LU-2: Intelligent Agents

Objectives

- To find PEAS description for the task environment

- To discuss the properties of task environment for agent implementation

PEAS stands for:
1. Performance
2. Environment
3. Actuators
4. Sensors

Outcomes

- Specify the PEAS description for the task environment

- Understand the task environment properties for agent implementation

Agents

- An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators

- Human agent: eyes, ears, and other organs for sensors; hands,
- legs, mouth, and other body parts for actuators

- Robotic agent: cameras and infrared range finders for sensors;
- various motors for actuators
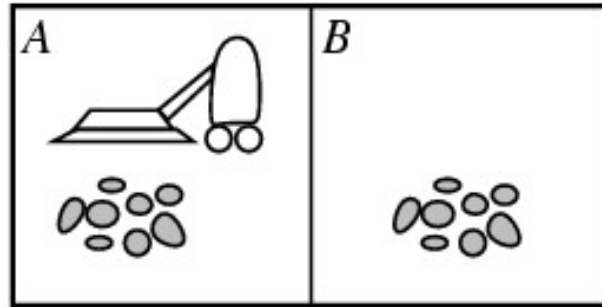
Agents and environments
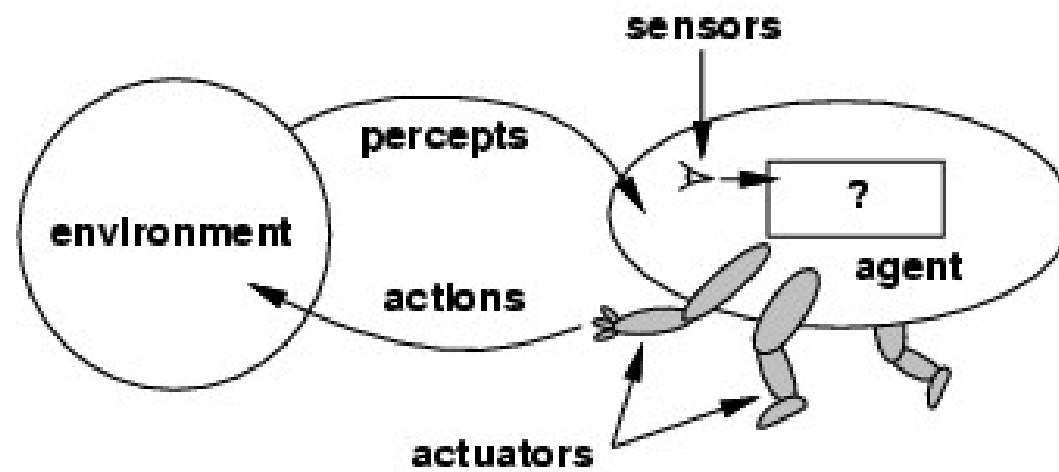
Agents and environments...contd

- The agent function maps from percept histories to actions:

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

- The agent program runs on the physical architecture to produce f

- agent = architecture + program

Example: Vacuum-cleaner world

- Percepts: location and contents, e.g., [A,Dirty]
- Actions: *Left*, *Right*, *Suck*, *NoOp*
- A vacuum-cleaner agent :
- \input{tables/vacuum-agent-function-table}

Rational agents

- An agent should strive to "do the right thing", based on what it can perceive and the actions it can perform. The right action is the one that will cause the agent to be most successful

- Performance measure: An objective criterion for success of an agent's behavior

- E.g., performance measure of a vacuum-cleaner agent could be:
  - **amount of dirt cleaned up**
  - **amount of time taken**
  - **amount of electricity consumed**
  - **amount of noise generated, etc.**

Rational agents

- Rational Agent: For each possible percept sequence, a rational agent should select an action that is expected to maximize its performance measure, given the evidence provided by the percept sequence and whatever built-in knowledge the agent has.

Rational agents

- Rationality is distinct from **omniscience** (all-knowing with infinite knowledge)

- Agents can perform actions in order to modify future percepts so as to obtain useful information (**information gathering, exploration**)

- An agent is autonomous if its behavior is determined by its own experience (**with ability to learn and adapt**)

Rational Agent Dependencies

- **P**erformance measure – deciding the degree of success
- What the agents know about the **E**nvironment
- The **A**ction that the agent can perform
- Percept Sequence: Everything that the agent has perceived (**S**ensed) so far

Ideal Agents

For each percept sequence, an ideal rational agent should do whatever **a**ction is expected to maximize its **p**erformance measure, on the basis of the evidence provided by the percept sequence (**s**ensed information sequence) and what ever the built in knowledge the agent has from the (**e**nvironment).

Ex: Taxi crossing the road (with no accident i.e looking all possible crossings)

Degenerate agent is the one which has empty percept (Ex. Clock)

Ideal Mapping from percept sequences to actions (with out a table)

Percept x	Action z
1.0	1.000000000
1.1	1.048808848
….	….
1.9	1.378404872
….	….

Function SQRT(x)

      z = 1.0   *//Initial guess*

      repeat until $|z^2 - x| < 10^{-15}$

            $z = z - (z^2 - x) /(2z)$

      end

      return z

Autonomy

- The autonomous system will decide its behaviour based on its experiences
- Adapt to environment
- Operate successfully in a wide variety of environments

Possible Assessment Questions

Define percept
Define percept sequence
Define rational agent
Specify the PEAS description of the task environment for a.   **Automated taxi** b.   **Part picking robot** c.   **Interactive English tutor** d.   **Internet book shopping agent** e.   **Mathematician's theorem proving assistant**
Can there be more than one agent program that implements a given agent function? Give an eg. Or show why one is not possible.
Discuss the possible agent designs for the cases in which clean squares can become dirty and the geography of the environment is unknown. Does it make sense for the agent to learn from its experience in these cases? If so, what should it learn?
Design a simple reflex agent for the vacuum environment