Artificial Intelligence

Lecture-5

Intelligent Agents

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Outlines

- …
- Rational Agents
- BDI Agents Model
- Autonomy in Agent
- PEAS Analysis
- Agents vs Other Software
- …

Rationality

- What is rational at any given time depends on **four things**:
  - The performance measure that defines the criterion of success.
  - The agent's prior knowledge of the environment.
  - The actions that the agent can perform.
  - The agent's percept sequence to date.
- Rationality is distinct from omniscience (all-knowing with infinite knowledge)

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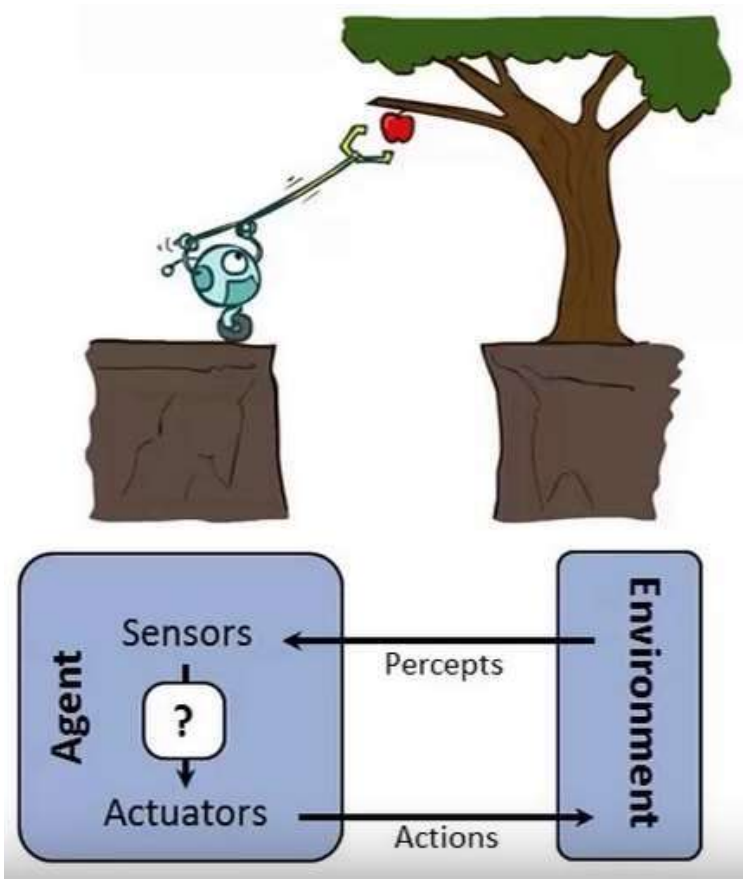
Do the right

Rational Agents

- An **rational agent** is one that **does 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.
- A **rational agent** selects actions that **maximize its (expected) utility**.
- Characteristics of the **percepts, environment, and action space** dictate techniques for selecting rational actions.
- 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.
- An **agent's percept sequence** is the complete history of everything, the agent has ever perceived.



BDI Agent Models

- Agents must represent and reason about others agents, human or software.
- The **BDI agent model** considers agents to have
  - **Beliefs** about itself, other agents and its environment (i.e., idea, trust or confidence)
  - **Desires** about future states (i.e., goals)
  - **Intentions** about its own future actions (i.e., plans)
- The BDI model is particularly useful for
  - Developing formal models of agents
  - Developing a deep model of agent communication
  - Inferring an agent's internal state from its behavior.

- A rational agent is modeled as making choices resulting in **intensions** in an attempt to optimize the expected utility with respect to their **desires** and consistent with their **beliefs**.

rationality

Beliefs + desires ⇨ **intentions**

Autonomy in Agent

- **The autonomy** of an agent is the extent to which its behavior is determined by its own experience (with ability to learn and adapt).

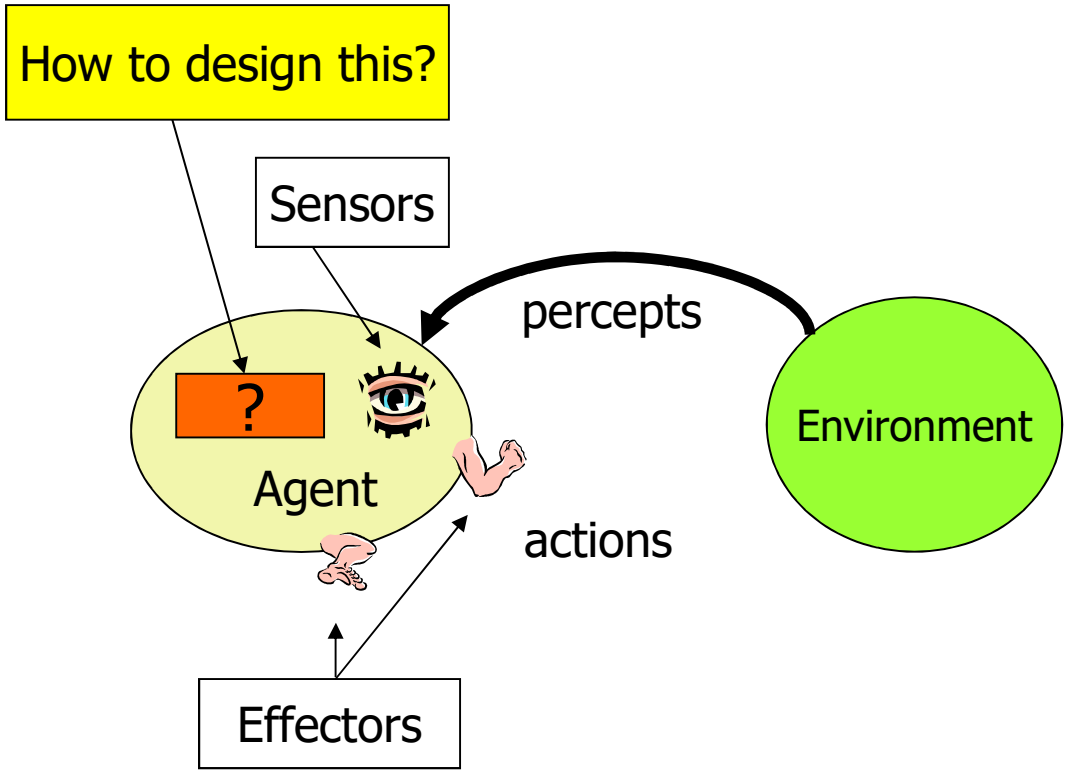
- The AI agent must have the followings:
  - Must sense
  - Must act
  - Must autonomous (to some extend)
  - Must rational

PEAS Analysis…

- **PEAS**: Performance measure, Environment, Actuators, Sensors
- Must first specify the setting for intelligent agent design.

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

For example, 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.

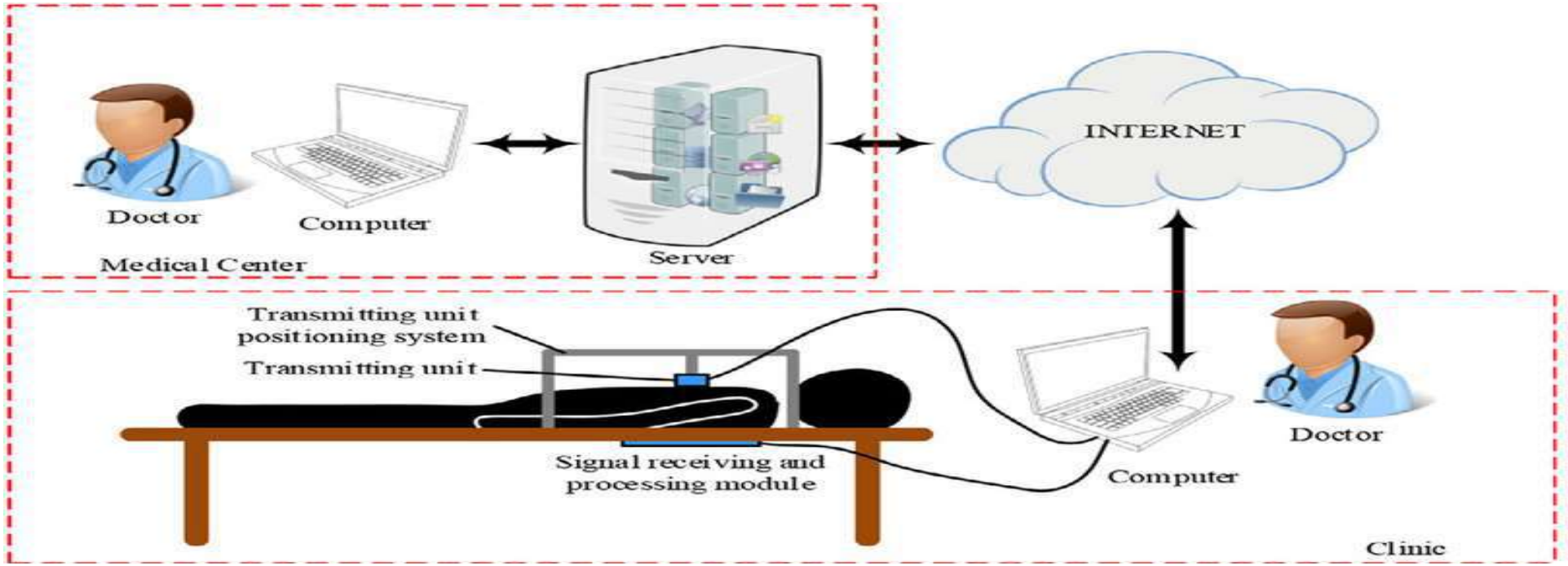


PEAS Analysis…

- The task of designing an agent: **An automated taxi driver**
  - **Performance measure:** Safe, fast, legal, comfortable trip, maximize profits
  - **Environment:** Roads, other traffic, pedestrians, customers
  - **Actuators:** Steering wheel, accelerator, brake, signal, horn
  - **Sensors:** Cameras, sonar, speedometer, GPS, odometer, engine sensors, keyboard

PEAS Analysis…

- **Agent: Medical diagnosis system**
  - **Performance measure:** Healthy patient, minimize costs, lawsuits
  - **Environment:** Patient, hospital, staff
  - **Actuators:** Screen display (questions, tests, diagnoses, treatments, referrals)
  - **Sensors:** keyboard (entry of symptoms, finding, patient's answers)



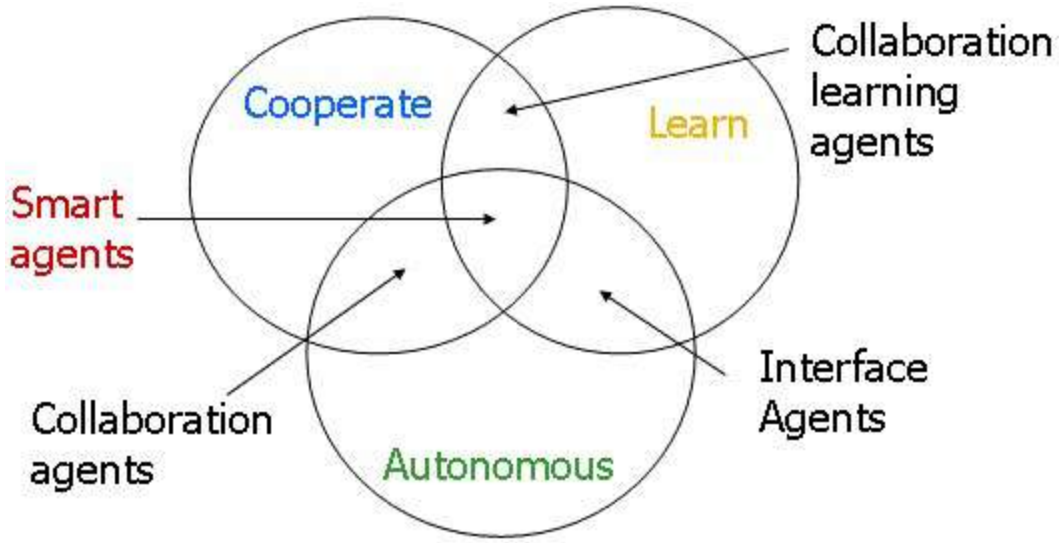
PEAS Analysis...

- **Agent: Part-picking robot**
  - **Performance measure:** Percentage of parts in correct bins
  - **Environment:** Conveyor belt with parts, bins
  - **Actuators:** Jointed arm and hand
  - **Sensors:** Camera, joint angle sensors

PEAS Analysis

- **Agent: Interactive English Tutor**
  - **Performance measure:** Maximize student's score on test
  - **Environment:** Set of students
  - **Actuators:** Screen display (exercises, suggestions, corrections)
  - **Sensors:** Keyboard

How is an Agent different from other software?



How is an Agent different from other software?

- Agents are **autonomous**, that is, they act on behalf of the user.
- Agents contain some level of **intelligence**, from fixed rules to learning engines that allow them to adapt to changes in the environment.
- Agents don't only act **reactively**, but sometimes also **proactively**.
- Agents have **social ability**, that is, they communicate with the user, the system, and other agents as required.
- Agents may also **cooperate** with other agents to carry out more complex tasks than they themselves can handle.
- Agents may **migrate** from one system to another to access remote resources or even to meet other agents.

Intelligent Agents

TO BE CONTINUED…