AI Agents

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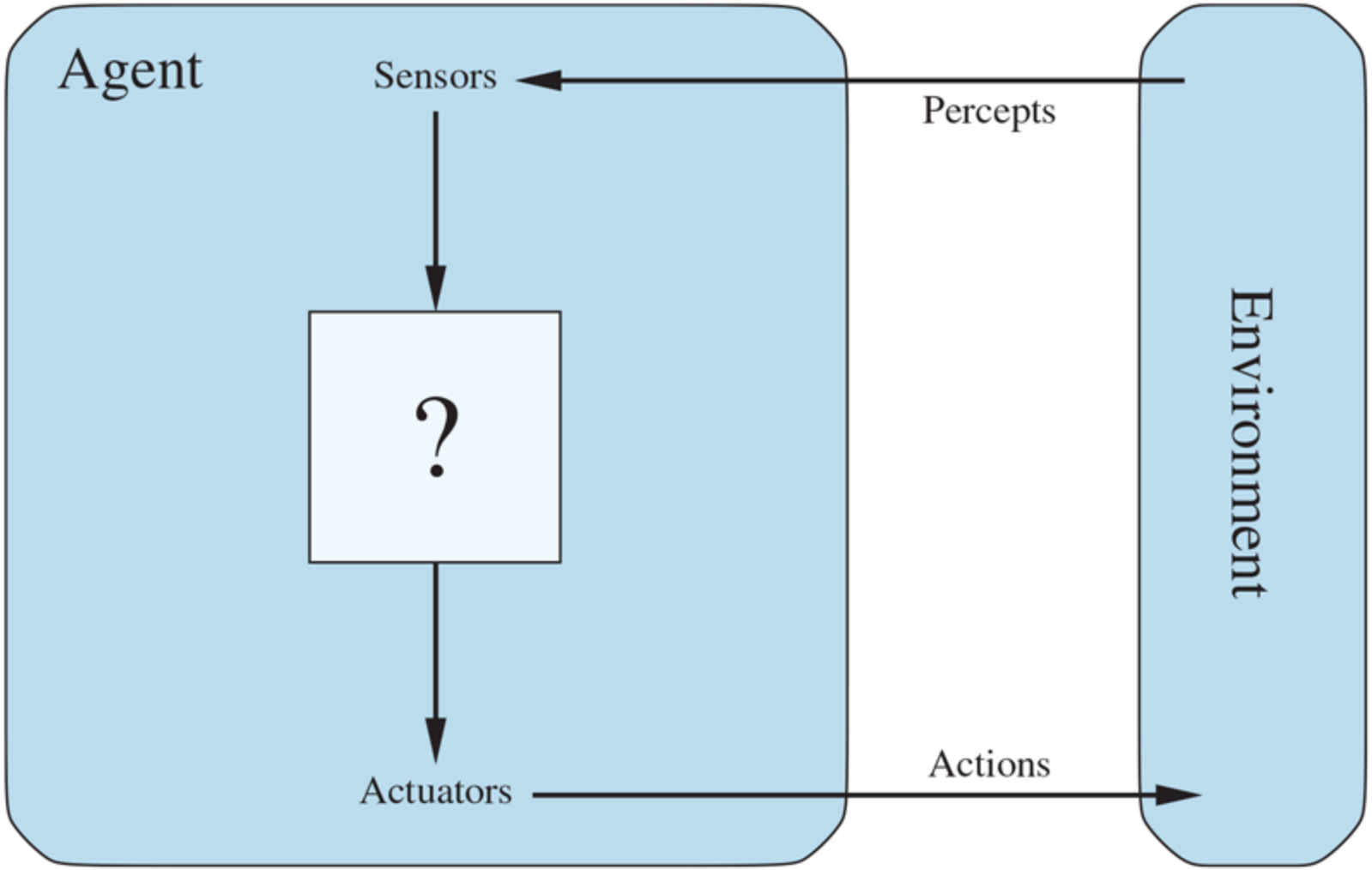


Fig 2.1, Russell & Norvig's Textbook

Percept Sequence

All the content that an agent has acquired from the environment through its sensors. The agent's actions depends on the full percept sequence ➔ ***human behavior depends on all of its past and present experiences***

Agent Function

A mathematical function that maps every percept sequence to an action. It describes the ***agent's behavior***. It can be represented as a table.

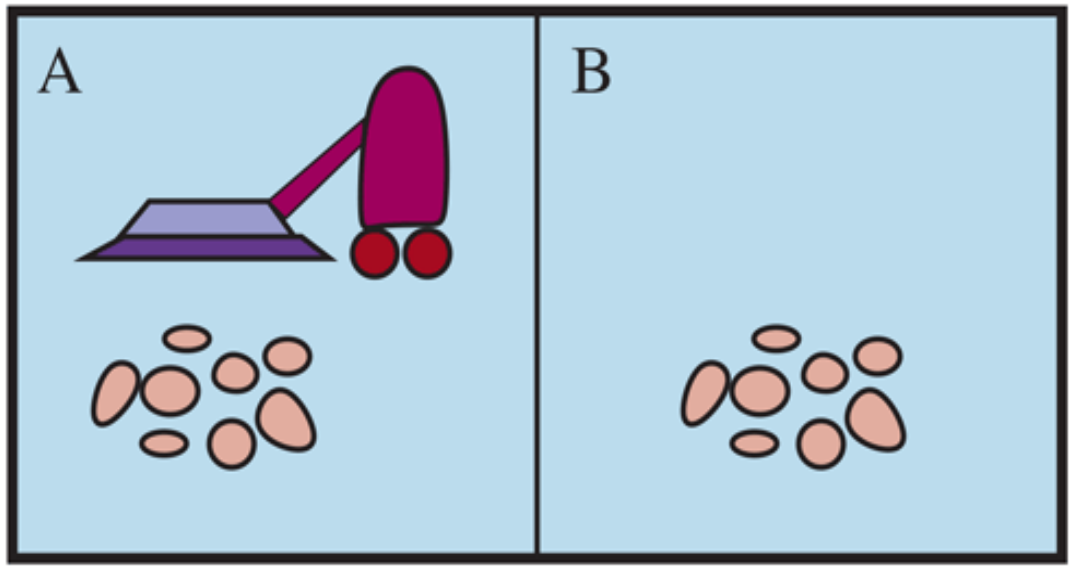


Fig 2.2, Russell & Norvig's Textbook

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*
⋮	⋮
$[A, Clean], [A, Clean], [A, Clean]$	*Right*
$[A, Clean], [A, Clean], [A, Dirty]$	*Suck*
⋮	⋮

Fig 2.3, Russell & Norvig's Textbook

What is an Intelligent Agent? It depends on the notion of Rationality.

Rational Agent

One that does the ***right*** thing. Evaluating whether an agent's action is right or wrong is done using some performance measure. It requires that the results of an action are measurable.

Rationality depends on

- Performance measure for success
- Percept sequence of the agent
- Prior knowledge of the environment
- Actions the agent can perform

“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.”

– Russell and Norvig

Definition of a “Rational Agent” in AI, A Modern Approach

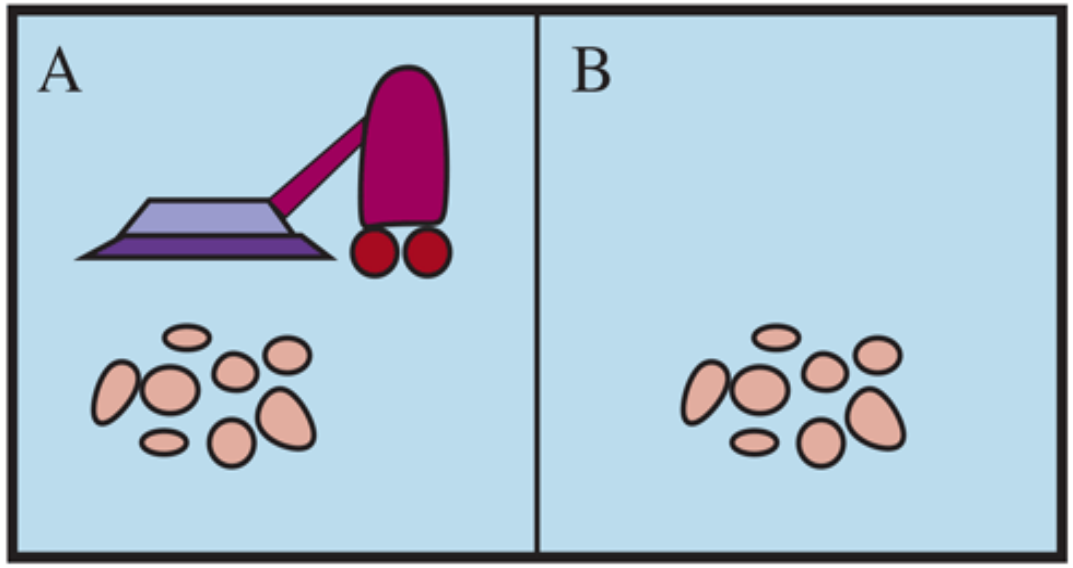


Fig 2.2, Russell & Norvig's Textbook

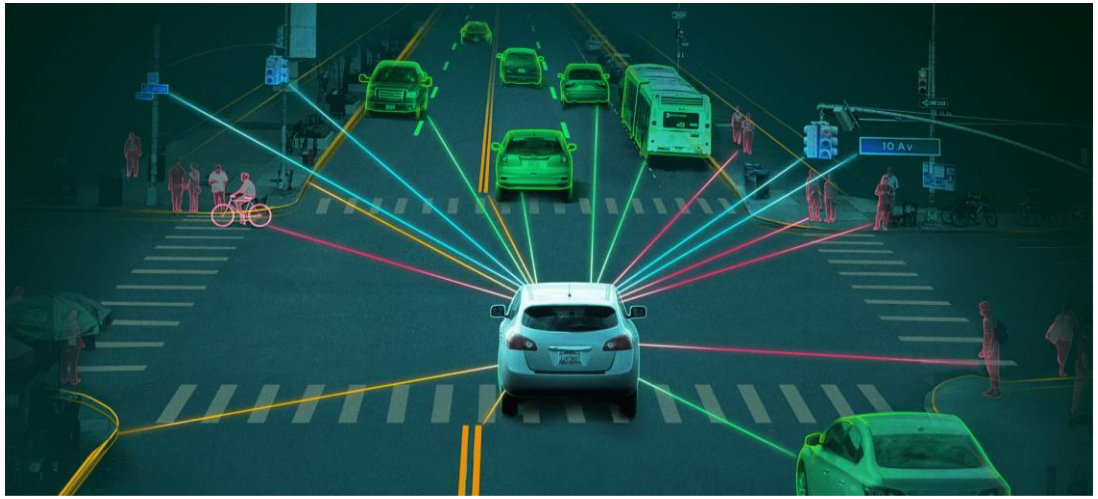
Percept sequence	Action
[A, Clean]	Right
[A, Dirty]	Suck
[B, Clean]	Left
[B, Dirty]	Suck
[A, Clean], [A, Clean]	Right
[A, Clean], [A, Dirty]	Suck
⋮	⋮
[A, Clean], [A, Clean], [A, Clean]	Right
[A, Clean], [A, Clean], [A, Dirty]	Suck
⋮	⋮

Fig 2.3, Russell & Norvig's Textbook

Is this Vacuum Cleaner a Rational Agent?

- What is the performance measure?
- What are the agent's possible actions?
- What is the percept sequence?
- What do we know about the environment?

It is essential to understand the task environment as it affects the performance outcome.

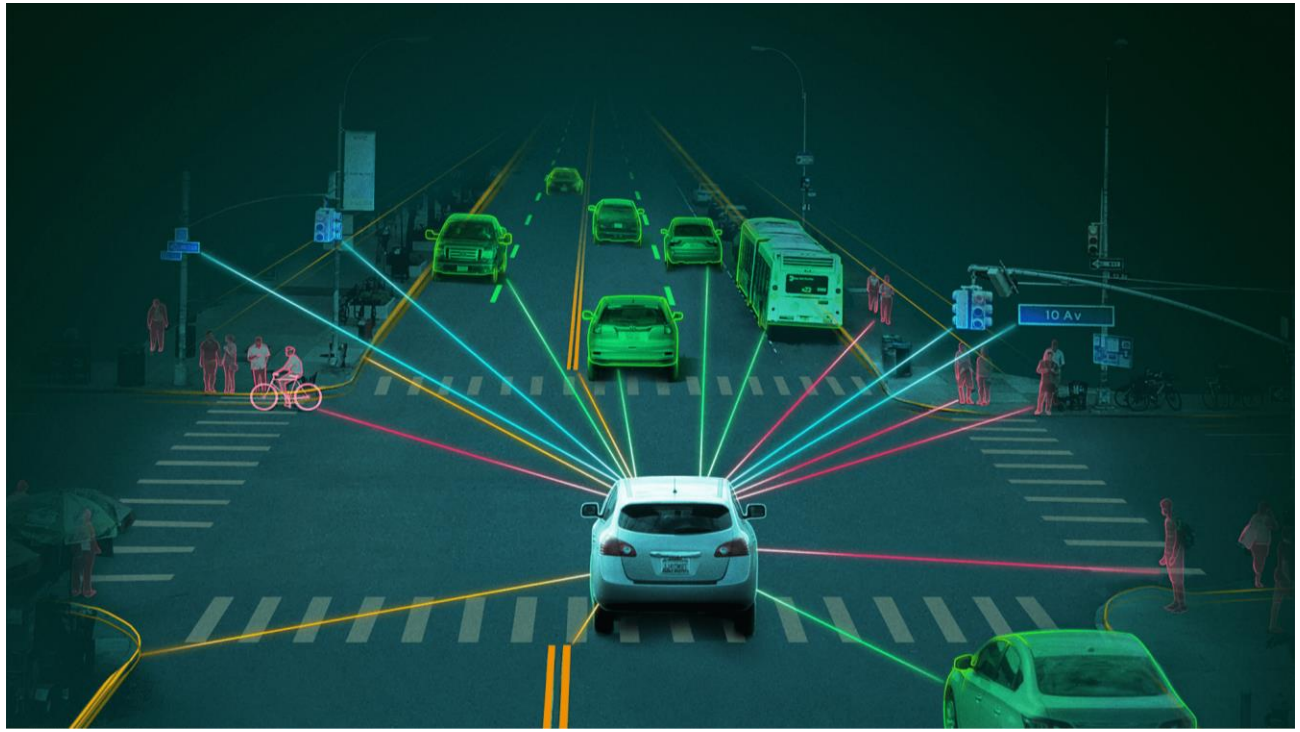


Agent Type	Performance Measure	Environment	Actuators	Sensors
Taxi driver	Safe, fast, legal, comfortable trip, maximize profits, minimize impact on other road users	Roads, other traffic, police, pedestrians, customers, weather	Steering, accelerator, brake, signal, horn, display, speech	Cameras, radar, speedometer, GPS, engine sensors, accelerometer, microphones, touchscreen

Fig 2.4, Russell & Norvig's Textbook

Properties of a Task Environment

Fully vs
Partially Observable



Properties of a Task Environment

Deterministic
vs Stochastic

Properties of a Task Environment

Episodic vs Sequential

Ping-Pong Playing Agent

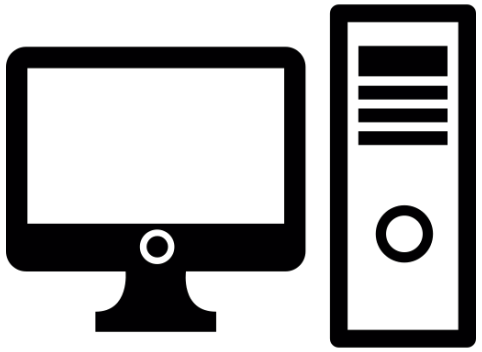
Autonomous Car Agent

Properties of a Task Environment

Discrete
vs Continuous

Single-Agent
vs Multiagent

Program



Architecture

Structure of AI Agents

Percept

Store Percepts

Process Percepts

Program

Action

Types of AI Agents

Reflex Agents `Percept → Action`

Model-based Agents

`Percept → Model → Action`

Partial Observation	Learn how the world works	Try & learn more

Goal-based Agents

Percept → Evaluate → Action

Select action that moves the agent towards the goal. (reaching destination)

Utility-based Agents

Percept → Evaluate → Action

For complex goals, a utility function is used to evaluate how each action yields a different utility value. (e.g., Faster vs. Safer)

Types of AI Agents

Learning Agents

Percept → Learn → Action

Able to learn how to function given a goal, performance metric, and a feedback mechanism to evaluate and refine its performance.

Modern AI programs focus on building Learning Agents.

Types of AI Agents