Survey on Fuzzy Expert System

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Abstract—Expert Systems are a computer software application whose strength is lies in knowledge base and knowledge is acquired from human experts and other source by knowledge engineers, which has the ability to replicate the thinking and reasoning capacity of human being based on some facts and rules present on it. Expert Systems provide an expert view of a problem in a specific domain area by accepting the input from user. But, the input gathered from human are uncertain and ambiguous in nature. As, fuzzy logic is able to handle the uncertainty and ambiguous data, so it is used in expert systems. This paper provides an overview of fuzzy expert systems that have been developed in diverse area and the techniques of reasoning of fuzzy logic used in expert systems.

Keywords—Artificial Intelligence, Expert Systems, Fuzzy logic, Reasoning, Rule.

I. INTRODUCTION

The field of Artificial Intelligence (AI) is concerned with methods of developing systems that display aspects of intelligent behavior. [1] There is much application in Artificial Intelligence; one of the most important applications is expert systems. Expert systems which have their respective domain knowledge which is used to concern with the problem in that specific area and on the basis of reasoning on a data, give their expert view. Expert Systems are a software application used to take an expert view in the absence of a human expertise. As human expertise in a particular domain is rarely and not able to present everywhere, so in that cases the software application of expert system is helpful.

II. EXPERT SYSTEM

To solve the real world complex problem there is need of expertise, as it is not possible that, everyone is expert in every field. The expertise give there expert view by using their reasoning capability as they have knowledge in particular domain area. As, It is not possible that expertise are present anywhere, any time, so to overcome this problem expert systems came into existence.

The strength of Expert Systems lies in knowledge base and organized collections of facts and heuristics about the system domain.

Expert Systems build the knowledge in knowledge bases from which conclusion are to be drawn by the inference engine and knowledge acquired from human experts and other source by knowledge engineers. [2]

![Fig.1: Components of a typical expert system][2]

Fuzzy logic, introduced in the year 1905 by Lofti A.Zadeh, which states that the principle of complexity and imprecision are correlated.

Fuzzy logic is a new concept to deal with reasoning that is approximate rather than precise. Fuzzy logic is completely opposite to crisp logic that deals with precise values and has truth values 0 and 1, while fuzzy logic mainly operates on the concept of membership which takes the truth values that ranges between 0 and 1.
The membership function is fuzzy logic is based on the probability theory to show that, how much change occur of that particular event.

Fuzzy logic system is used to solve the real world complex problem as it is able to deal with imprecise and vague data. As show in above figure 2, Fuzzy logic system take the input which may be imprecise and vague and applied reasoning that is approx, rather than precise and as a result give their decision.

Ambiguity increases the complexity that arises from the uncertainty in the data and tries to find some methodology, to solve such problem. Henceforth, the growth of fuzzy logic approaches to handle the ambiguity and uncertainty existence in the complex problem. [2]

IV. LITERATURE REVIEW

“A Methodology Based on an Expert Fuzzy System for the Selection of the Architecture, Technology and Characteristics of a Domotics System”

R. Mayo Bayon, F. Mateos Martin, L. Reina Ortega, B. Fanjul Vina, A. Robles Alvarez, A.M. Lopez Rodriguez. In [3] author deal with fuzzy expert system to help the different sectors involved in construction to find a rational use of the building installations with energy savings. Author using a software tool called Fuzzy CLIPS to make and expert system based in fuzzy logic. The basic idea represent is determining the functionalities, that client wants to control and analysis in detail the physical and spatial characteristics of buildings. Expert system take the user input which is categories into different group like type of building, state of building etc. and then the expert system will make a list of fuzzy intermediate concept like maintenance, cost value and so on. Also domatics system automatically control some functions and also give some preference selection in some area and produce final result using comparative tables and diagrams but the result were not reliable for the big amount of available technologies.[3]

“A Flexible Fuzzy Expert System for Fuzzy Duplicate Elimination in Data Cleaning”

Hamid Haidarian Shahri & Ahmad Abdollahzadeh Barforush In [4] author proposed fuzzy expert systems for detection and elimination of fuzzy duplicates to clean the data gathered from different sources. Author suggests the sorted neighborhood method (SNM) in which key is created for each tuples such that the duplicates will have similar keys. The tuples are sorted using the key and finally a window of size w slides over the sorted data and performing n (w-1) comparison where n is total no of tuples after comparison the duplicate of record is detected. System use fuzzy rules to specify the criteria for the detection of duplicates. For reasoning author suggest the Mamdani method of inference in which the consequent variable is fuzzy set & rule ends with probability value. The system is very flexible and domain depended and obviously domain knowledge helps the duplicate elimination process. Domain knowledge is representing in the form of fuzzy rules which resemble human way of reasoning under vagueness and uncertainty. These fuzzy IF-THEN rules are simple structured and manipulate. For implementing the system they use Borland C++ Builder Enterprise suite and Microsoft SQL Server 2000 are used.

“Yarn Strength Modelling Using Fuzzy Expert System”

Abhijit Majumdar, Ph.D., Anindya Ghosh, Ph.D. In [5] author deals with modeling of ring spun cotton yarn strength using a simple fuzzy expert system. A MATLAB (version 7.0) based coding is used to execute proposed fuzzy expert system. The system takes the four input parameter of cotton fibers namely fiber bundle tenacity (cN/tex), HVI mean length (mm), micronaire and AFIS short fiber content (%) from the user. Now, Fuzzy linguistic rules provide quantitative reasoning that relates input fuzzy sets with output fuzzy sets. A fuzzy set consist of a fuzzy IF-THEN rules and use two form of membership function (Gaussians & Triangular) where tried for input & output. Theoretically there could be 81 fuzzy rules and each of them having three linguistic levels. However, the simplify the expert system only 36 fuzzy rule were developed and the output of each rule is also a fuzzy set which is aggregated into a single fuzzy set known as aggregation. Finally, the resulting set is resolved to a single crisp number by defuzzification. In Future try to incorporate more input variables in the expert system so that the modeling accuracy could be enhanced.
“Human Disease Diagnosis Using a Fuzzy Expert System”

Mir Anamul Hasan, Khaja Md. Sher-E-Alam & Ahsan Raja Chowdhury In [6] author describe a project work of fuzzy expert system for diagnosing the human diseases, which used to exchange the health information between health care professionals and patients. Author makes a comparative analysis to identify which symptoms are major symptoms for particular diseases, then the uniform structure is made mathematical equivalence is formed which will be used to diagnosis by the fuzzy expert system. Based on the selection of problem area, expert system give symptom from which user needs to select symptoms. Now user has to answer some question that based on the knowledge and add some catalyst factor than on the basis of IF-THEN rule the expert system computes the probabilities of problem diseases and filter before showing.

“Application of Expert System with Fuzzy Logic in Teachers Performance Evaluation”

Abdur Rashid Khan, Hafeez Ullah Amin, Zia Ur Rehman In [7] author deal with expert system used to evaluate the teachers performance. In the development on intelligent expert system the knowledge acquisition toll is developed for the teacher assessment problem. Author have extracted a set of 99 attributes from literature data & divided into 15 groups and on the basis of experienced subject experts, the attributes are ranked means which attributes effects more the teacher performance get the highest weight ranked. By using IF-THEN rule the above main attributes with its sub factors the knowledge is represent and concept of fuzzy set and the membership functions to map the linguistic characteristics of teachers performance that either ranked high, very high etc. After completion of input data the fuzzy expert system used to scale to rank the three cases A, B & C and calculate numeric result of the three cases from qualitative input data map the numeric value into the linguistic output such is poor, satisfied, good etc.

“Fuzzy Expert System for Diabetes using Fuzzy Verdict Mechanism”

M. Kalpana, Dr A.V Senthil Kumar[8] In this paper author deal with fuzzy expert system which construct large scale knowledge based system effectively for diabetes. The PIDD (Pima Indians Diabetes Database) is first retrieved from the internet to become the experimental database. According to the American Diabetes Association & OGTT five attributes i.e. Glucoses, 2-hour serum insulin (INS), Body mass index (BMI), Diabetes pedigree function (DPF), & age are selected as the input fuzzy variables of the adopted fuzzy rule-based inference system.

To explain, how the system work author proposed a algorithm of verdict mechanism which have 6 step. Step1, take input for all the five attributes. Step2 set the triangular membership function. Step3, first it built the fuzzy number for all the 5 attributes of input set then built the fuzzy number for diabetes mellitus (DM) for the output set. Step4, the fuzzy inference are execute by Mamdani’s method, in which input the rule as {Rule 1,2…k} and calculate the matching degree of rule with OR fuzzy disjunction are calculated for fuzzy input set and then calculate the aggregation of the fired rules having same consequences for fuzzy output set DM. Step5, defuzzify into the crisp values and finally in step6 present the knowledge in the form of human nature language. The proposed fuzzy expert system implemented with the MATLAB.

“Fuzzy Knowledge based System with Uncertainty for Tropical Infectious Disease Diagnosis”

Putu Manik Prihatini & I Ketut Gede Darma Putra In [9] author deal with two problem and to solve the problem use fuzzy logic methods to handle the uncertainty experienced by the patients symptoms and the certainty factor method is used to handle the inability of an expert in defining the relationship between the symptoms of disease with certainty. Author makes a knowledge acquisition which is obtained for the seven diseases, and consists of 22 symptoms and 6 symptoms from syndrome and laboratory and also proposed a model. A rule based system used, to distinguish a single syndrome among same symptoms for several diseases and also add the certainty factor before give the final result. They use SQLyog community edition to build knowledge base, Macromedia Dreamweaver 8 with PHP and java script to build the application and CSS to design the interface.

“A Novel Web-based Human Advisor Fuzzy Expert System”

Vahid Rafe, Mahdi Hassan Goodarzi In [10] author developed a web based fuzzy expert system for common human advisor. The software is built on 5 tier layer. Initially, user login to the portal and selects the type of advisory service and enters crisp data in web application layer, than system asks the question related to the problem. CHA translates the user input to linguistic variables, makes the fuzzy rule and generate the fuzzy answer and with Segono model the fuzzy answer are deffuzzified to crisp output and is reported to user. When web server receive the user inputs, IF part of the rule is generated. Then the inference engine refers to the system knowledge base and if the match is found by using Mamdani model than the fuzzy answer for the THEN part of the rule is generated.
In case if the input data does not match any patterns in the rule base, an appropriate message stating that the system cannot find the answer is displayed. The system is implemented by using Microsoft Visual Studio .NET 2010, MVC and Microsoft SQL Server 2012.

“Literature Review on Fuzzy Expert System in Agriculture”

Er. Navjot Kaur, Er. Navleen Singh Rekh, Anand Nayyar In [11] author give the review of expert system based on fuzzy logic. This expert system represents expertise knowledge as data or rules within the computer. These rules and data can be called upon when needed to solve problem. System has been developed in such diverse area such as science, engineering business and Medicine. In this they introduce concepts of fuzzy logic in expert system and to represent knowledge, in a fuzzy inference they use IF-THEN rules and implements fuzzy reasoning.

“Review of Expert Systems based on Fuzzy logic”

Sonal Dubey, R.K Pandey, S.S Gautam In [12] author presents a review of various fuzzy expert systems in agriculture over the last two decades. There is a many expert systems which give a expert view related to Rice Corp, olive growing, soybean pest, pest activity in rice crop, disease management in finger millets, forecasting warning about frost & freeze, image based paddy disease diagnostic expert system, WIDDS, controlling a groundnut insect pests and in this they give a suggestion, that expert system for farmer in India, should be developed in mother tongue with more and more visual aids.

V. CONCLUSION

This paper tries to present a review of fuzzy Expert Systems which developed in various diverse fields and on the basis of survey done on the fuzzy expert system; the conclusion drawn is fuzzy expert system use the rule based reasoning. So, further research can be done to develop a fuzzy expert systems using case based reasoning.

REFERENCES