ARTIFICAL INTELLIGENCE

# Introduction

## AI and its influences

Artificial Intelligence is seeming to be increasingly involved in our everyday lives and rightly so. Throughout humanity we have made tools to optimize our lives, and this Tool is no different. However, AI in of itself is not just a tool but a collection of tools with different purposes. Within this essay we will be focusing on Rule Based AI. What is Rule Based AI? “A system designed to achieve artificial intelligence (AI) via a model solely based on predetermined rules is known as a rule-based AI system.”(Mario Grunitz 2021 – Ref 1.1) . This method of Operation is very successful and hence been used in many formats but its predominant utility is data manipulation Due to its simplicity of implementation and Consistency. This is due to its “if-then” coding statements allowing the user to have full control in the models pre-defined outcomes insofar requiring no form of training.

## AI and a Goal in Mind

With These Utilizations in mind and its predominant strength of data manipulation I believe there is potential for this AI model to have success within the Medical Field more specifically in the use of determining potential patients with heart disease via Common attributions like Age , Chest Pain , Blood Pressure , Cholesterol , ECG and more.

This is due to these attributes having identifiers that can assist with diagnosis via diagnostic data. And as discussed before Rule Based Algorithms Preferred use is Data Manipulation. This Scientific paper will explore how this approach, rooted in clear “if-then” logic can be of enhancement to modern medical diagnostics, potentially offering a practical solution in an already increasingly data driven healthcare landscape.

# Literature Review

Although Rule Based AI is as simple as “if-then” we need to better explore its inner workings as to how it handles these “if then” Operations. This section explores the Essential Components that underpin Rule Based systems.

**1. Rules: The Core Mechanism**

At the core of any rule-based system are the rules, which define the system’s outcome. Each rule follows the general format of:

* **IF** [condition(s)] **THEN** [action].

For example:

* **IF** an individual is tired **AND** it is nighttime, **THEN** sleep.

These rules incorporate logical relationships between conditions and corresponding actions, forming the basis for the systems operation.

**2. Knowledge Base: Repository of Rules and Facts**

To evaluate conditions and execute actions, the system utilizes a **Knowledge Base**, which serves as a repository for two critical components:

* **Rules**
* **Facts**

In rule-based artificial intelligence, Data is denoted as FACTS. For instance, to conclude that an individual should sleep, the system must first verify that the FACTS "tired" and "nighttime" are present in the Knowledge Base and are True.

**3. Inference Engine: Applying Rules to Derive Conclusions**

The process of applying rules to available facts is needed bringing us to the **Inference Engine**, a key component responsible for Conclusions. The Inference Engine functions by iteratively evaluating the conditions specified via the RULES against the FACTS stored in the Knowledge Base.

The Inference Engine can utilize different reasoning strategies to reach a conclusion, such as forward chaining (starting from known facts to derive conclusions) or backward chaining (working backward from a desired conclusion to find supporting facts).

**4. Working Memory: Temporary Storage for Dynamic Processing**

The use of Iteration requires the Inference Engine to use an extra component known as Working Memory to temporarily store current facts.

**5. User Interface (Optional)**

Many rule-based systems incorporate a User Interface (UI) to enable user interaction. This interface allows users to:

* Input new facts or modify existing ones within the Knowledge Base.
* Receive conclusions generated by the system’s reasoning process.

**Benefits of Rule-Based Systems in Healthcare**

Now that we have a firm understanding of rule-based systems, it is essential to explore their application within the healthcare industry. Currently, Rule Based systems are recognized as effective tools specifically in their integration into electronic health records and clinical decision support systems. These systems streamline clinical workflows. However, significant gaps remain in understanding how AI, could be incorporated within the healthcare industry As highlighted by ([Jiang et al., 2017](https://www.sciencedirect.com/science/article/pii/S0952197623000787#b65), [Tekkeşin et al., 2019](https://www.sciencedirect.com/science/article/pii/S0952197623000787" \l "b148)) “ It is all too common for humans to be overlooked when discussing AI’s role in real-world applications”

Within the same scientific paper Kumar emphasizes the potential of AI-driven systems to analyze vast amounts of medical data, transforming them into diagnostic information. This Reflects the diagnostic reasoning by human clinicians, suggesting that rule-based models could effectively mimic human decision making. The resemblance indicates the possibility of constructing rule sets that align with human logic in clinical diagnosis, which is perfectly suited towards Rule Based AI systems

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# Chaining Methods in Rule-Based AI

Forward Chaining  
Forward chaining is a data-driven inference method that begins with known facts and applies rules iteratively until a specific goal is achieved. For example:

* + Fact: A patient has a fever.
  + Goal: A fever indicates the possibility of the flu.

Backward Chaining  
backward chaining is the opposite being a goal-driven approach that starts with a goal and works backward to gather supporting data. For instance:

* + Goal: A fever may indicate the presence of a cold.
  + Fact: The patient presents with a fever.

# Viability of Forward and Backward Chaining

Both forward and backward chaining can be viable in clinical diagnosis, depending on the data available and the diagnostic use. Forward chaining is well-suited for scenarios where observable symptoms need to be linked to potential diagnoses, while backward chaining is useful when a hypothesis-driven approach is needed to confirm or refute specific conditions.

# Hybrid Chaining

A third approach hybrid chaining is another chaining method combining the strengths of forward and backward chaining. Hybrid systems are particularly valuable in complex diagnostic scenarios where both data-driven reasoning and goal-oriented reasoning are required. These systems can dynamically shift between reasoning strategies.

# Machine Learning

Although machine learning is not rule-based, it warrants consideration in the medical domain due to its powerful pattern recognition capabilities. Machine learning models can analyze large datasets to identify patterns and make predictions about future data in this case future patient problems, such as predicting the likelihood of heart disease in patients who have not yet presented with symptoms.

# Methodology

## Support

### Example

### Example

## Support

### Example

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## Support

### Example

### Example

# RESULTS

## Support

### Example

### Example

## Support

### Example

### Example

## Support

### Example

# RESULTS

# DISCCUSION

# Conclusion

## Restate topic

## Summarise three main points

## Revisit introduction or tie all ideas together

## References

### 1.1

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