Lecture 1: Intelligent Agents

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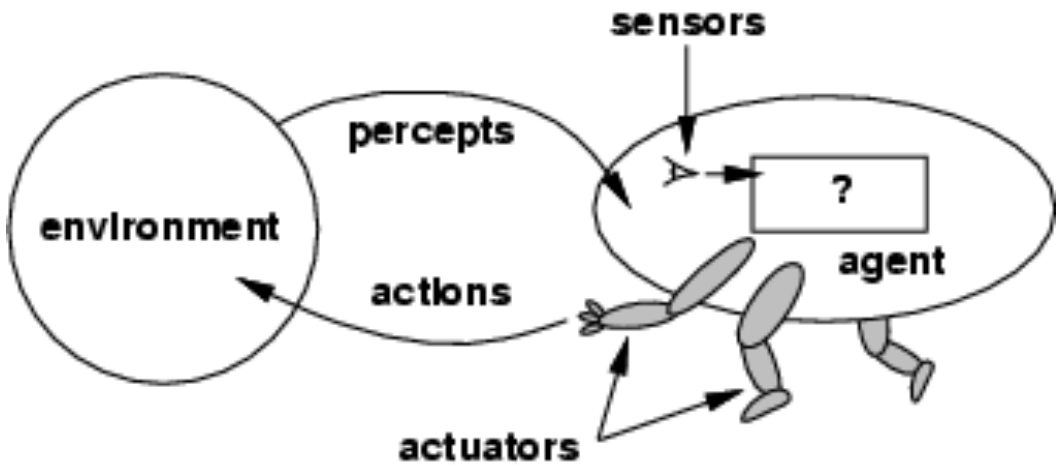
Outline

- What is the concept of agent?
- Types of intelligent agents

What is Agent



- An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators to change the states of the environment

Agent Examples

- Human agent

  Sensors: eyes, ears, and other organs for feeling;
  Actuators: hands, legs, mouth, and other body parts

- Robotic agent
  Sensors: cameras, sonar, and infrared range finders
  Actuators: robotic arm, various motors

Agent Function and Program

- The agent function maps from percept histories to actions:

$$[f: \mathcal{P}^{\star} \rightarrow \mathcal{A}]$$

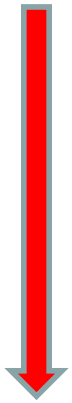
- Agent behavior decided by the agent function

- The agent program runs on the physical architecture (computing device) to implement the agent function f

Types of Intelligent Agents

Four types of agents in order of increasing complexity:

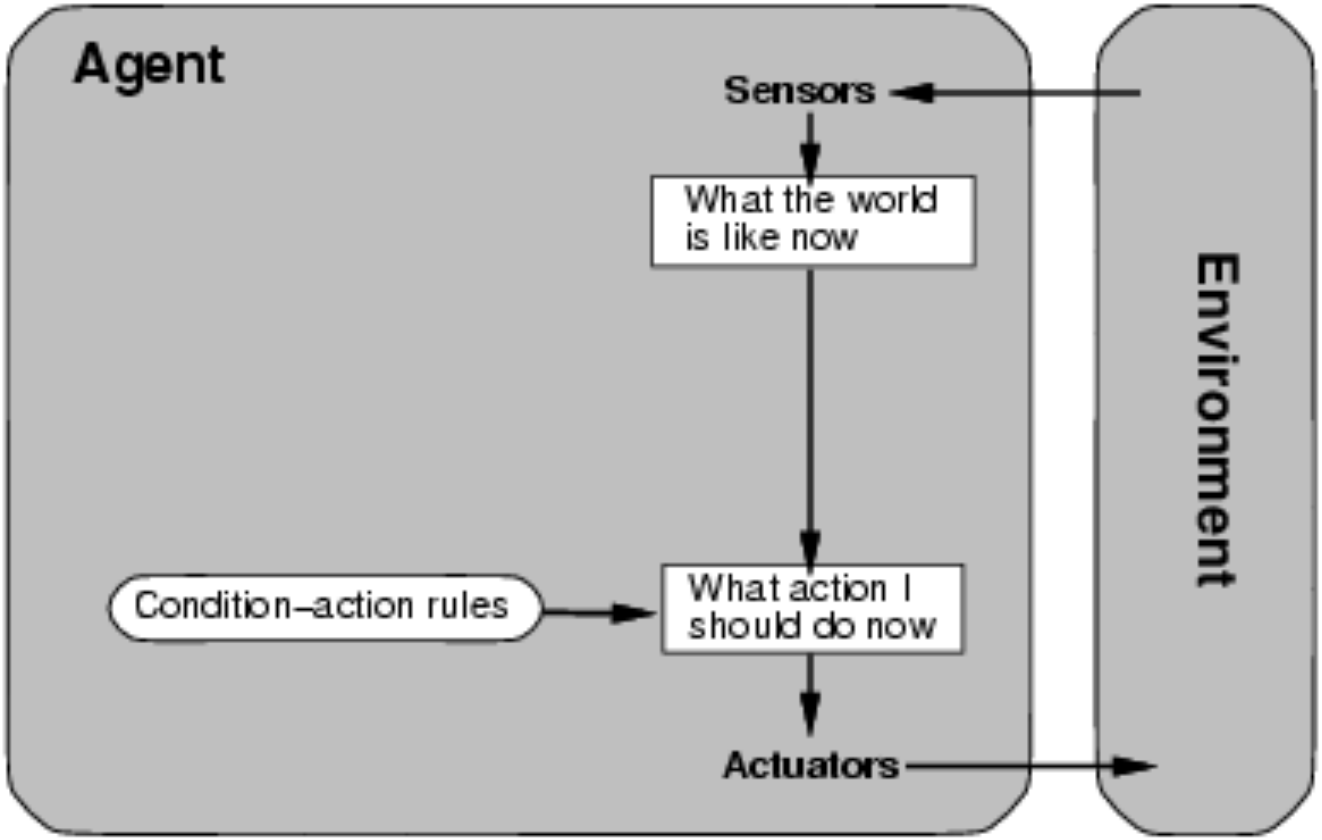
- Simple reflex agents
- Model-based reflex agents
- Goal-based agents
- Learning agents



Increasing complexity

The lectures cover key techniques for designing various types of intelligent agents

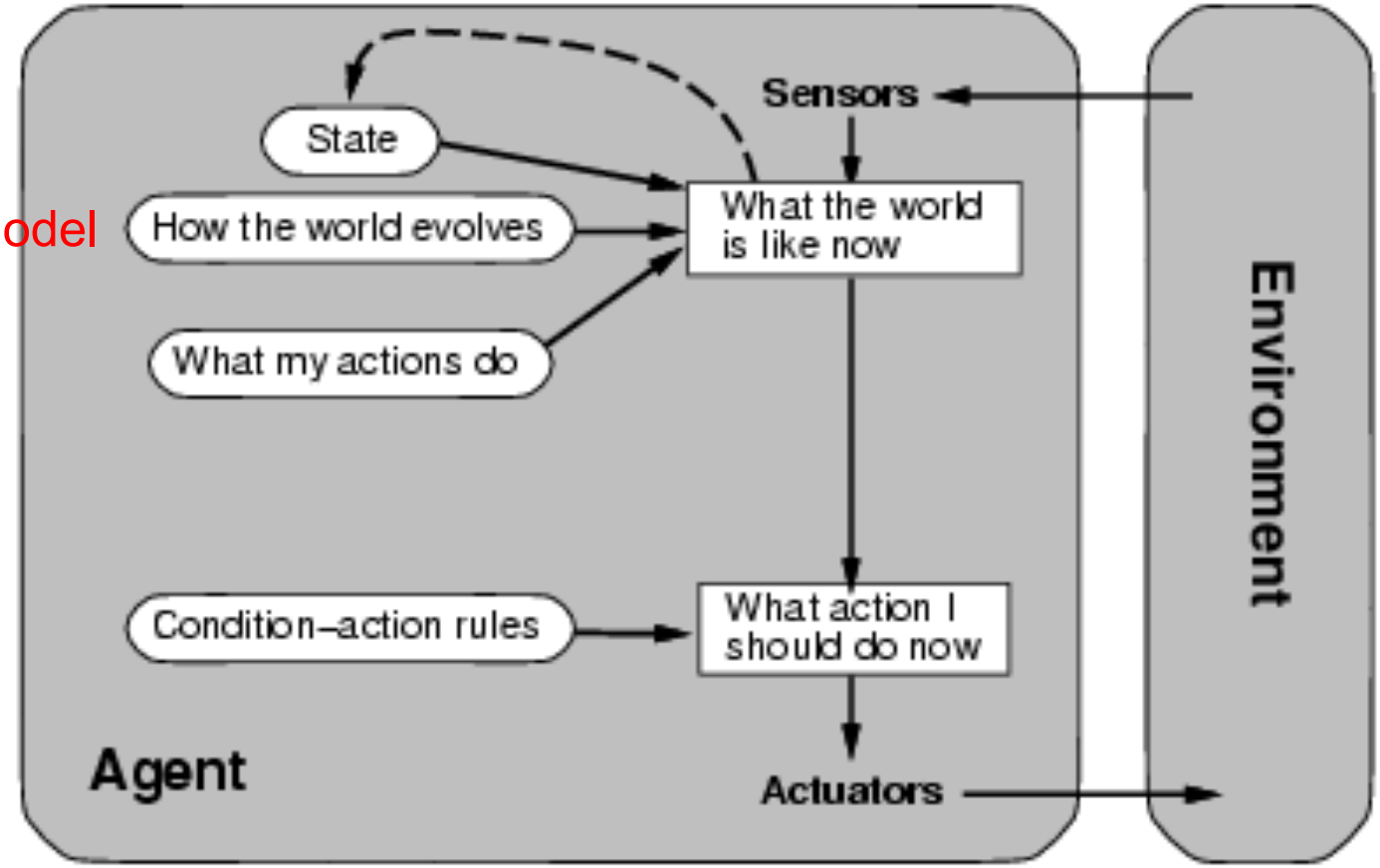
Simple reflex agents



- Use if-then rules to define mapping from percepts to actions
- Behavior-based intelligence without reasoning (in robotics)

Model-based reflex agents

World model

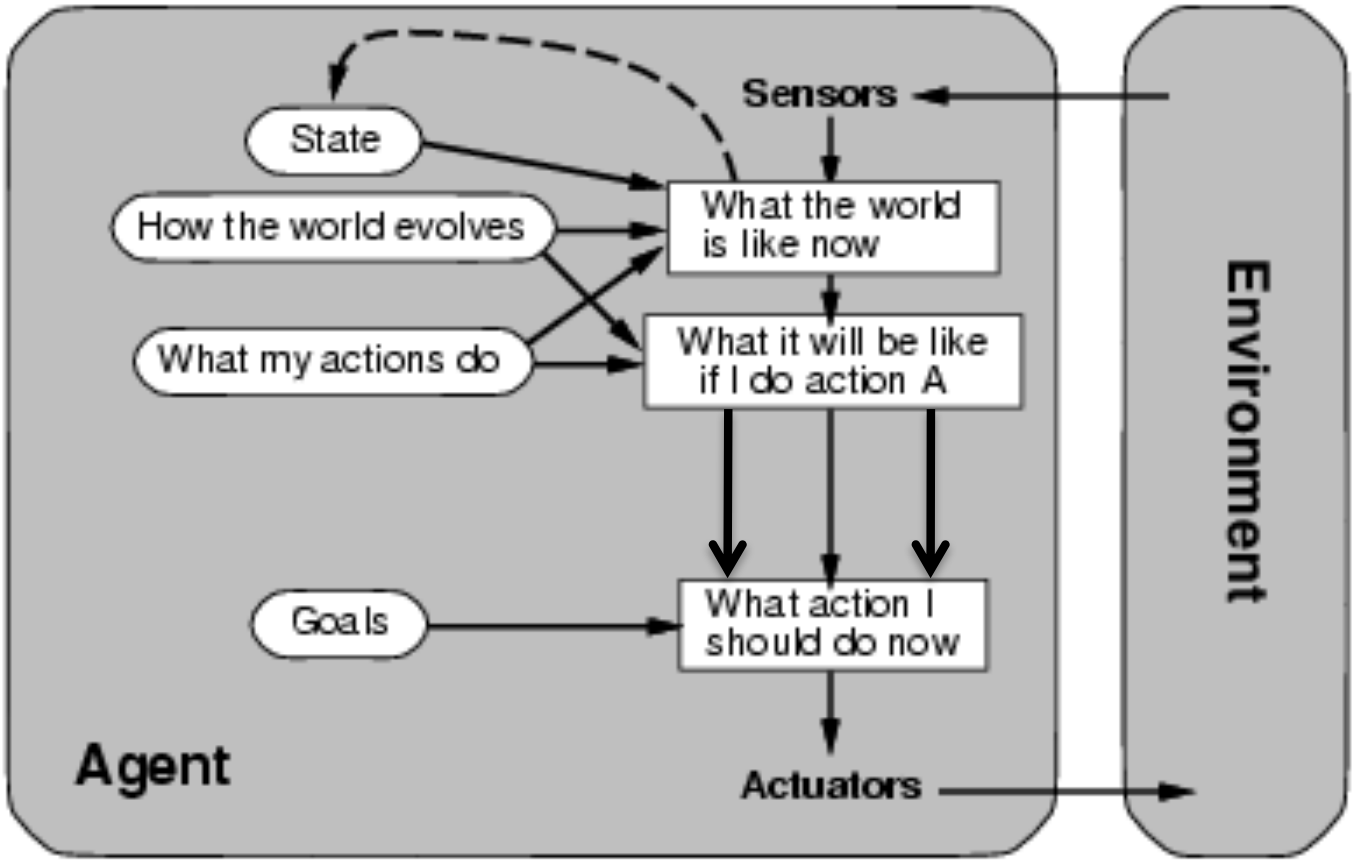


When the world state is not fully observable, use the model of the world to estimate the current state given the sensor observations

Multi-sensor data fusion

Lecture 6 will discuss how agents can utilize multi-sensor data and other information to better estimate the hidden states of the environment and to acquire better situation awareness

Goal-based agents

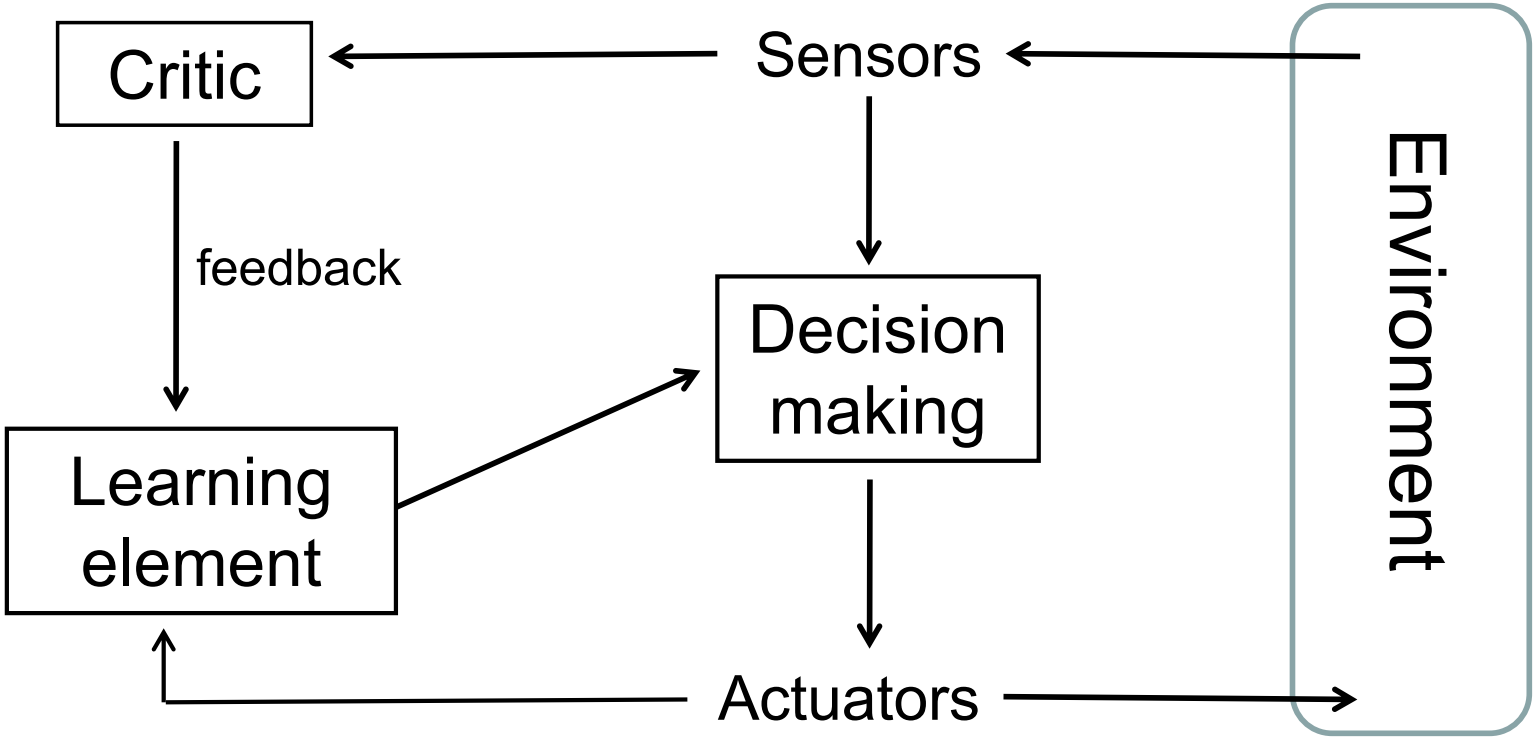


Analyze and predict resulting outcomes of possible actions, choose the most promising action to satisfy the goal

Goal-Based Agents

- Lecture 4: decision theory and analysis for helping selection of rational actions
- Lecture 5: How to make decisions by exploiting previous experiences
- Lecture 7: How to find a set of interesting, trade-off solutions with multiple conflicting objectives

Learning agents



- Learning element: modify agent functions in decision making
- Decision making: agent function to select external actions
- Critic: evaluate how well agent is doing

Learning Mechanism

Lecture 3: fuzzy adaptive control.

- on-line modification of fuzzy decision rules based on performance feedback.

Recommended Reference on Agents

Chapter 2: Intelligent agents, in: Artificial Intelligence: A modern approach, by Stuart Russel and Peter Norvig, Prentice Hall.