

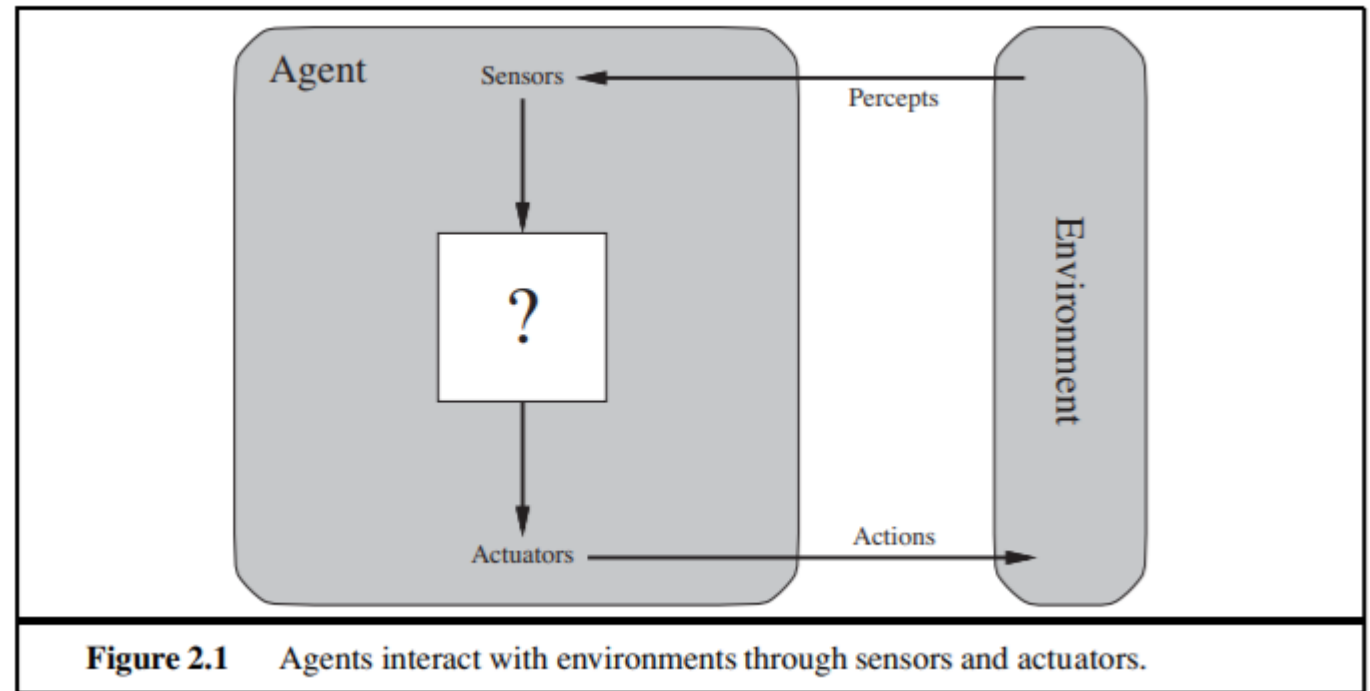
# Artificial Intelligence

Intelligent Agents

Lecture -2

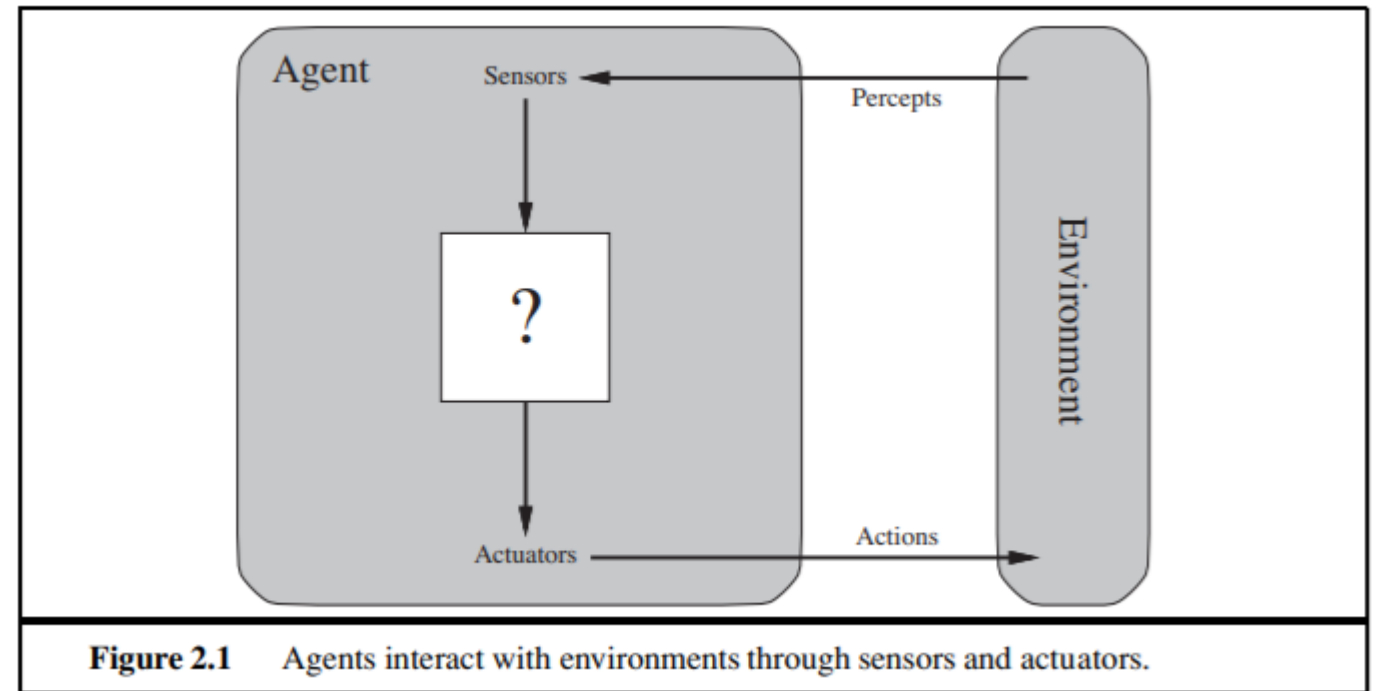
# Agents and Environments

- An **agent** is a software or system that is designed to act autonomously and perform specific tasks
- It perceives its environment through *sensors* and **acts upon that environment** through *actuators*
- **Human**: sensors are eyes, ears; actuators (effectors) are hands, legs, mouth



# Agents and Environments

- Software Agent
  - **sensory input:** keystrokes, file contents, and network packets
  - **Actuator:** acts on the environment by displaying on the screen, writing files, and sending network packets



# Rational Agent

- A rational agent is one that does the right thing
- **Rationality:**
  - The performance measure that defines criterion of success
  - The agent prior knowledge of the environment
  - The actions that agent can perform

DEFINITION OF A  
RATIONAL AGENT



This leads to a **definition of a 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.*



# PEAS

- Performance measure
- Environment
- Actuators
- Sensors

Agent Type	Performance Measure	Environment	Actuators	Sensors
Taxi driver	Safe, fast, legal, comfortable trip, maximize profits	Roads, other traffic, pedestrians, customers	Steering, accelerator, brake, signal, horn, display	Cameras, sonar, speedometer, GPS, odometer, accelerometer, engine sensors, keyboard

**Figure 2.4** PEAS description of the task environment for an automated taxi.



# Properties of Task Environments

- Fully observable vs. partially observable **or Unobservable**
- Deterministic vs. stochastic / strategic
  - If the next state of the environment is completely determined by the current state and the action executed by the agent, then we say the environment is deterministic; otherwise, it is stochastic
  - Stochastic systems, involve a certain degree of randomness or probability.
  - Strategic systems refers to decision making process where the decision maker take into account the potential actions of other decision makers and their potential reactions to the decision maker's own actions.



# Properties of Task Environments

- Taxi driving: stochastic (behavior of traffic cannot be determined)
- Vacuum cleaning: deterministic
  - Variations may include stochastic elements such as randomly appearing dirt and an unreliable suction
- Single agent vs. multiagent (Solving crossword puzzle vs chess playing)
  - For Multi-Agents: Competitive (in Chess)
  - cooperative multi-agent env (in driving to avoid collision)
  - Partially competitive: only one car can occupy a parking space

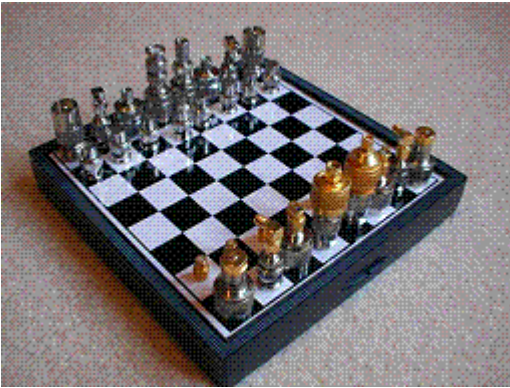


# Properties of Task Environments

- Episodic vs. sequential
  - In each episode, the agent receives a percept and then performs a single action that doesn't affect the action in previous episodes.
  - In sequential environments, the current decision could affect all future decisions
- Static vs. dynamic
  - If the environment can change while an agent is deliberating, then we say the environment is dynamic for that agent; otherwise, it is static
- Discrete vs. continuous
  - Discrete has finite countable states
  - Taxi-driving is continuous-state, chess is discrete
- Known vs Unknown -- Focused on Agent's state of knowledge and not on env



# Environment Properties



Environment	Observable	Deterministic	Episodic	Static	Discrete	Agents
Chess with a clock						
Chess without a clock						

# Environment Properties



Environment	Observable	Deterministic	Episodic	Static	Discrete	Agents
Chess with a clock	Fully	Deterministic Strategic	Sequential	Semi	Discrete	Multi
Chess without a clock						

# Environment Properties



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# Environment Properties



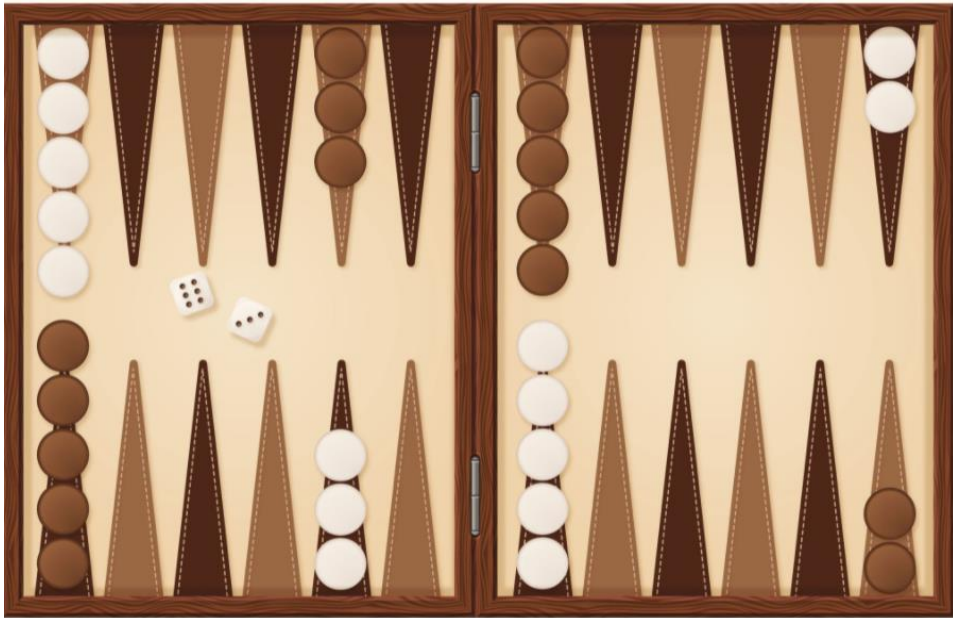
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Chess without a clock	Fully	Strategic	Sequential	Static	Discrete	Multi
Poker						

# Environment Properties



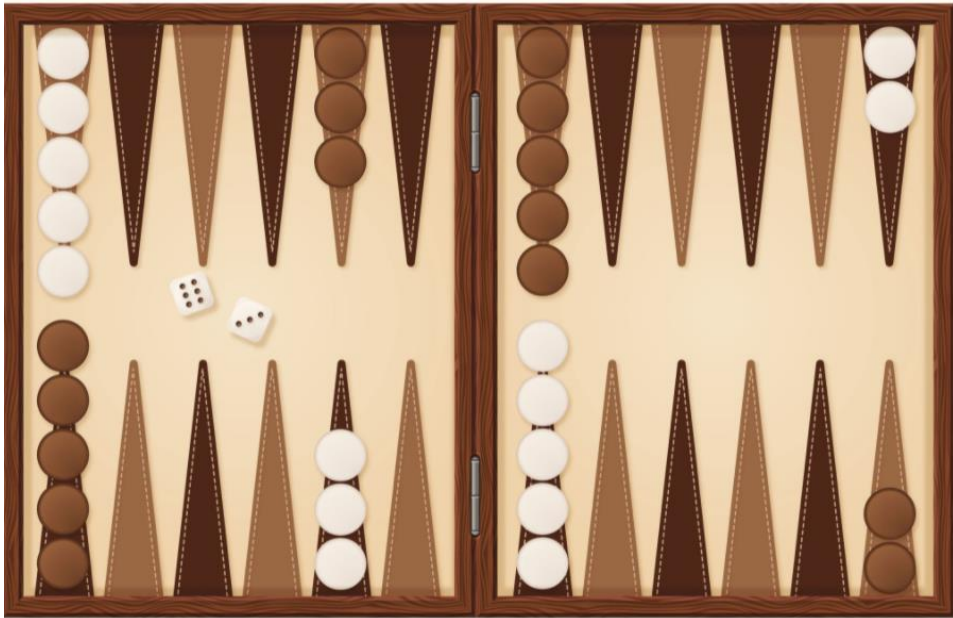
Environment	Observable	Deterministic	Episodic	Static	Discrete	Agents
Chess with a clock	Fully	Strategic	Sequential	Semi	Discrete	Multi
Chess without a clock	Fully	Strategic	Sequential	Static	Discrete	Multi
Poker	Partial	Strategic	Sequential	Static	Discrete	Multi

# Environment Properties



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Poker	Partial	Strategic	Sequential	Static	Discrete	Multi
Backgammon						

# Environment Properties



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Taxi driving						
Medical diagnosis						





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