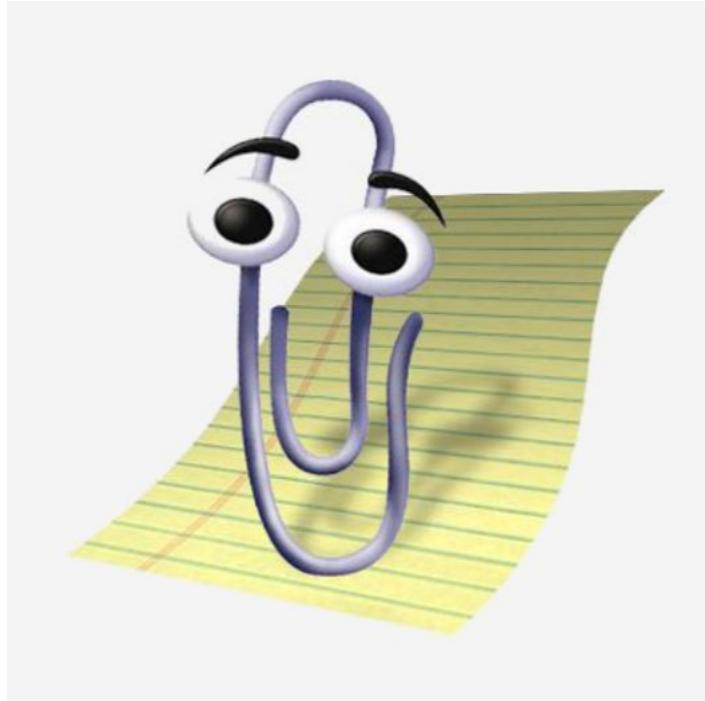
Paper-Clip Optimiser

- Another thought experiment
- Hypothetical super-AI designed to maximise number of paper clips in its collection
- Innocuous objective, right?
- AI cares for nothing else
- Builds robots to convert all natural resources on the planet to paper clips....

Not so different...



Not so different...



Another for my collection...

Ethical Issues

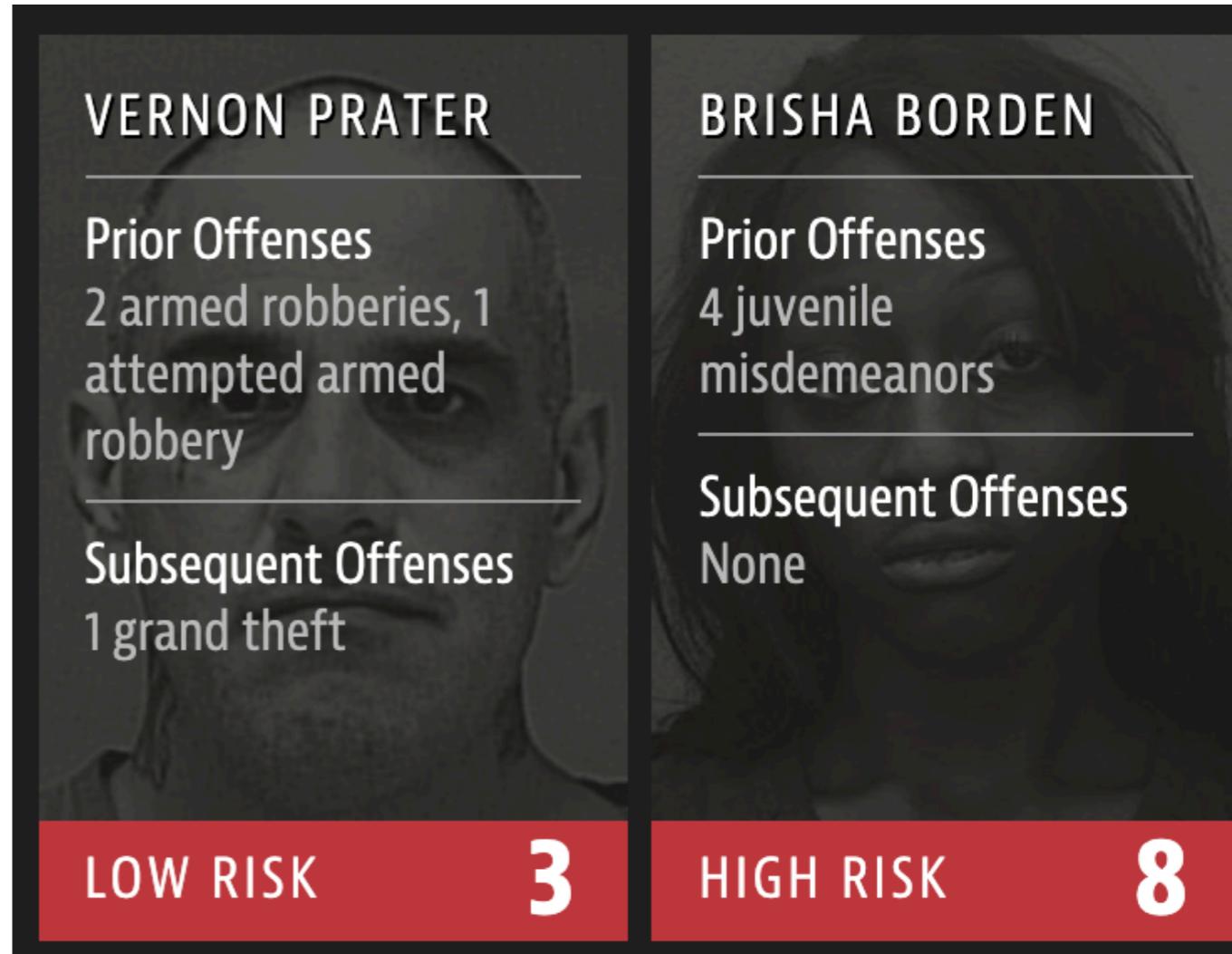
- “AI is the new electricity” - Andrew Ng
- A lot of scope for potential benefit
- Also room for a lot of harm
 - Including from otherwise well-intentioned actions



We did it Patrick! We saved the city.

COMPASS

- System designed to predict recidivism
- Plan was to use it to help determine parole decisions
- Was found to encode racial bias by accident



Ethical Issues

- Many AI models are black-boxes
 - We design the underlying algorithm but cannot always interrogate the system's decisions
- Preventing incidences such as the COMPASS system and trying to build more accountable models is part of emerging sub-field in AI
 - Abbreviated as FAIR - Fairness, Accountability, Interpretability, and Reliability

Image References

- Slide 2 - The Sydney Opera House
- Slide 6 - From Star Wars Episode III: Revenge of the Sith
- Slide 16 - <https://medium.com/thinkmobiles/evaluating-artificial-intelligence-from-turing-test-to-now-b64a8fced070>
- Slide 19 - Brown's csci1410
- Slide 23 - Star Wars Episode VII: The Force Awakens
- Slide 24 -
- Slide 30 - <https://medium.com/acing-ai/what-is-the-chinese-room-argument-in-artificial-intelligence-d914abd02601>
- Slide 32 - Clippy
- Slide 34 - General Grevious from Star Wars Episode III
- Slide 37 - Spongebob

Content References and Further Reading

- Chinese room argument - [https://plato.stanford.edu/
entries/chinese-room/](https://plato.stanford.edu/entries/chinese-room/)
- Russell and Norvig Chapters 1 and 2
- Some content inspired by George Konidaris's csci1410
slides