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
- Recitation later this week (Friday afternoon?) for those not familiar with Python: Introduction to Python – Part 2
- Thursday:
  - Task Environments, Problem Formulation, Search basics

Agents and environments

• An agent is specified by an agent function \( f: P \rightarrow a \) that maps sequences of percept vectors \( P \) 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 \( f \)
  - agent = architecture + program

• “Easy” solution: table that maps every possible sequence \( P \) to an action \( a \)
  - One small problem: exponential in length of \( P \)

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

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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
  - *(Book's definition — standard usage differs.)*

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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>Suck</td>
</tr>
<tr>
<td>[B, Clean]</td>
<td>Left</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>

```python
function Reflex-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
```

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