Good Afternoon, Colleagues
Good Afternoon, Colleagues

Are there any questions?
Logistics

- Reading responses
Logistics

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  - Sorry about textbook availability!
Logistics

• Reading responses
  – Sorry about textbook availability!

• Programming assignment
Logistics

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- Programming assignment
  - C tutorial helpful?
Logistics

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- Programming assignment
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- Next week’s readings are up:
  - Brooks’ reactive robots
  - A more deliberative architecture
  - RoboCup case study
Logistics

- Reading responses
  - Sorry about textbook availability!

- Programming assignment
  - C tutorial helpful?

- Next week’s readings are up:
  - Brooks’ reactive robots
  - A more deliberative architecture
  - RoboCup case study

- Class discussions start Thursday
  - Finalize after the first few
Franklin and Graesser Definition

An autonomous agent is a system situated within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to affect what it senses in the future.
Franklin and Graesser Definition

An autonomous agent is a system situated within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to affect what it senses in the future.

1. “over time... so as to affect what it senses in the future”

2. “in pursuit of its own agenda”
Thermostats

- Are they agents or not?
- How does Wooldridge resolve this?
My Requirements of Agents

- They must **sense** their environment.
- They must **decide** what action to take ("think").
- They must **act** in their environment.
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**Complete Agents**
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**Multiagent systems:** Interact with other agents
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**Learning agents:** Improve performance from experience
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**Complete** Agents

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Autonomous Bidding, Cognitive Systems, Traffic management, **Robot Soccer**
Your Agent Examples
Your Agent Examples

**Automotive:** Anti-lock brake system (2); Engine Control Unit; Adaptive cruise control; Traffic light.

**Physical Control:** Automatic sprinkler system; Auto coffee maker; Washing machine; Electric Guitar

**Software Control:** File system indexer; BitTorrent client; Auto song shuffler for radio

**Human monitoring:** Pacemaker

**Game/entertainment:** First Person Shooter enemy; Poker bot

**Service:** Stock trading agent
Formalizing My Example

Knowns:
Formalizing My Example

Knowns:

- $\mathcal{O} = \{\text{Blue, Red, Green, Black, ...}\}$
- Rewards in $\mathbb{R}$
- $\mathcal{A} = \{\text{Wave, Clap, Stand}\}$

$o_0, a_0, r_0, o_1, a_1, r_1, o_2, \ldots$
Formalizing My Example

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Knowns:

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Unknowns:

- \( \mathcal{S} = 4 \times 3 \) grid
- \( \mathcal{R} : \mathcal{S} \times \mathcal{A} \rightarrow \mathbb{R} \)
- \( \mathcal{P} : \mathcal{S} \rightarrow \mathcal{O} \)
- \( \mathcal{T} : \mathcal{S} \times \mathcal{A} \rightarrow \mathcal{S} \)

\( o_0, a_0, r_0, o_1, a_1, r_1, o_2, \ldots \)
Formalizing My Example

Knouns:

- $\mathcal{O} = \{\text{Blue, Red, Green, Black, . . .}\}$
- Rewards in $\mathbb{R}$
- $\mathcal{A} = \{\text{Wave, Clap, Stand}\}$

Unkowns:

- $S = 4 \times 3$ grid
- $\mathcal{R} : S \times A \mapsto \mathbb{R}$
- $\mathcal{P} = S \mapsto \mathcal{O}$
- $\mathcal{T} : S \times A \mapsto S$

$o_i = \mathcal{P}(s_i)$
Formalizing My Example

Knowns:
- $O = \{\text{Blue, Red, Green, Black, \ldots}\}$
- Rewards in $\mathbb{R}$
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Unknowns:
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- $\mathcal{R} : S \times A \mapsto \mathbb{R}$
- $\mathcal{P} = S \mapsto O$
- $T : S \times A \mapsto S$

\[ o_i = \mathcal{P}(s_i) \quad r_i = \mathcal{R}(s_i, a_i) \]
Formalizing My Example

Knowns:
- \( \mathcal{O} = \{ \text{Blue, Red, Green, Black, ...} \} \)
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\[
\begin{align*}
o_0, a_0, r_0, o_1, a_1, r_1, o_2, & \ldots \\
o_i = \mathcal{P}(s_i) & \quad r_i = \mathcal{R}(s_i, a_i) & \quad s_{i+1} = \mathcal{T}(s_i, a_i)
\end{align*}
\]
Environments

Environment $\rightarrow$ sensations, actions
Environments

Environment $\iff$ sensations, actions

- fully observable vs. partially observable (accessible)
- deterministic vs. non-deterministic
- episodic vs. non-episodic
- static vs. dynamic
- discrete vs. continuous
- single-agent vs. multiagent
The Decision
The Decision

- reactive vs. deliberative
The Decision

- reactive vs. deliberative
- multiagent reasoning?
The Decision

- reactive vs. deliberative
- multiagent reasoning?
- learning?
It is worth observing that state-based agents as defined here are in fact no more powerful than the standard agents we introduced earlier. In fact, they are identical in their expressive power.
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- Standard agent: \(\text{action} : S^* \rightarrow A\)
Reactive Agents

- \textit{action} : \mathcal{P} \rightarrow \mathcal{A}

- Decision based entirely on the present
Reactive Agents

- *action*: $\mathcal{P} \rightarrow \mathcal{A}$

- Decision based entirely on the present

Reactive agents for Thursday’s assignment task?
Discussion

What new autonomous do you expect to see in the next 10 years?