

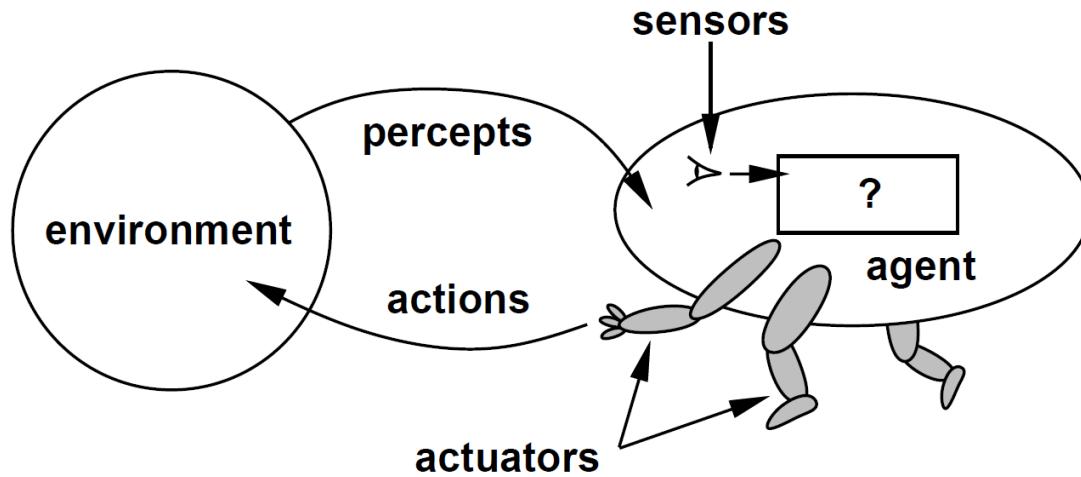
Intelligent Agents

Chapter 2

Outline

- ◆ Agents and environments Rationality PEAS (Performance
measure, Environment, Actuators, Sensors) Environment types
- ◆ Agent types

Agents and environments



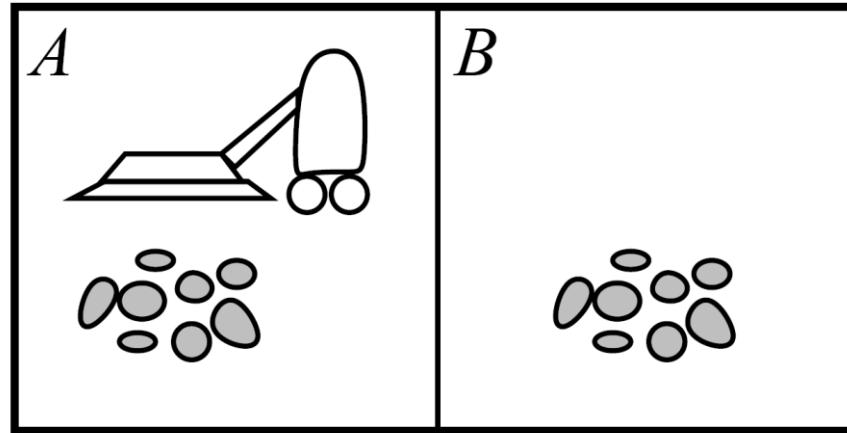
Agents include humans, robots, softbots, thermostats, etc.

The agent function maps from percept histories to actions:

$$f : P^* \rightarrow A$$

The agent program runs on the physical architecture to produce f

Vacuum-cleaner world



Percepts location and contents, e.g., [A, Dirty]

:Actions:Left, Right, Suck,

NoOp

A vacuum-cleaner agent

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

Your text-book has psedo-code for a simple reflex agent that returns an action, given a percept-sequence

Rationality

Fixed **performance measure** evaluates the **environment sequence**

- one point per square cleaned up in time T?
- one point per clean square per time step, minus one per move?
- penalize for $> k$ dirty squares?

A **rational agent** chooses whichever action maximizes the **expected value** of the performance measure **given the percept sequence to date**

Rationality does not guarantee success

- percepts may not supply all relevant information
- action outcomes may not be as expected

But may require:

exploration, learning

PEAS

To design a rational agent, we must specify the **task environment**

Consider, e.g., the task of designing an automated taxi:

Performance measure?? safety, destination, profits, legality, comfort,

Environment?? US streets/freeways, traffic, pedestrians, weather,

Actuators?? steering, accelerator, brake, horn, speaker/display, . . .

Sensors?? video, accelerometers, gauges, engine sensors, GPS, . . .

Internet shopping agent

Performance measure?? price, quality, appropriateness, efficiency

Environment?? current and future WWW sites, vendors, shippers

Actuators?? display to user, follow URL, fill in form

Sensors?? HTML text, graphics, scripts)

Environment types

Observable??

Deterministic ??

Episo dic??

Static??

Discrete??

Single-agent??

The environment type largely determines the agent design

AI agents have to function in an environment that is:

partially observable,

stochastic

sequential

dymnamic

continuous

multi-agent

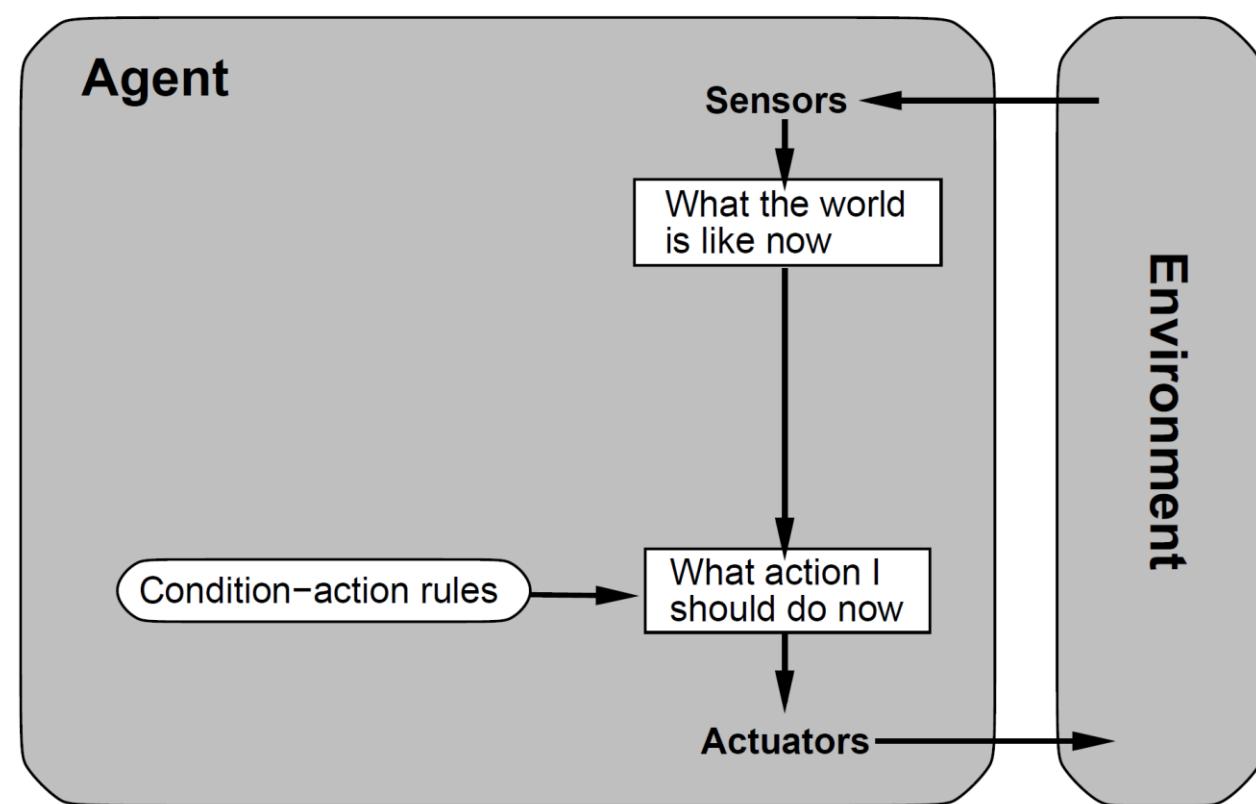
Agent types

Four basic types in order of increasing generality:

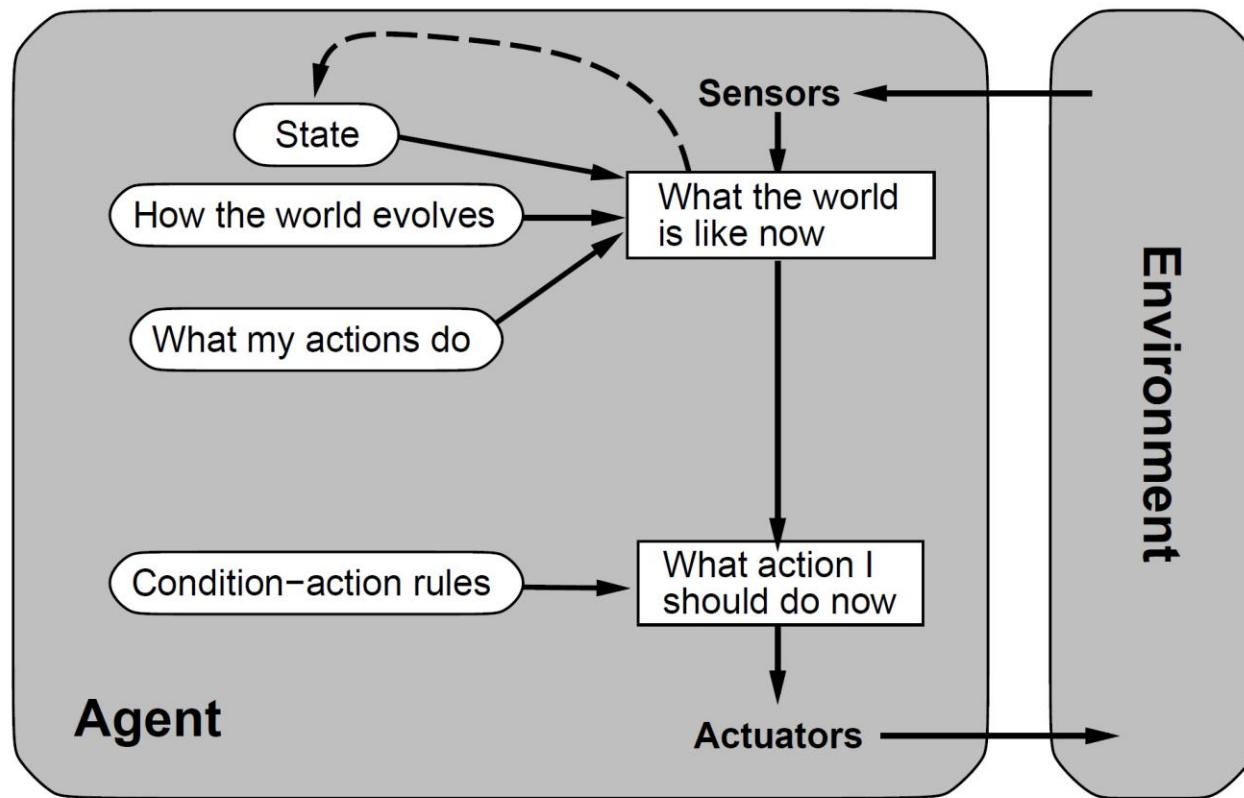
- simple reflex agents –
- reflex agents with state –
- goal-based agents –
- utility-based agents

All these can be turned into learning agents

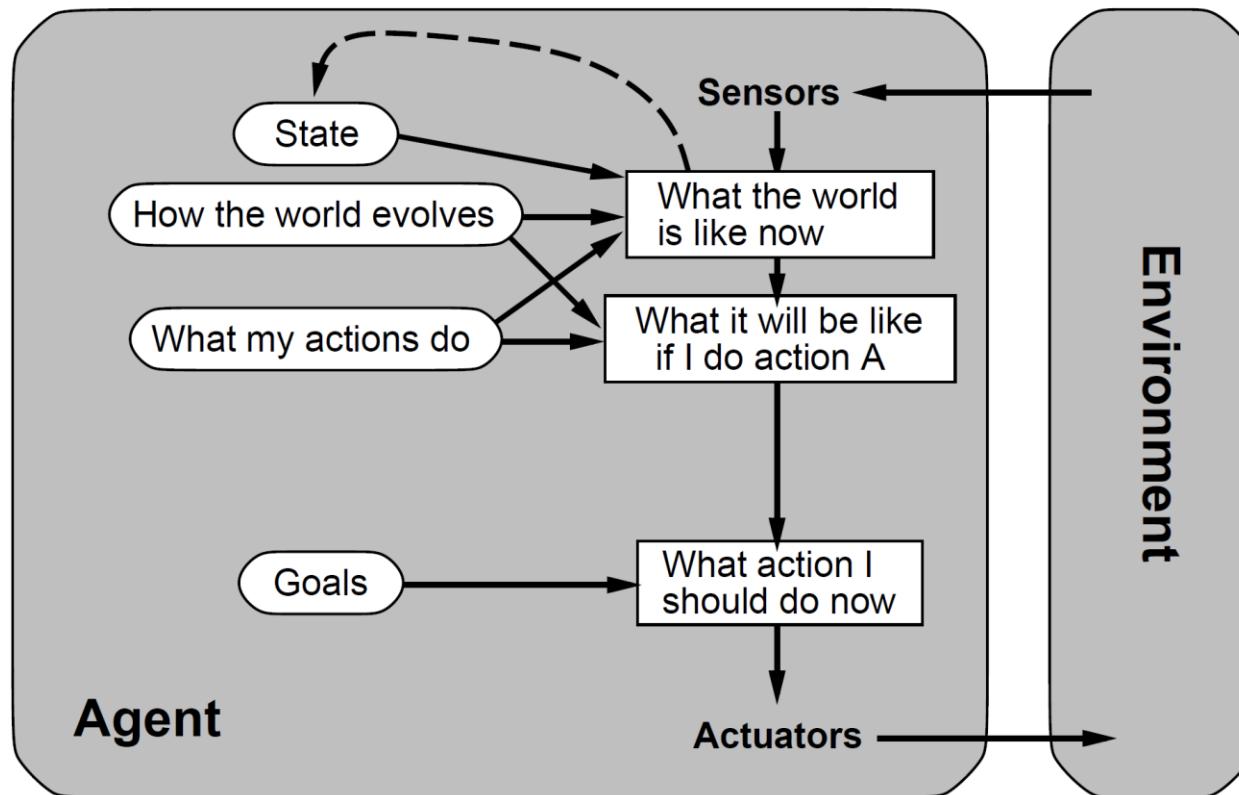
Simple reflex agents



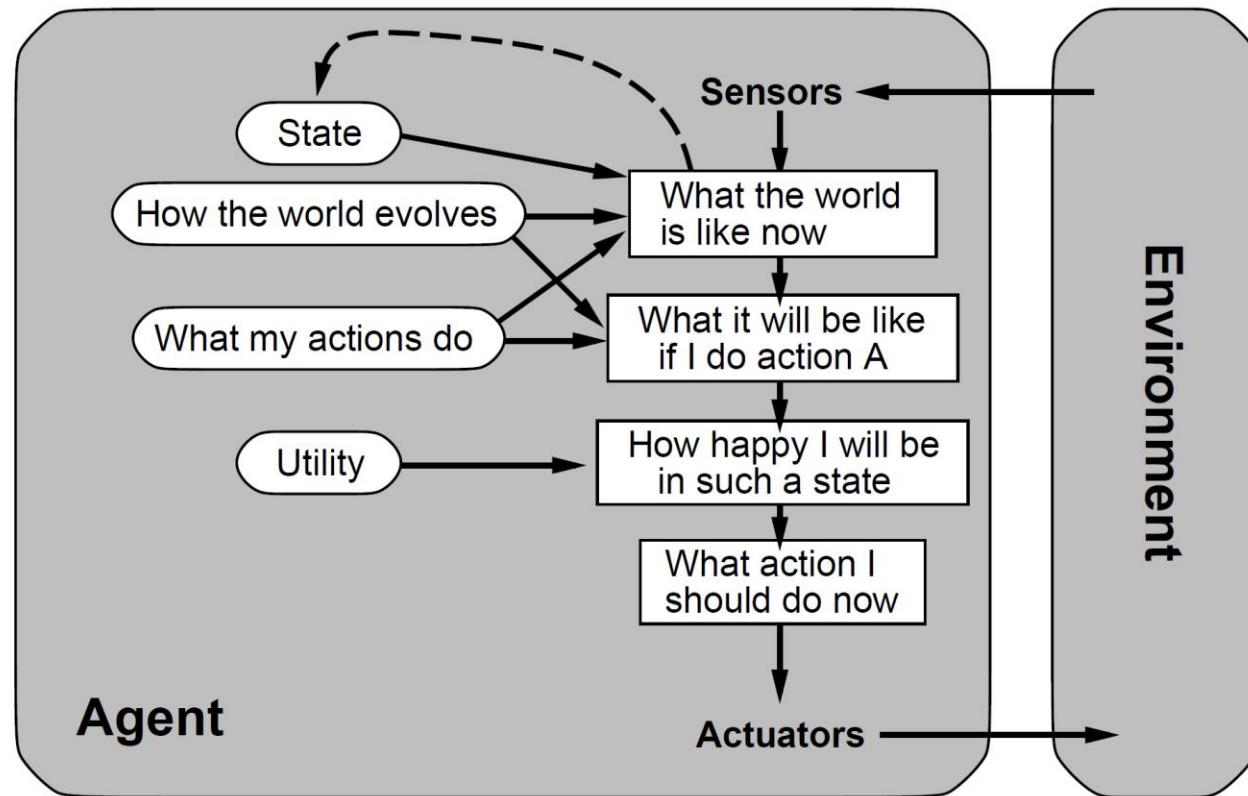
Reflex agents with states



Goal-Based Agents



Utility-Based Agents



Summary

Agents interact with environments through actuators and sensors. The agent function describes what the agent does in all circumstances. The performance measure evaluates the environment sequence. A perfectly rational agent maximizes expected performance. Agent programs implement (some) agent functions. PEAS descriptions define task environments. Environments are categorized along several dimensions:

observable? deterministic? episodic? static? discrete? single-agent?

Several basic agent architectures exist:

reflex, reflex with state, goal-based, utility-based

Try This

Try using an LLM to generate code for:

A simple reflex vacuum-cleaning agent that described by

A table of percept-values and actions (as shown)

Given a sequence of percepts, your “agent” should return a sequence of actions

Read Ahead (if you have the time): Agentic software for LLMs

For eg. Ch 6, Chip Huyen (2024) “AI Engineering”. O’Reilly.