

Report on Forward Chaining

Introduction to Forward Chaining

Forward chaining is a reasoning strategy used in rule-based expert systems. It is a data-driven approach where reasoning starts from known facts and rules are applied iteratively to derive new facts until a conclusion or goal is reached. Forward chaining is commonly used in applications such as medical diagnosis, troubleshooting systems, and decision support systems.

Objective of the Assignment

The objective of this assignment is to implement a simple yet realistic forward chaining system in C++ that demonstrates how knowledge can be inferred using rules. The system uses a real-life example from medical diagnosis, where symptoms of a disease are used to infer conclusions such as the presence of flu and recommended actions.

Rule-Based Systems and Logic

Rule-based systems consist of a knowledge base (facts) and an inference engine (rules). A rule generally has the structure: IF conditions THEN conclusion. Forward chaining starts with initial facts and repeatedly applies rules until no new information can be derived. This approach is called 'data-driven' because it relies on available facts to progress forward to conclusions.

Implementation in C++

The implementation is carried out in C++ using the following structures: - A Rule structure that contains conditions and a conclusion. - A set data structure to store facts, enabling efficient O(1) lookup. - A forwardChaining function that iteratively applies rules and infers new facts until no further conclusions can be drawn. The system uses a medical diagnosis example with rules such as: 1. IF Fever AND Cough THEN Flu 2. IF Flu THEN RestNeeded 3. IF Flu THEN SeeDoctor

Explanation of the Code

1. Initial facts are provided as symptoms observed in a patient (Fever, Cough, BodyAche). These are stored in a set. Example: {"Fever", "Cough", "BodyAche"} 2. A set of rules is defined where each rule has conditions and a conclusion. 3. The forwardChaining function runs in a loop until no new fact is added: - For each rule, it checks if all conditions are satisfied. - If so, and if the conclusion is not already known, the conclusion is added as a new fact. 4. At each step, newly inferred facts are displayed to provide a trace of reasoning. 5. The process stops when no new facts can be inferred. Example Run: - Initial Facts: Fever, Cough, BodyAche - Rule 1 triggers: Flu is inferred. - Rule 2 triggers: RestNeeded is inferred. - Rule 3 triggers: SeeDoctor is inferred. - Final Facts: Fever, Cough, BodyAche, Flu, RestNeeded, SeeDoctor

Conclusion

Forward chaining is an essential reasoning technique for rule-based systems. This assignment demonstrated how it can be implemented in C++ with a realistic medical diagnosis scenario. The system begins with initial symptoms and infers further knowledge through defined rules until a conclusion is reached. Such systems can be expanded to more complex domains like legal

reasoning, expert advisory systems, and intelligent assistants.