# Introduction to Artificial Intelligence

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**DUKE**
COMPUTER
SCIENCE
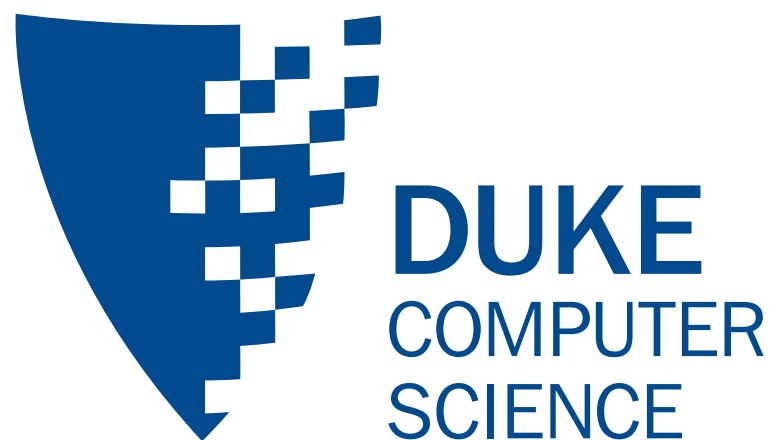
**Spring 2016**

# 270 Team
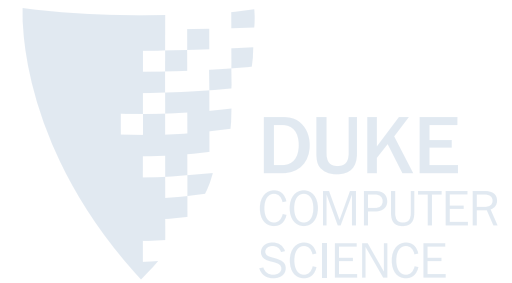
**Instructor**: George Konidaris
Mon 5-6pm, Tues 12pm-1pm, **North 133 (*not LSRC D224*)**

**TA**: Cam Allen
Weds 11:30am-12:30pm, Thurs 11am-12pm, LSRC D309

**UTAs**:
*Yixin Lin*                                            *Ying Qi*
Thurs 6:30pm- 9:30pm, The Link     Tues 7-9pm, Fri 12-1pm, The Link

*Yilun Zhou*
Mon 9am-12pm, North 306

# Logistics

Course webpage:

http://www.cs.duke.edu/courses/spring16/compsci270/

- Syllabus
- Calendar
- Office hours etc.

Comms (Q&A, announcements) via Piazza
**Make sure to sign up!**
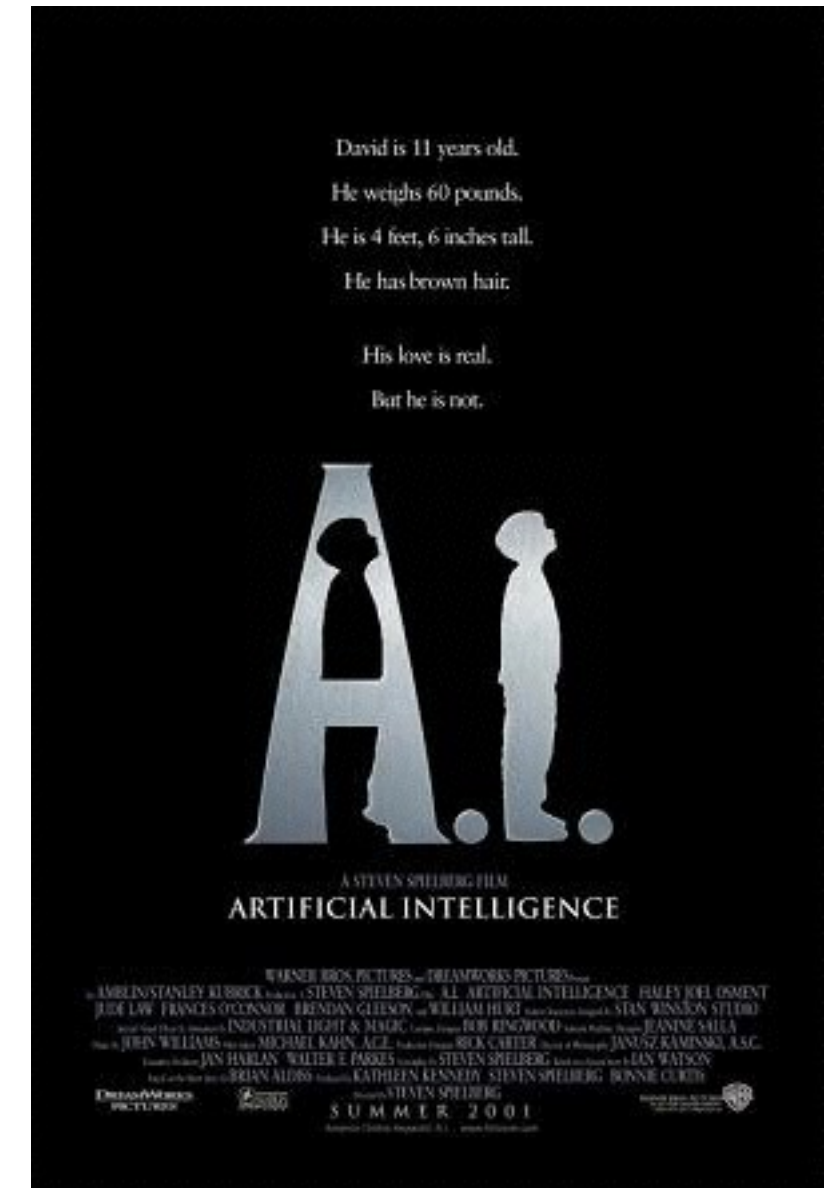
Assignment submissions (**only**) via Sakai.

# AI: The Very Idea

For as long as people have made machines, they have wondered whether machines could be made intelligent.



(pictures: Wikipedia)

(pictures: Wikipedia)

# Turing

Computing machinery and intelligence. *Mind*, October 1950.

*"Can machines think?"*

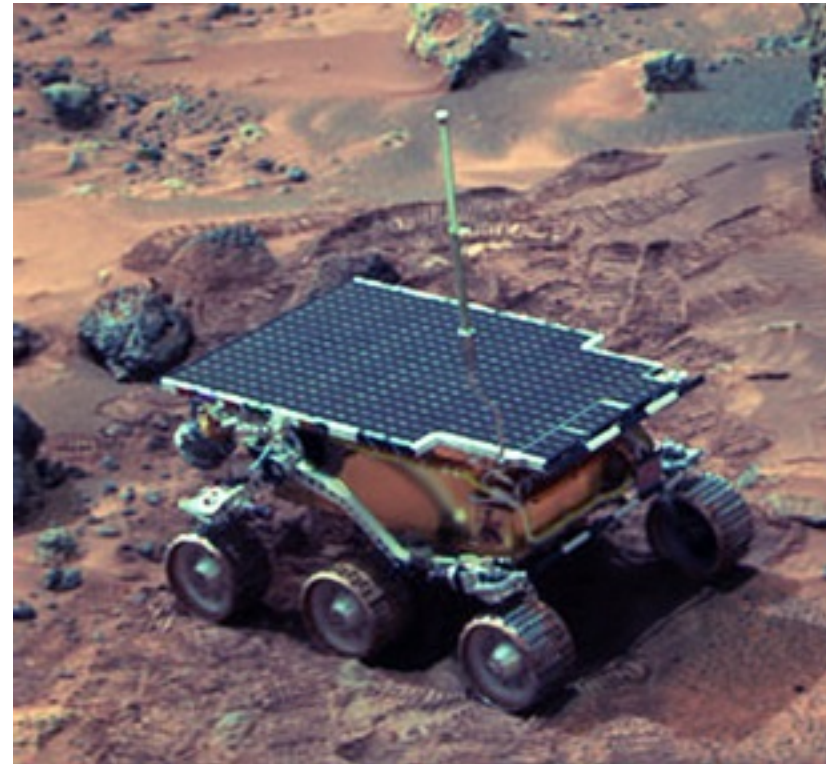(picture: Wikipedia)

# Dartmouth, 1956

# Modern AI

Subject of intense study:

- Nearly every CS department has at least 1 AI researcher.
- Heavily funded (NSF, DARPA, EU, etc.).
  - Pays itself back fast (e.g., DART).
- Google, Amazon, Microsoft, etc.
- ~ 700 PhDs a year in the US
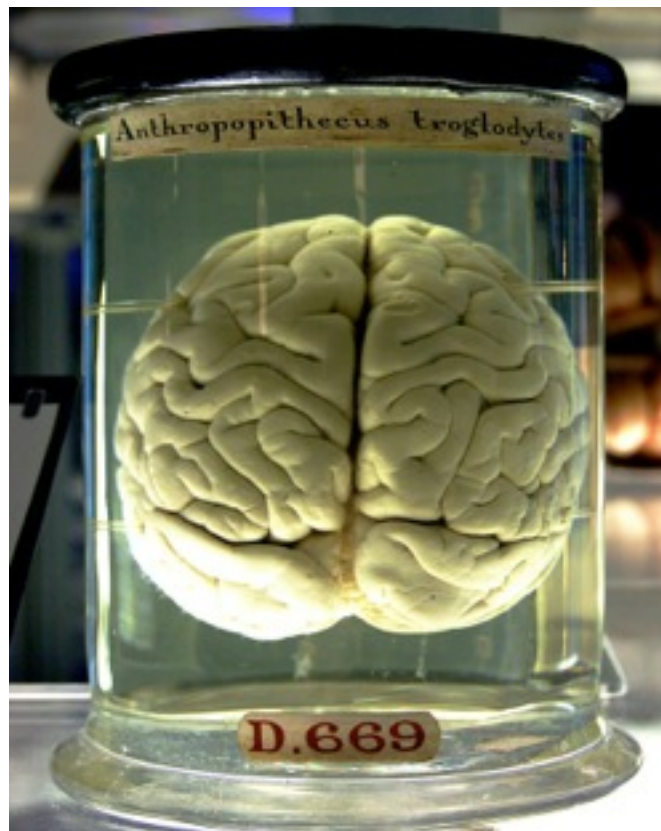- Thousands of research papers written every year.

# Modern AI

# What *is* AI?

# Fundamental Assumption

**The brain is a computer.**
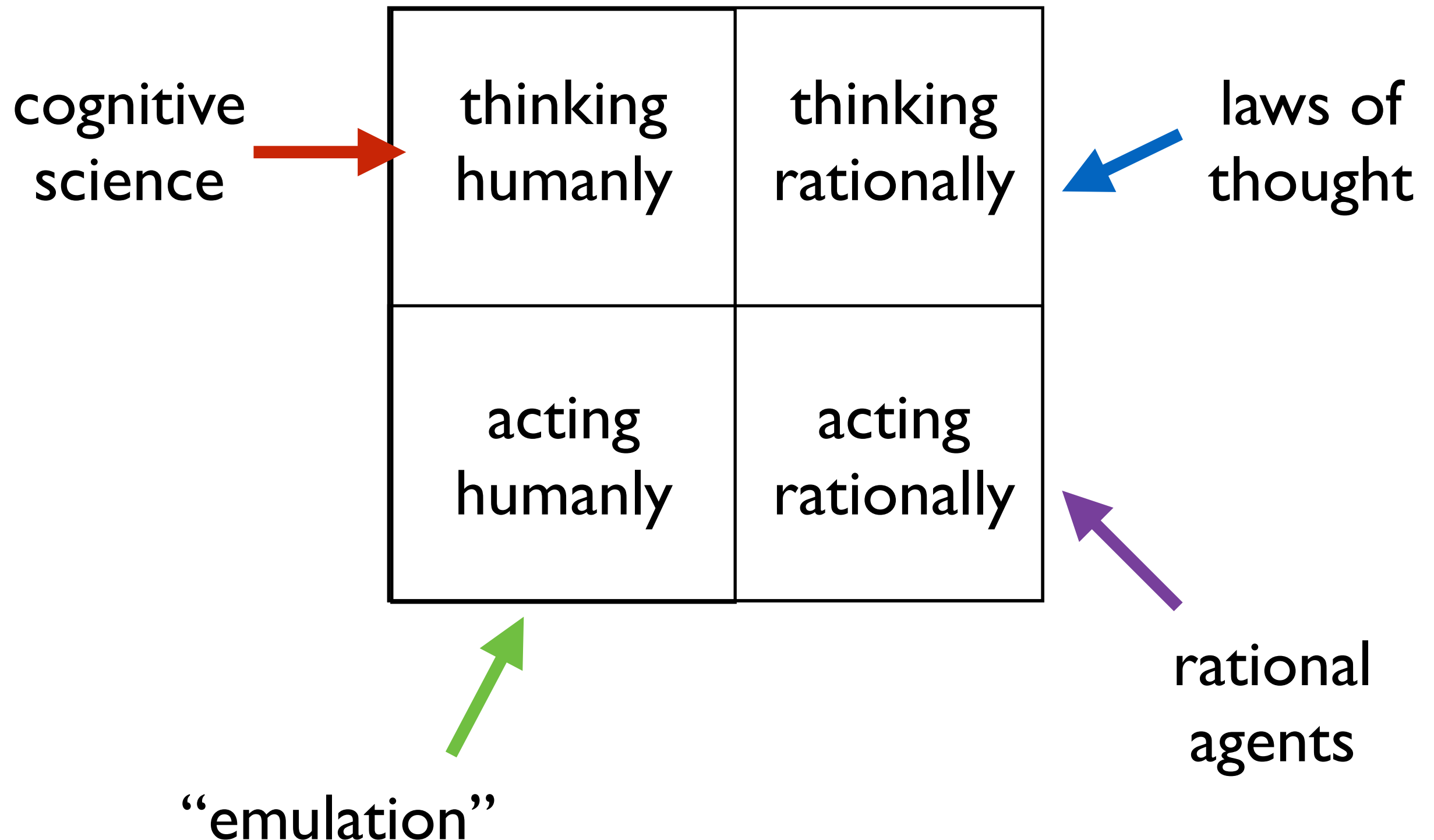


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(picture: Wikipedia)

# What is AI?

**This turns out to be a hard question!**

Two dimensions:
- "Humanly" vs "Rationally"
- "Thinking" vs. "Acting".

| thinking humanly | thinking rationally |
|---|---|
| acting humanly | acting rationally |

# What is AI?

cognitive science →

| thinking humanly | thinking rationally |
|---|---|
| acting humanly | acting rationally |

← laws of thought

↗ "emulation"

↖ rational agents

# What is a Rational Agent?

agent program

sensors

actuators
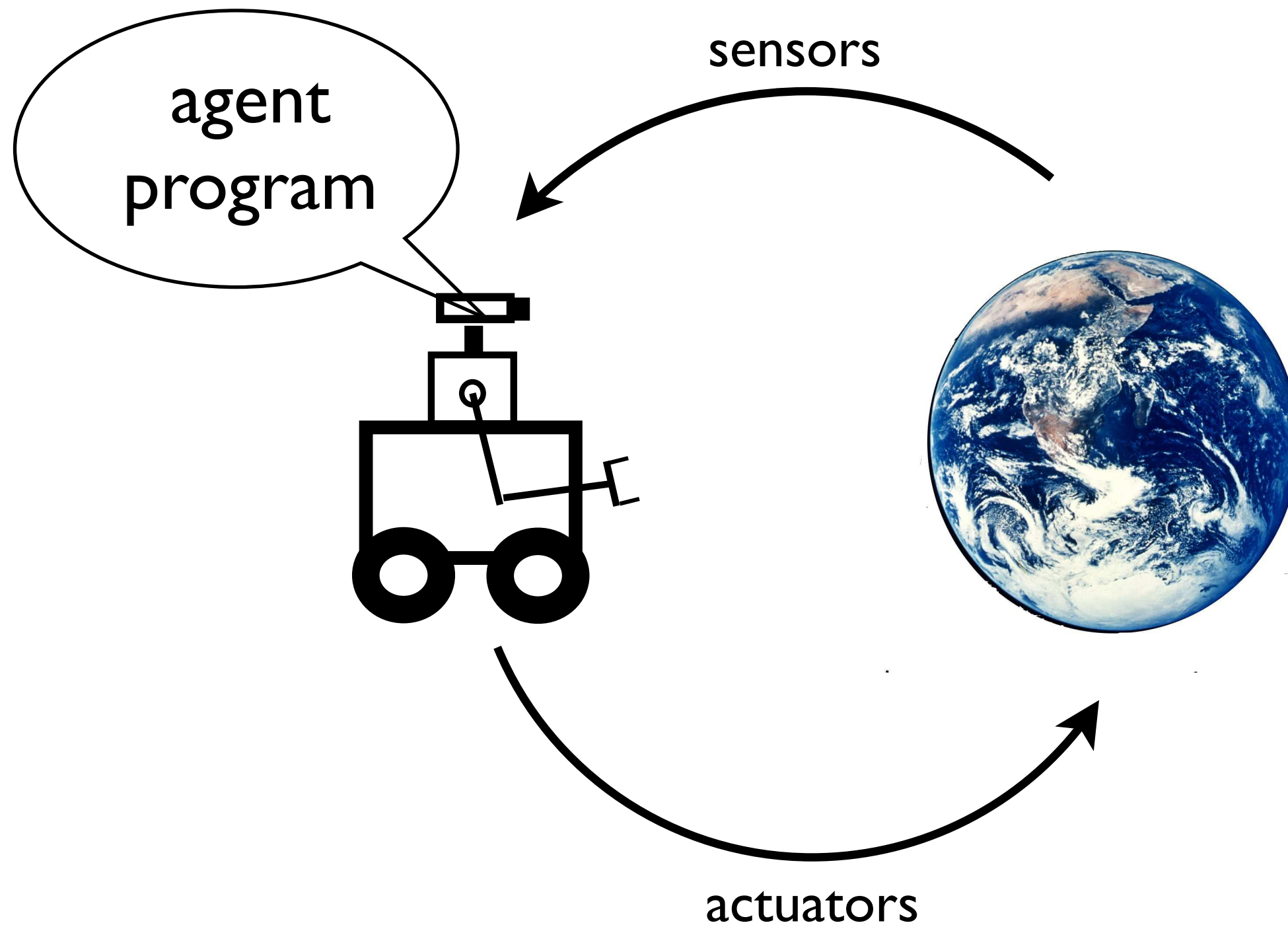
**Performance measure.**

# Rational Agents

A rational agent **acts in its environment,** according to **what is has perceived,** in order to **maximize its expected performance measure.**
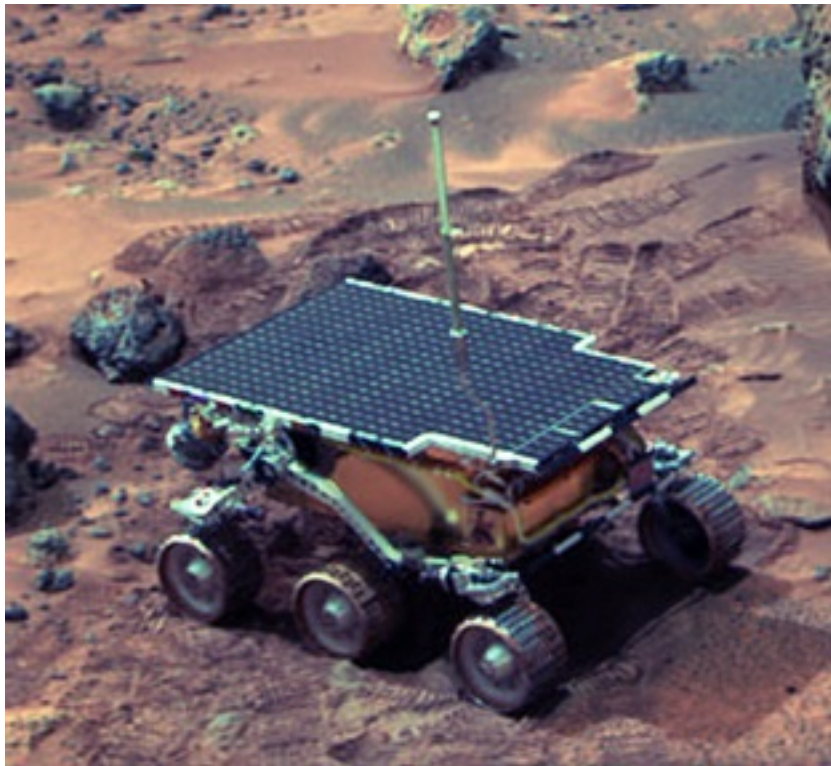
# Example: Chess

Performance measure?

Environment?

Prior knowledge?

Sensing?

Actions?

(picture: Wikipedia)

# Example: Mars Rover



Performance measure?
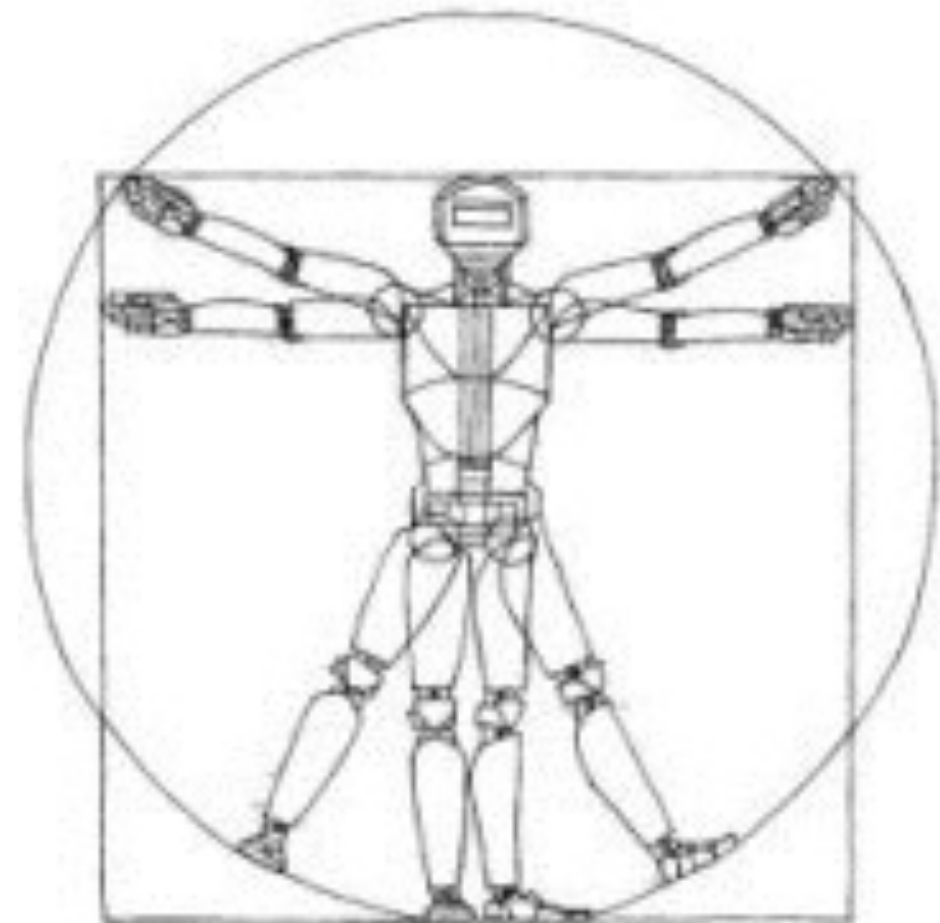
Environment?

Prior knowledge?

Sensing?

Actions?

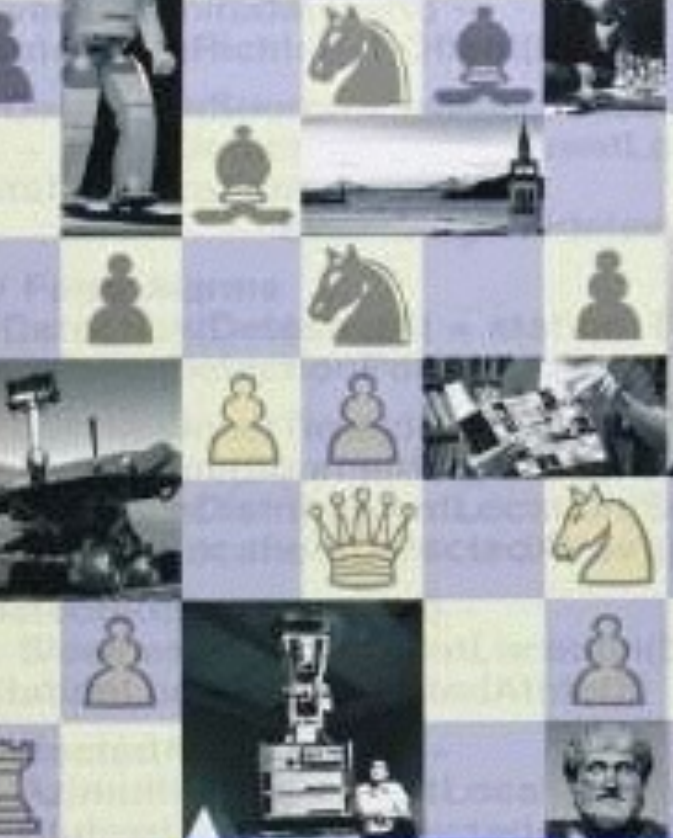(picture: Wikipedia)

# Are We Making Progress?

Specific vs. General

# Major Topics Covered

1. Agents and Agenthood
2. Search
   - Uninformed
   - Informed
   - Mini-Max for Game Playing
3. Knowledge Representation and Reasoning
   - Propositional Logic
   - First-Order Logic
   - Reasoning and Logical Inference
   - Uncertain Knowledge
     - Bayes' Rule
     - Probabilistic Reasoning
     - Bayes Nets
4. Planning
   - Task Planning
   - Robot Motion Planning
5. Learning
   - Supervised Learning
   - Unsupervised Learning
   - Reinforcement Learning
6. Philosophy of AI

# Required Text

*Artificial Intelligence, A Modern Approach*
Russell & Norvig, **3rd** Edition.

# On Lectures

The textbook contains everything you need to know.

Lectures contain everything you need to know.

Lecture notes **do not contain everything you need to know**.

Suggested approach:
- Come to lectures and pay attention.
- Revise via textbook (immediately).
- Clarify at office hours.

# Grading

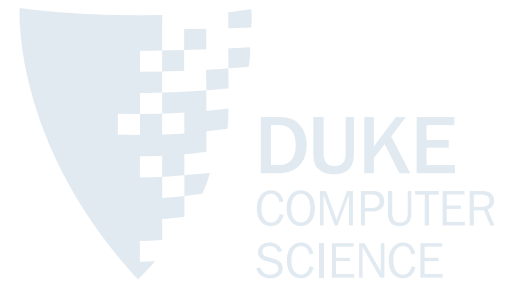Exams: **(closed book)**
 Midterm: 30%, in class.
 Final: 30%, finals week.

Coursework: 40% of grade.
5 assignments, mix of:

- Short proofs.
- Algorithm design.
- Programming (Python).
- Analysis.

# Academic Honesty

**I expect all Duke students to conduct themselves with the highest integrity, according to the *Duke Community Standard*.**
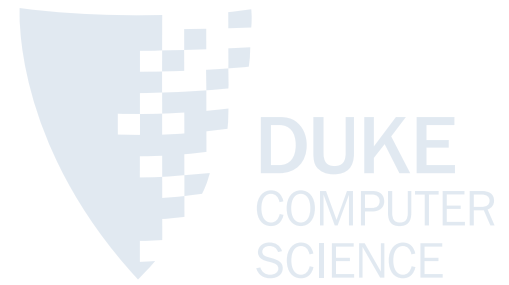
It is OK to:

- Have high-level discussions.
- Google for definitions and background.

**It is NOT OK TO:**

- Hand in anyone else's **code**, or **work**, in part or in whole.
- Google for solutions.

ALWAYS HAND IN YOUR OWN WORK.

# Academic Honesty

Consequences of cheating:

- Your case will be reported.
- Possible consequences include zeros on the assignment, suspension, failure to graduate, retraction of job offers.

If I catch you I **will** refer you to the Office of Student Conduct.

**DO NOT CHEAT.**

# Homework

I will post some reading on the course website.

- Please join Piazza.
- Please do the reading.
- Please do the coding homework.