Discussion

CS 5/7320 Artificial Intelligence

Intelligent Agents AIMA Chapter 2

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with figures from the AIMA textbook.

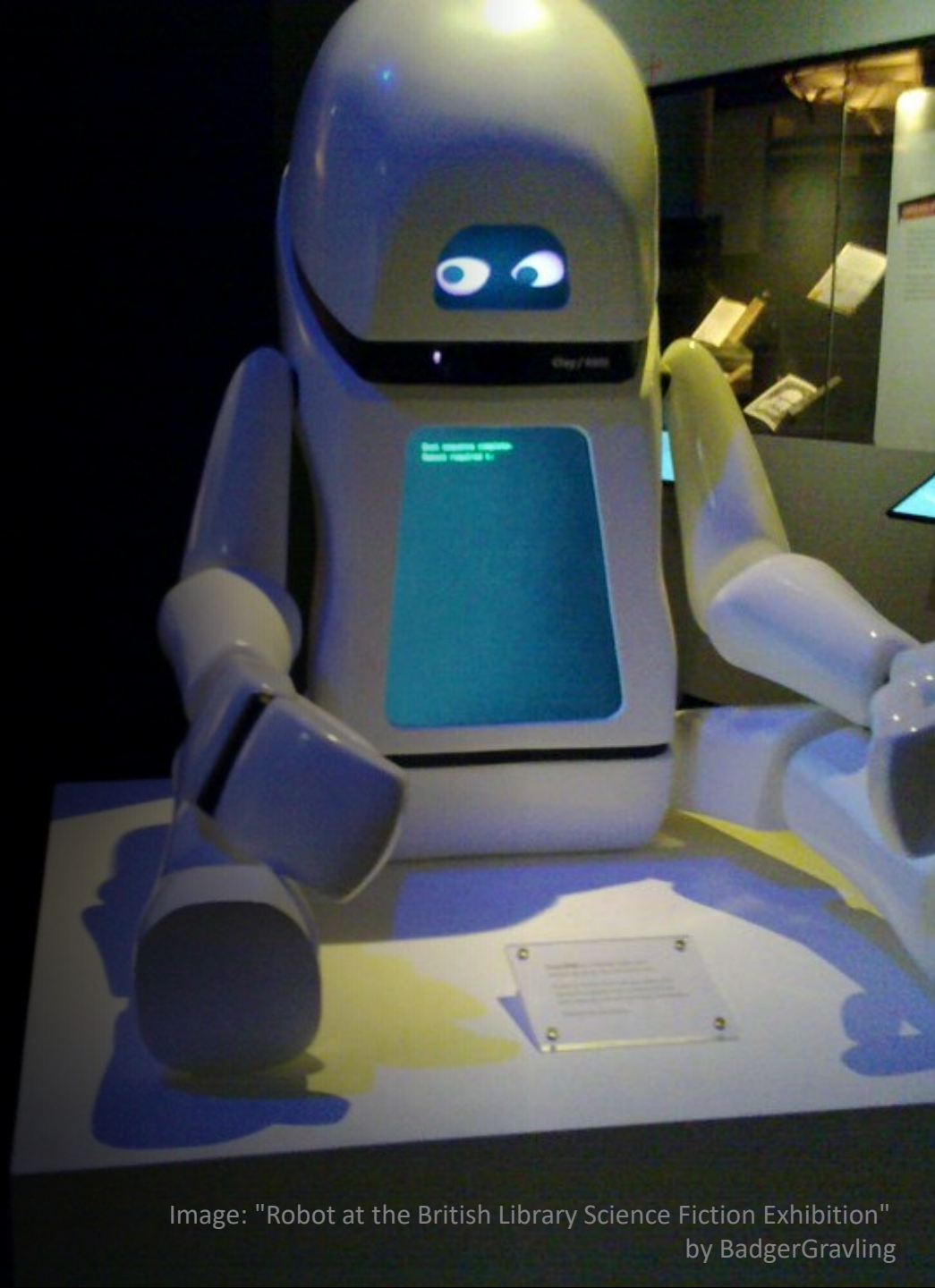


Image: "Robot at the British Library Science Fiction Exhibition" by BadgerGravling

Self-driving Cars

SAE Automation Levels

- Level 1 - Driver Assistance (“hands on”)
- Level 2 - Partial Automation (“hands off”)
- Level 3 - Conditional Automation
- Level 4 - High Automation
- Level 5 - Full Automation (“steering wheel optional”)

Components

- Sensing
- Maps
- Path planning
- Controlling the vehicle

Why is this so hard?

A Self-Driving Car as a Rational Agents

Rule: Pick the action that maximize the expected utility

$$a = \text{argmax}_{a \in \text{A}} \, E(U \mid a)$$

- If we have two cars and one provides more (expected) utility. Which car is rational?
- Can a rational self-driving car be involved in an accident?
- How would a self-driving car explore and learn?
- What does bounded rationality mean for a self-driving car?

PEAS Description of the Environment of a Self-Driving Car

Performance measure	Environment	Actuators	Sensors

Percepts and States: Self-Driving Car

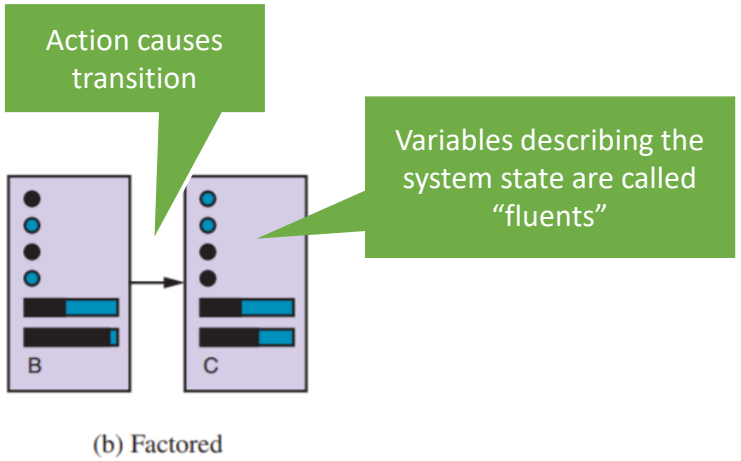
Percepts	**States**

State Representation: Self-Driving Car

States help to keep track of the environment and the agent in the environment.

Design a structured representation for the state of a self-driving car.

- What fluents should it contain?
- What actions can cause transitions?



(b) Factored

Environment for a Self-Driving Car

Fully observable: The agent's sensors always show the whole **state**.

vs.

Partially observable: The agent only perceives part of the **state** and needs to remember or infer the test.

Deterministic: **Percepts** are 100% reliable and changes in the environment is completely determined by the current **state** of the environment and the agent's **action**.

vs.

Stochastic:

- **Percepts** are unreliable (noise distribution, sensor failure probability, etc.). This is called a stochastic sensor model.
- The **transition function** is stochastic leading to transition probabilities and a Markov process.

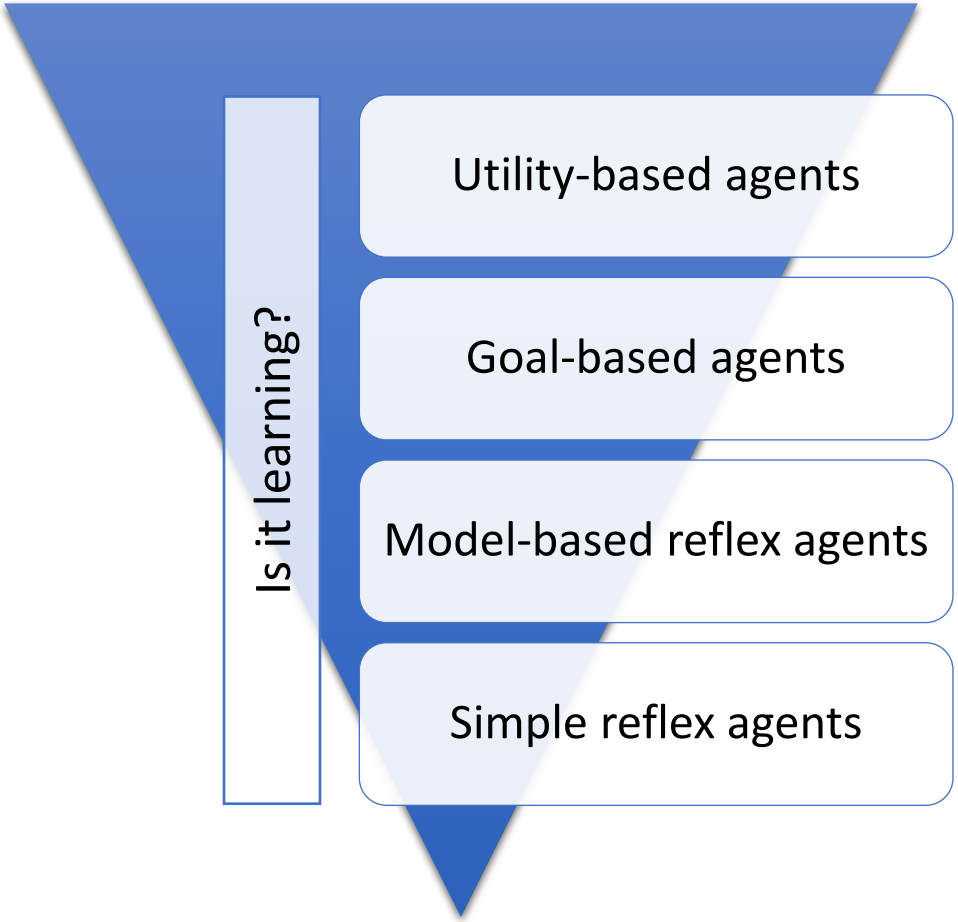
Known: The agent knows the **transition function**.

vs.

Unknown: The needs to **learn the transition function** by trying actions.

☑ Check what applies and explain what it means for a self-driving car.

What Type of Intelligent Agent is a Self-Driving Car?



Does it collect utility over time? How would the utility for each state be defined?

Does it have a goal state?

Does it store state information. How would they be defined (atomic/factored)?

Does it use simple rules based on the current percepts?

☑ Check what applies

Self-driving Cars

Why is this so hard?

- Self-driving cars operate in a very complicated partially observable, stochastic dynamic environment.
- Can only use bounded rationality because of limits with sensors and computational power.
- Require a set of different agents to cooperate.