A brief Review on Rule Based Systems

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Abstract

Artificial Intelligence is science of systems which either learn by experience or by perform tasks according to the instructions already fed in their database. Rule-Based Systems are the simplest machines which are bench mark for Expert Systems when it comes to their architecture. It's easy for an organization or a company to design an Expert system if the basics to design a rule-based system are clear in the minds of developers. AI is a discipline of uncertainties if one is trying to define it, but Rule-based systems are simplest form of AI which we are going to discuss in this search paper.

1. Introduction

Rule-based systems are the devices that use information encoded in the form of production laws, better said, artificially intelligent devices. After applying these rules to the input given to it and also using the information database fed into it the system derives result. They are also called Industrial networks. The basic architecture for expert systems and other information-based structures is a rule-based framework.

2. Classifications of Rule Based System

Rule Based System is classified in four classes.

(a) Monotonic learning is not going to substitute a statement with its negation because an entity does not learn the information that contradicts what it already knows or does exist [1]. So, the knowledge base can only expand in a monotonous fashion with new facts.

(b) Non-monotonic learning is when an agent may learn the new information that is in contradiction with what they already know or exist. So, it replaces old information with new if it feels that there is justification enough to do so.

(c) A Partially Commutative Production System is a rule-based system with the property that if the application of a given sequence of rules transforms state x into state y, then any permutation of those rules that is allowable also transforms state x into state y.

(d) A Commutative Output System is both Monotonic and Partly Commutative, rule-based system [3].

The working mechanism of a rule-based system is shown in figure 1.

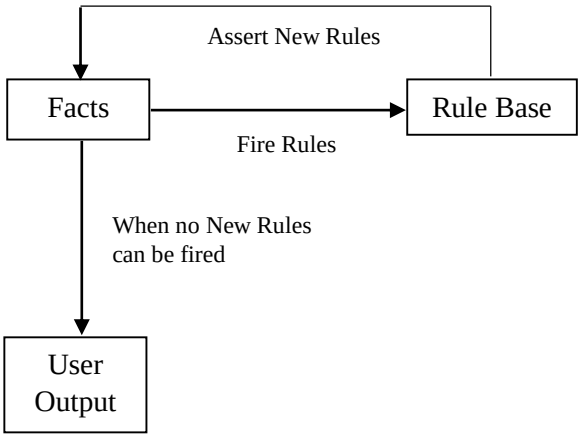

Figure 1. Work Flow of Rule-Based System

3. Architecture

A typical rule-based system has four categorized basic components which explain well its architecture. In this section, discussion will be proceeded by taking the expert MYCIN method as an example. MYCIN lets the doctor prescribe drugs unique to the illness [2]. MYCIN advises itself of individual cases by seeking information on specific cases and asking the physician for details on the symptoms of a diagnosis, general illness, history and findings of laboratory tests that can be obtained conveniently and rapidly. The four basic components are discussed below:

(a) A collection of rules or base of rules that can also be named as a particular form of base of knowledge. Essentially, it is a representation in which:

- There are Application-specific symbols and Pattern symbols
- Patterns are structures which consist of application-specific symbols and pattern symbols, and rules consist of patterns.
- Rules symbolize constraints that enable procedures to seek new assertions or to validate a hypothesis.

  It also consists of constructors that:
- Construct a rule, given an ordered list of LHS's patterns and a RHS's patterns.

  Consists of Set of readers that:
- Produce a list of a given rule's LHS's patterns
- Produce a list of a given rule's RHS's patterns

(b) An inference engine or semantic reasoner that infers knowledge or takes action based on input and rule base interactions. The inference engine accepts user input queries and answers to questions through the I / O interface and uses this dynamic information along with the static knowledge stored in the base of knowledge [4]. The knowledge in the base of knowledge is used to draw information about the current case or situation as provided by feedback from the user.

The method of inferring is practiced recursively in three stages:

- Match
- Select
- Execute

The production system inference cycle is as shown below:

Rule-based system that works from given assertions to new deduced assertions follows Forward Chaining. Backward Chaining is also possible. A rule-based system can form a hypothesis and use the antecedent-consequent rule to work backward toward hypothesis-supporting assertions.

MYCIN's pool of knowledge consists of approximately 500 antecedent-consequent rules, which give MYCIN the ability to recognize about 100 causes of bacterial infections. MYCIN is a backward-chaining system, because physicians prefer to think about one hypothesis at a time. A forward-running system can jump around, working fast toward one conclusion and then toward another, seemingly at random.

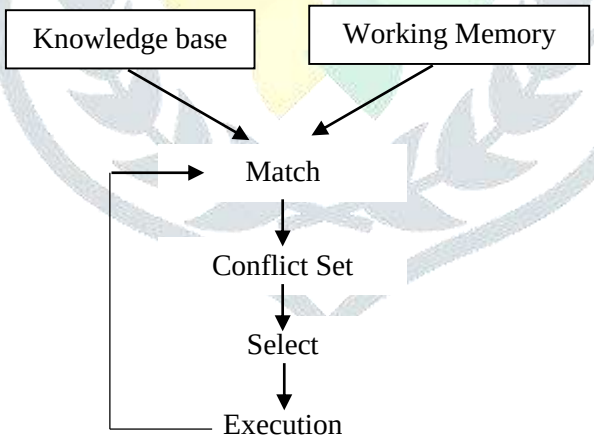

Figure 2. Production System Inference Cycle

(c) Temporary working memory is the functional component of short-term memory in the interim includes the creation, retrieval, storage and compilation of information in the system. Working memory performs functions of intensive control or manipulation of the associated information or behaviors. This is a scientific term within the neuroscience and cognitive psychology [5]. There are hypotheses about both the theoretical nature of working memory and the role of particular parts of the brain

involved in working memory. Studies often recognizes that the frontal cortex, parietal cortex, anterior cingulate and portions of the basal ganglia are essential for the functioning of memory

The neural basis of working memory has usually been derived from animal lesion studies and realistic imagery on humans. There are application-specific symbols and pattern symbols within Temporary Working Memory. Assertions are lists of specific application symbols, and patterns are lists of specific application symbols and pattern symbols. In some world the assumptions represent truth. Builders add statements to working memory. Readers, given a sequence, generate a list of the corresponding statements in working memory.

(d) User interface or other external link from which input and output signals are received and sent. The input-output interface helps the user to interact more easily with the program by allowing the use of simple menus of selection or the use of a language that is similar to a natural language. That means the program has to have special prompts or specific vocabulary that encompasses the domain expertise's given terminology. The system building stage includes the prompts written, in the Standard English. In addition to numerous common words, MYCIN may understand other medical terms needed to communicate. Has a vocabulary of almost 2000 words for this MYCIN. The commercial PC version of the MYCIN architecture, Personal Consultant Plus, uses menus and English prompts to interact with the user. How and why are exceptions given in natural language form as well. MYCIN is a backward chain framework, which simplifies the development of an English-speaking GUI. The code must deal directly from the triggering combination of answers to specific questions, rather than with free-form, creative text.

4. Characteristics

Rule-based systems vary in many important levels from traditional computer systems.

(a) Such systems use information to guide the solution mechanism rather than data and much of the information used is heuristic in nature rather than algorithmic.

(b) The information is encoded and held as a separate entity from the control system. It enables the gradual introduction and alteration of the base of information without recompiling the control programs.

(c) Such systems are able to clarify how a specific decision was drawn, and why the information requested is needed during consultation [3]. This is important, because it gives the user an opportunity to access and appreciate the analytical capacity of the system, thus raising the trust of the user in the system.

(d) Expert systems use symbolic representations for information and execute their inference through symbolic computations which closely resemble natural language manipulations.

(e) Metaknowledge is also argued by the expert systems. We reason with knowledge about themselves, and limitations and capacities of their own experience.

5. Conclusion

There are many aspects which categorize rule-based in a different category from that of simple computer systems. They are more skillful than human experts as they can possess more knowledge than human experts as well as they can process it at a faster pace. The workers performing tasks via them can better understand the problem as they have dearth of knowledge with them. They have come up with new services that were not possible with simple systems. The services could be any like diagnostics. A new processing media and communication channel for knowledge. They provide more updated and more efficient education as they provide the largest possible database of knowledge. These are machines can quickly adapt the changing conditions. The chapter discusses the classification, architecture and characteristics of a rule-based system.

6. References

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