2. Intelligent Agents

Contents:

Rational Agent Approach 理性智能体方法

Here we concentrate on general principles of rational agents and on components for constructing them.

我们在此专注于理性智能体的一般原理和构造智能体的组件。

Why rational agent 为何理性智能体

- More general than the "thinking/acting humanly" approaches, because correct inference is just one of several possible mechanisms for achieving rationality.

  与"人性思考/动作"方式相比更通用，因为正确推理只是为了获得理性的可行机制之一。

- More amenable to scientific development than the "thinking/acting humanly" approaches.

  与"人性思考/动作"方式相比更顺应科技的发展。

Examples: Intelligent Agents 智能体

- A human agent 人类智能体
  - sensors: eyes, ears, and other organs.
    感受器：眼、耳、和其它器官。
  - actuators: hands, legs, vocal tract, and so on.
    执行器：手、脚、声道、如此等等。
- A robotic agent (robot) 机器智能体（机器人）
  - sensors: cameras, infrared range finders.
    感受器：摄像头、红外测距仪。
  - actuators: various motors.
    执行器：各种马达。
- A software agent (softbot) 软件智能体（软件机器人）
  - sensors: keystrokes, file contents, and network packets.
    感受器：击键、文件内容、以及网络包。
  - actuators: display on screen, write files, and send network packets.
    执行器：屏幕显示、写文件、以及发送网络包。

Abstract Intelligent Agents 抽象智能体

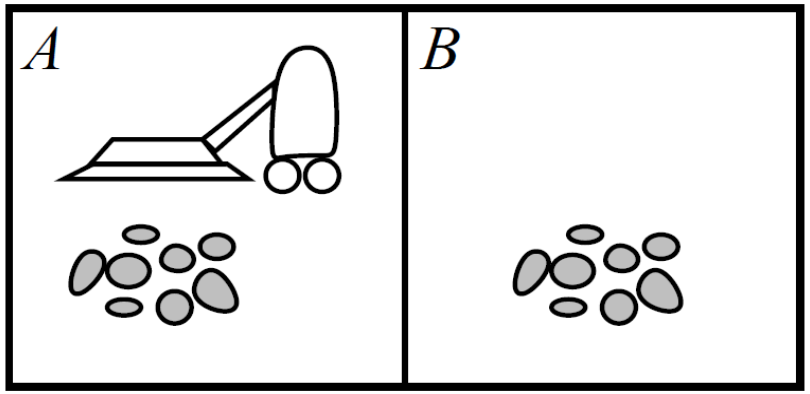
- Intelligent agents are often described schematically as an abstract functional system similar to a computer program.
  智能体经常被大致地描述成一个类似于计算机程序的抽象功能系统。
- They are sometimes called abstract intelligent agents to distinguish them from their real world ones as computer systems, biological systems, or organizations.
  它们有时被称为抽象智能体，将其与现实世界的计算机系统、生物系统、或组织机构加以区别。
- Some definitions of intelligent agents emphasize their autonomy, and so prefer the term autonomous intelligent agents.
  某些智能体的定义强调其自主性，因而喜欢自主智能体这个术语。
- Still others considered goal-directed behavior as the essence of intelligence, and so prefer a term borrowed from economics, rational agent.
  其他人仍然将目标导向行为作为智能的本质，故而喜欢从经济学借用的术语，理性智能体。

A Variety of Definitions 各种定义

- Accommodate new problem solving rules incrementally.
  逐渐顺应新的问题求解规则。
- Adapt online and in real time.
  适合在线与实时。
- Able to analyze itself in terms of behavior, error and success.
  能够从行为、错误与成功方面进行自我分析。
- Learn and improve through interaction with the environment.
  通过与环境交互进行学习与改善。
- Learn quickly from large amounts of data.
  迅速从大量的数据中学习。
- Have memory-based exemplar storage and retrieval capacities.
  具有基于内存的样本存储和检索能力。
- Have parameters to represent short and long term memory, forgetting, etc.
  具有表示短期和长期记忆、遗忘等参数。

Example: Vacuum-cleaner world 真空吸尘器世界

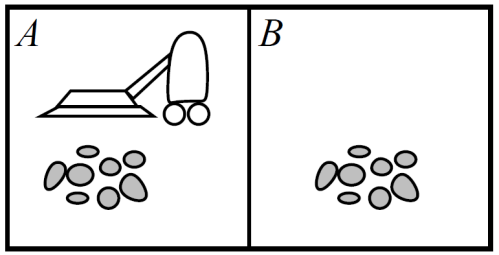
- A vacuum-cleaner world with just two locations: squares A and B.
  一个仅仅有两个地点的真空吸尘器世界：方形区域A和B。
- The vacuum agent perceives which square it is in and whether there is dirt in the square. It can choose to move left, move right, suck up the dirt, or do nothing. I.e.,
  该吸尘器智能体感知它在那个方形区域，以及该方形区域是否有灰尘。它可以选择左行、右行、吸尘、或者空操作。即：
  - Percepts:
    location and contents, e.g., [*A*, *Dirty*]
    感知：位置和内容
  - Actions:
    Left, *Right*, *Suck*, *NoOp*
    动作：左行、右行、吸尘、空操作



A vacuum-cleaner world with just two locations

Example: Vacuum-cleaner world 真空吸尘器世界

- What is the right function?
  正确的功能是什么?
- Can it be implemented in a small agent program?
  能用一个小智能体程序实现吗?



Partial tabulation of a simple agent function
一个简单智能体功能的部分列表

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

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*

The agent program for a simple reflex agent in the two-state vacuum environment.
This program implements the agent function in upper right table.
两状态吸尘器环境下一个简单反射智能体的程序。该程序实现右上表的智能体功能。

What is a Rational Agent 什么是理性智能体

- It is one that does the right thing — every entry in the table for the agent function is filled out correctly.

  是一个有正确行为的智能体 —— 该功能表中的每个条目都正确填写。

What is the Right Thing 什么是正确的行为

- An agent in an environment generates a sequence of actions according to the percepts.

  一个智能体在一个环境中依据感知生成一系列动作。

- Those actions causes the environment to go through a sequence of states.

  这些动作经由一系列状态而引起环境发生变化。

- If the sequence is desirable, then the agent has performed well.

  如果该系列变化是所期望的，则该智能体表现良好。

Right Thing = Rational Action 正确的行为 = 理性的动作

- **Rational** 理性的

  exploration, learning, autonomy.

  探索、学习、自主

- **Rational action** 理性的动作

  Maximizes the expected value of performance measure given the percept sequence.

  对给定的感知序列，能使期待的性能指标最大化。

Rational = Best	■	理性 = 最佳
Rational = Optimal	■	理性 = 最优
Rational ≠ Omniscience	■	理性 ≠ 全知全能
Rational ≠ Clairvoyant	■	理性 ≠ 明察秋毫
Rational ≠ Successful	■	理性 ≠ 百战百胜

Concept of Rationality 理性的概念

- Rationality depends on four things:

  理性依赖于四件事：

  - The performance measure that defines the criterion of success.

    定义成功标准的性能指标。

  - The agent's prior knowledge of the environment.

    智能体对环境的先验知识。

  - The actions that the agent can perform.

    智能体能够完成的动作。

  - The agent's percept sequence to date.

    智能体最新的感知序列。