

# Machine Problem No. 1

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CSST 101

# Introduction to AI and Knowledge Representation

- The goal of artificial intelligence (AI), a branch of computer science, is to build machines that are able to do tasks like learning, reasoning, problem-solving, and language comprehension that normally need human intelligence. The organization and storage of information within an AI system is known as knowledge representation, and it is one of the most important parts of AI. AI can only make sense of complex data, infer, make decisions, and engage meaningfully with the outside world when its knowledge representation is effective. It is the foundation of any artificial intelligence system since it determines how the system interprets and processes data.



# Types of Knowledge Representation

Knowledge representation can take various forms, each with its own strengths, applications, and limitations. Here are three common types:

## Logic-Based Representation:

- Example: Propositional and first-order logic are used to represent facts and rules about the world. For instance, a simple rule might be "If it rains, the ground will be wet."
- Application: Used in expert systems, theorem proving, and natural language processing. Logic-based representations are powerful for reasoning tasks as they provide a structured way to express relationships and constraints.
- Advantages: Provides a precise and unambiguous representation of knowledge, allowing for clear inference and decision-making.
- Challenges: Can become complex when dealing with uncertain or incomplete information.

## Semantic Networks:

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- Advantages: Provides a precise and unambiguous representation of knowledge, allowing for clear inference and decision-making.
- Challenges: Can become complex when dealing with uncertain or incomplete information.

## Frame-Based Representation:

- Example: Frames are data structures that represent stereotypical situations, like a "birthday party" with slots for date, location, attendees, etc. A specific event can fill these slots with relevant data.
- Application: Used in AI systems that require understanding of typical scenarios, such as expert systems or natural language understanding.
- Advantages: Enables AI to represent knowledge in a structured, hierarchical manner, supporting inheritance and default reasoning.
- Challenges: Can be rigid and difficult to adapt to scenarios that don't fit predefined frames.

# Case Study Overview: AI Application Using Knowledge Representation

I chose a medical diagnostic system that employs AI to assist physicians in making clinical choices for my case study. This application uses a combination of frame-based structures and logic-based rules to describe knowledge. Features like test results, treatment alternatives, and symptoms are used to frame medical disorders. On the basis of patient data, logic-based methods are utilized to deduce potential diagnoses.

## Challenges Addressed

- Organizing and converting massive volumes of medical data into insights that can be put to use.

## Challenges Addressed

- Making individualized therapy recommendations based on intricate patient information.

## Challenges Addressed

- Lowering diagnostic mistakes by providing AI-driven recommendations to physicians.

# Your Knowledge Representation Model

I created a straightforward knowledge representation model to illustrate how to diagnose an illness based only on its symptoms. The model combines frames with a rule-based methodology:

- How the Model Works:
  - The model has frames that contain information about diseases, including typical symptoms and treatments, as well as rules that map symptoms to potential diagnosis.
  - For instance, the model compares a patient's symptoms, such as fever, cough, and weariness, to a set of rules in order to deduce possible illnesses like COVID-19 or the flu.



# Conclusion

In artificial intelligence (AI), efficient knowledge representation is essential because it dictates how the machine interprets, processes, and applies information to solve problems. This exercise taught me that all representation strategies have their own advantages and difficulties, and that the representation method selected must meet the particular needs of the AI application. The secret is to organize knowledge in a way that improves the system's reasoning abilities and tackles problems encountered in the real world, regardless of whether it is being used for disease diagnosis or question answering.