PEAS: Agents and Environments

CSC 411: AI
Fall 2013

What's an agent?

Agents include humans, robots, softbots, thermostats, etc.

The agent function maps from percept histories to actions: $f : \mathcal{P}^* \rightarrow \mathcal{A}$.

The agent program runs on the physical architecture to produce f.

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We first specify the setting. Let's design an automated taxi:

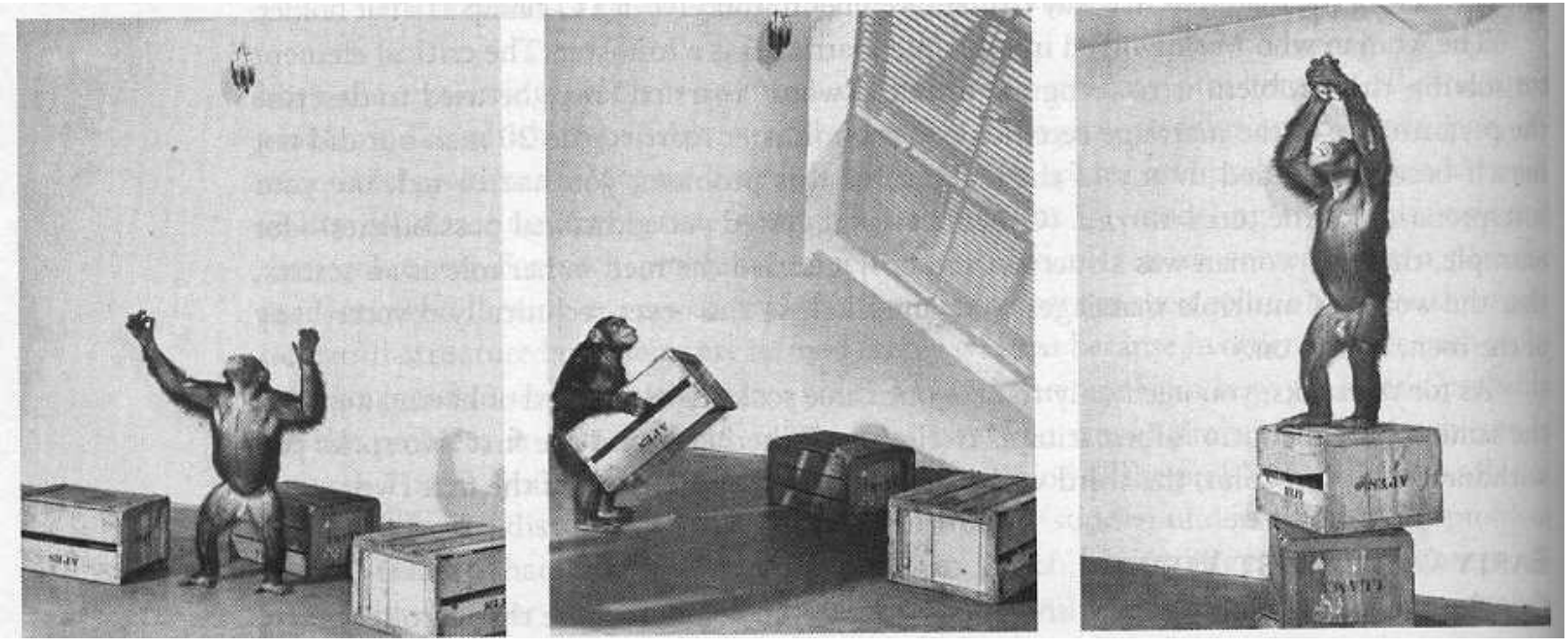
- **Performance measure:**
- **Environment:**
- **Actuators:**
- **Sensors:**

PEAS

We first specify the setting. Let's design an automated taxi:

- **Performance measure:** Be safe, reach destination, maximize profits, obey laws, . . .
- **Environment:** Urban streets, freeways, traffic, pedestrians, weather, customers, . . .
- **Actuators:** Steering wheel, accelerator, brake, horn . . .
- **Sensors:** Video, accelerometers, gauges, engine sensors, keyboard, GPS, . . .

An aside on actuators and sensors



An aside on actuators and sensors

Some agents can modify their own actuators and sensors with the use of tools.

- Wasps
- Ravens
- Dolphins
- Gorillas
- Human beings

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A medical diagnosis system?

- **Performance measure:**
- **Environment:**
- **Actuators:**
- **Sensors:**

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A medical diagnosis system?

- **Performance measure:** Healthy patient, minimal costs, no lawsuits, . . .
- **Environment:** Patient, hospital, pharmacy, doctors, nurses, equipment, . . .
- **Actuators:** Screen display (questions, tests, diagnoses, treatments, referrals, . . .)
- **Sensors:** Keyboard (entry of symptoms, findings, patient's answers, . . .)

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How about an Internet shopping agent?

- **Performance measure:**
- **Environment:**
- **Actuators:**
- **Sensors:**

PEAS

How about an Internet shopping agent?

- **Performance measure:** Price, quality, appropriateness, efficiency, . . .
- **Environment:** Current and future Web sites, vendors, shippers, . . .
- **Actuators:** Display to user, follow URL, fill in form . . .
- **Sensors:** Web pages (text, graphics, scripts. . .)

Rational agents

Without loss of generality, "goals" are specifiable by a performance measure defining a numerical value for any environment history.

Rational action: whichever action maximizes the expected value of the performance measure *given the percept sequence to date*.

Rational $\neq$ omniscient
Rational $\neq$ clairvoyant
Rational $\neq$ successful

Environment properties

- Fully (vs. partially) observable: An agent's sensors give it access to the complete state of the environment at each point in time.
- Deterministic (vs. stochastic): The next state of the environment is completely determined by the current state and the action executed by the agent.
- Episodic (vs. sequential): The agent's experience is divided into atomic "episodes" (in which the agent perceives then performs one action), and the choice of action in each episode depends only on the episode itself.

Environment properties

- Static (vs. dynamic): The environment is unchanged while an agent is deliberating. (The environment is semidynamic if the environment itself does not change with the passage of time but the agent's performance score does.)
- Discrete (vs. continuous): A limited number of distinct, clearly defined percepts and actions.
- Single agent (vs. multiagent): An agent operating by itself in an environment.

Environment example

Crossword puzzle:

Observable:
Agents:
Deterministic:
Episodic:
Static:
Discrete:

Environment example

Crossword puzzle:

Observable:	Fully
Agents:	Single
Deterministic:	Deterministic
Episodic:	Sequential
Static:	Static
Discrete:	Discrete

Environment example

Taxi driving:

Observable:
Agents:
Deterministic:
Episodic:
Static:
Discrete:

Environment example

Taxi driving:

Observable:	Partially
Agents:	Multi
Deterministic:	Stochastic
Episodic:	Sequential
Static:	Dynamic
Discrete:	Continuous

Environment example

English tutor:

Observable:
Agents:
Deterministic:
Episodic:
Static:
Discrete:

Environment example

English tutor:

Observable:	Partially
Agents:	Multi (why?)
Deterministic:	Stochastic
Episodic:	Sequential
Static:	Dynamic
Discrete:	Discrete

Environment example

Image analysis:

Observable:
Agents:
Deterministic:
Episodic:
Static:
Discrete:

Environment example

Image analysis:

Observable:	Fully
Agents:	Single
Deterministic:	Deterministic
Episodic:	Episodic
Static:	Semi
Discrete:	Continuous