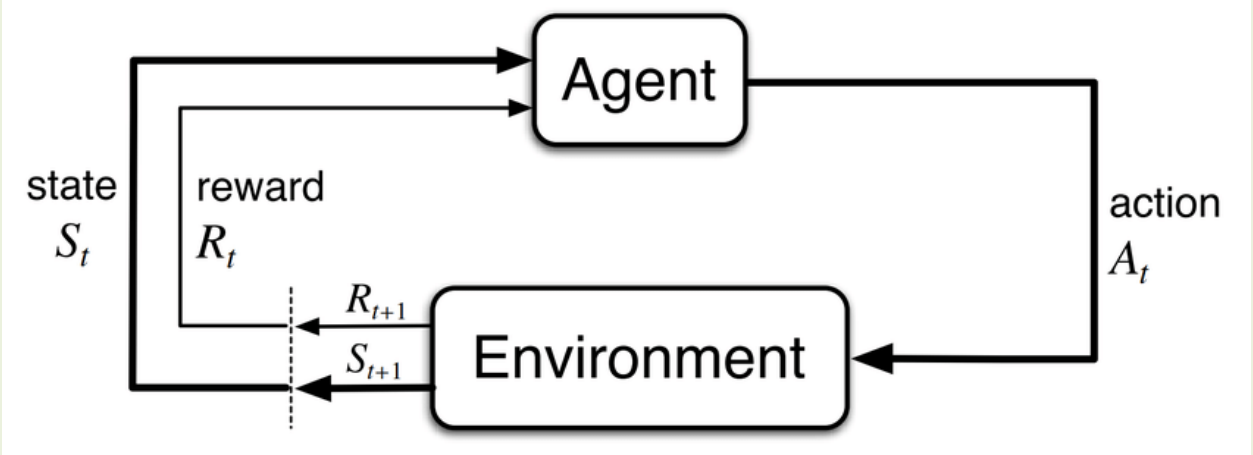
Introduction to Intelligent Agents

- What is an Agent in AI?

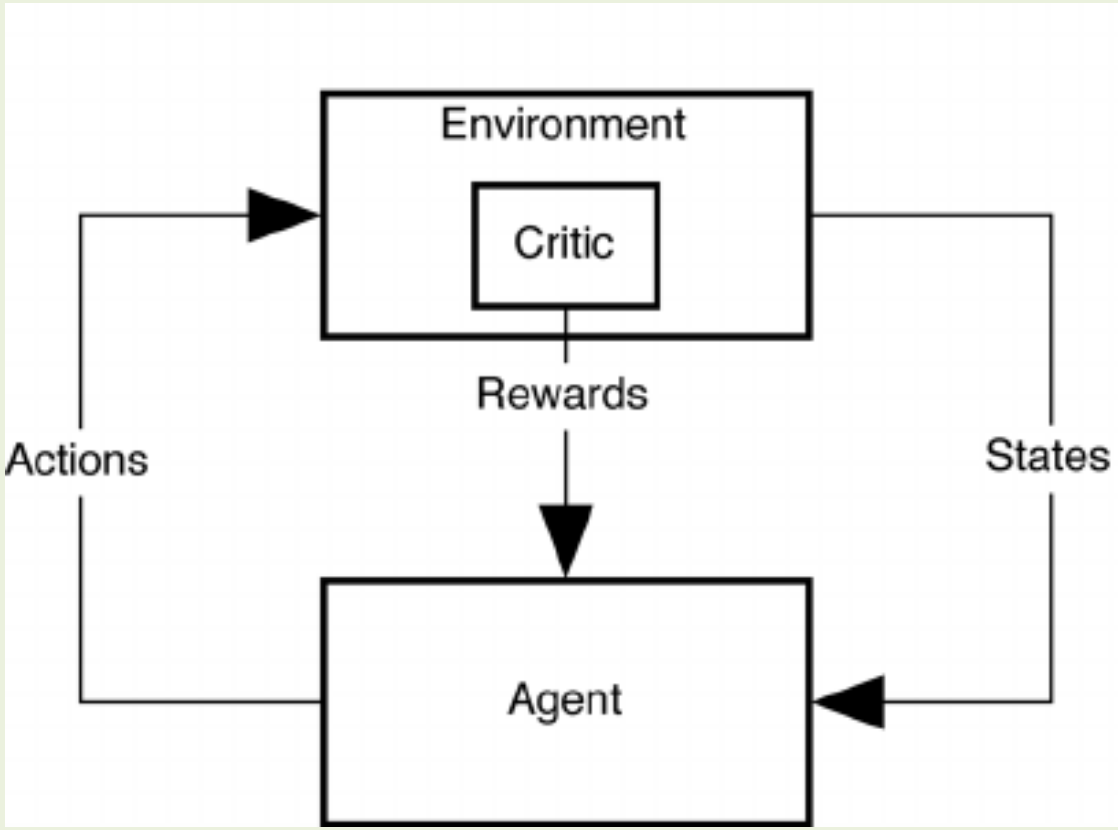
- An agent perceives its environment through sensors and acts upon it through actuators.

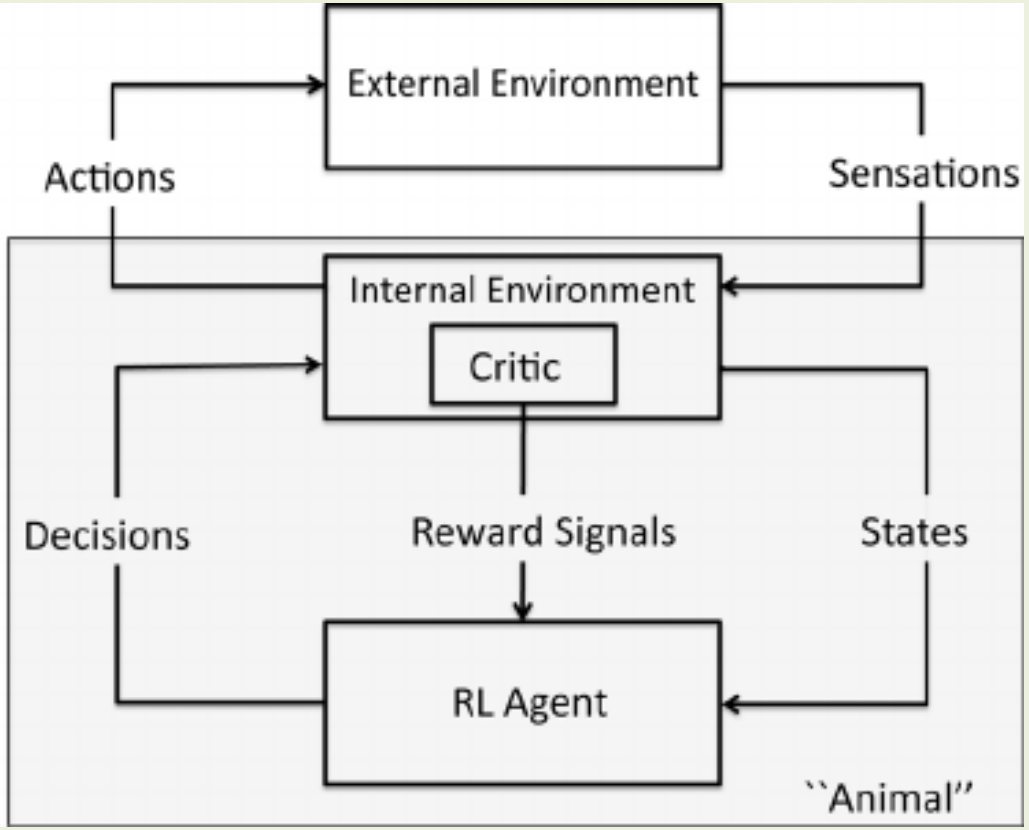
The Agent-Environment Loop I

- Agents receive percepts from the environment and take actions in response, forming a loop.



The Agent-Environment Loop II





PEAS Framework

- PEAS = Performance measure, Environment, Actuators, Sensors
- Used to define agent tasks
-  Example: Self-Driving Car
- Performance: Safety, speed, legality
- Environment: Roads, traffic, weather
- Actuators: Steering, throttle, brake
- Sensors: Cameras, lidar, GPS

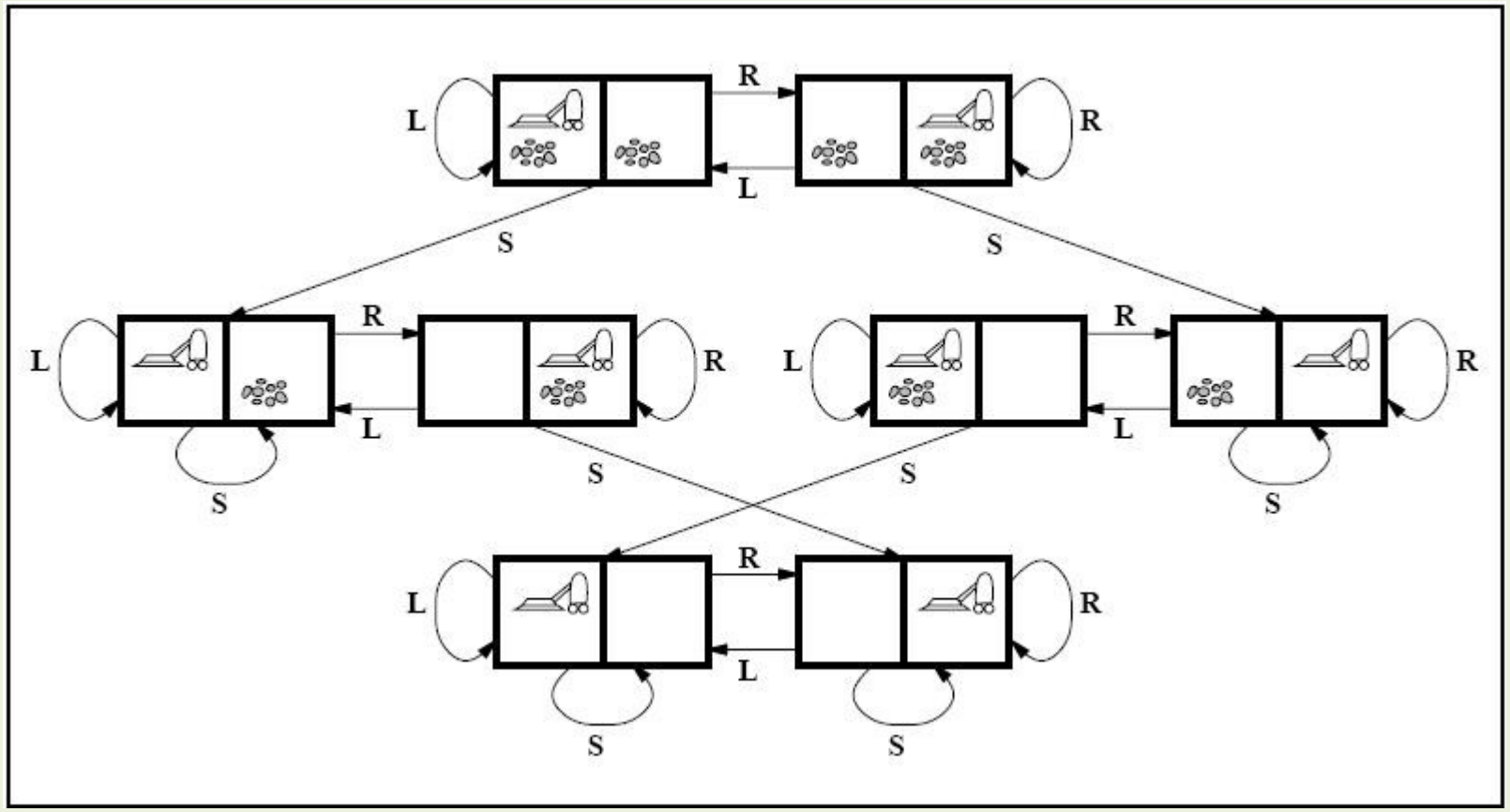
Types of Agents

- 1. Simple Reflex
- 2. Model-Based Reflex
- 3. Goal-Based
- 4. Utility-Based
- 5. Learning Agents

Simple Reflex Agents

- React to current percept only using condition-action rules.
- Example: Basic vacuum cleaner robot
- Work on condition-action rules (if...then...)
- No memory of past percepts
  - 🟡 Example: Vacuum cleaner
  - 🧠 Limitation: Cannot deal with partial observability or long-term planning

Basic vacuum cleaner robot



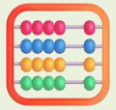
Model-Based Reflex Agents

- Maintains internal state to keep track of unobserved parts of the world
- Better at handling partial observability.
- Requires a model of how the world works
  -  Improved decision-making compared to simple reflex agents
- Maintain internal state based on history to make decisions.

Goal-Based Agents

- Adds a goal component
- Use goals to choose among possible actions.
- Can evaluate possible future actions based on their outcomes
  - 🔁 Requires search and planning
  - 📍 Example: Route planning agent

Utility-Based Agents

- Choose actions based on utility values (a measure of happiness or desirability)
- Can handle conflicting goals
  -  Involves trade-off and decision theory

Learning Agents

- Adapt and improve over time using **feedback**.
- Components:
  - Learning element
  - performance element
  - critic
  - problem generator.

Rationality

- A rational agent selects the action expected to maximize performance, given knowledge and percepts
- Not necessarily omniscient or successful
  - ⚠️ Rational ≠ Perfect

Agent Environments

- Classified along several dimensions:
  - **Fully vs. Partially Observable**
  - **Deterministic vs. Stochastic**
  - **Episodic vs. Sequential**
  - **Static vs. Dynamic**
  - **Discrete vs. Continuous**
  - **Single-agent vs. Multi-agent**

Examples of Agent Types

Agent	Type	Environment	Goal
Google Maps	Goal-based	Dynamic	Fastest route
Roomba	Simple Reflex	Partially observable	Clean floor
Chatbot	Model-based + Utility	Sequential	Engage user
Stock Trading Bot	Learning Agent	Stochastic	Maximize returns

Class Activity

- Create PEAS for:
- 1. Chatbot
- 2. Warehouse robot
- 3. Drone delivery

- Present to class.

Key Takeaways

- Agents are core to AI.
- PEAS defines agent problems.
- Types depend on task/environment.

Suggested Reading

- Russell & Norvig, Ch. 2
- Optional: YouTube video on agents and environments.