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BSCS 3B IS | CSST 101

Introduction to Knowledge Representation



Advance Representation and Reasoning





Section 1: Introduction to AI and Knowledge Representation



What is Artificial Intelligence?

- AI simulates human intelligence in machines, allowing them to perform tasks such as decision-making, problem-solving, and learning.
- AI systems are built on algorithms that process data, learn from it, and apply this knowledge to perform specific tasks.



Section 1: Introduction to AI and Knowledge Representation

The Importance of Knowledge in AI



- Knowledge is the foundation of AI's ability to reason and make decisions.
- AI systems require structured information to interpret data and generate meaningful responses.



Section 1: Introduction to AI and Knowledge Representation

Introduction to Knowledge Representation



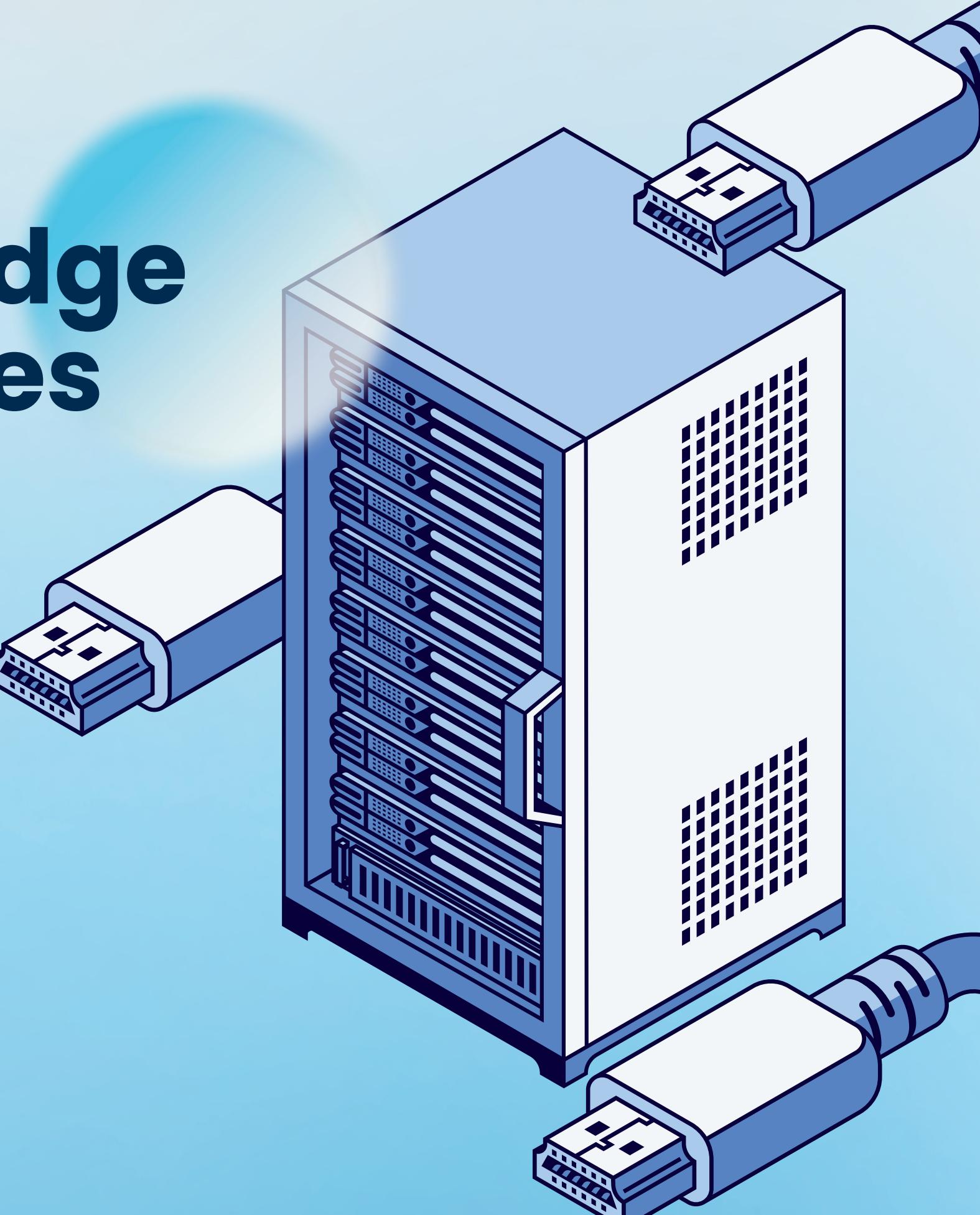
- Knowledge representation is how information is formally structured within an AI system.
- It enables AI to process, interpret, and utilize information effectively.



Section 2: Types of Knowledge Representation

Overview of Knowledge Representation Types

- Knowledge can be represented in various forms, each suited to different AI tasks and applications.

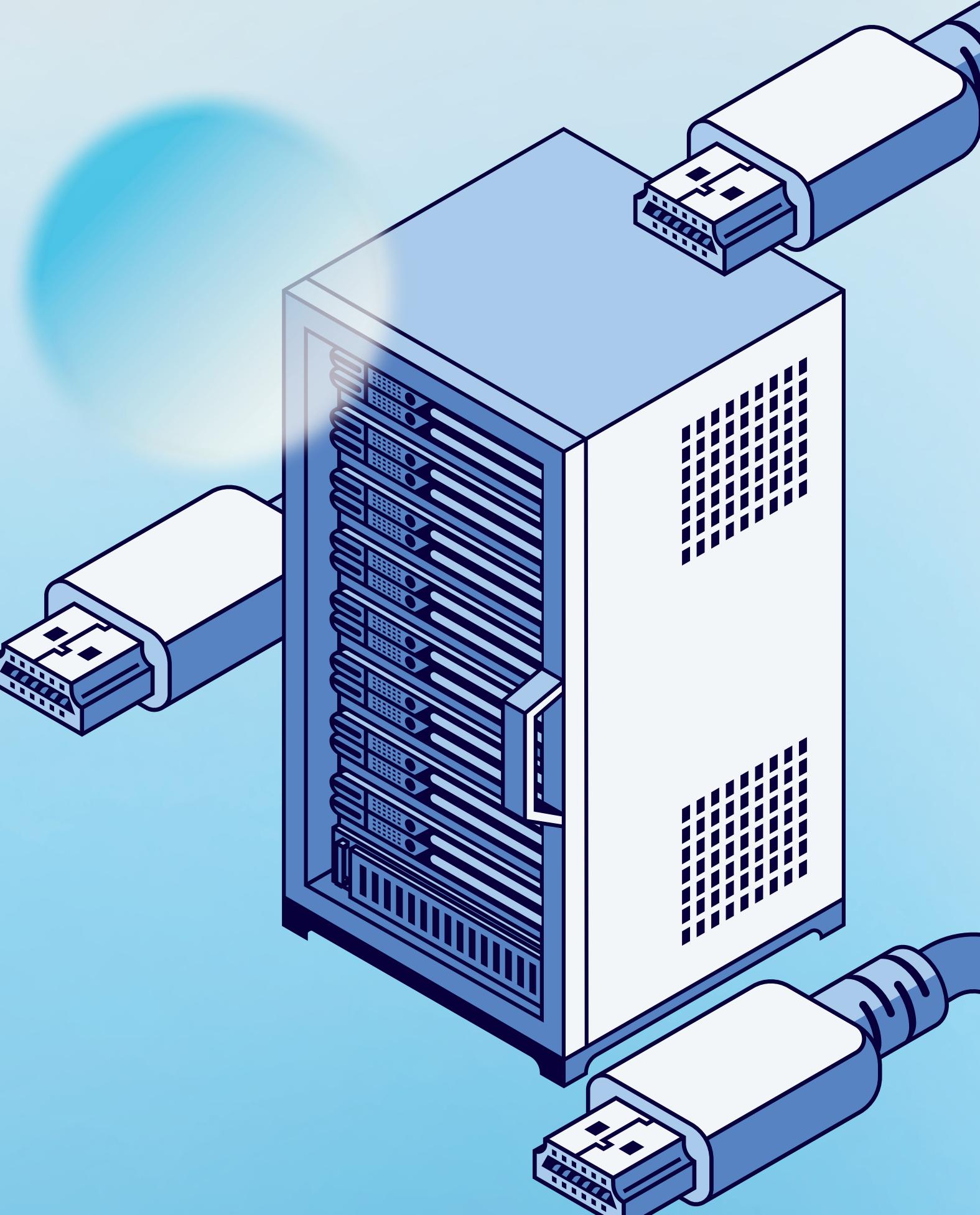




Section 2: Types of Knowledge Representation

Semantic Networks

- A graph structure that connects concepts through relationships.
- **Example:** A semantic network for language processing might link words to their meanings, synonyms, and usage contexts.

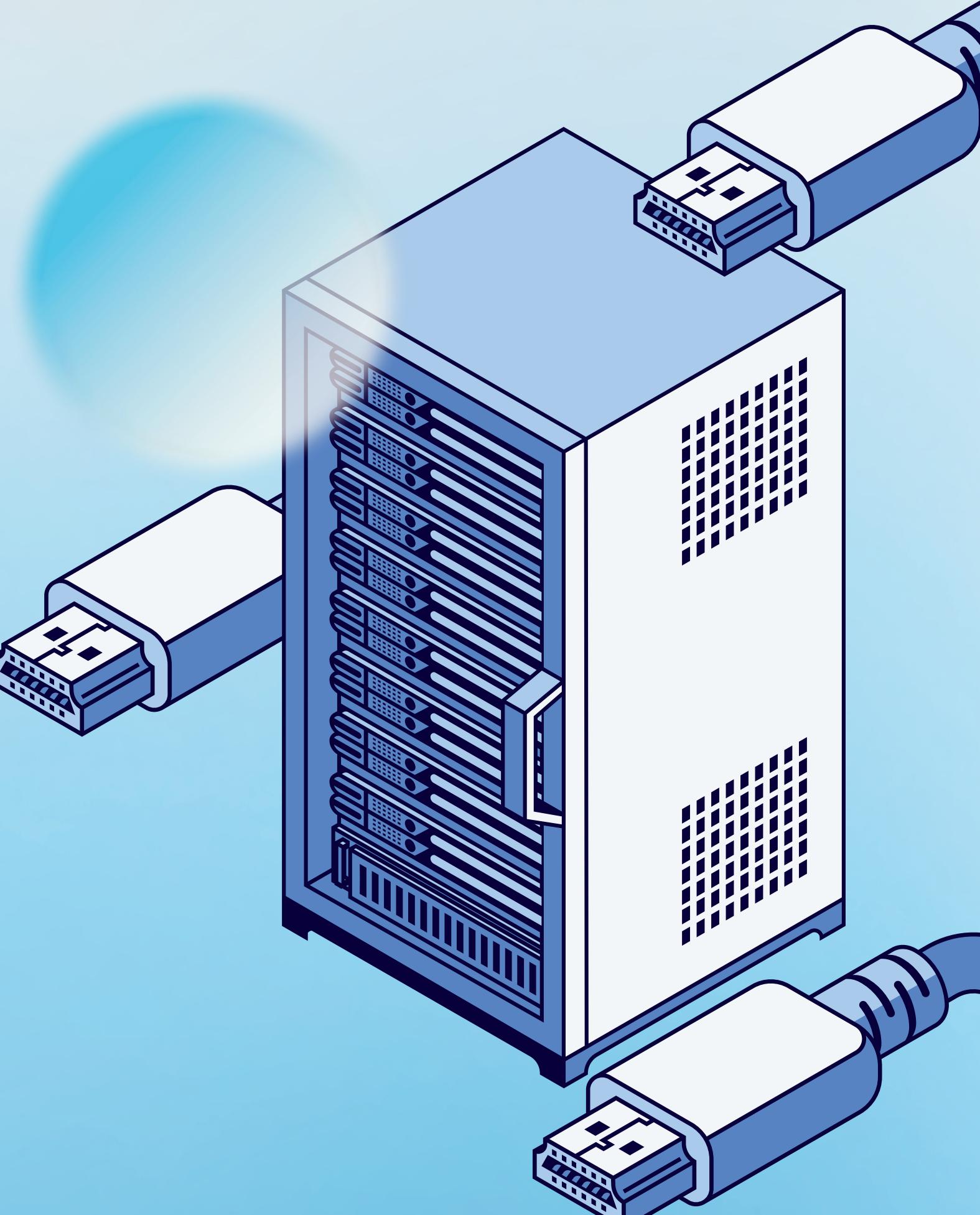




Section 2: Types of Knowledge Representation

Frames

- Data structures that store stereotypical knowledge, with slots for specific attributes.
- **Example:** An expert system might use frames to represent a patient's medical history, symptoms, and possible diagnoses.

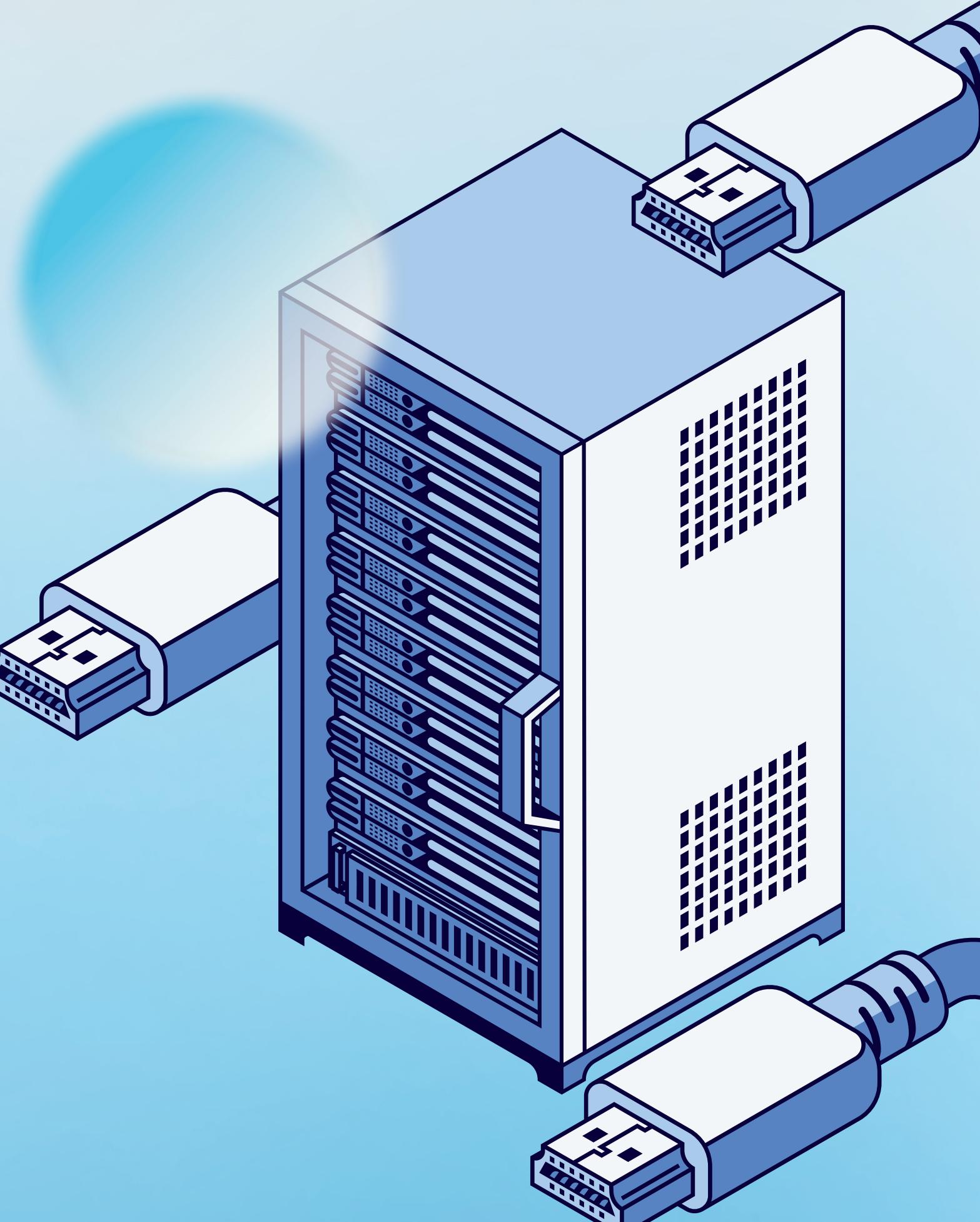




Section 2: Types of Knowledge Representation

Logic-Based Representations

- Use formal logic to represent and reason about knowledge.
- **Example:** An AI system might use logical rules to deduce whether a certain condition is true or false.

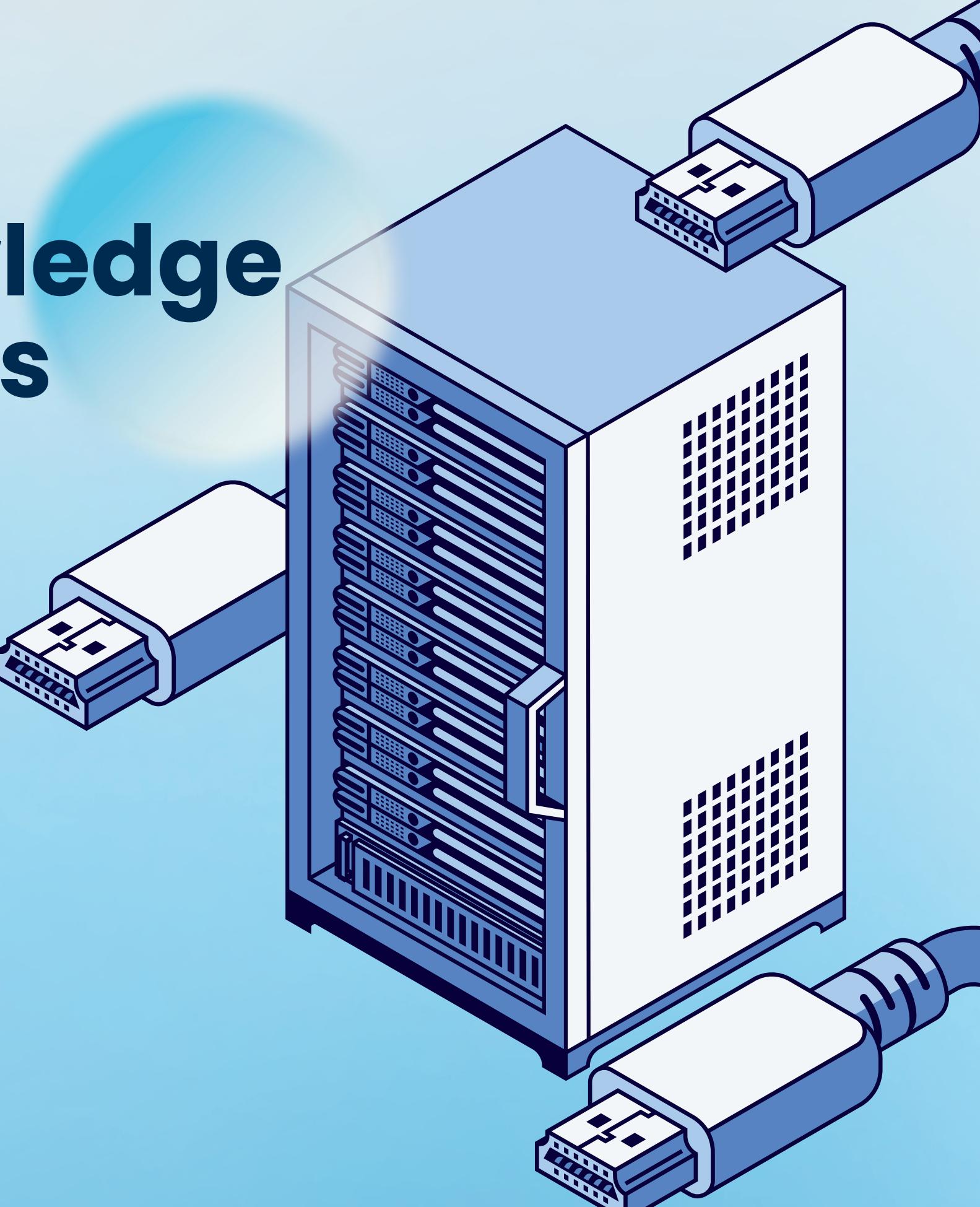




Section 2: Types of Knowledge Representation

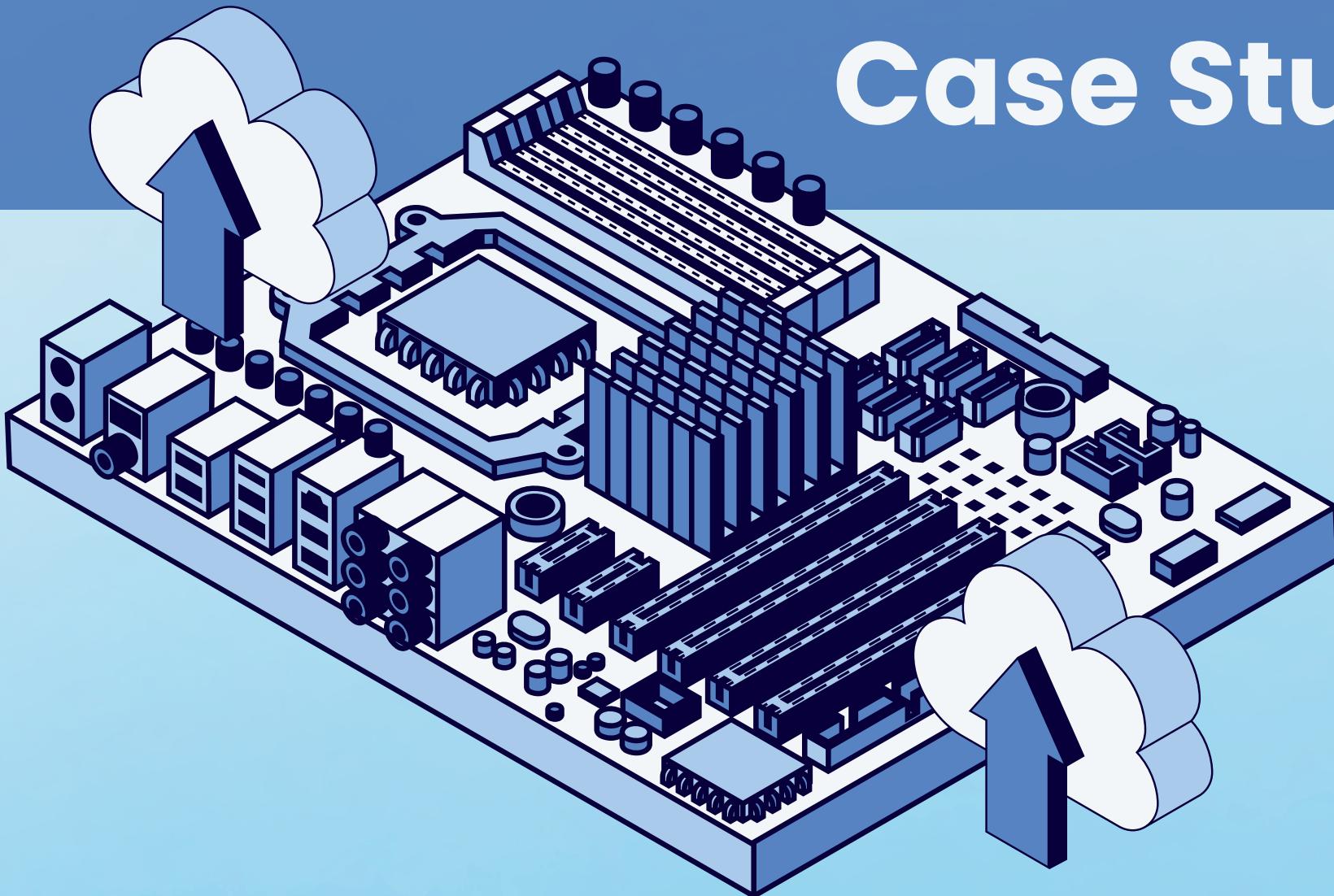
Comparison of Knowledge Representation Types

- **Semantic Networks:** Good for associative knowledge, but may become complex with many relationships.
- **Frames:** Suitable for structured information, but limited in dynamic reasoning.
- **Logic-Based Representations:** Precise and powerful for reasoning, but computationally intensive.





Section 3: Case Study Overview



Case Study: Autonomous Vehicles

Application:

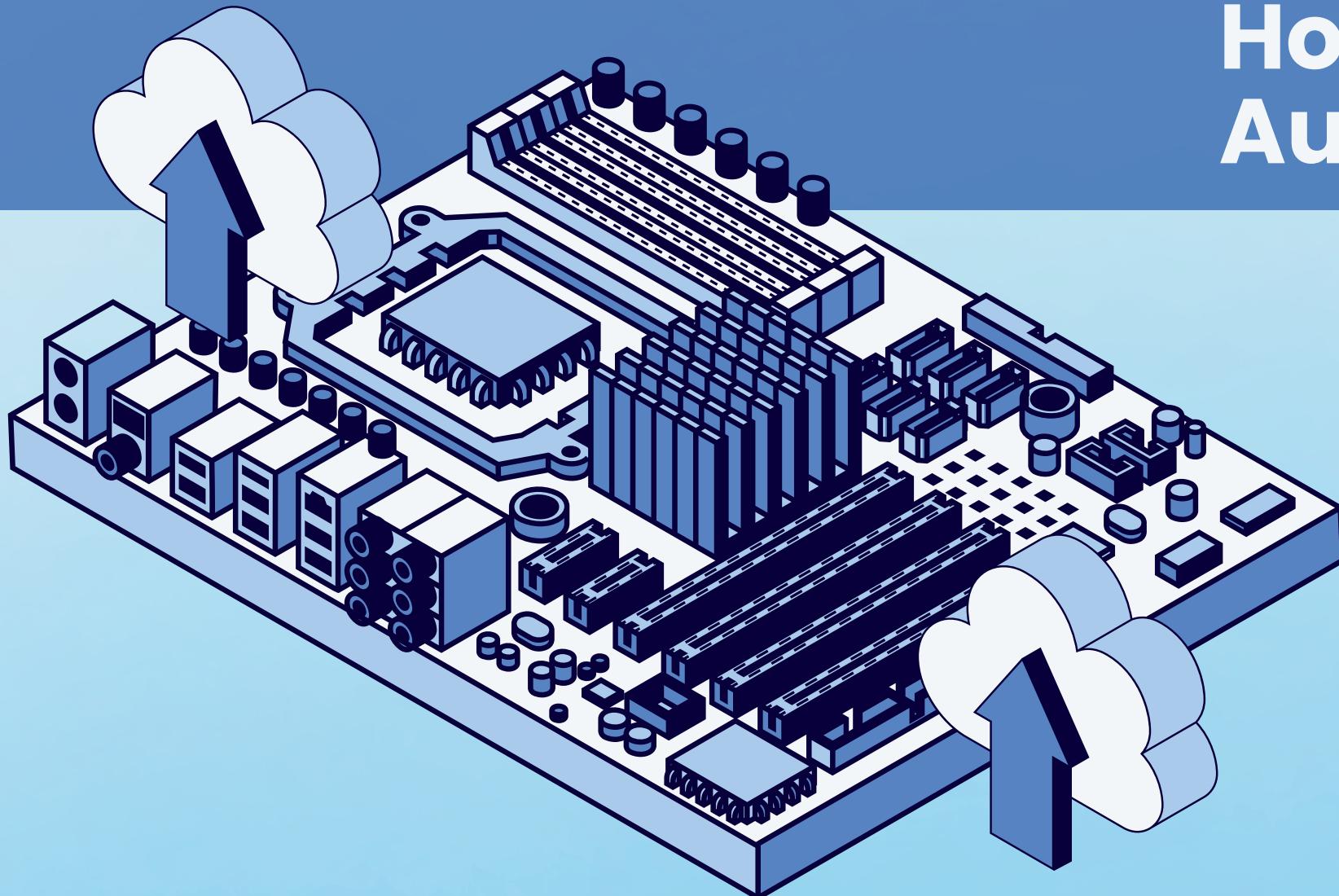
Autonomous driving requires real-time decision-making in dynamic environments.

Knowledge Representation Used:

Ontologies and logic-based frameworks are crucial in interpreting sensor data and making driving decisions.



Section 3: Case Study Overview



How Knowledge is Represented in Autonomous Vehicles

■ **Ontologies:**

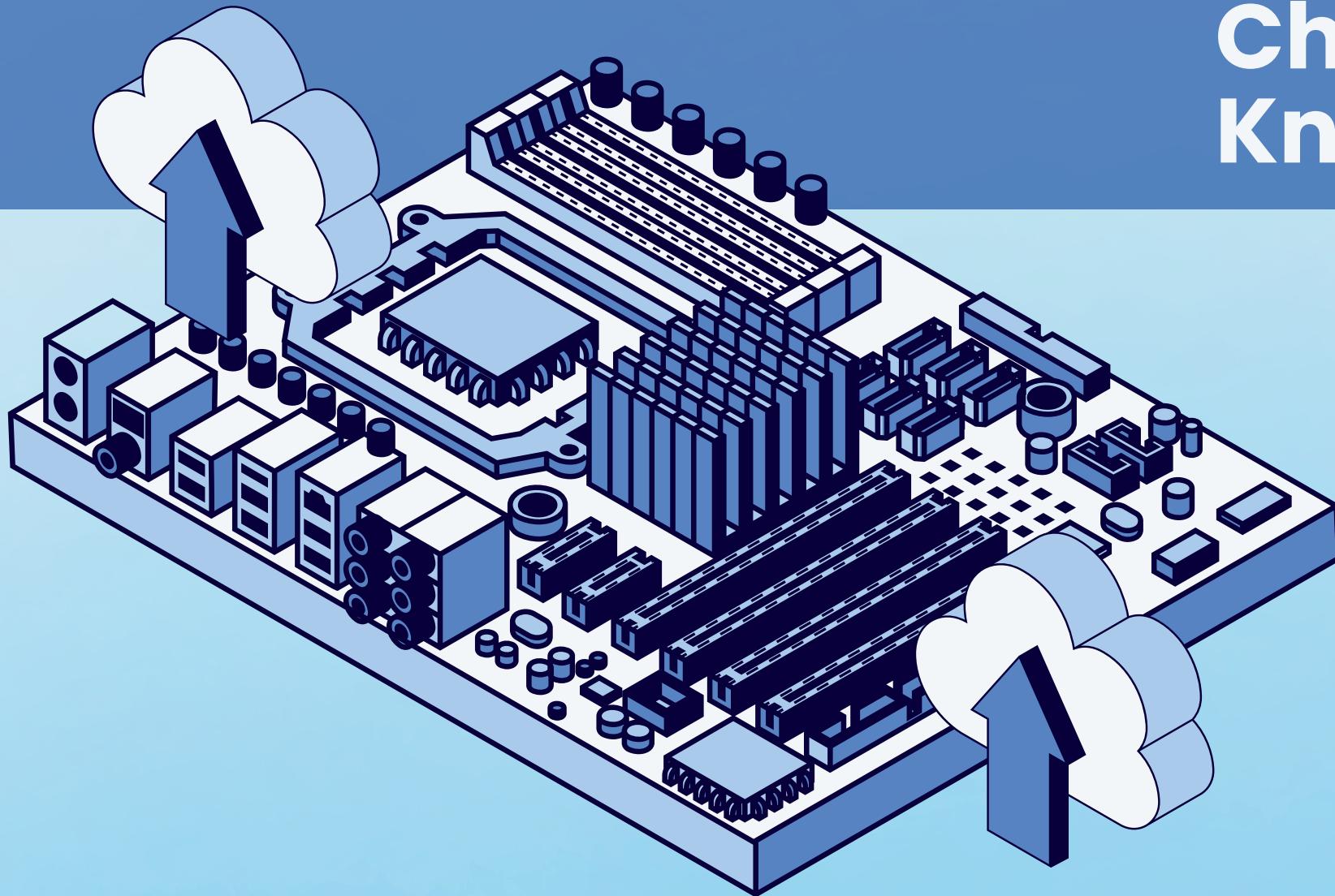
Define the relationships between different entities in the environment (e.g., vehicles, pedestrians, traffic signals).

■ **Logic-Based Frameworks:**

Use predefined rules to determine actions (e.g., stopping at a red light).



Section 3: Case Study Overview



Challenges Addressed by Knowledge Representation

Complex Decision-Making:

AI systems must navigate varying road conditions, traffic laws, and unexpected obstacles.

Real-Time Processing:

Knowledge representation allows for quick interpretation and response, ensuring safe navigation.



Section 4: My Knowledge Representation Model

Problem Statement

- **Problem:** How can an autonomous vehicle effectively identify and respond to traffic signals?

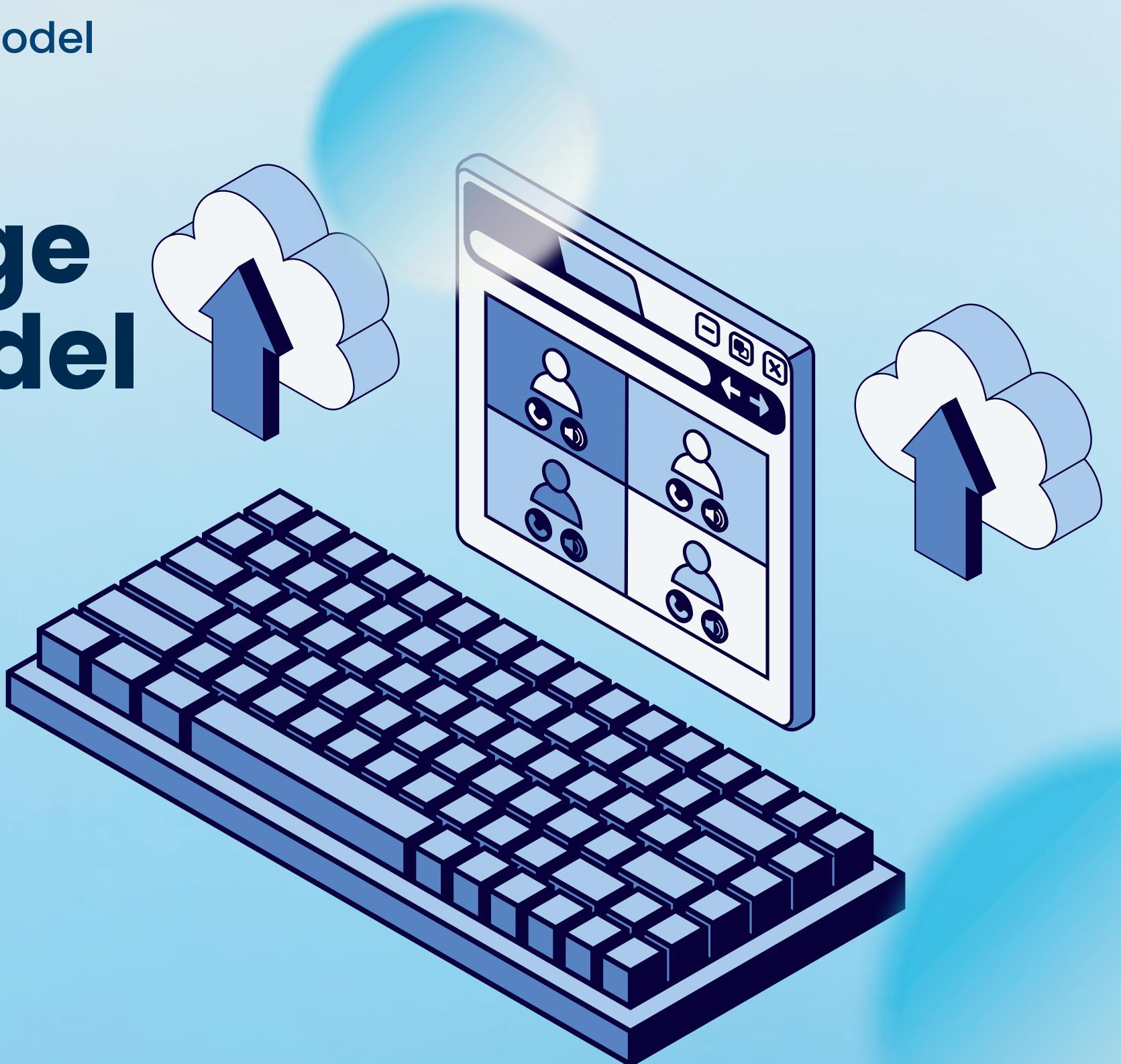




Section 4: My Knowledge Representation Model

Proposed Knowledge Representation Model

- **Model Type:** Logic-Based Framework
- **Goal:** To provide clear and actionable rules for the AI system to follow based on traffic signal input.





Section 4: My Knowledge Representation Model

Traffic Signal Knowledge Representation Model

Traffic Signal Decision Model

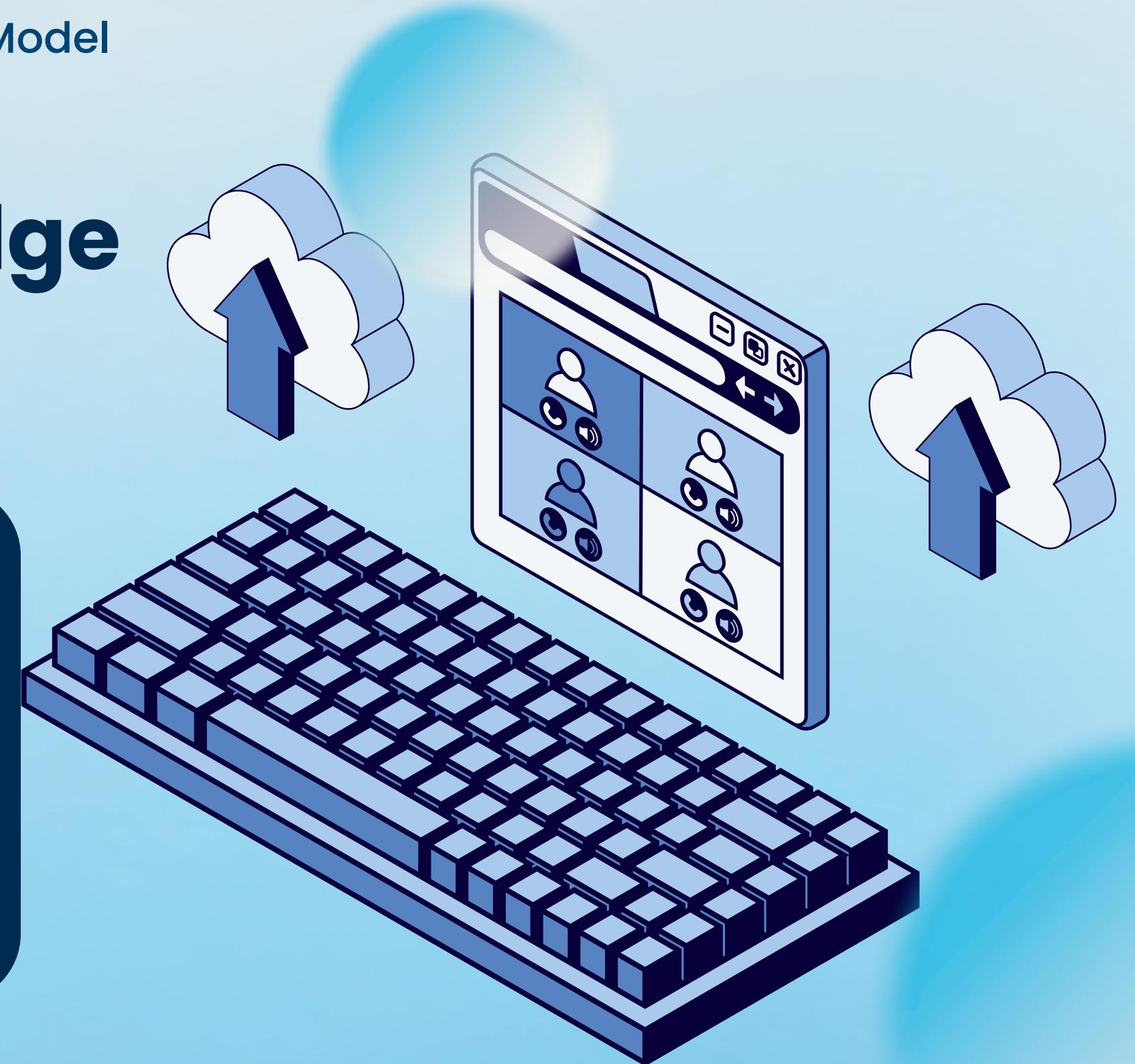
Traffic Signal Input

If the traffic signal matches the color:

Stop

Slow Down

Go





Section 4: My Knowledge Representation Model

How the Model Works

- The AI system continuously monitors traffic signal inputs.
- Depending on the signal color, predefined logic rules determine the vehicle's action (stop, slow down, go).
- The model simplifies decision-making, ensuring that the vehicle responds appropriately in real time.





Section 4: My Knowledge Representation Model

Implementation in Autonomous Vehicles

- **Integration:** This model can be integrated into the vehicle's central control system.
- **Impact:** Enhances the vehicle's ability to make safe and efficient driving decisions.





Section 5: Conclusion

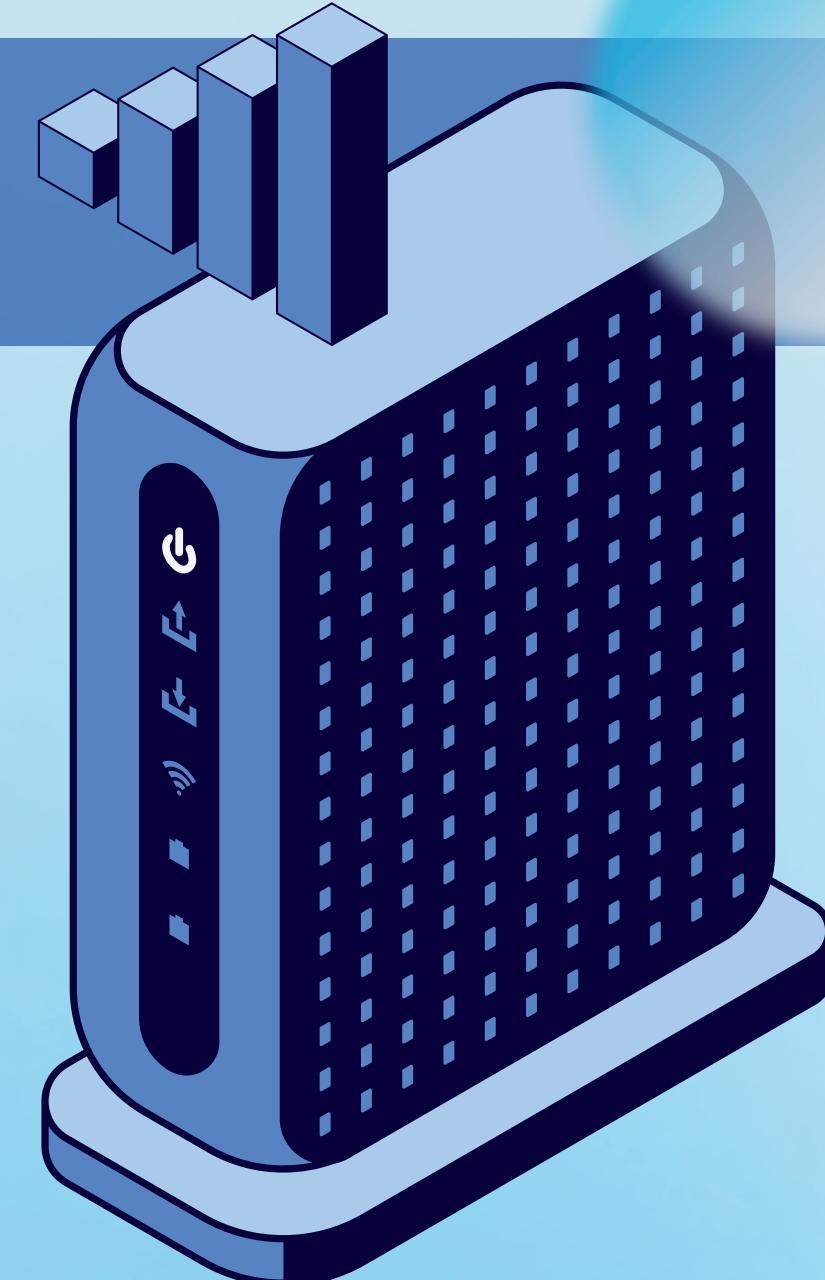
Summary of Knowledge Representation in AI

■ **Knowledge Representation:**

Knowledge representation is a foundational element in AI, enabling systems to interpret and act on information.

■ **Purposes of Knowledge Representation:**

Different forms of knowledge representation serve various purposes, from processing language to making complex decisions.





Section 5: Conclusion

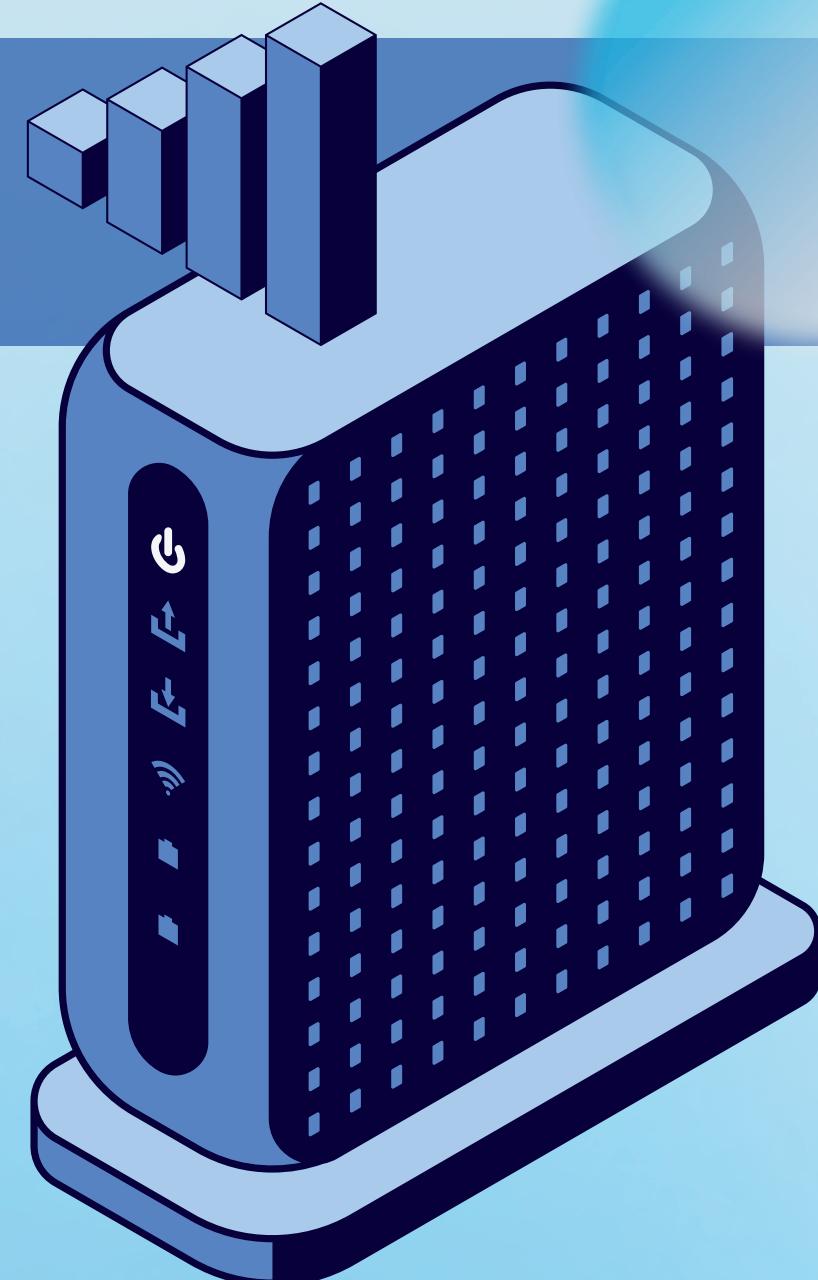
Reflection on the Case Study

■ Significance:

The case study of autonomous vehicles illustrates the critical role of knowledge representation in real-world AI applications.

■ About my model:

The logic-based model presented demonstrates how structured knowledge can guide AI decision-making processes.





Section 5: Conclusion

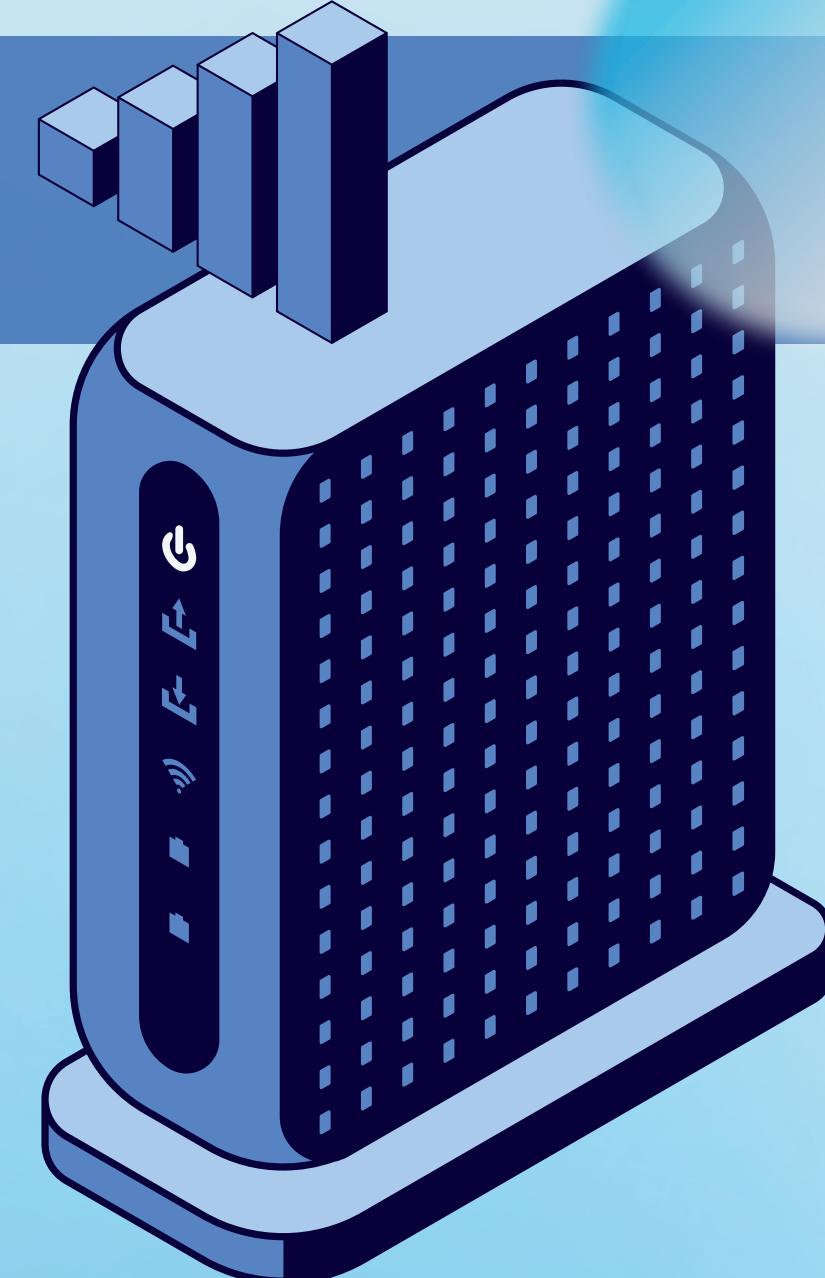
Final Thoughts

■ What I think:

Effective knowledge representation is essential for advancing AI technologies.

■ What I learned:

Understanding these concepts not only aids in the development of AI systems but also provides insights into how machines can simulate human-like reasoning and learning.





Section 6: References

References:

- **Russell, S., & Norvig, P. (2020).** *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson.
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