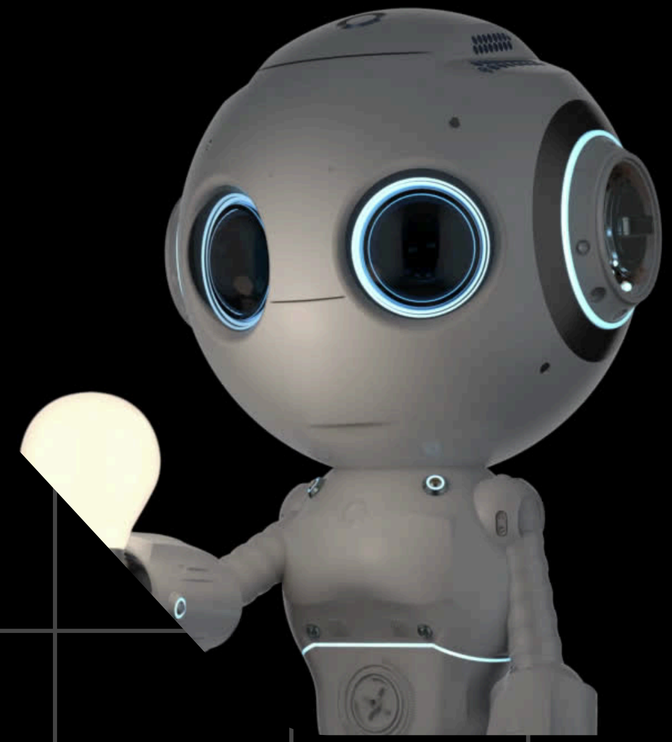
# Artificial Intelligence

THE FUTURE OF WORLD





*Prepared by: Montesa, Rosemarie D.*

# Topic List

Topic List:

- Understanding the Artificial Intelligence
- Three Domains or Forms of Knowledge
- Case Study Selection
- Representation Creation

UNDERSTANDING

# Artificial Intelligence

Artificial intelligence (AI) is the simulation of human intelligence in machines that are programmed to think and act like humans. It is a method of making a computer, a computer-controlled robot, or a software think intelligently like the human mind. AI is accomplished by studying the patterns of the human brain and by analyzing the cognitive process.

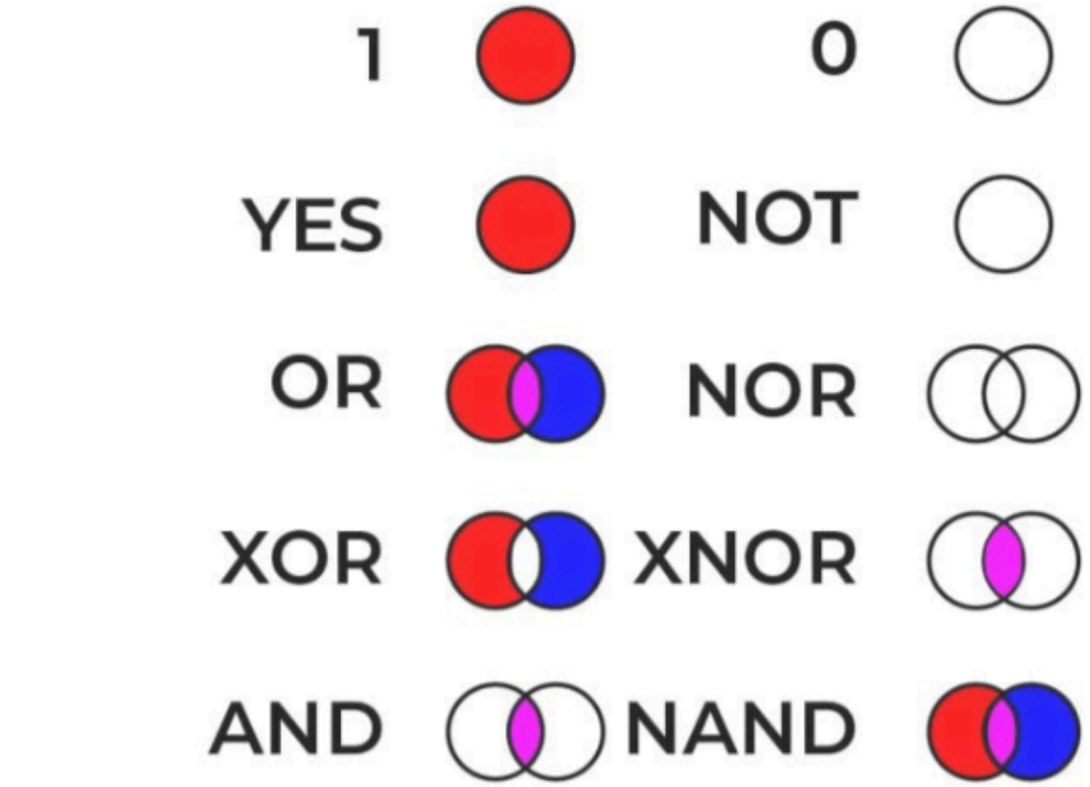
# Three Forms of Knowledge Representation

01

## LOGICAL REPRESENTATION

It is the most basic form of representing knowledge to machines where a well-defined syntax with proper rules is used. This syntax needs to have no ambiguity in its meaning and must deal with prepositions. Thus, this logical form of presentation acts as communication rules and is why it can be best used when representing facts to a machine.

# LOGICAL REPRESENTATION




ANALYTIXLABS

Logical Representation can be of two types:

- Propositional Logic: This type of logical representation is also known as propositional calculus or statement logic. This works in a Boolean, i.e., True or False method.

- First-order Logic: This type of logical representation is also known as the First Order Predicate Calculus Logic (FOPL). This logical representation represents the objects in quantifiers and predicates and is an advanced version of propositional logic.

If you may or may not have noticed by now, this form of representation is the basis of most of the programming languages we know of where we use semantics to convey information, and this form is highly logical. However, the downside of this method is that due to the strict nature of representation (because of being highly logical), it is tough to work with as it’s not very natural and less efficient at times.

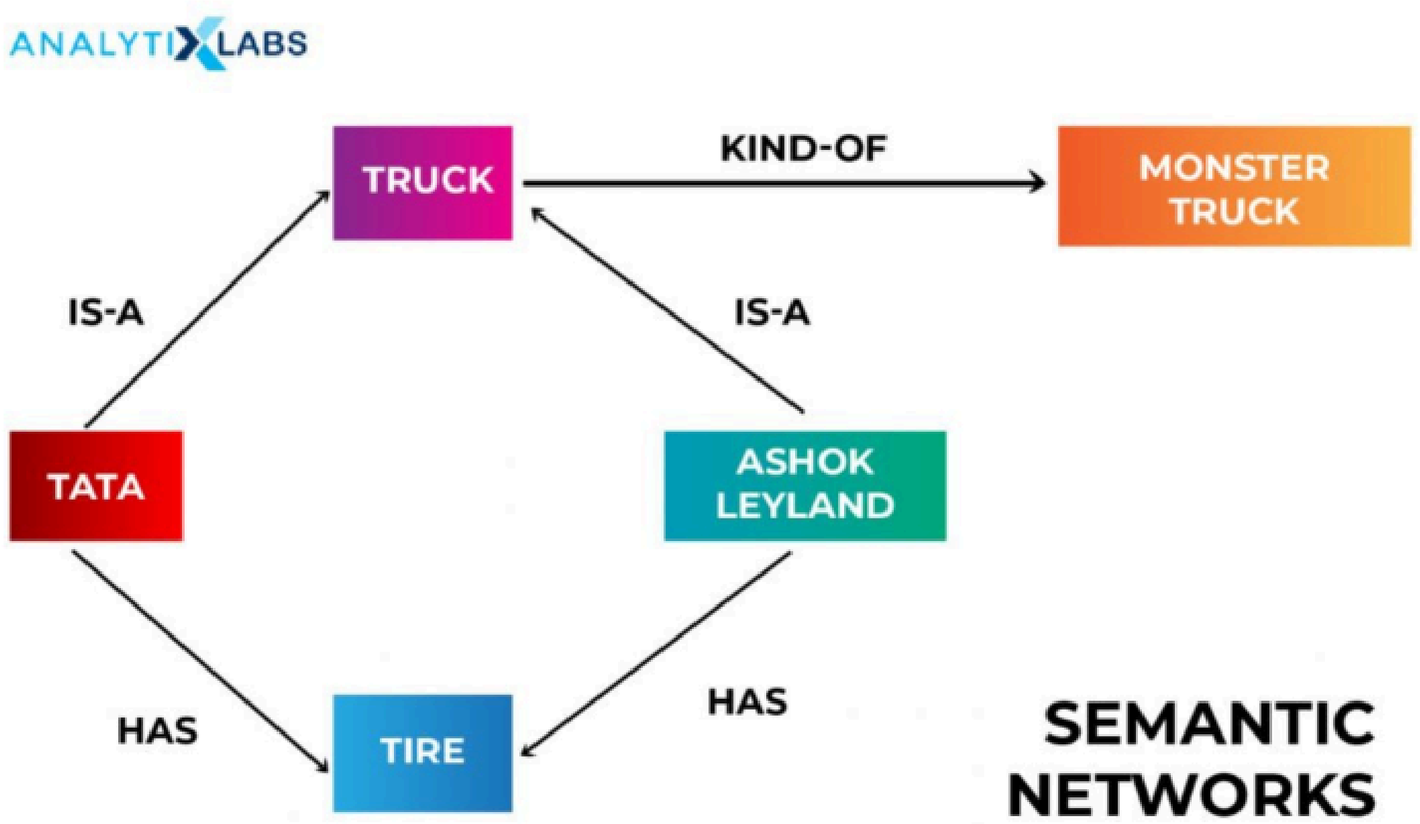
# Three Forms of Knowledge Representation

02

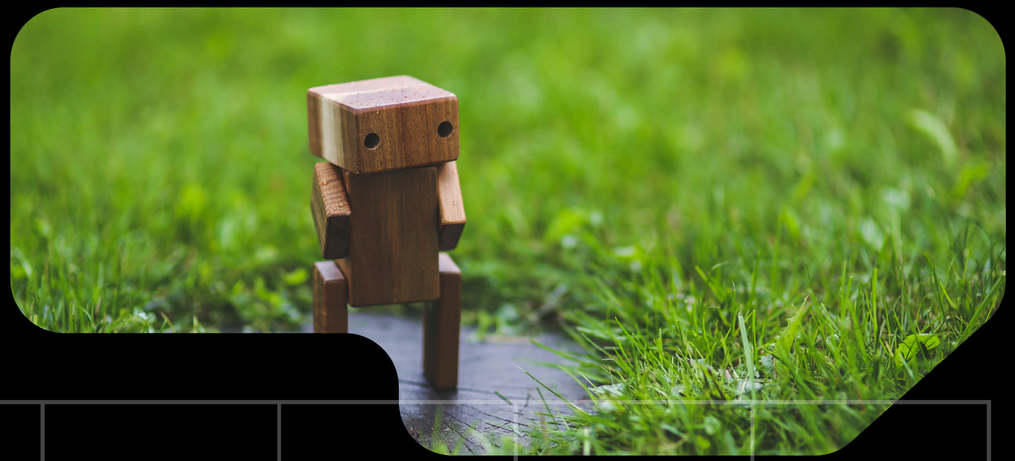
## SEMANTIC NETWORK

A semantic network allows you to store knowledge in the form of a graphic network with nodes and arcs representing objects and their relationships. It could represent physical objects or concepts or even situations. A semantic network is generally used to represent data or reveal structure.

## Semantic Networks



In this form, a graphical representation conveys how the objects are connected and are often used with a data network. The Semantic networks consist of node/block (the objects) and arcs/edges (the connections) that explain how the objects are connected. This form of representation is also known as an alternative to the FPOL form of representation. The relationships found in the Semantic Networks can be of two types – IS-A and instance (KIND-OF). This form of representation is more natural than logical. It is simple to understand however suffers from being computationally expensive and do not have the equivalent of quantifiers found in the logical representation.



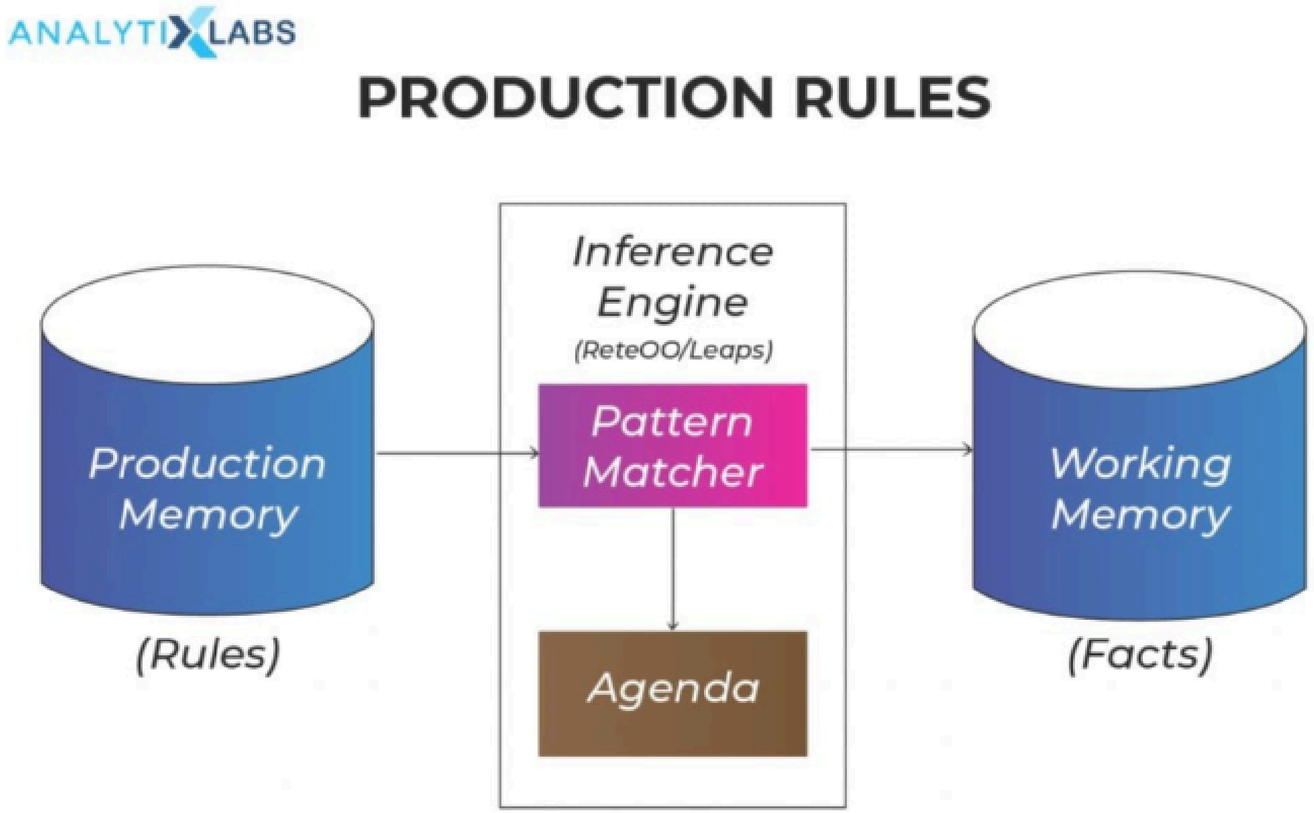
# Three Forms of Knowledge Representation

03

## PRODUCTIVE RULES

It is among the most common ways in which knowledge is represented in AI systems. In the simplest form, it can be understood as a simple if-else rule-based system and, in a way, is the combination of Propositional and FOPL logics. However, a more technical understanding of production rules can be understood by first understanding what this representation system is comprised of.

## Production Rules



This system comprises a set of production rules, rule applier, working memory, and a recognize act cycle. For every input, conditions are checked from the set of a production rule, and upon finding a suitable rule, an action is committed. This cycle of selecting the rule based on some conditions and consequently acting to solve the problem is known as a recognition and act cycle, which takes place for every input.

This method has certain problems, such as the lack of gaining experience as it doesn't store the past results and can also be inefficient as, during execution, many other rules may be active. The cost of these disadvantages can be redeemed because the rules of this system are expressed in natural language, where the rules can also be easily changed and dropped (if required).

# KNOWLEDGE REPRESENTATION MODEL

## Title: Semantic Networks for Medical Diagnosis

Semantic networks represent knowledge using nodes and edges. In this model, nodes represent medical concepts such as symptoms, diseases, and treatments. Edges represent relationships like “symptom of” or “treated by.”

# HOW IT WORKS

Nodes: “Fever,” “Cough,” “Flu,” “Antiviral Medication.”

Relationships:

- “Fever” and “Cough” are connected to “Flu” with “symptom of” edges.
- “Flu” is connected to “Antiviral Medication” with a “treated by” edge.

This structure shows how symptoms lead to a diagnosis and how the diagnosis can be treated.

# HOW IT HELPS AI SYSTEM

- The AI can analyze symptoms to diagnose diseases by following the relationships in the network.
- It can recommend treatments based on the diagnosis, improving the accuracy of medical decision-making.

# CONCLUSION

Importance of Effective Knowledge Representation:

- Effective knowledge representation is crucial for AI systems to understand complex relationships in medical data.
- It enables accurate diagnosis and appropriate treatment recommendations by capturing detailed connections between symptoms and diseases.

# CONCLUSION

Reflection on the Activity

- Building the semantic network taught me that having a clear and organized way to represent knowledge can really boost an AI system’s ability to solve problems, like diagnosing diseases and suggesting treatments.

# Extension Activity

# Research

01

## NEURO-SYMBOLIC SYSTEMS

Neural-symbolic AI is the field that seeks to integrate deep learning with symbolic, logic-based methods, as they have complementary strengths. These systems combine neural networks (which excel at pattern recognition) with symbolic reasoning (which deals with rules and logic).

# HOW IT WORKS

- Neural networks are great for learning from data but lack explainability. Symbolic reasoning, on the other hand, can provide clear, rule-based decision-making.

- By integrating the two, neural-symbolic systems can both learn from data and reason using high-level, interpretable knowledge structures.

# POTENTIAL IMPACT ON FUTURE AI SYSTEMS

- This hybrid approach can allow AI to not only recognize patterns but also explain its decisions in human-understandable terms.

- It could lead to breakthroughs in areas like legal reasoning, where understanding and explaining decisions is crucial, and robotics, where AI systems need to combine perception (neural networks) with planning and reasoning (symbolic logic).

# FUTURE OUTLOOK

- Neural-symbolic systems could be key to creating more general AI—systems that can reason like humans and apply knowledge in a variety of contexts.
- This form of representation may lead to AI systems that are both highly capable and interpretable, making AI more trusted and widely adopted in industries like healthcare, law, and finance.
- This emerging form brings together two powerful paradigms in AI and is seen as a way to bridge the gap between learning and reasoning in future AI systems.

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# THANK YOU.