Intelligent Agents

- Agents
- Environments
- Rationality
Example: Vacuum World

- Vacuum agent to clean a pair of rooms
- Can move left, move right or suck dirt
- Can sense location and cleanliness
Example: VW Performance Measure

- Average cleanliness
- End cleanliness
- Noise levels
- Power consumption
Rationality Gotchas

- Agents not expected to be omniscient (expected, not actual performance).
- Information gathering and exploration may improve performance measure.
- Learn from percepts.
- Autonomy and designer bias.
Environment Properties

- Fully vs partially observable
- Deterministic vs stochastic
- Episodic vs sequential
- Discrete vs continuous
- Static vs dynamic
- Single vs multiple agent
- Known vs unknown
Environment
- Performance
- Environment
- Actuators
- Sensors

Observability
- Uncertainty
- Duration
- Stability
- Granularity
- Participants
- Knowledge

Actions

Percepts

Agent

Agent Function

Rationality
- Performance Measure
- Prior Knowledge
- Possible Actions
- Percept Sequence

Sensors

Actuators
Rationality

- Rationality should be measured as the average performance measure of an agent over a large number of environments from an environment class.
Agent Program Implementations

- Table driven
- Simple reflex
- Model based reflex
- Goal based
- Utility based
- Learning
Table with all possible percept sequences as keys, Actions to take as values

Add new percepts to percept list.

What should I do now?
Table Driven Agents

- Entry for every possible percept sequence
- Translates percept sequence into action
- How does this rely on designer bias?
- For what kinds of environments is this a good choice? Bad choice?
- Very large tables, usually not feasible
**Environment**

- **Sensors**
  - What is the world like right now?

- **Actuators**
  - Condition-action rules
  - What should I do now?

**Simple Reflex Agent**

- **Percepts**
Simple Reflex Agent

- Only looks at current percepts, not entire percept sequence.
- Table only needs to store entry for each possible percept set.
- How much designer bias?
- What if designer misses entries?
- For what kinds of environments is this a good choice? Bad choice?
Environment

Percepts

Sensors

Model Based Reflex Agent

What is the world like right now?

Update State
How the world changes
What my actions do

Condition-action rules

What should I do now?

Actions

Actuators
Model Based Reflex Agent

- Updates current state based on percepts
- Table needs to store entry for each possible state.
- How much designer bias?
- What if designer misses entries?
- For what kinds of environments is this a good choice? Bad choice?
Environment

Model Based Goal Agent

Sensors

Percepts

Actuators

Actions

Goals

What is the world like right now?
What will the world be like next?
Update State
How the world changes
What my actions do

What should I do now?
Model Based Goal Agent

- Updates current state based on percepts
- Searches for multi-step path to a goal state.
- How does designer contribute?
- How much designer bias?
- For what kinds of environments is this a good choice? Bad choice?
Environment

Percepts

Sensors

Model Based Utility Agent

Actions

Actuators

What is the world like right now?
What will the world be like next?
Update State
How the world changes
What my actions do

How happy will I be then?
Utility

What should I do now?
Model Based Utility Agent

- Updates current state based on percepts
- Searches for multi-step path to goal states. Chooses “best” path.
- How does designer contribute?
- How much designer bias?
- For what kinds of environments is this a good choice? Bad choice?
Environment

Learning Agent

Sensors

Critic

Learning element

Problem generator

Performance element

Percepts

feedback

changes

knowledge

learning goals

Actions

Actuators
Learning Agent

• Learning element updates performance element.

• Uses critic to decide what needs to change, and what needs to stay the same.

• Problem generator causes exploration actions to occur, just for learning.

• For what kinds of environments is this a good choice? Bad choice?
Agent Representations

- Atomic
- Factored
- Structured
- Benefits and costs of expressiveness