Agents & Environments
473 Topics

- Agents & Environments
- Problem Spaces
- Search & Constraint Satisfaction
- Knowledge Repr’n & Logical Reasoning
- Machine Learning
- Uncertainty: Repr’n & Reasoning
- Dynamic Bayesian Networks
- Markov Decision Processes
Intelligent Agents

- Have sensors, effectors
- Implement mapping from percept sequence to actions

- Performance Measure
Types of Agents: Robots

Xavier (CMU)  Walking (MIT)  Aibo (Sony)  Humanoid - Cog (MIT)
Types of Agents: Immobots

- Intelligent buildings
- Autonomous spacecraft
- **Softbots**
  - jango.excite.com
  - askjeeves.com
  - Expert Systems
  - Cardiologist
Types of Agents: Immobots

- Autonomous spacecraft
- Intelligent buildings
Rolling Robots

Xavier (CMU)  MIT Mobile Robot Group
Driving Robots

DAWN (CMU Robotics Lab)
Walking Robots

Quadraped (MIT Leg Lab)

Flamingo (MIT Leg Lab)
Humanoid Robots

Cog Project (MIT)
Software Robots
Defn: Ideal rational agent

“For each possible percept sequence, does whatever action is expected to maximize its performance measure on the basis of evidence perceived so far and built-in knowledge.”

- Rationality vs omniscience?
- Acting in order to obtain valuable information
Defn: Autonomy

An agent is autonomous to the extent that its behavior is determined by its own experience.

Why is this important?

The parable of the dung beetle
Implementing ideal rational agent

• Table lookup agents
• Agent program
  Simple reflex agents
  Agents with memory
    • Reflex agent with internal state
    • Goal-based agents
    • Utility-based agents
Simple reflex agents

AGENT

Sensors
what world is like now

Condition/Action rules
what action should I do now?

Effectors

ENVIRONMENT
Reflex agent with internal state

What world was like

How world evolves

Sensors

what world is like now

Condition/Action rules

what action should I do now?

Effectors

ENVIROMENT

AGENT

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Goal-based agents

The diagram illustrates the interaction between an **Agent** and its **Environment**. The Agent has a set of **Goals** that it seeks to achieve. Through **Sensors**, it perceives the current state of the world, which is represented as "what world is like now". From this information, the Agent can infer how the world evolves and what it will be like if it performs certain actions. This leads to the question of "what action should I do now?".

- **What world was like**: Represents past states of the world.
- **How world evolves**: Based on current and past states, the world evolves.
- **What my actions do**: Shows the impact of actions on the world.
- **Goals**: The desired states or outcomes.
- **what world is like now**: Current state of the world.
- **what it’ll be like if I do acts A1-A_n**: Future state given certain actions.
- **what action should I do now?**: Decision process based on current and predicted future states.

The **Effectors** are the means by which the Agent can change the world.
Utility-based agents

What world was like

How world evolves

What my actions do

Utility function

What world is like now

what it’ll be like if I do acts A₁-Aₙ

How happy would I be?

what action should I do now?

Effectors

Sensors
Properties of Environments

• Observability: full vs. partial vs. non
• Deterministic vs. stochastic
• Episodic vs. nonepisodic
• Static vs. ... vs. dynamic
• Discrete vs. continuous

• Travel agent
• WWW shopping agent
• Coffee delivery mobile robot
While driving, what’s the best policy?

- Always put blinker on before turning
- Never use your blinker
- Look in mirror, and use blinker only if you observe a car that can observe you

- What kind of reasoning?
  - logical, goal-based, utility-based?
- What kind of agent is necessary?
  - reflex, goal-based, utility-based?