A Soft Computing Approach For The Architecture of An Expert System Shell

Scholor
Chander Kumar

Supervisor
Dr. Khurram Mustafa
Reader, Deptt. Of Comp. Science
Jamia Millia Islamia
Co-Supervisor
Dr. A.K.Sharma
Prof. & Head (Comp. Engg. Deptt.)
YMCA Instt. Of Engg. Faridabad

The expert systems use knowledge to solve problems in a narrow domain, which normally require human intelligence. They act as intelligent assistants to human experts and assist to people who otherwise do not have access to the expertise. This is in contrast to the conventional programs which process data using algorithm to find numerical results. The knowledge required for the expert systems is received from the domain experts.

Since the experts are humans, their expressions more often are moderated by the terms such as *may be, could be, low, high, very high*. These imprecise terms can be easily managed using soft computing techniques especially fuzzy logic. Therefore, fuzzy logic is a potential tool for developing the expert systems.

The expert systems process knowledge in the form of rules and use symbolic reasoning to solve problems. The rules being independent pieces of knowledge, it is quite difficult to understand how individual rules contribute to the overall inference process. Since, the logical interaction between the rules is opaque, it becomes a difficult task to build and maintain a complete and consistent large set of rules. This leads to many types of structural defects such as circularity, redundancy, unreachable goals, conflicts and deadends especially when the rule base is large. A large rule base also suffers from the side effects when subjected to the validation process.

The use of fuzzy logic in expert systems puts a pressure on its performance. The reason being that when a fact maps to overlapping zones of fuzzy sets, it has to be matched with multiple rule antecedents. Nevertheless, a fuzzy fact has to be properly asserted by firing all those rules where it exists as a consequent. Therefore, the designers of the fuzzy expert systems make a trade off between the true spirit of the fuzzy logic and speed of inference.

This thesis proposes a solution to the above problems in the form of an embedded fuzzy rule base frame architecture. The proposed scheme decomposes the total domain into a set of sub-domains. A small rule base, called local rule base, representing a sub-domain is embedded into frame itself. The inference mechanism marks a set of frames depending upon the initial facts/ query submitted by the user. The conflict resolution strategy selects a frame which is used to provide the fine tuned inference about the sub-domain. This leads to context dependent search, saving of search time and hence a faster inference. A compact representation has been used to represent the rule. The representation eliminates the search within the rule. Moreover, the local rule base can be designed as per the specific requirements of the sub-domain. This leads to a credible inference.

A mechanism has been proposed, which uses dependency graph to construct local rule base within the frame. This mechanism minimizes the chances of occurrence of structural defects. It also helps in partitioning the frame rule base into various sections enabling the expert system to assert all the fuzzy intermediate and output variables within a single scan of the frame rule base. Thus, making the fuzzy expert systems as fast as their non fuzzy counterparts.

The proposed work also provides a mechanism to transform an existing expert system into the embedded rule base frame architecture. The transformation eliminates the structural errors from the rule base and helps

in the effective validation of the expert system input/ output without side effects.