

Review On Intelligent Law Based Working Systems

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Abstract: There are many laws which are developed for the citizens of India. It is possible that all the people may not have enough knowledge about the laws which are developed for their benefit. In most of the case, the person needs to approach a professional for getting advice on the legal matters due to lack of information and knowledge. This paper aims at the discussion on the fuzzy inference system and the needs to develop the system for the law-based suggestion. Also, some other systems based on similar domain and technology are being discussed.

1. INTRODUCTION

FUZZY INFERENCE SYSTEM (FIS):

Fuzzy Inference System can be considered as the base component of the fuzzy logic system. There are many other ways in which FIS can be denoted like fuzzy associative memory, fuzzy rule-based system, fuzzy model and fuzzy expert system. The development of such a system is done for decision making, and it is possible by formulating the rules using FIS. The rules are supporting decision making and can be made using "IF...THEN" statements and the connectors like "OR" or "AND". The output which will be generated by the system will be fuzzy in nature irrespective of the type of input which can be fuzzy or crisp [1].

WORKING OF FIS:

Fuzzy inference system is divided into five functional units like the fuzzification interface, rule base, decision-making unit, database, and defuzzification interface. Each unit has different functionality and working which is discussed below [1], The fuzzification unit takes the input as crisp values or fuzzy values and compares those values with the membership functions which are developed and stored in the database for getting the membership value. For each linguistic label, there will be different membership value which will show the degree of membership of label to the function. It can be said that this unit converts the crisp data into fuzzy data [1]. The next is the rule base which contains all the IF-THEN rules which are to be applied in the process of decision making. All the rules define the criteria's, which are supporting the decision-making process [1]. The database will be containing all the membership functions of the fuzzy sets, which will be applied as fuzzy rules [1].

The main part of the fuzzy inference system is the decision-making unit which will fire operations over the data using the rules and will give output in the form of a decision [1]. The last unit of the fuzzy inference system is the defuzzification unit which will convert the fuzzy data back into corresponding crisp data [1].

2 RELATED WORK

Till date, there are many domains for which fuzzy logic is being used, but some of the best systems developed for the particular domain of discussion, i.e. legal domain are discussed.

2.1 ASHSD-II A computational model for litigation support

The system is developed by Kamalendu Pal and John Campbell, which is using rule-based and case-based reasoning methods. It is developed for the matrimonial home settlement cases of UK. The architecture which is being followed by system is shown and discussed below [2],

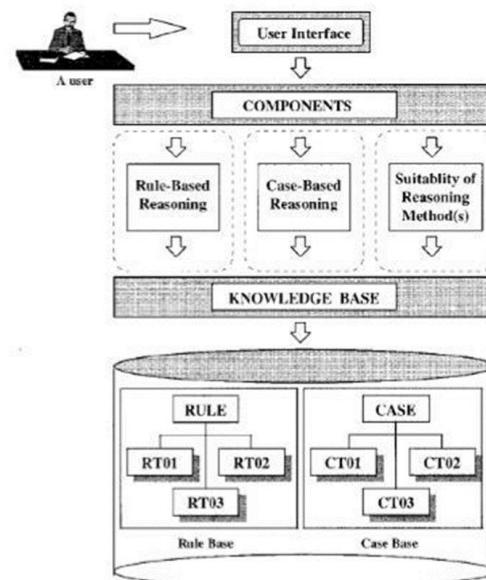


Fig. 1. ASHSD-II Architecture [2]

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While using the system, the user is given the option to select any one from the rule-based, case-based or suitability reasoning methods. For the rule-based option being selected, the system will provide the output again on the basis of two criterions. In rule-based reasoning method, the result is provided on the basis of the exact rule which will be described

in the legal documents and the second way is to provide the result based on the expected judgment from the available options. In case-based reasoning, the result is generated on the basis of previous similar cases which are available as reference. The third is to select the reasoning method, which is most suitable for the case will be applied [2].

2.2 CHIRON

The system was developed by Kathryn E. Sanders and is using case-based and rule-based reasoning. It is developed for the tax-based law and codes of the US. The architecture which is followed system is shown and discussed below [3],

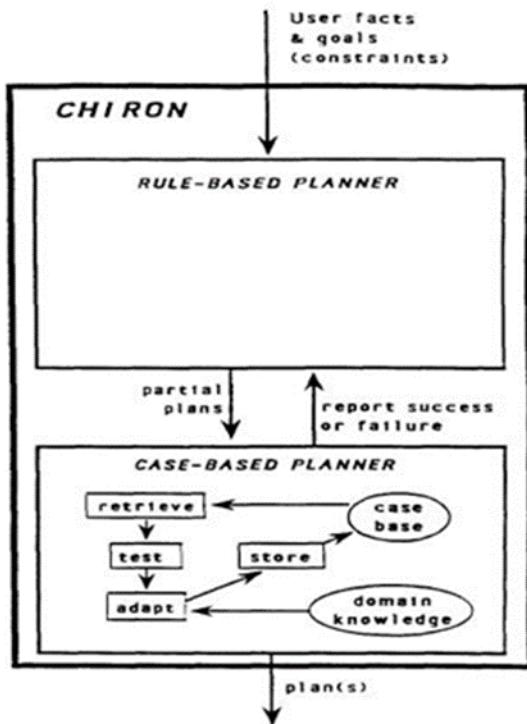


Fig. 2. CHIRON Architecture [3]

The system will take input from the user and will send the data to the rule-based planner, after applying rules the partial plan is developed and forwarded to next step in which the plan will be tested and if required rule case-based embeddings will be done, and the final plan will be developed. The plan will be presented to the user, if the user is satisfied and accepts the plan than the system will stop working else, it will continue to make plans till the user is not satisfied, or all the possibilities for the development of the plan gets over [3].

2.3 JUDGE

The system was developed by William M. Bain and is using rule-based reasoning similar to case-based reasoning. It is developed for the criminal laws of Australia, Brazil, Canada and USA. It will work in a similar fashion as an original judge works while working on any case. When the new case is given to the system as input, the system will start the work on the basis of the rule which will be provided and will move to the older cases for developing a new rule. Even though it is said to be following a rule-based approach, but it works in a way similar to the case-based approach [4].

2.4 SPLIT-UP

The system was developed by Andrew Stranieri and John Zeleznikow. It is using a rule-neural hybrid system. In the rule neural hybrid system, there are twenty neural networks integrated with fifteen rule sets. It is developed for the divorce cases of Australia. The use of the neural network is to deal with the difficulty of the reasoning steps for this particular domain. The tasks are first divided into sub-tasks and are checked, some sub-tasks employ the ruleset, and the left sub-parts will use the neural network. Basically, the neural network is used for providing the conclusion from the arguments and data provided in support of arguments. The rule base can be used for providing the provide explanation for the training set developed from the real-world data. In this system, the arguments are collected from applicants, and the best solution for the separation with the distribution of the property is provided [5].

2.5 TAXMAN

The system was developed by L. Thorne McCarty. It is using only rule-based reasoning method. It is developed for the corporate tax laws of the USA. The user will give all the inputs in detail about a corporate organization, and it checks if the organizational transactions are qualified for the tax-free treatment. The process starts with the introduction of data in the system using the forward chaining technique and expanding to a greater level of detail. After getting all the level of details, it will start backward chaining to check if the facts generated are satisfying all the provisions as per the revenue code [6].

3 METHODOLOGY

There are many different components which are needed for the development of the expert systems like the knowledge base, inference engine, and the user interface [1]. The knowledge base will be collecting many things like the rule base in which all the rules related to the domain will be stored, all the local documents which can be used as a reference in the system, the expert advice and opinions, the reference of web and the definitions of membership functions [1]. The main unit which will be responsible for the decision making will be the interface engine. The type II fuzzy inference will be used for getting the most accurate result. It will have a fuzzification unit which will convert the crisp data into fuzzy data and will be sent to the decision-making unit. The rules which will contain all the if-then rules which will help to improve the decision quality. The rules will be applied to the decision-making unit [7]. The output generated will be of type 2 fuzzy set. The type 2 fuzzy set will be converted to type 1 fuzzy set using the type reducer. There are many methods which can be separately or combinedly used for the type reduction. The last step is to convert the type 1 fuzzy set to crisp data using the defuzzifier [8]. The last is the user interface which will be designed for the best interaction possible between the users and the system. The design should be made in a way that the most efficient use of the system can be made by the user. While the development of the expert system, the most difficult task is to make the knowledge base which must be accurate, correct and sufficient. In the following case, the collection of knowledge is an evolving process which will be consisting of many steps like referring the books, interacting with the lawyers, developing questionnaires, and interviews. The architecture which will be followed for the development of the

expert system will be as shown in the figure below,

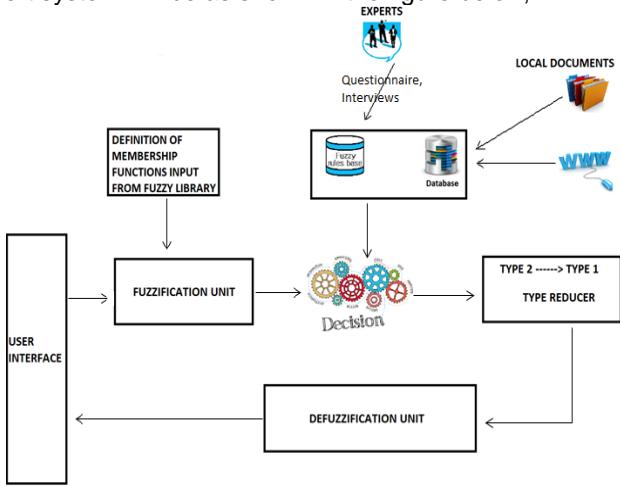


Fig. 3.

Development of any system will require some list of steps which are to be followed, which is generally known as a procedure. After analyzing a lot of things and all the criteria's, the procedure was designed for the development of the system. All the step which are listed needs to be followed in great detail. The first requirement is to study all the concepts related to the expert system and the concepts which are to be taken care of in the development of such systems. The next is to understand the domain in detail which will be going through the books and materials available as well as the questionnaire, interview and discussions with the lawyers of the particular domain. The use of the understanding of the knowledge is very important for the development of rules which will be used in the decision making. The rules are always required to be incorporated in the expert systems which will be helping in the decision-making process. The last will be the development of the final system including the user interface.

4 CONCLUSIONS

All the law-based domain consists of the rules which are converted into code to be implemented in the expert system. Generally, people are not having good knowledge of legal practices and rules. People have less knowledge and maybe misguided by the experts for any of their intentions, and so such systems can help those people. The reason for developing the legal expert system is for layman's who can help themselves instead of going to the lawyers for normal legal matters and conditions. All the domain cannot be covered in such kind of the systems as the enforcement of the law, and the decision was taken are different for each and every domain.

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