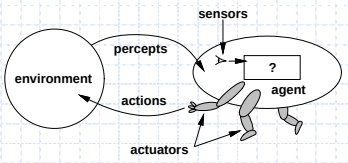
Intelligent Agents

Russell and Norvig:
Chapter 2

Agents

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

What are the sensors and actuators?



Agents

- For example
  - Humans
  - Animals
  - Robots
  - Various software systems

Agents: Terminology

- Perceiving
  - **Percept**: Agent's perceptual inputs at any given instant
  - **Percept sequence**: Complete history of everything the agent has perceived.

Agents: Terminology

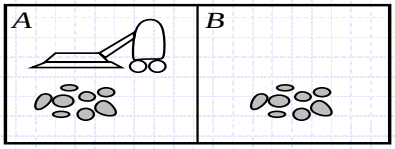
- Acting
  - **Agent function**: decides what action to take in any given situation (possibly non-deterministic)
  - In general, an agent's choice of action can depend on the *entire percept sequence* observed to date.
  - **Agent program**: implements an agent function internally.

Agent Program

- The AI is to design the **agent program**
  - Agent = architecture + program
- Easy?
  - Simply fill out the agent function table!

Even though we could, impractical except for most simple problems

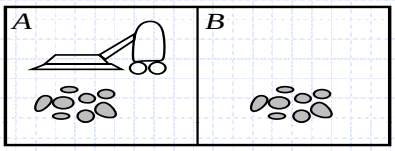
The Vacuum-Cleaner World



- Agent Function

Percept sequence	Action
[A, Clean]	Right
[A, Dirty]	Suck
[B, Clean]	Left
[B, Dirty]	Suck
[A, Clean], [A, Clean]	Right
…	

The Vacuum-Cleaner World



- Agent Program

```
function DECIDE([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
```

The Concept of Rationality

- Rational behavior is making the "right" decisions *based on what you know*.
- What is rational at any given time depends on
  - The performance measure that defines the criterion of success
  - The agent's prior knowledge of the environment
  - The actions that the agent can perform
  - The agent's percept sequence to date.

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."
- Note:
  - Does not imply *perfect* decision making.
  - Does usually imply a learning agent.

The Nature of Environments

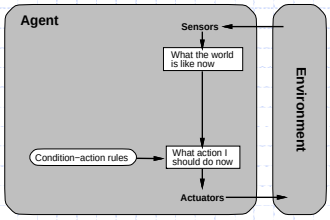
- Task environment
  - "Problem domain"
- Specifying the task environment
  - **P**erformance measure
  - **E**nvironment
  - **A**ctuator
  - **S**ensors
- See figures 2.4 and 2.5 for examples

The Nature of Environments

- Properties of environments
  - Fully vs. partially observable
  - Deterministic vs. Stochastic
    - Deterministic except for other agents: strategic
  - Episodic vs. Sequential
  - Static vs. Dynamic
  - Discrete vs. Continuous
  - Single vs. Multi-agent
    - Cooperative
    - Competitive

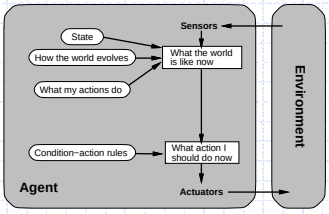
Simple Reflex Agent

- Simple reflex agents
  - Only current percept
  - Condition-Action Rules



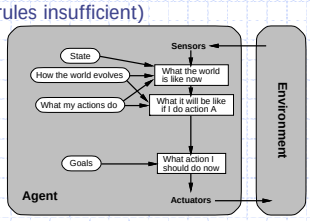
Model-Based Reflex Agent

- Model-based reflex agents
  - Model of world – internal state
  - World evolves
  - Actions affect it



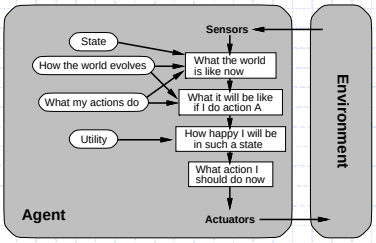
Goal-Based Agent

- Goal-based agents
  - Current State and a Goal.
  - Desired Future State: planning and search used.
  - (condition-action rules insufficient)

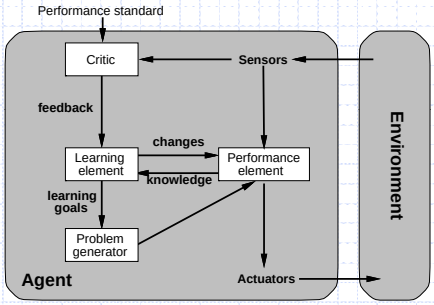


Utility Based Agent

- Utility based agents
  - Utility function returns a “happy value” about state



Learning Agents



Summary

- Agent
- Rational Agent
- Task environment
- Structure of Agents
  - Simple reflex
  - Model-Based
  - Goal-Based
  - Utility-Based
- Learning Agents