

Agents

CPSC 433: Artificial Intelligence Fall 2024

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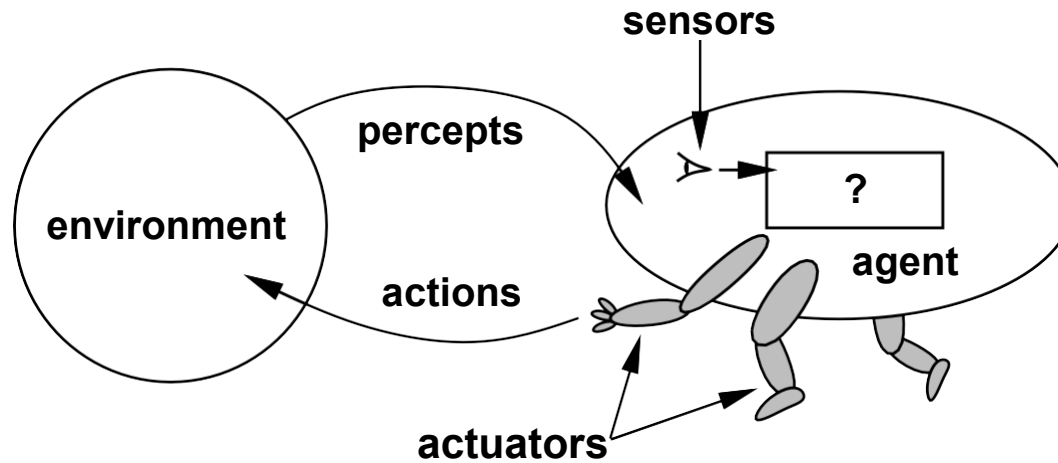
Outline

- Agents
- Agent types
- Learning Agents
- Knowledge Processing
- Task Environment
- Environment Types

Agents

Double O

Agent



- Agents include humans, robots, softbots, thermostats, etc.
- An agent can be anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators
- The agent function maps from percept histories to actions

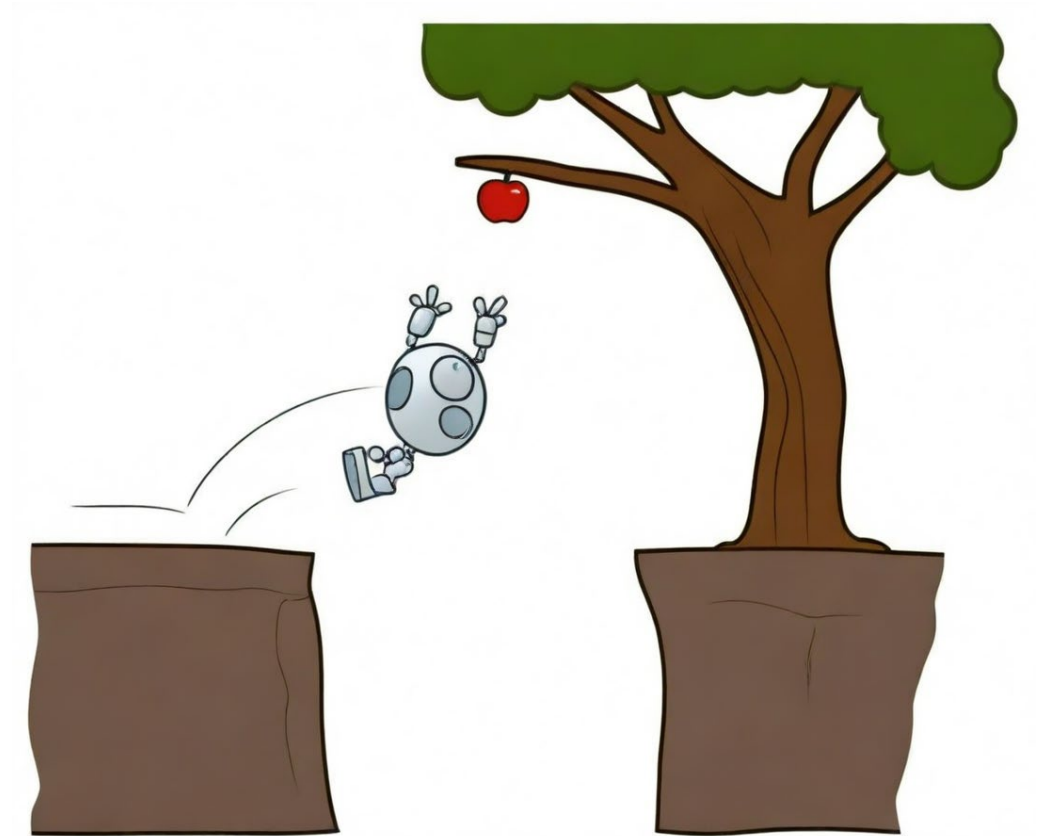
Agent Types



007?

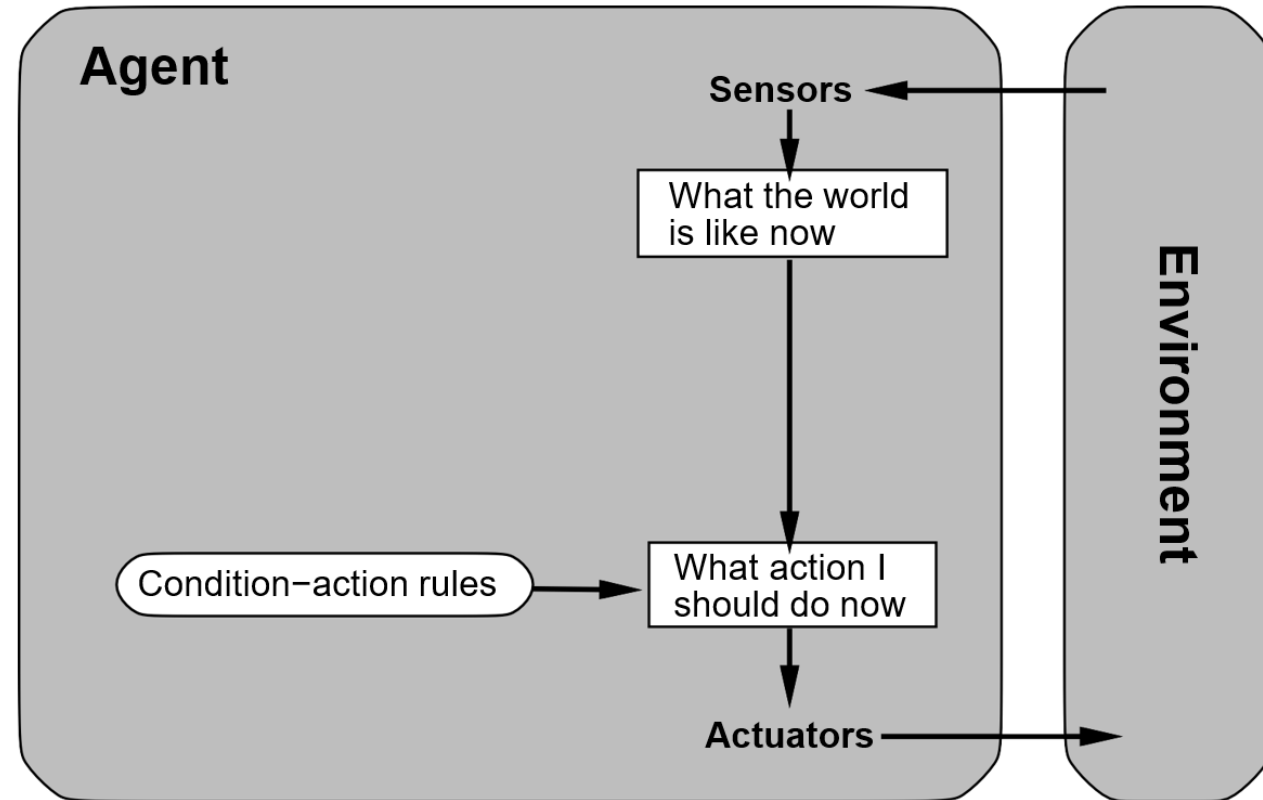
Reflex Agents

- Reflex agents:
 - Choose action based on current perception



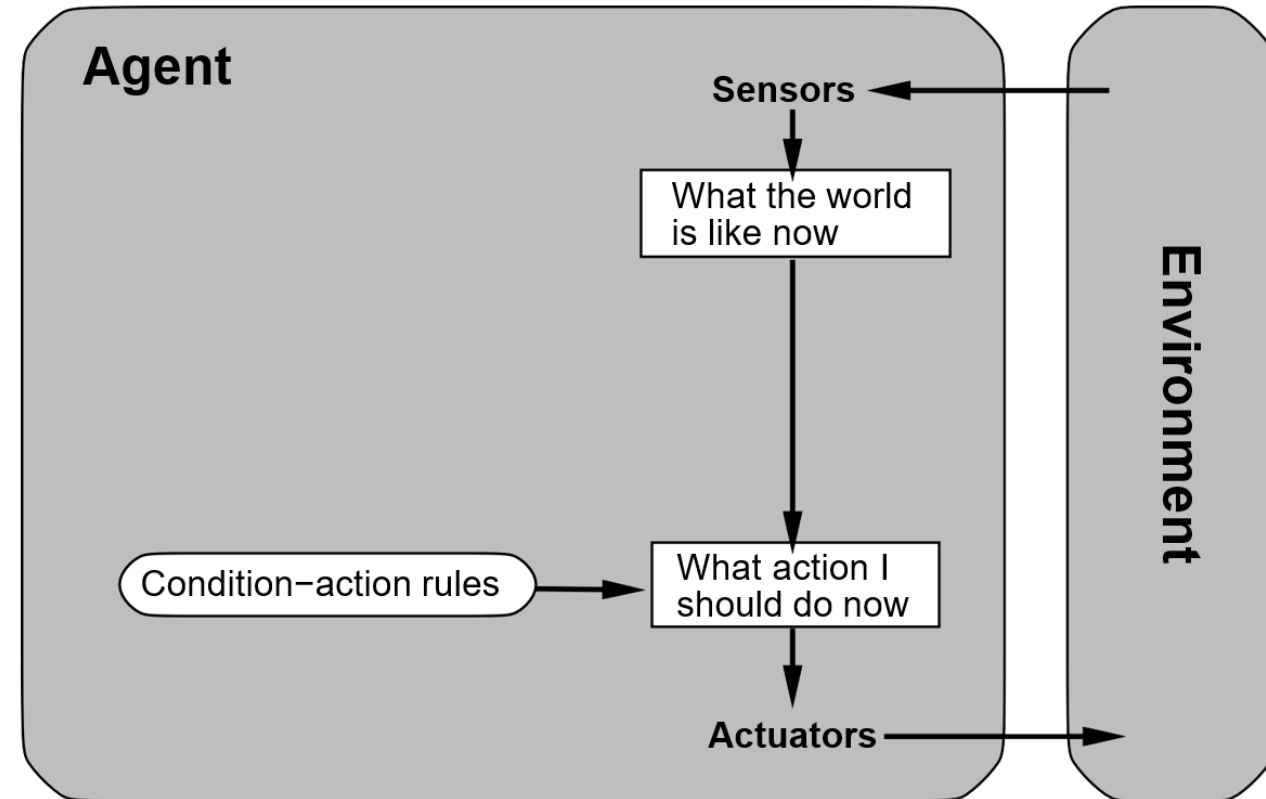
Reflex Agents

- Reflex agents:
 - Choose action based on current perception
- *Can a reflex agent be rational?*

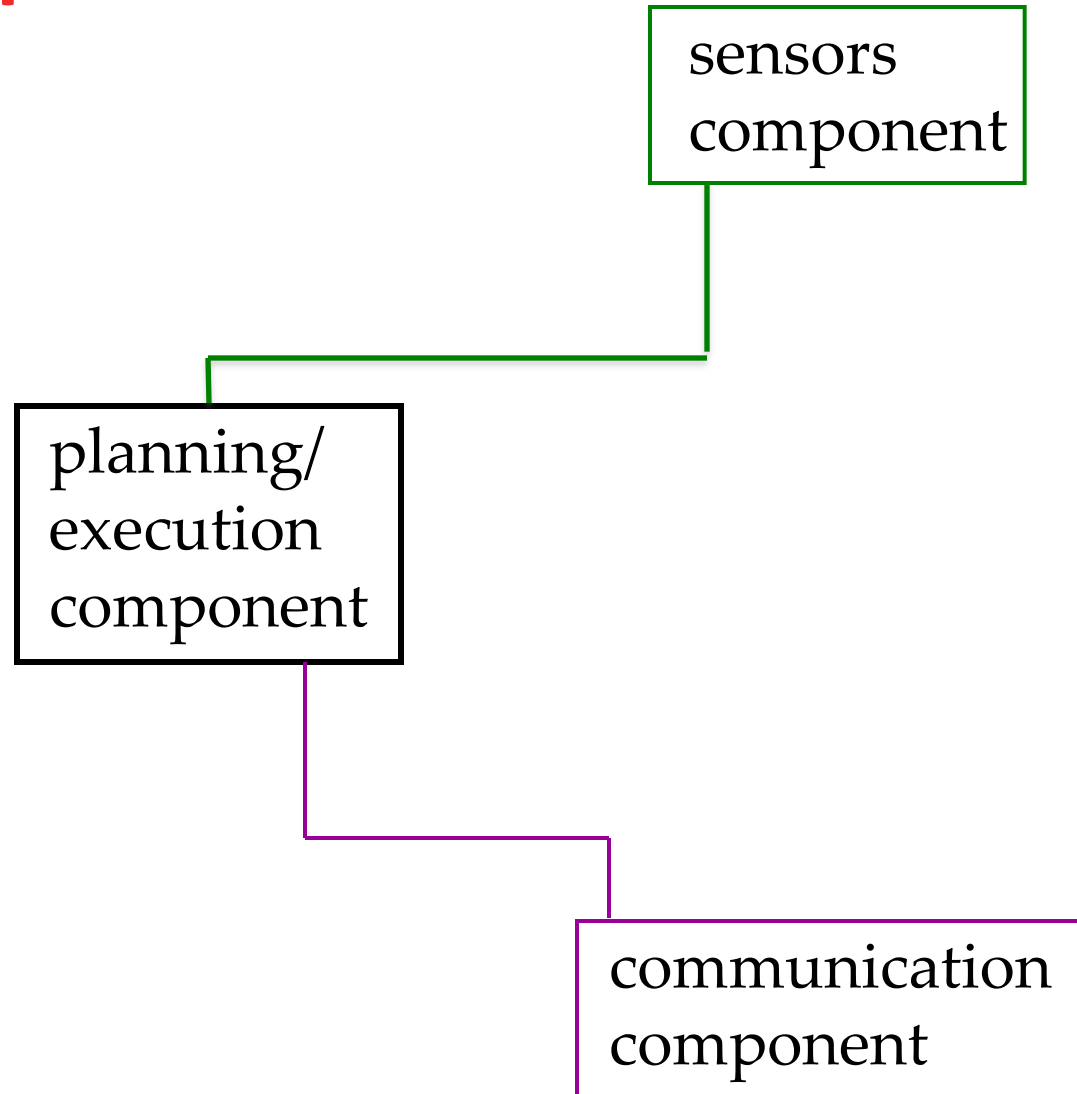


Reflex Agents

- Reflex agents:
 - **Choose action** based on current perception
- *Can a reflex agent be rational?*
 - *By itself, no*
 - *But the human designing itself could embed their rational decisions*

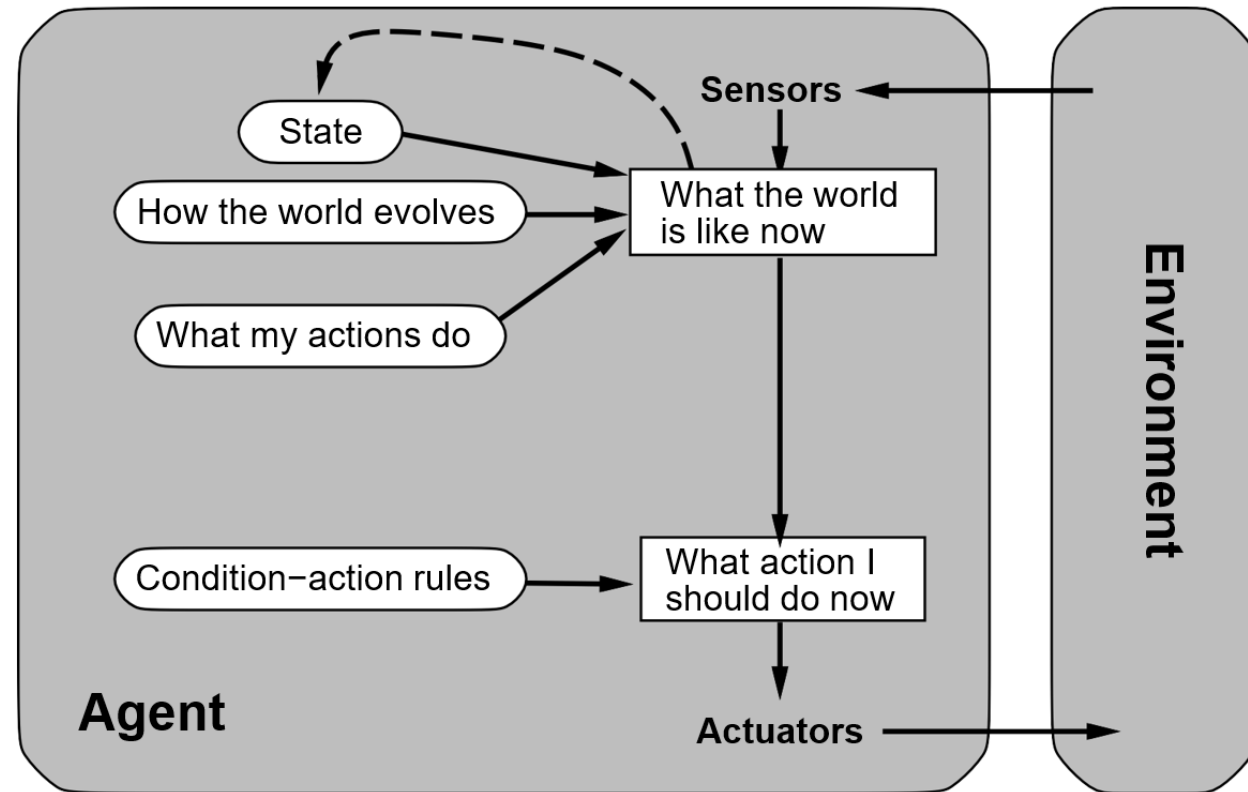


A very general AI system



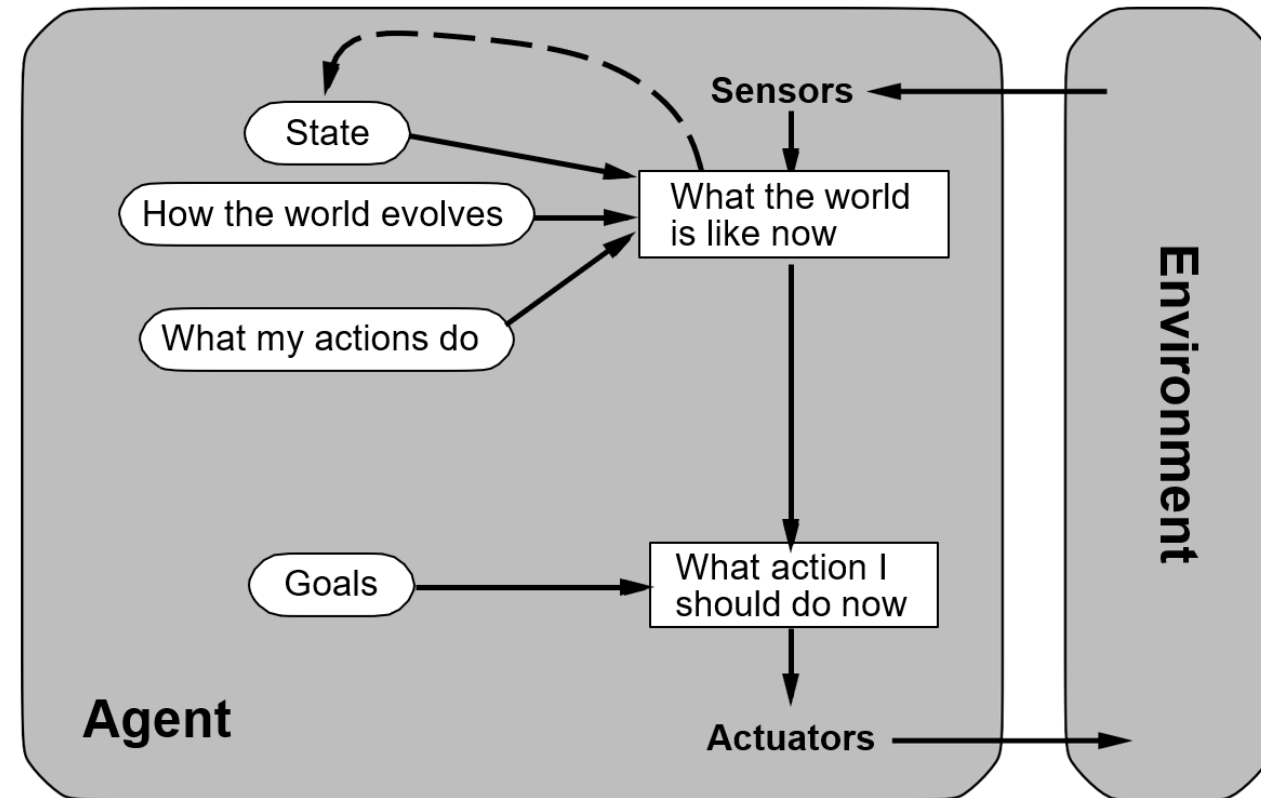
Reflex Agents with State

- Reflex agents with State:
 - Choose action based on current perception
 - Have **memory** or the world's state



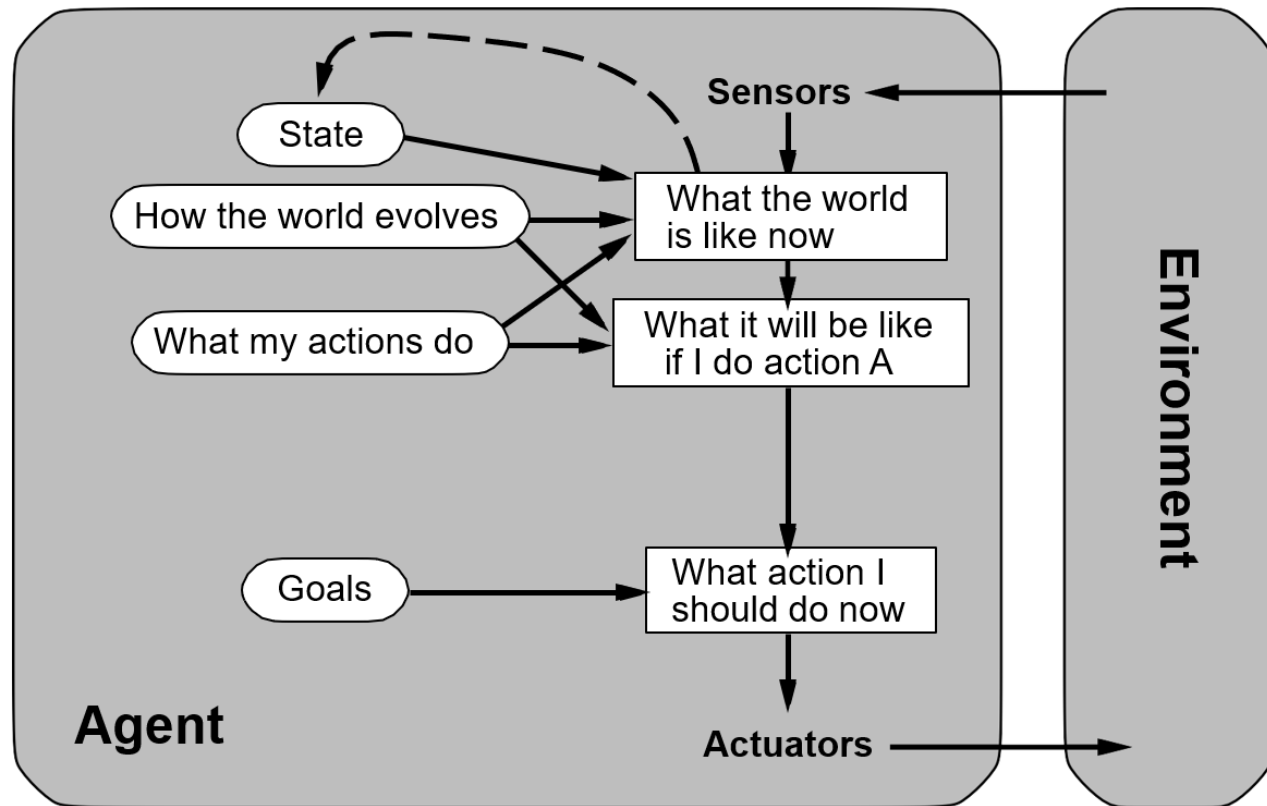
Goal-based Agents

- Goal-based Agents:
 - Choose action based on current perception
 - Have memory or the world's state
 - Have more **abstract definition of overall goal** that drives more complex choice of situation-action pairs



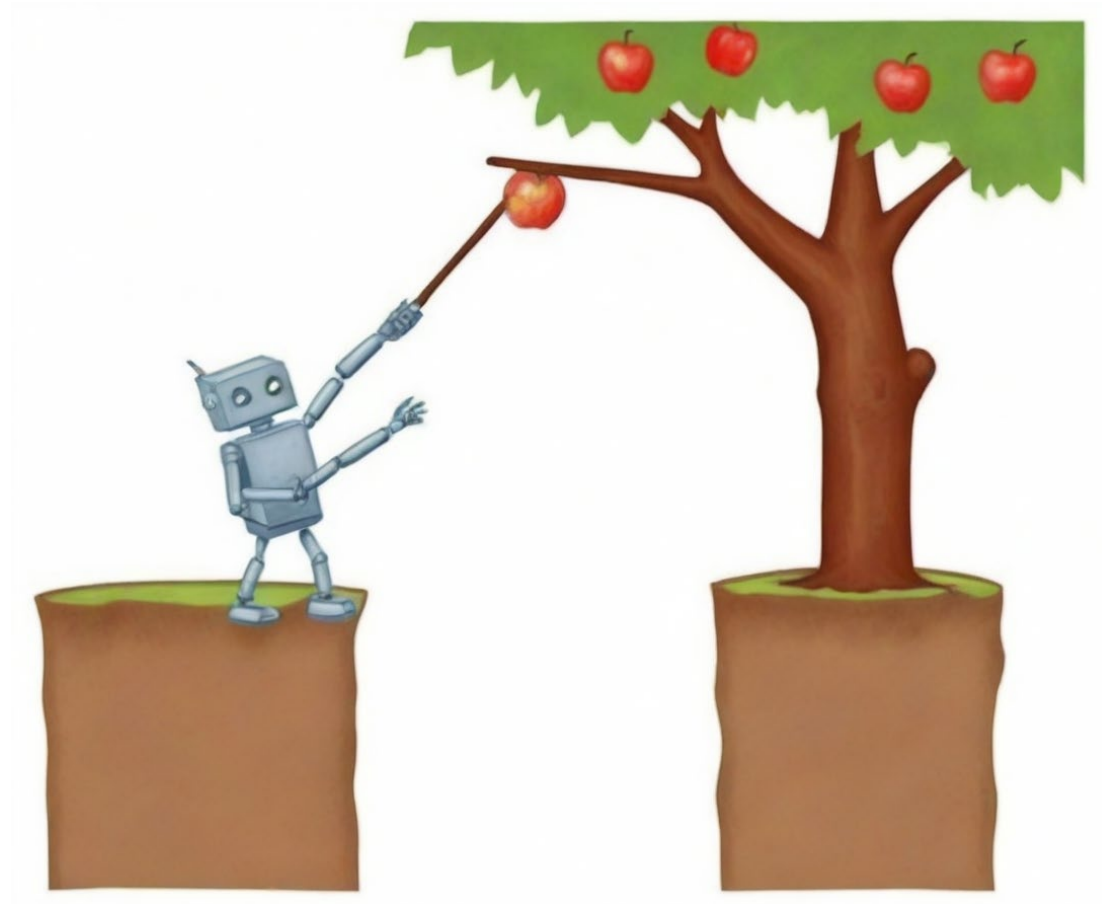
Model-based Agents

- Model-based Agents:
 - Choose action based on current perception
 - Have memory or the world's state
 - Have more abstract definition of overall goal that drives more complex choice of situation-action pairs
 - **Model** the **consequence** of action choice



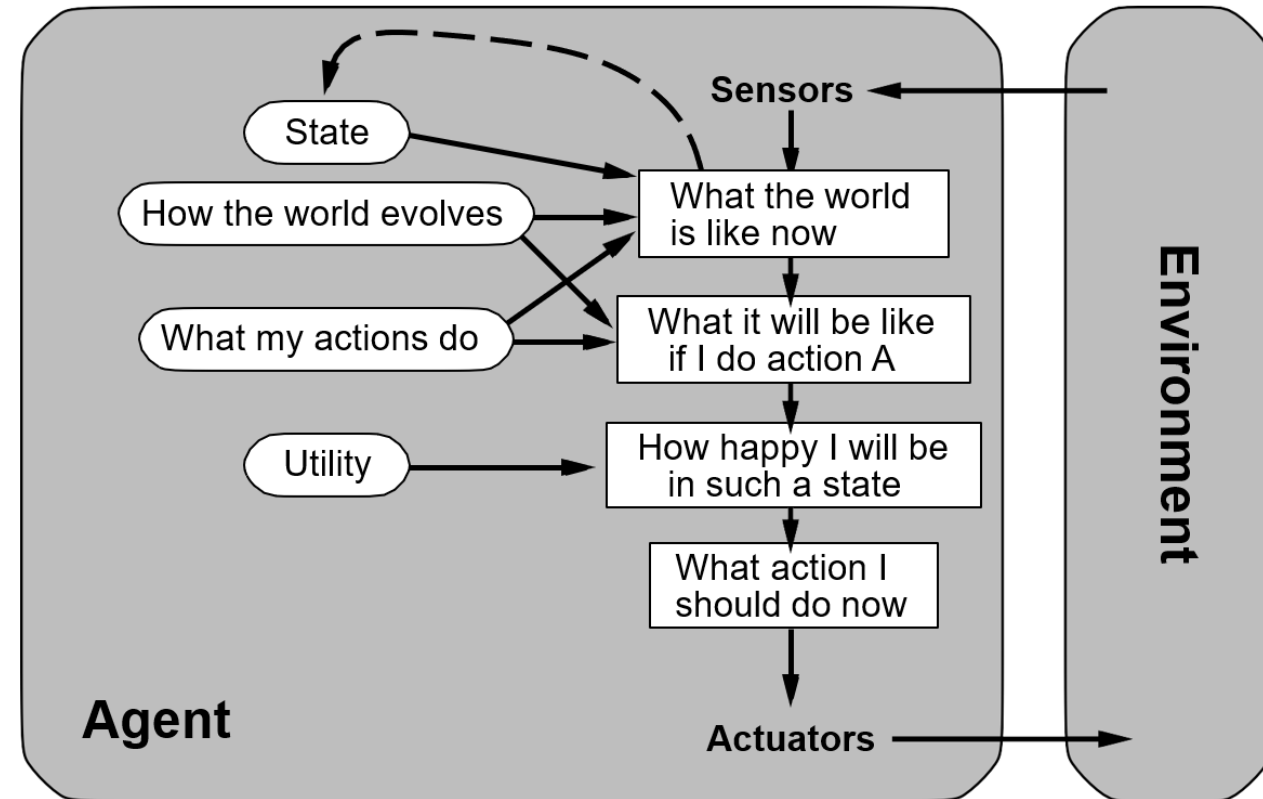
Planning Agents

- Planning agents:
 - Model-based agents that explore **multiple step** consequences of modeled actions
- Types
 - Optimal vs. complete planning
 - Planning vs. re-planning

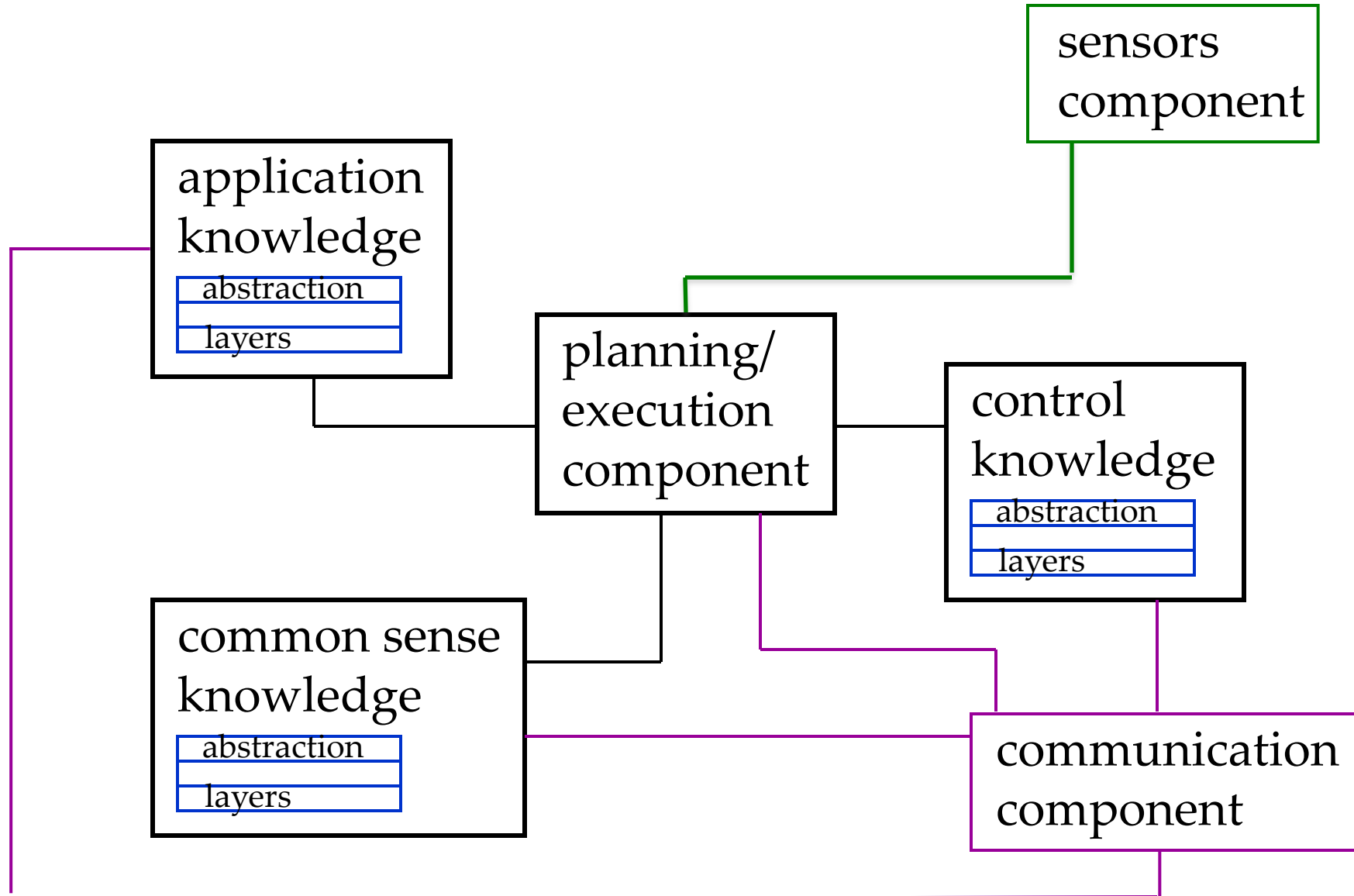


Utility-based Agents

- Utility-based Agents:
 - Choose action based on current perception
 - Have memory or the world's state
 - Have more abstract definition of overall goal that drives more complex choice of situation-action pairs
 - Model the consequence of action choice
 - Use **utility** function to judge consequences
- *A supplemented reflex agent into a utility-based agent is now rational!*
 - *existence of utility function we can maximize*



with Knowledge Processing



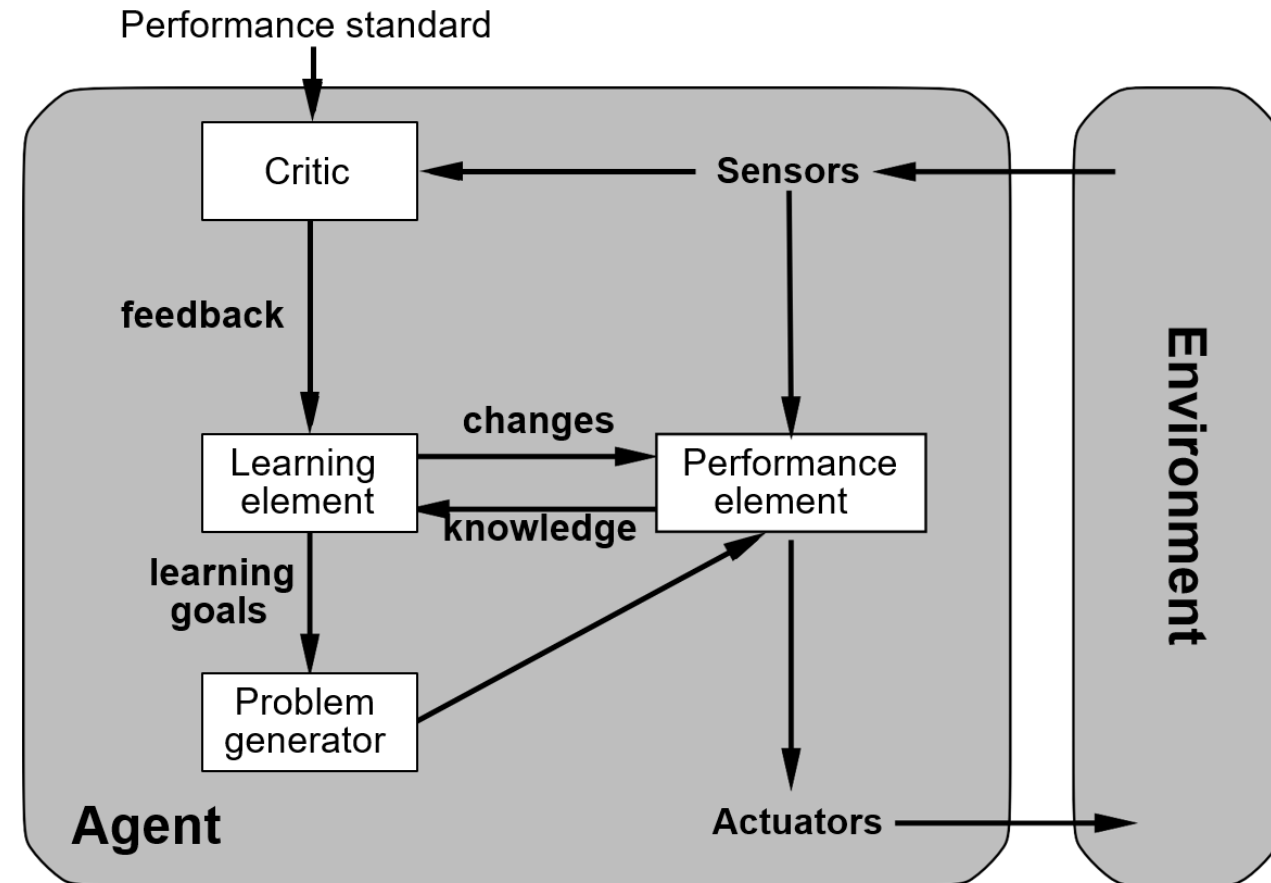
Learning Agents



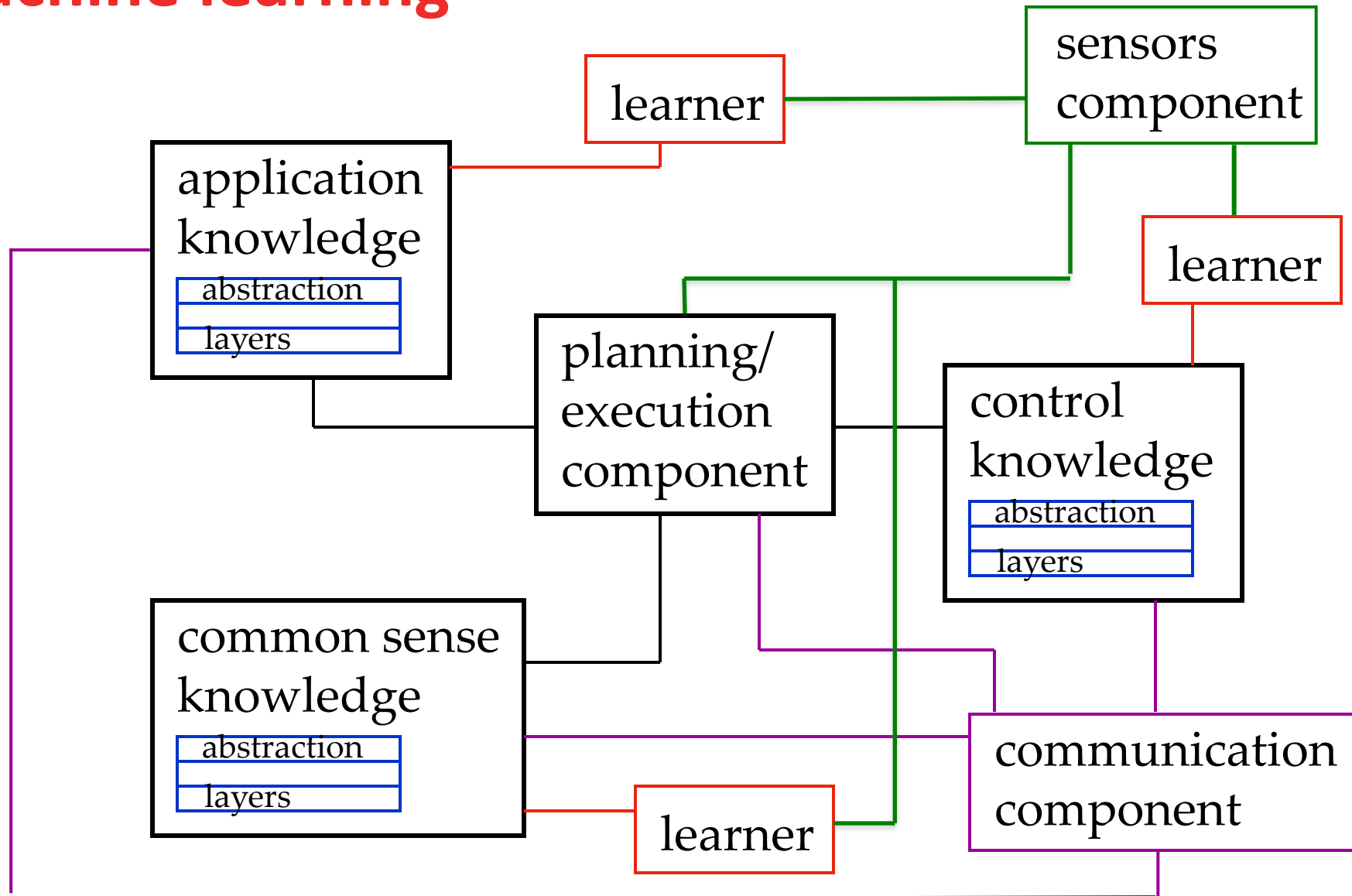
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Learning Agents

- Learning Agents:
 - Choose action based on current perception
 - Have memory or the world's state
 - Have more abstract definition of overall goal that drives more complex choice of situation-action pairs
 - Model the consequence of action choice
 - Use utility function to judge consequences
 - **Feedback loops** to change future behaviour



and machine learning



Task Environment

I have a mission for you if you choose to accept it



Task Environment

- To design a rational agent, we must specify the task environment
- Consider, e.g., the task of designing an automated taxi:
 - 1. Performance measure??**
 - 2. Environment??**
 - 3. Actuators??**
 - 4. Sensors??**



PEAS

- To design a rational agent, we must specify the task environment
- Consider, e.g., the task of designing an automated taxi:
 1. **Performance measure??** safety, destination, profits, legality, comfort, . . .
 2. **Environment??** US streets/freeways, traffic, pedestrians, weather, . . .
 3. **Actuators??** steering, accelerator, brake, horn, speaker/display, . . .
 4. **Sensors??** video, accelerometers, gauges, engine sensors, keyboard, GPS, . . .

Environment types

This message will self-destruct

Environment Types

- The environment type largely determines the agent design
- The real world is (of course) partially observable, stochastic, sequential, dynamic, continuous, multi-agent

	Solitaire	Backgammon	Internet Shopping	Taxi
Observable				
Deterministic				
Episodic				
Static				
Discrete				
Single Agent				

Environment Types

- The environment type largely determines the agent design
- The real world is (of course) partially observable, stochastic, sequential, dynamic, continuous, multi-agent

	Solitaire	Backgammon	Internet Shopping	Taxi
Observable	Yes	Yes	No	No
Deterministic	Yes	No	Partially	No
Episodic	No	No	No	No
Static	Yes	Partially	Partially	No
Discrete	Yes	Yes	Yes	No
Single Agent	No	No	Yes (auctions?)	No

Summary



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
- Several basic agent architectures exist:
 - reflex, reflex with state, goal-based, utility-based
- PEAS descriptions define task environments
- Environments are categorized along several dimensions:
 - observable? deterministic? episodic? static? discrete? single-agent?

Next...search

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