CS2109S Intro to AI and ML

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January 12, 2023

Chapter 1

Lecture 01

1.1 Agent

Question. *What is an **agent**?*

Anything that can be viewed as

1. Perceiving its environment through sensors; and
2. Acting upon that environment through actuators.

Question. *What is a **rational agent**?*

A rational agent will choose an action that is expected to maximize its performance measure, given the evidence provided by:

- the **percept sequence**; and
- the **built-in knowledge** it has.

Question. *When do we say that an agent is **autonomous**?*

If its behavior is determined by its own experience.

Question. *What is the **PEAS** framework?*

- Performance Measure
- Environment

- Actuators
- Sensors

1.2 Characterizing the environment

Question. *When do we say that an environment is **fully observable** (v.s. partially observable)?*

An agent's sensors give it access to the complete state of the environment at each point in time.

Question. *When do we say that an environment is **deterministic** (v.s. stochastic)?*

The next state of the environment is completely determined by the current state and the action executed by the agent.

Question. *When do we say that the environment is **strategic**?*

If the environment is **deterministic** except for the actions of other agents, then the environment is strategic.

Question. *When do we say that the environment is **episodic** (v.s. sequential)?*

The agent's experience is divided into atomic "episodes", where each episode consists of the agent perceiving and then performing a single action.

The choice of action in each episode depends only on the episode itself.

Question. *When do we say that the environment is **static** (v.s. dynamic)? When do we say that the environment is **semi-dynamic**?*

The environment is **unchanged** while an agent is deliberating.

The environment is **semi-dynamic** if the environment itself does not change with the passage of time but the agent's performance score does.

Question. *When do we say that a environment is **discrete** (v.s. continuous)?*

When there are a **limited** number of **distinct**, **clearly defined** percepts and actions.

Question. *When do we say that the environment is **single-agent** (v.s. multi-agent)?*

When an agent is operating by itself in an environment.

1.3 Models for Agent Organization

Question. *What are the five models for agent organization?*

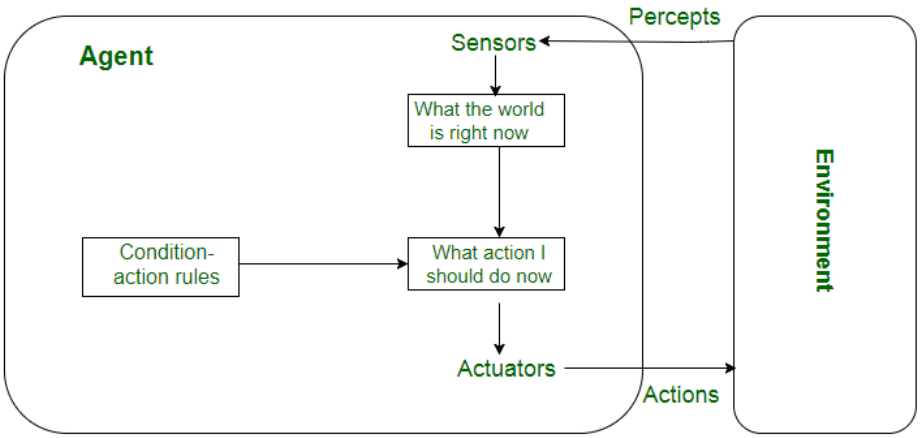
1. Simple reflex agents;
2. Model-based reflex agents;
3. Goal-based agents;
4. Utility-based agents;
5. Learning agents.

1.3.1 Simple Reflex Agents

Question. *What is a **simple reflex agent**? What is the agent function based on?*

Simple reflex agents **ignore** the rest of the percept history and act only on the basis of the current percept.

The agent function is based on the **condition-action rule**.



Question. *What is the **percept history**?*

It is the history of all that an agent has perceived to date.

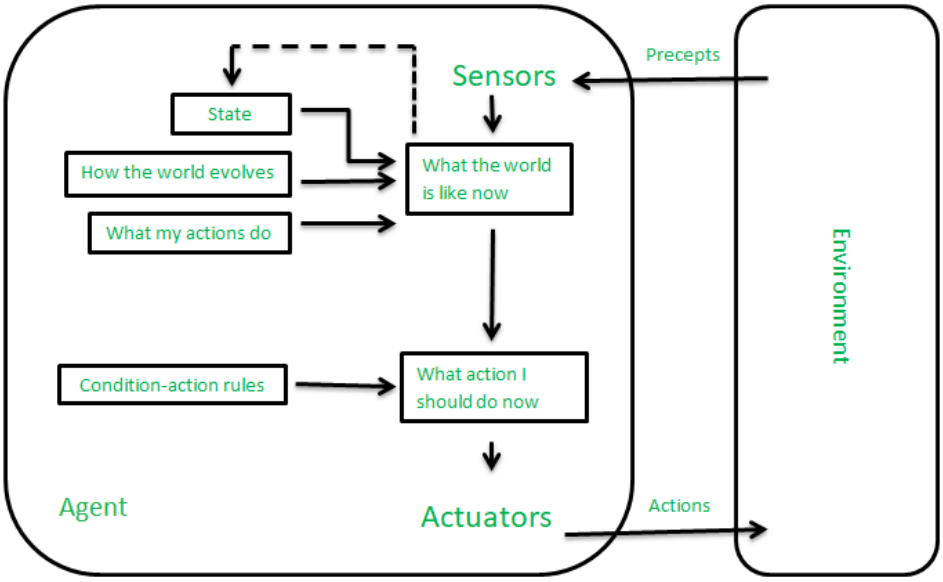
Question. *What are the **downsides** of a **simple reflex agent**?*

- Very limited intelligence.
- No knowledge of non-perceptual parts of the state.
- Usually too big to generate and store.
- If there occurs any change in the environment, then the collection of rules need to be updated.

1.3.2 Model-Based Reflex Agents

Question. *What is a **model-based reflex agent**? How does it work?*

A model-based reflex agent works by finding a rule whose condition matches the current situation.



Question. *Can a model-based agent handle partially observable environments?*

Yes, it can, by **the use of a model about the world**.

Question. *What does **model-based reflex agent** do to its percepts?*

It keeps track of the **internal state**, which is adjusted by each percept and that depends on the percept history.

Question. *How does a **model-based reflex agent** update its **internal state**? (i.e. what two pieces of information does it need?)*

- How the world evolves independently from the agent; and
- How the agent's actions affect the world.

1.3.3 Goal-based agents

Question. *What are **goal-based agents**? How do they make decisions?*

Goal-based agents make decisions based on **how far they are currently from their goal**. Their every action is intended to reduce its distance from the goal.

1.4 Exploitation and Exploration

Question. *What is the **trade-off between exploitation and exploration**?*

An agent in operating in the real world must often choose between:

- Maximizing its expected utility according to its current knowledget about the world;
- trying to learn more about the world.