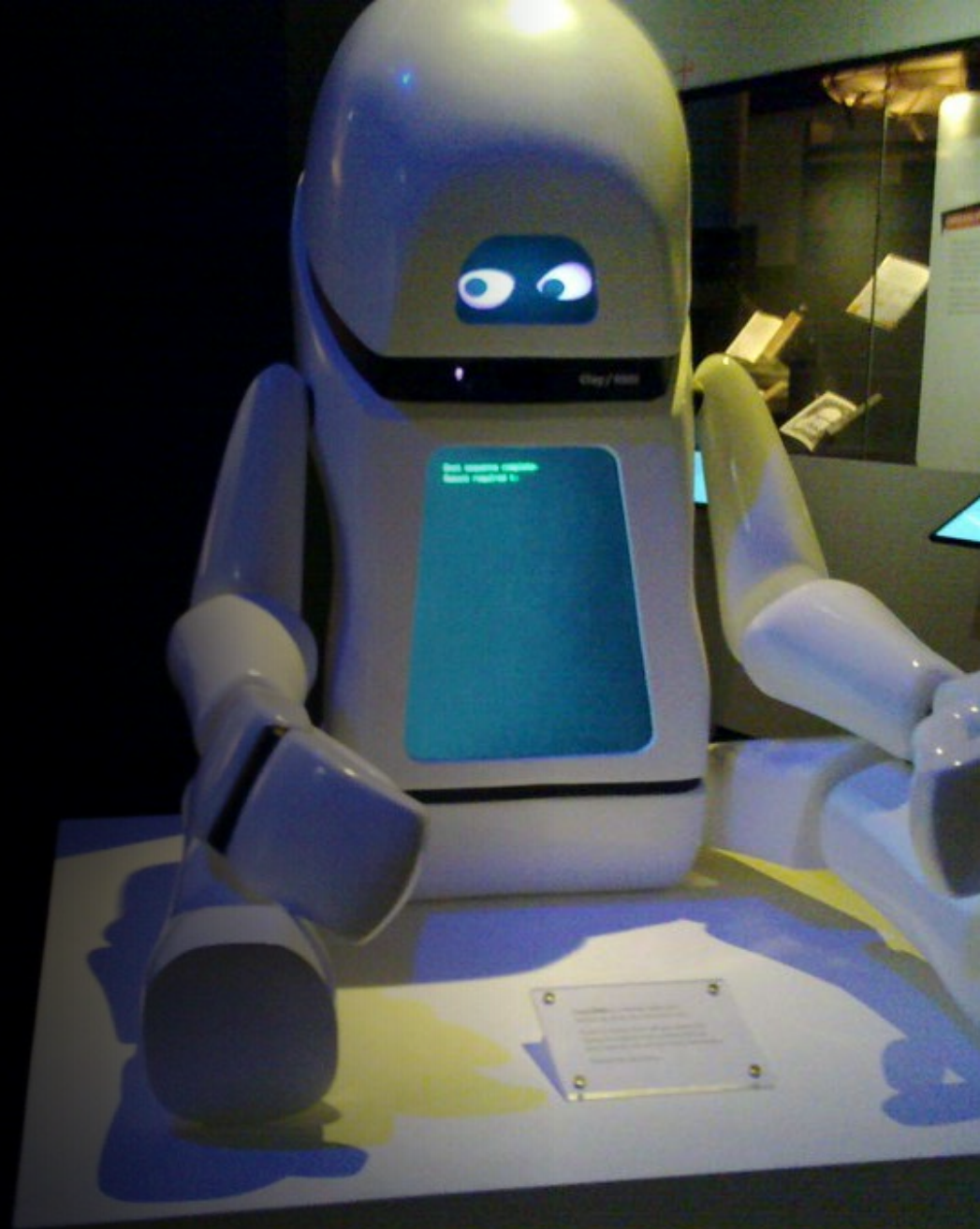Discussion

CS 5/7320 Artificial Intelligence

Intelligent Agents AIMA Chapter 2

Slides by Michael Hahsler
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

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

Answer the following questions:

- 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

Complete the PEAS description.

Performance measure	Environment	Actuators	Sensors

Percepts and States: Self-Driving Car

Describe percepts and states.

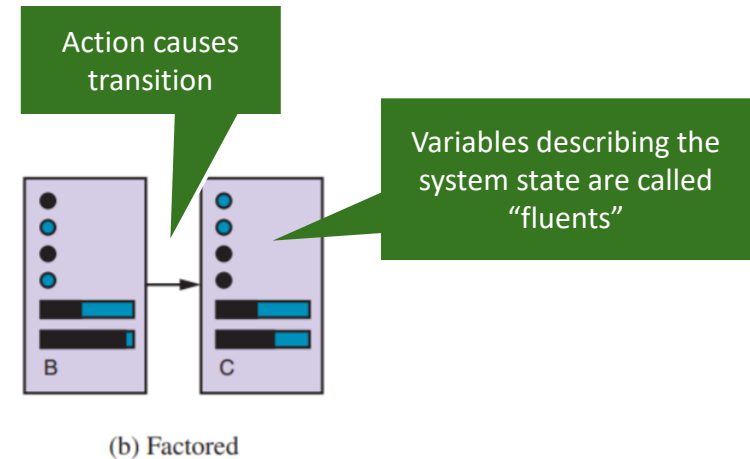| Percepts	States

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.

a)   What fluents should it contain?

b)   What actions can cause transitions?

c)   Draw a small transition diagram.

Action causes transition

Variables describing the system state are called "fluents"

B   C

(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:
☐ a) **Percepts** are 100% reliable
☐ b) Changes in the environment are completely determined by the current **state** of the environment and the agent's **action**.

vs.

Stochastic:
☐ a) **Percepts** are unreliable (noise distribution, sensor failure probability, etc.). This is called a stochastic sensor model.
☐ b) 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?

Is it learning?

☐

☐ Utility-based agents

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

☐ Goal-based agents

Does it have a goal state?

☐
Model-based reflex agents

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

☐ Simple reflex agents

Does it use simple rules based on the current percepts?

☑ Check what applies

Why is this so hard?

- Self-driving cars operate in a very complicated partially observable, stochastic, and dynamic environment.

- Can only use bounded rationality because of limits with sensors and computational power.

- Require a set of different agents that cooperate.