

AIE111 :

Artificial Intelligence

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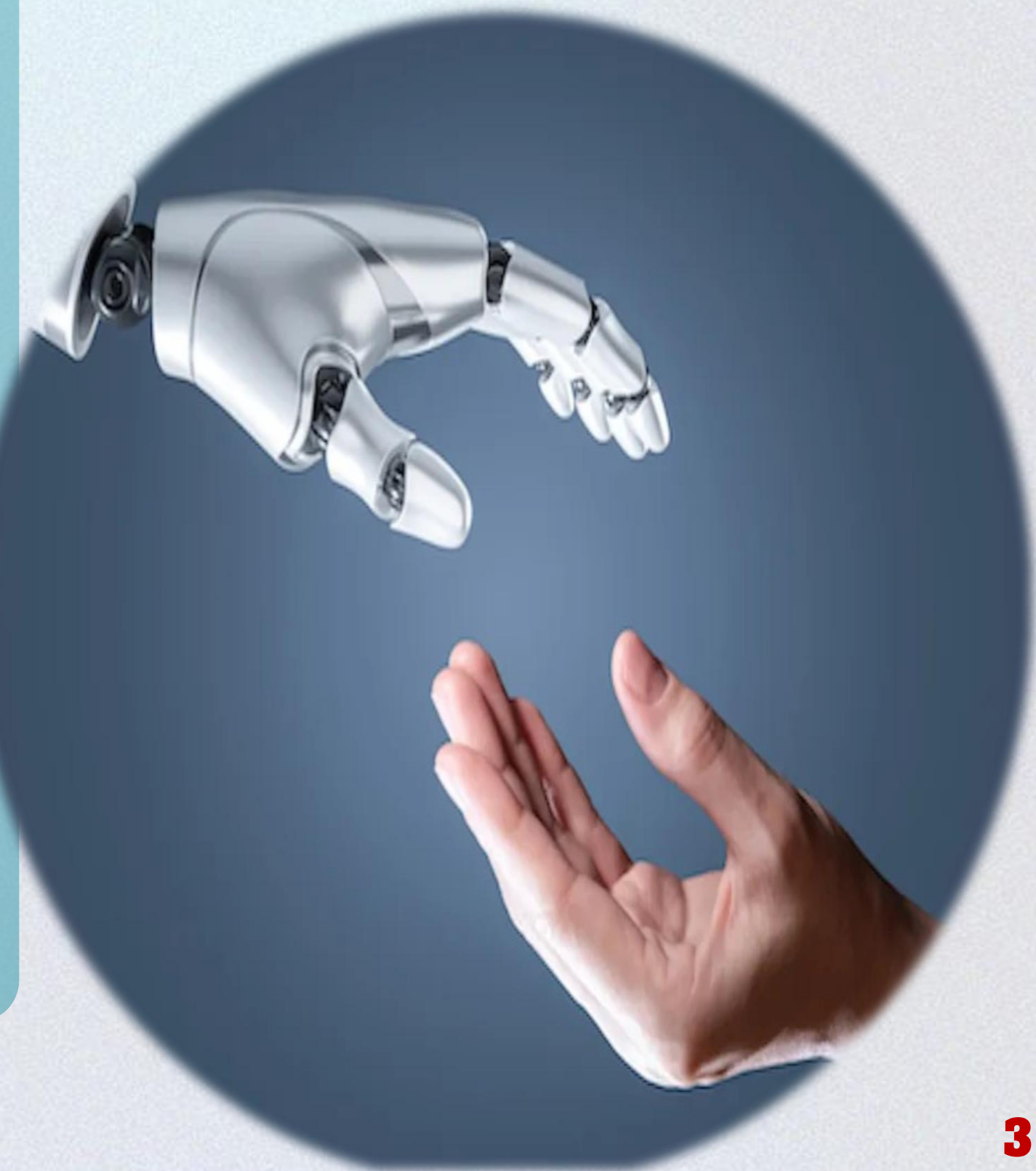


Lecture 1:

AI Agents & Environment Properties

1. Understanding AI Environments?

- In Artificial Intelligence, the environment refers to the external factors that an agent interacts with while trying to accomplish a specific goal.
- The **environment** is everything the AI agent interacts with.
- Depending on its properties, it can **affect how the AI agent behaves**.



2. Environment Properties

□ Fully Observable vs. Partially Observable

1. Fully Observable: The agent has complete access to the state of the environment at all times.

Example: Chess (AI can see the entire board).

2. Partially Observable: The agent has limited access to the state of the environment due to missing or noisy data.

Example: Self-driving car (Cannot see other drivers' intentions).

2. Environment Properties

❑ Deterministic vs. Stochastic (Random)

1. Deterministic: The same action always produces the same result.

Example: Solving a math problem (**2 + 2 always equals 4**).

2. Stochastic (Non-Deterministic): The result of an action is uncertain or random.

Example: Traffic navigation (AI cannot predict sudden accidents).

2. Environment Properties

❑ Episodic vs. Sequential

1. Episodic: Each action is independent of previous actions.

Example: Spam filter (Each email is classified separately).

2. Sequential: Current actions affect future outcomes.

Example: Chess (Each move impacts the next move).

2. Environment Properties

❑ Static vs. Dynamic

1. Static: The environment does not change while the agent is deciding.

Example: Crossword puzzle (It remains the same).

2. Dynamic: The environment keeps changing as the agent decides.

Example: Self-driving car (Traffic conditions change constantly).

2. Environment Properties

❑ Discrete vs. Continuous

1. Discrete: The AI has a fixed number of choices.

Example: Chess (Finite number of moves).

2. Continuous: The AI has infinite possibilities.

Example: Self-driving cars (Speed, steering angle, etc.).

❑ Single-Agent vs. Multi-Agent

1. Single-Agent: AI operates alone without interaction.

Example: Medical diagnosis AI (It analyzes patient data independently).

2. Multi-Agent: AI interacts with other AI agents or humans.

Example: Poker AI (Competes against other players).

2. Environment Properties (Summary)

Property	Description	Example
Fully Observable vs. Partially Observable	AI can either see everything in the environment or only part of it.	Chess (Full), Self-driving car (Partial)
Deterministic vs. Stochastic (Random)	AI actions have predictable or uncertain outcomes.	Solving a math problem (Deterministic), Stock market prediction (Stochastic)
Episodic vs. Sequential	AI decisions are either independent or affect future outcomes.	Spam filter (Episodic), Chess (Sequential)
Static vs. Dynamic	Environment stays the same or changes over time.	Crossword puzzle (Static), Self-driving car (Dynamic)
Discrete vs. Continuous	AI choices are either limited or infinite.	Chess moves (Discrete), Car steering (Continuous)
Single-Agent vs. Multi-Agent	AI works alone or interacts with others.	Medical diagnosis AI (Single), Poker AI (Multi)

3. Examples of AI Environments

Environment	Observable?	Deterministic?	Episodic?	Static?	Discrete?	Agents?
Chess (With Clock)	✓ Fully	🎯 Strategic	🔄 Sequential	🕒 Semi	📊 Discrete	👥 Multi
Poker	✗ Partial	🎯 Strategic	🔄 Sequential	✓ Static	📊 Discrete	👥 Multi
Self-Driving Car	✗ Partial	🎲 Stochastic	🔄 Sequential	🔥 Dynamic	📈 Continuous	👥 Multi
Medical Diagnosis AI	✗ Partial	🎲 Stochastic	📦 Episodic	✓ Static	📈 Continuous	🤖 Single
Web Crawler	✓ Fully	✓ Deterministic	🔄 Sequential	✓ Static	📊 Discrete	🤖 Single

4. Types of AI Agents

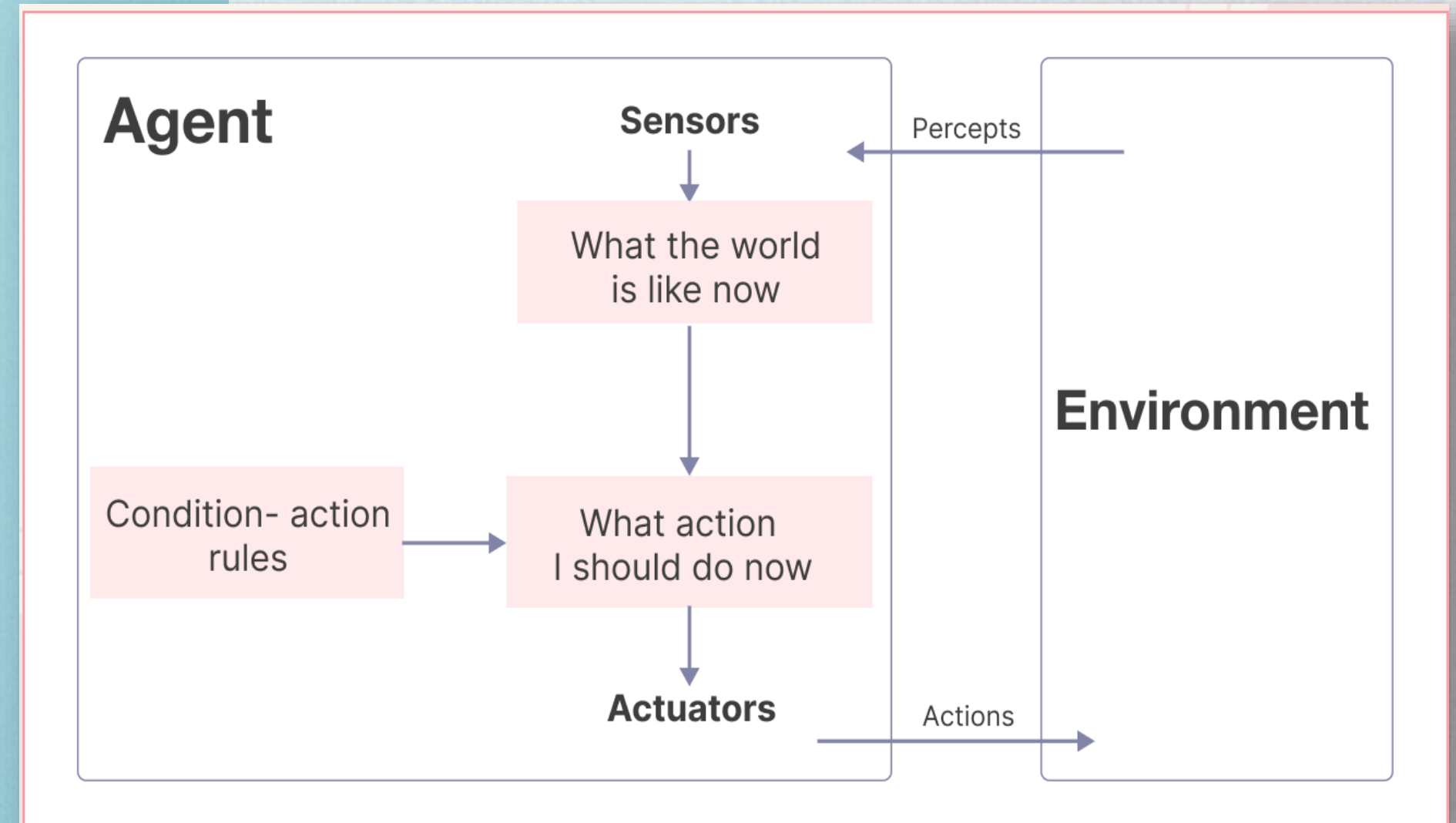
1. Simple reflex agents
2. Model-based reflex agents
3. Goal-based agents
4. Utility-based agents
5. Learning agent



4. Types of AI Agents

1. Simple Reflex Agents

- Works based on simple **IF-THEN** rules.
- Does NOT use memory
(reacts only to the current situation).
- **Example:** Vacuum Cleaner AI
 - IF floor is dirty → THEN clean.
 - IF floor is clean → THEN move left or right.
 - **Limitation:** Cannot handle **complex environments**
(e.g., cannot remember where it has already cleaned).



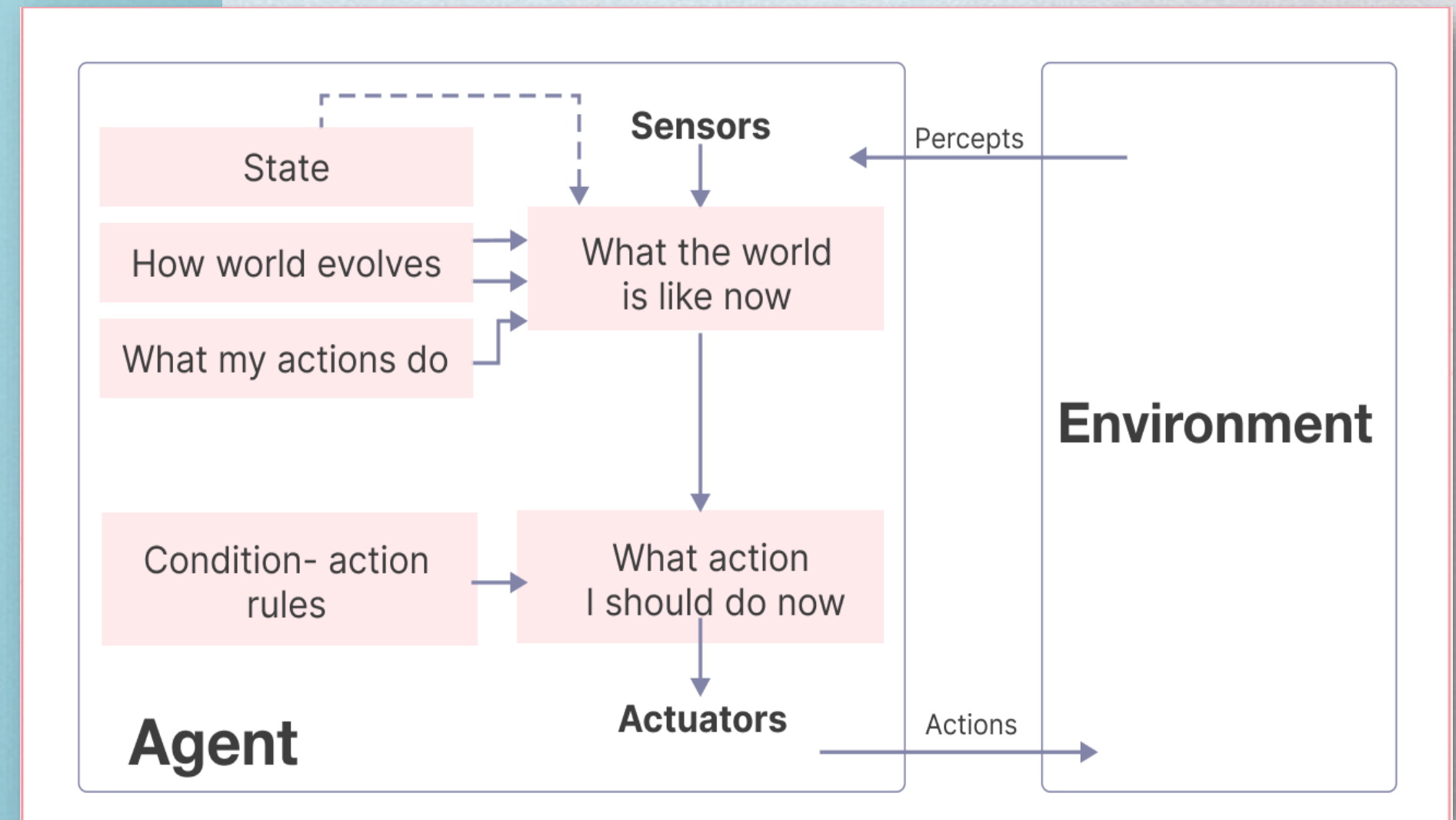
4. Types of AI Agents

2. Model-Based Reflex Agents

- Uses memory (internal state) to store past experiences.

Example: Self-Driving Car 

- Uses a **camera** to detect road signs and traffic lights.
- **Remembers** previous signals for better decision-making.



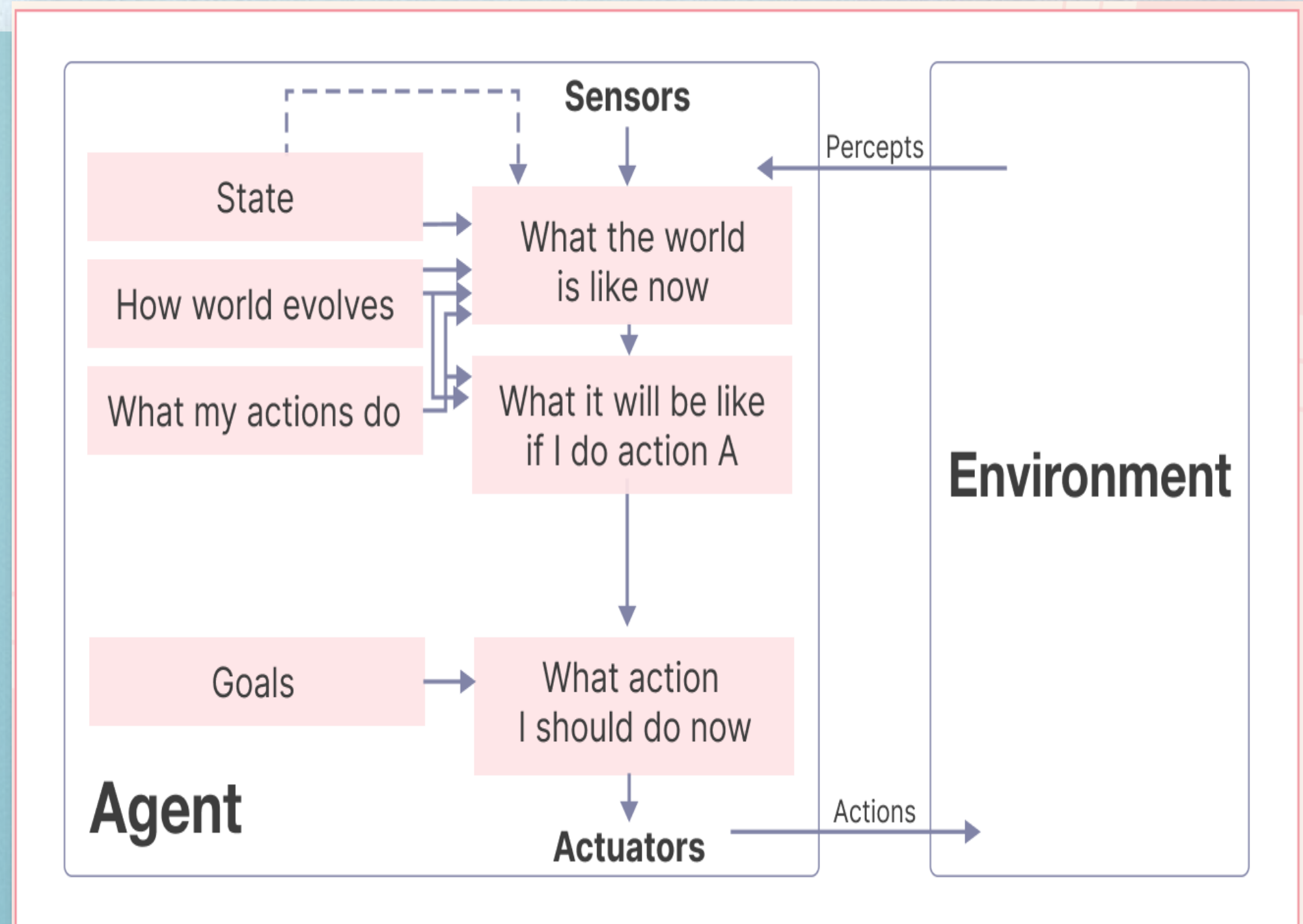
4. Types of AI Agents

3. Goal-Based Agents

Chooses actions based on a goal
(not just reacting).

- **Example:** Navigation AI (Google Maps)

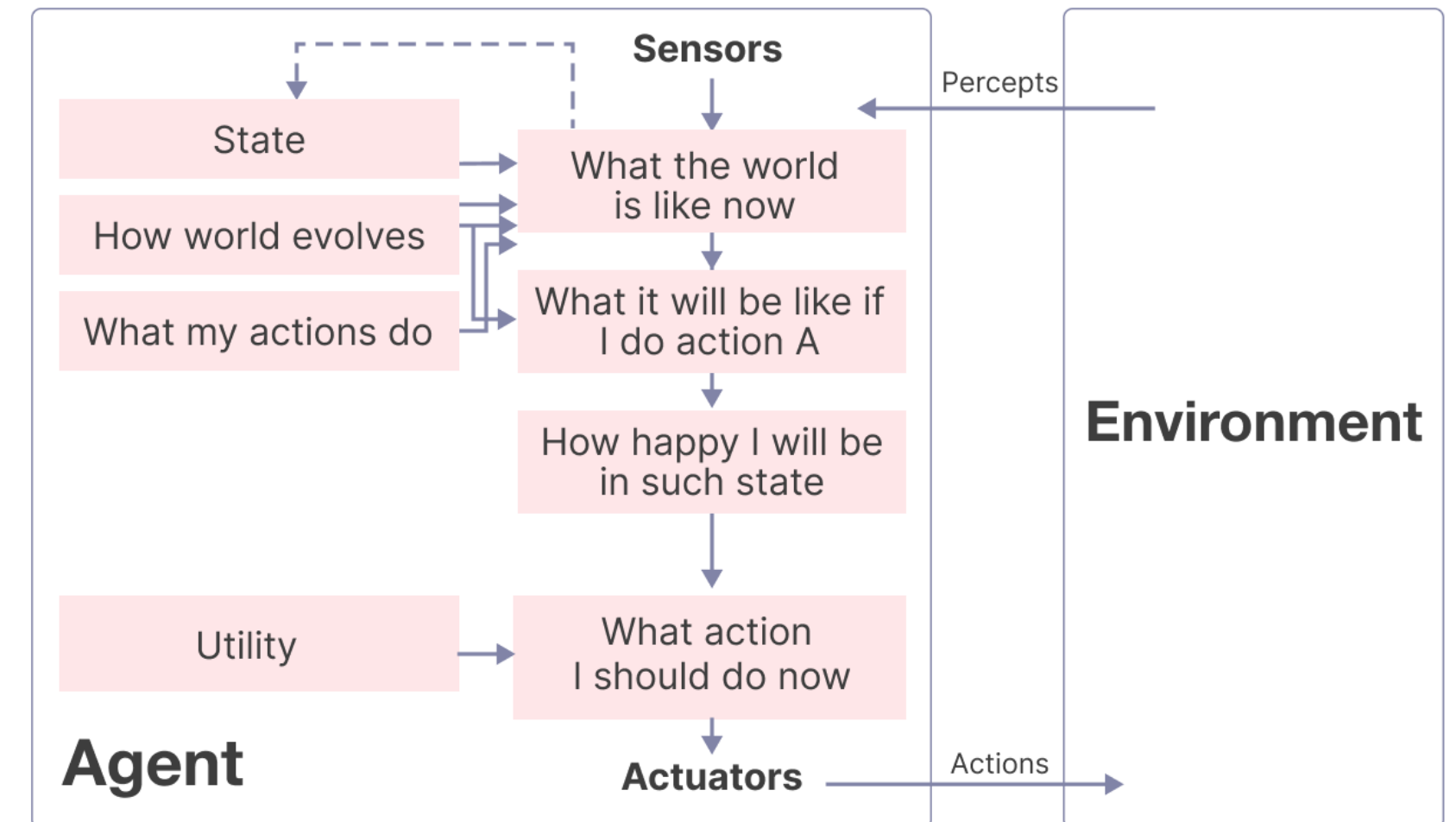
- Instead of just moving randomly, it calculates the shortest route to the destination.



4. Types of AI Agents

4. Utility-Based Agents

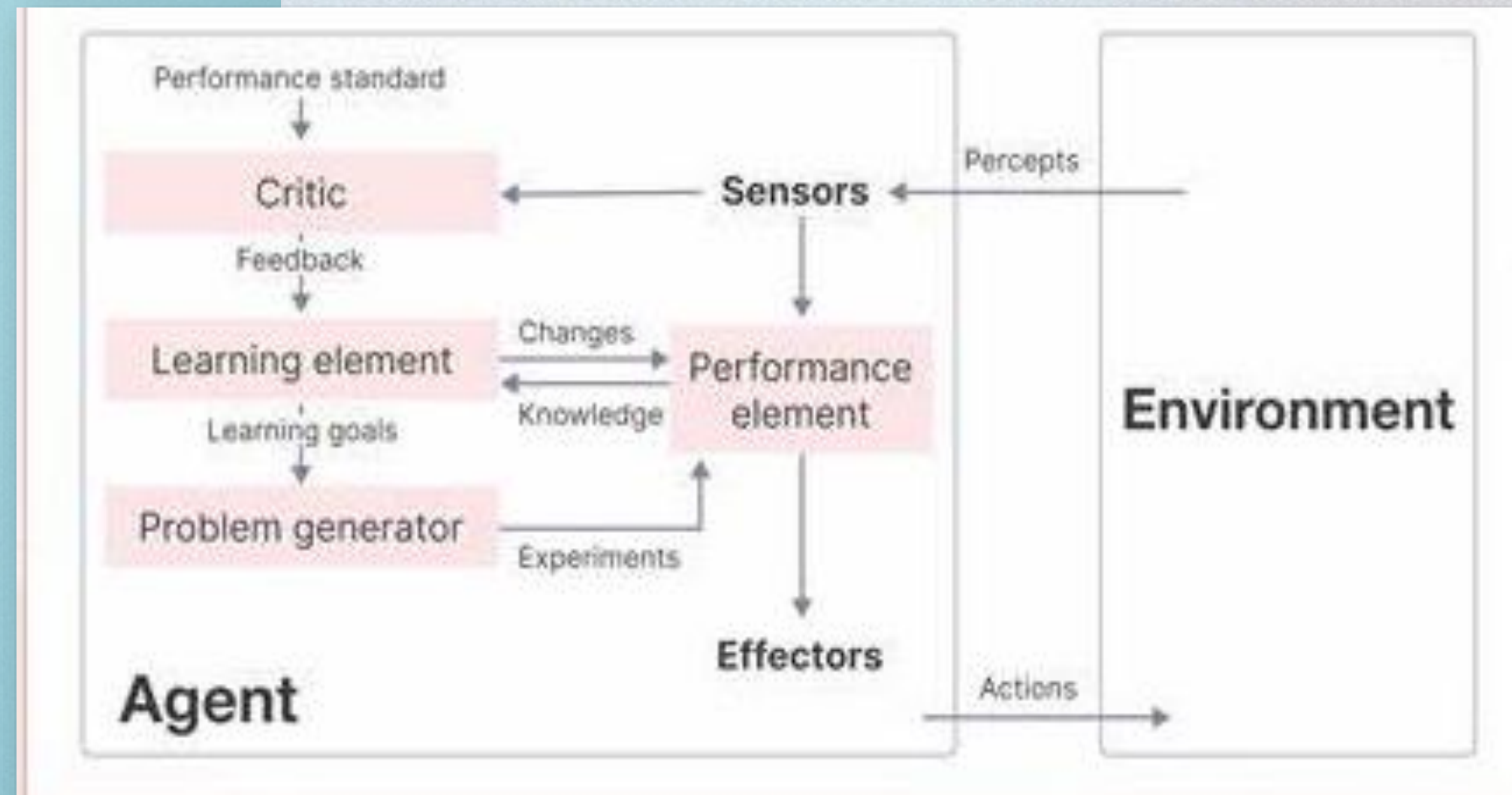
- Optimizes performance using a "**utility function**."
- **Example:** Uber AI (Ride-Hailing Service)
 - Chooses the fastest, safest, and most profitable **route** instead of just any valid route.



4. Types of AI Agents 🤖

5. Learning Agents 🤖

- Improves performance over time using experience.
- **Example:** AI Chess Player
 - Learns from **past games** and improves its strategy over time.



5. Real-World AI Examples

Application	Environment Type	Key Feature
Self-Driving Car 🚗	Partially Observable, Stochastic, Sequential, Dynamic	Uses cameras and sensors for navigation.
Medical Diagnosis AI 🏥	Partially Observable, Stochastic, Episodic, Static	Analyzes patient symptoms and predicts diseases.
AI Chess Player ♟️	Fully Observable, Strategic, Sequential, Static	Uses game algorithms to calculate best moves.
Stock Market AI 📈	Partially Observable, Stochastic, Sequential, Dynamic	Predicts trends and automates investments.
AI Chatbot (Siri, Alexa) 🗣️	Partially Observable, Stochastic, Sequential, Dynamic	Understands speech and responds intelligently.
AI Web Crawler 🌐	Fully Observable, Deterministic, Sequential, Static	Searches and indexes web content automatically.

THANK YOU!

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