Intelligent Agents

AIMA, Chapter 2.1-2.2

Roadmap for Module 1

- Today: Rational Agents (Chap 2.1-2.2)
- Today: Introduction to Python – Part 1
  - Homework 1 distributed: Python
- Thursday: Introduction to Python – Part 2
- Tuesday, Sept 9:
  - Task Environments (Chap 2.3)
  - Problem Formulation (Chap 3.1-3.3)

Agents and environments

- An agent is specified by an agent function \( f \) that maps a sequence of percepts \( Y = \{y_0, y_1, \ldots, y_t\} \) to an action \( a \in A \), \( A = \{a_0, a_1, \ldots, a_k\} \)

Example: A Vacuum-cleaner agent

- Percepts: location and contents, e.g., \((A, \text{dirty})\)
  - (Idealization: locations are discrete)
- Actions: move, clean, do nothing:
  - \( \text{LEFT, RIGHT, SUCK, NOP} \)
Rational agents II

- **Rational Agent**: For each possible percept sequence, a rational agent should select an action that is **expected to maximize** its performance measure.
- **Performance measure**: An objective criterion for success of an agent’s behavior, given the evidence provided by the percept sequence.

  - A performance measure for a vacuum-cleaner agent might include one or more of:
    - +1 point for each clean square in time $T$
    - +1 point for clean square, -1 for each move
    - -1000 for more than $k$ dirty squares

Rationality is *not* omniscience

- **Ideal agent**: maximizes actual performance, but needs to be **omniscient**.
  - Usually impossible..... But consider tic-tac-toe agent...
  - Rationality ≠ Success

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

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

Outline for rest of lecture

- **Rational Agents**
- Defining Task Environments
- Environment types
- Agent types

Agents and environments

An agent is specified by an **agent function** $f: P \rightarrow a$ that maps sequences of percepts $P$ to an action $a$ from a set $A$:

$P = \{ p_0, p_1, \ldots, p_t \}$

$A = \{ a_0, a_1, \ldots, a_k \}$

Agents

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

- **Human agent**:
  - Sensors: eyes, ears, ...
  - Actuators: hands, legs, mouth, ...

- **Robotic agent**:
  - Sensors: cameras and infrared range finders
  - Actuators: various motors

- Agents include humans, robots, softbots, thermostats, ...
Agent function & program

- The agent program runs on the physical architecture to produce /
  - agent = architecture + program
- “Easy” solution: table that maps every possible sequence $P$ to an action $a$
  - One small problem: exponential in length of $P$

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 Vacuum-cleaner world: agent function

<table>
<thead>
<tr>
<th>Percept sequence</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>[A, Clean]</td>
<td>Right</td>
</tr>
<tr>
<td>[A, Dirty]</td>
<td>Left</td>
</tr>
<tr>
<td>[B, Clean]</td>
<td>Suck</td>
</tr>
<tr>
<td>[B, Dirty]</td>
<td>Suck</td>
</tr>
<tr>
<td>[A, Clean], [A, Clean]</td>
<td>Right</td>
</tr>
<tr>
<td>[A, Clean], [A, Dirty]</td>
<td>Suck</td>
</tr>
</tbody>
</table>

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  (Book’s definition – standard usage differs.)