Lecture 03
Intelligent Agents

Artificial
Intelligence

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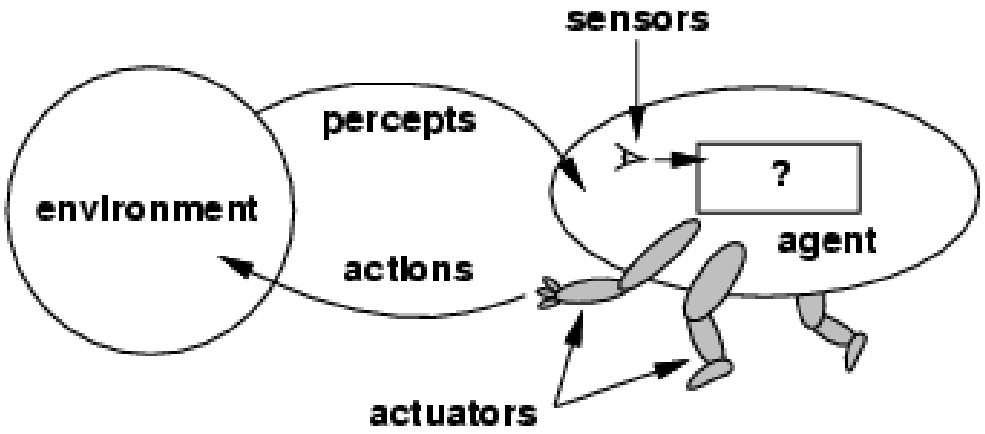
Today's Agenda

- Agents and environments
- Rationality
- Software Agents
- Task Environments
- PEAS (Performance measure, Environment, Actuators, Sensors)

Agents

- An **agent** is anything that can be viewed as **perceiving** its **environment** through **sensors** and acting upon that environment through **actuators**



Agents (*Cont.)*

- Human agent
  - —**Sensors:** eyes, ears, and other organs
  - —**Actuators:** hands, legs, mouth, and other body parts
- Robotic agent
  - —**Sensors:** cameras and infrared range finders
  - —**Actuators:** various motors

Agents and environments

Agent **Function:**

- The agent function maps from **percept histories** to **actions**:

$$[f: \mathcal{P}^{\star} \rightarrow \mathcal{A}]$$

- **Percept**- Agent's input (the basis for its actions)
- **Percept History/Sequence** – Complete history of what has been perceived

Agents and environments *(Cont.)*

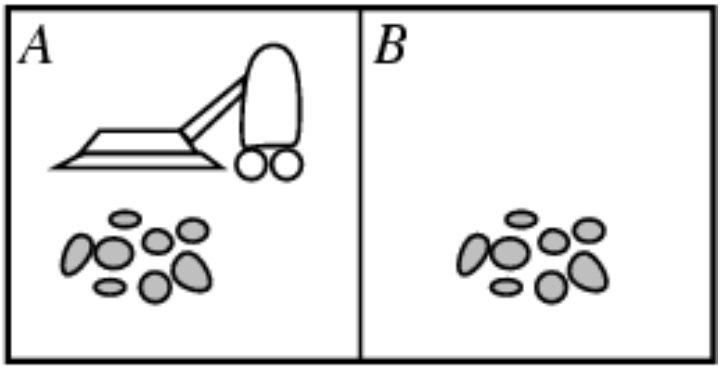
- Agent **Program:**
  - The **agent program** runs on the physical **architecture** to produce *f*

agent = architecture + program

  - Actual implementation of **agent function** (by using some programming language)

Vacuum-cleaner world

- **Environment:**
  Square A & B
- **Percepts:**
  Location and contents, e.g., [A,Dirty]
- **Actions:**
  Left, Right, Suck, NoOp



Example vacuum agent program

Function-vacuum-agent ([location, status]) returns an action

- *if* status = Dirty *then* return Suck
- *else if* location = A *then* return Right
- *else if* location = B *then* return Left

A vacuum-cleaner agent

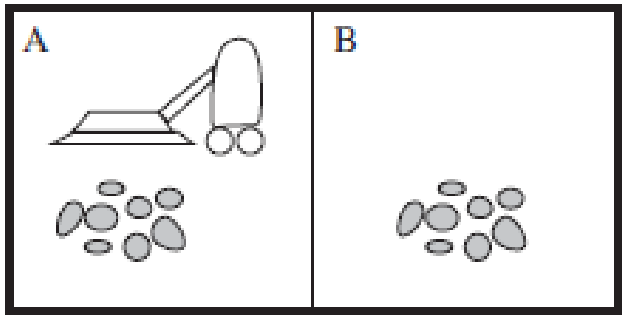


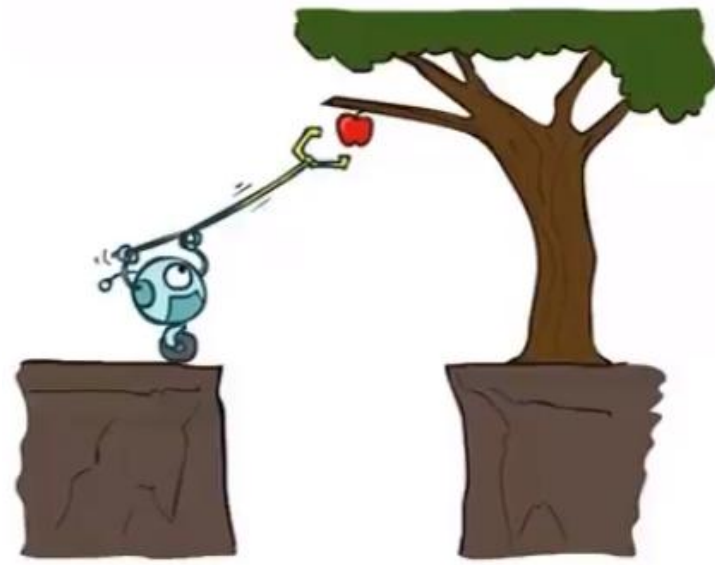
Figure 2.2 A vacuum-cleaner world with just two locations.

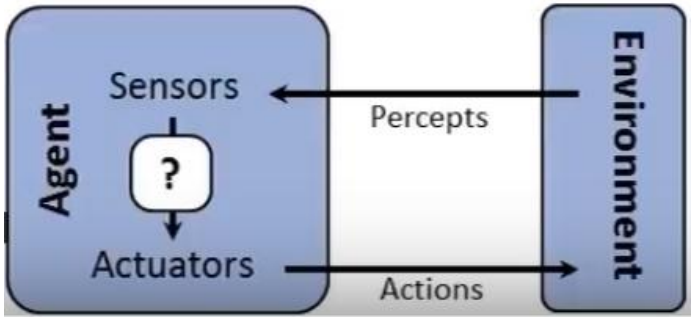
Percept sequence	Action
$[A, Clean]$	*Right*
$[A, Dirty]$	*Suck*
$[B, Clean]$	*Left*
$[B, Dirty]$	*Suck*
$[A, Clean], [A, Clean]$	*Right*
$[A, Clean], [A, Dirty]$	*Suck*
⋮	⋮
$[A, Clean], [A, Clean], [A, Clean]$	*Right*
$[A, Clean], [A, Clean], [A, Dirty]$	*Suck*
⋮	⋮

Figure 2.3 Partial tabulation of a simple agent function for the vacuum-cleaner world shown in Figure 2.2.

Rational Agent

- An **agent** is an entity that *perceives* and *act*
- A **rational agent** selects actions that maximizes its (expected) **utility**
- Characteristics of the **percepts**, **environment**, and **action space** dictate techniques for selecting rational agents
- **This course** is about:
  - General AI techniques for a variety of problem types
  - Learning to recognize when and how a new problem can be solved with an existing technique





Rational agents

- An agent should strive to "**do the right thing",** based on what it can perceive and the actions it can perform.
- Performance measure: An objective criterion for success of an agent's behavior (rationality)

- E.g., performance measure of a vacuum-cleaner agent could be amount of dirt cleaned up, amount of time taken, amount of electricity consumed, amount of noise generated, etc.

Rational agents

- **Rational Agent:** For each possible percept sequence, a rational agent should select an action that is expected to maximize its performance measure, given the evidence provided by the percept sequence and whatever built-in knowledge the agent has.

Omniscience

- Rationality is distinct from omniscience (all-knowing with infinite knowledge)
- An omniscient agent knows the ***actual*** outcome of its actions and can act accordingly;
- But omniscience is impossible in reality.

Learning

- Agents can perform actions in order to modify **future percepts** so as to obtain useful information (information gathering, exploration)

- It requires rational agent not only to gather information but also to **learn** as much as possible from what it perceives.

- The agent's initial configuration could reflect some **prior knowledge** of the environment, but as the agent gains experience this may be modified and augmented.

Autonomy

- An agent relying on prior knowledge of its designer rather than on its own percepts, we say that this agent **lacks autonomy**

- A rational agent should be autonomous-An agent is **autonomous** if its behavior is determined by its own experience (with ability to learn and adapt)

Software Agents

- Sometimes, the environment may not be the real world
  - E.g., flight simulator, video games, Internet
  - They are all artificial but very complex environments
  - Those agents working in these environments are called
    - Software agent (software robots or softbots)
    - Because all parts of the agent are software

PEAS

- **Task Environment**
  —Problems to which rational agents are solution

- To specify task environment we need:

- **P** - Performance measure
- **E** - Environment
- **A** - Actuators
- **S** - Sensors

- In designing an agent, the **first** step must always be to specify the **task environment** as fully as possible.

Task Environment
Automated Taxi Driver Agent

- **Performance Measures:**

-Getting to correct Destination

-less cost

-high safety

- **Environment:**

-variety of roads

-Traffic

-different types of passenger

Actuators:

-Accelerators

-Steering & brakes

SENSORS:

-Camera

-GPS

- IR sensors

Task Environment
Medical Diagnoses System

- **Performance measures**

-Healthy patients
-minimize cost

- **Environment**

-patients
-hospital
-staff

Actuators :

-Screen Display
(Questions test, Treatment)

SENSORS

-Keyboard
(Entry of symptoms)

Part Picking Robot

Task Environment
Part Picking Robot

- **Performance Measures**
  - —Percentage of parts in correct bins
- **Environment**
  - —Conveyer belt with parts
  - —bins
- **Actuators**
  - —Joined arm
  - —Hand
- **Sensors**
  - —Camera
  - —Joint angle sensors

Homework for Lecture 03 (Individual Assignment)

- Perform PEAS analysis for following agents:
  - —KFUEIT Biometric Attendance System
  - —Automatic Car Park System
  - —Automated Door Security System
  - —Weather Station
  - —Automatic Plant Watering System
- Must include title page
- Must include table of contents
- Must include page numbers
- Cited works should be properly referenced.

How to submit the work

- Make a .pdf file of your work
- Name the file with your reg no. eg. CS1811109
- Upload the file as per LMS date and time.
- For future homework, please do in a similar way.
- Copied material will be marked 0.