Artificial Intelligence

Lecture-4

Intelligent Agents

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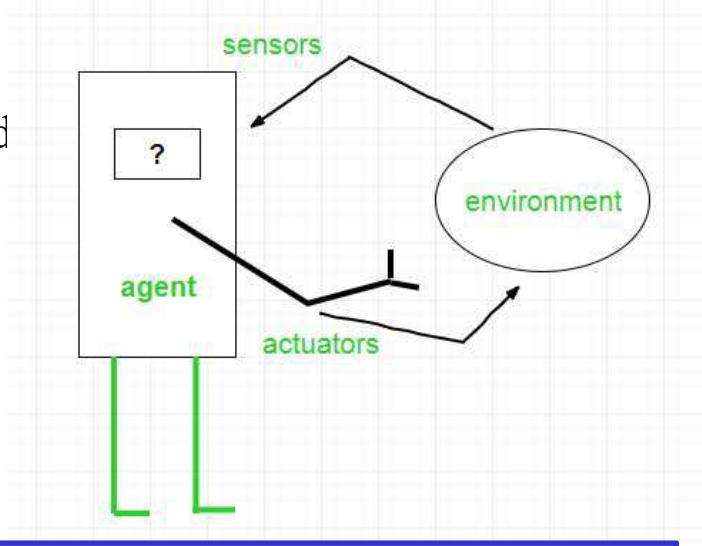
Lecture Outlines

- What is an (Intelligent) Agent?
- Rational Agents
- PEAS Analysis
- Interacting Agents
- Environment Types
- Structure of an Agent
- Agent Types

What is an (Intelligent) Agent?

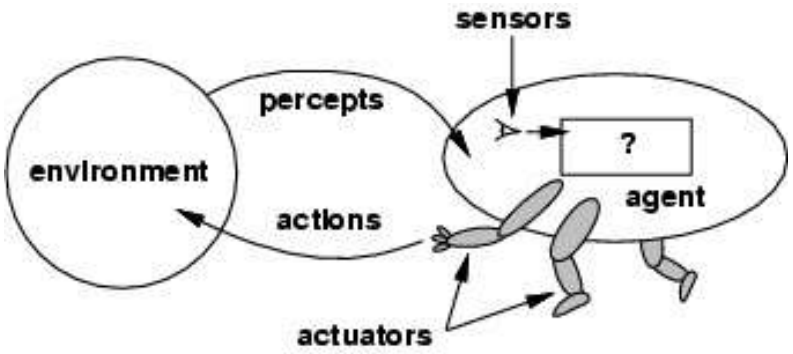
- An agent is anything that can
  - *perceive* its *environment* through *sensors*, and
  - *act* upon that environment through *actuators* (or *effectors*)



- **Examples of Agent:-**
  - A **software agent** has Keystrokes, file contents, received network packages which act as sensors and displays on the screen, files, sent network packets acting as actuators.
  - A **Human agent** has eyes, ears, and other organs which act as sensors and hands, legs, mouth, and other body parts acting as actuators.
  - A **Robotic agent** has Cameras and infrared range finders which act as sensors and various motors acting as actuators.

Structure of an Intelligent Agent

Agent = Architecture + Program



- To understand the structure of Intelligent Agents, we should be familiar with *Architecture* and *Agent Program*.

Structure of an Intelligent Agent

- **Architecture** is the machinery that can execute the agent program on it. It is a device with sensors and actuators, for example, general-purpose computer (PC), specialized device, a robotic car, a beobot (like autonomous robot), etc.

- **Agent program** is an implementation of an agent function. An **agent function** is a map from the percept sequence (history of all that an agent has perceived till date) to an action.
  - The agent function maps from percept histories to actions (the agent's perception-action mapping): [f : P* ⇨ A]
  - The agent program runs on the physical architecture to produce f

Structure of an Intelligent Agent

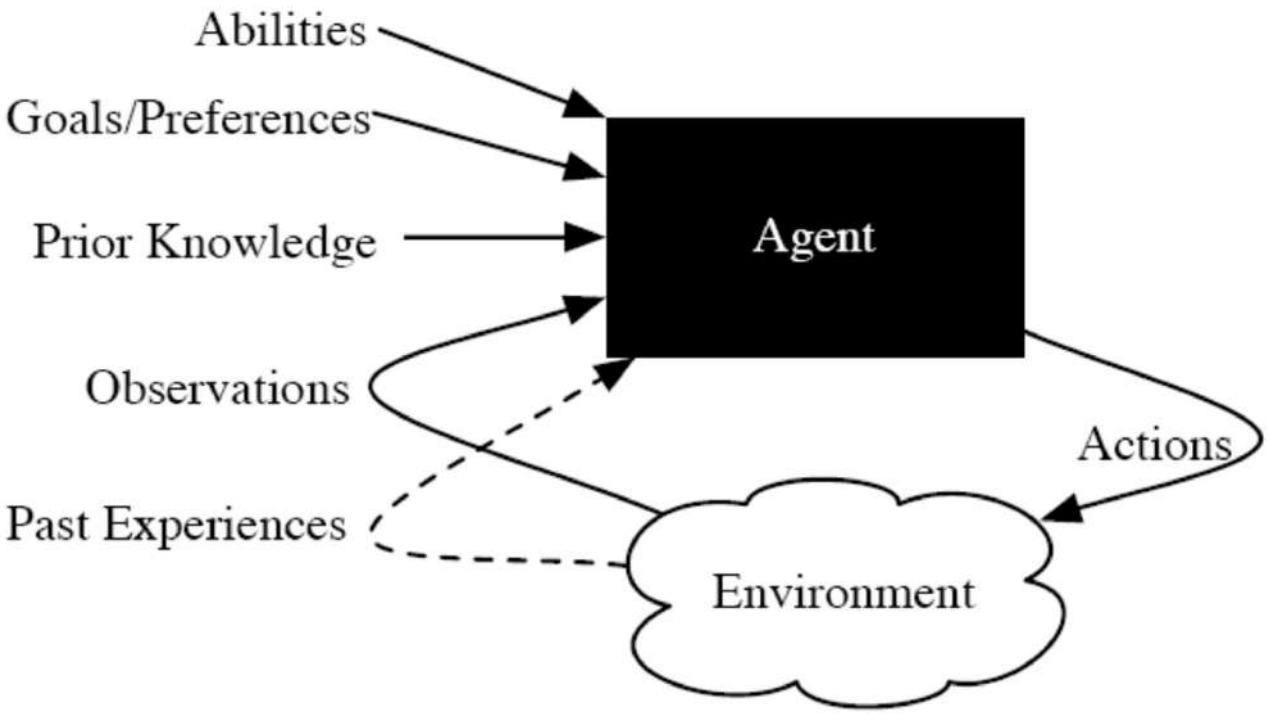
A Skeleton Agent:

```
function Skeleton-Agent(percept) returns action
  static: memory, the agent's memory of the world

  memory ← Update-Memory(memory, percept)
  action ← Choose-Best-Action(memory)
  memory ← Update-Memory(memory, action)
  return action
```

- All agents have the same basic structure:
  - accept percepts from environment
  - generate actions and acts on environment
- Observations:
  - agent may or may not build percept sequence in memory (depends on domain)
  - performance measure is not part of the agent; it is applied externally to judge the success of the agent.

Major Features of Agents



Major Features of Agents

- **Example agent: Robot**
  - **Abilities** : movement, grippers, speech, facial expressions.
  - **Observations** : vision, sonar, sound, speech recognition, gesture recognition.
  - **Goals** : deliver food, rescue people, score goals, explore.
  - **Past experiences** : effect of steering, slipperiness, how people move.
  - **Prior knowledge** : what is important feature, categories of objects, what a sensor tell us.

Major Features of Agents

- **Example Agent: Teacher**
  - **Abilities** : present new concept, drill, give test, explain concept.
  - **Observations** **:** test results, facial expressions, errors, focus.
  - **Goals** **:** particular knowledge, skills, social skills.
  - **Past experiences** **:** prior test results, effects of teaching strategies.
  - **Prior knowledge** **:** subject material, teaching strategies.

Major Features of Agents

- **Example Agent: Medical Doctor**
  - **Abilities** : operate, test, prescribe drugs, explain instructions.
  - **Observations** : verbal symptoms, test results, visual appearance.
  - **Goals** : remove disease, relieve pain, increase life expectancy, reduce costs.
  - **Past experiences** : treatment outcomes, effects of drugs, test results given symptoms.
  - **Prior knowledge** : possible diseases, symptoms, possible causal relationships.

Major Features of Agents

- **Example Agent: User Interface**
  - **Abilities** : present information, ask user, find another information source, filter information, interupt.
  - **Observations** : users request, information retrieved, user feedback, facial expressions.
  - **Goals** : present information, maximize useful information, minimize irrelevant information, privacy.
  - **Past experiences** : effect of presentation modes, reliability of information sources.
  - **Prior knowledge** : information sources, presentation modalities.

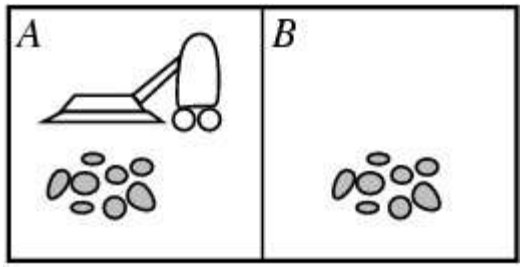
PAGE Properties

- **PAGE** (Percepts, Actions, Goals, Environment)

- Task-specific & specialized: well-defined goals and environment
- The notion of an agent is meant to be a tool for analyzing systems:
  - It is not a different hardware or new programming languages

PAGE Properties

- Example: Vacuum Cleaner Agent



- **Percepts:** location and contents, e.g., [*A, Dirty*]
- **Actions:** *Left, Right, Suck, NoOp*

Percept sequence	Action
$[A, Clean]$	$Right$
$[A, Dirty]$	$Suck$
$[B, Clean]$	$Left$
$[B, Dirty]$	$Suck$
$[A, Clean], [A, Clean]$	$Right$
$[A, Clean], [A, Dirty]$	$Suck$
⋮	⋮

Intelligent Agents

TO BE CONTINUED…