

A Review of Applications of Fuzzy Rule Based Expert System In The Field of Education

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Abstract: In artificial intelligence, Expert system is a computer based system which acts as an expert and makes decision. Plethora of researches are going on and already done in this field. Expert systems are developed to answer the complex questions. This review of literature consists of various expert systems development ranging from student performance systems to the expert systems which determine the performance of the teachers and evaluation of their presentation skills.

Keywords: Expert system, fuzzy inference system, mamdani function, neuro fuzzy logic.

Introduction

Expert system is an important branch of Artificial Intelligence. It emulates like a human being expert and solves complex problems. Newell, Simon and Shaw developed a General Problem Solver in 1959 which emulates like a summary of the thinking activity of people. They are the first team who thought about developing a rough idea of human's thinking process. They converted their idea and processed. They divided human's thinking process into

three: 1) developed a rough plan 2) according to the plan solving the given problem 3) Analysing the method and process of implementation. According to The National Aeronautics and Space Administration in 1965, the Stanford University developed a DENDRAL system for the first time. Then in the following years many expert systems were developed focusing the prediction, diagnosis, Design, interpretation, planning, debugging, monitoring and so on. Expert systems like PUFF, MYCIN, Mistral, and EyedentKaleidos were developed in order to address the problem of inferring system malfunctions from observables. The first medical diagnosis systems were MYCIN and CADUCEUS. There was an attempt called Hearsay a voice recognition approach using fuzzy inference system. Most of the voice recognition expert systems are unsuccessful. There's also a fuzzy rule based system for assessing the performance of the students who have multiple disabilities.

1.1 CHARACTERISTICS OF EXPERT SYSTEM

As per the formal definition of expert system, fuzzy expert system is a system which is interactive and reliable and uses heuristics and facts to solve a problem. The few of the characteristics of expert systems include:

- a) Level of expertise: Expert system gives high level of expertise by giving accuracy and efficiency.
- b) Rate of reaction time: As soon we give a problem statement, Expert system replies within a reasonable amount of time.
- c) High reliability: Expert system is highly reliable and it doesn't make any mistake like humans.

1.2 EXPERT SYSTEM ARCHITECTURE

Components of expert system includes i) Knowledge base ii) inference engine iii) user interface

1. Knowledge Base

Facts are the collection of data. Knowledge is the combination of information, data and the past experience. An expert system's success depends upon the knowledge it has. The more

accurate and precise the knowledge, the more efficient Expert system. The knowledge base of an expert system has two types of knowledge, one is factual knowledge and the other is heuristic knowledge. Factual knowledge is which is accepted by the domain experts and scholars. While, the heuristic knowledge is all about estimation and judgement.

a) Knowledge Representation

Knowledge Representation is the form of representing the acquired knowledge in a IF-THEN-ELSE rules

b) Knowledge Acquisition

An expert system is successful, if and only if the information stored in the knowledge base is accurate. The knowledge base is formed by the knowledge from the experts and scholars.

c) Knowledge engineer

Knowledge engineers are those who have quick learning capability and have empathy. Knowledge engineer gets knowledge from domain expert by interviewing them, observing their works etc. His duty is to categorize the acquired knowledge in a meaningful way like in the form of IF-THEN-IF rules to be used by the inference engine.

2. INFERENCE ENGINE

Inference Engine is known as the brain of the expert system. The role of inference engine in expert system is to work on the data which is available from the system and the user to derive the answer to the problem. The main motive of inference engine is to extract the answers and to give predictions and suggestions just like a human being. It contains rules to solve specific problems. There are two types of inference engines i) forward chaining ii) backward chaining. Forward chaining is used when exact solution is unknown, it takes the data first when the solution is known. While, in backward chaining, the solution is known and the system works backwards to find the facts which support that solution.

3. USER INTERFACE

It is an interface which the users can interact with the expert system. Facilities like menu, graphical interface allows an easy communication between the system and the user.

2.REVIEW OF LITERATURE

(Nischal K Verma, 2019)Each and every second there's millions and trillions of data generating. The sources of data are vast and hence it is difficult for the researchers to get the apt data for their research. Learning each data and extracting the required data from the voluminous data is a tedious task.Unlike the architectures which are available now, this architecture has multiple nodes of inference system. They proposed a novel approach in a fashion similar to that of ANN.In this chapter Mamdani fuzzy inference system has an input layer, a hidden layer, and an output layer which is very much similar to a 3 layers feed forward artificial neural network.The validation of the system has done by taking two case studies, one is a nonlinear system identification and the other one is Truck Backer-Upper problem. The evaluation of the performance of this architecture is done by comparing with the artificial neural network similar architecture. The results showed that this architecture has the highest capability of modelling the system.

(Gonil, Gumpy, & P B , 2018)Success rate of a college or university depends upon the quality of the students they select while giving the admission, Good quality students will maintain the dignity and the name of the institution hence it is very important to the management team to filter the students while the admission process and to monitor the performance of the students. This paper deals with a fuzzy inference system which has developed for performance analysis of students in theAdawa state.The system was finally tested by some students. Unlike other papers, this paper has explored the real factors which affect students' performance and used that factors as input. Type of the school attended(private or government), age of the student, Unified Tertiary Matriculation Examination (UME)scores' level result (a subject based course result) were the input and gives student performance as result. Gaussian membership function is used in this work and entire work was carried on MATLAB 12. Results showed that the system is 90% accurate.

(Meenakshi & Nagar, 2015)This research study proposes a new fuzzy inference evaluation method. Research only focuses on students who are doing undergraduate course in IT. In this method three parameters are taken in to consideration. First is the attendance of the individual students, internal marks of each courses and external marks which are considered to evaluate students in an IT related undergraduate course. Then an expert system on Mamdani technique has been designed and tested on some of the students and the two results have been

compared. The output parameter is the student performance and input parameters are as mentioned above. T test is conducted to find the accuracy of the system.

(Natividad, B, & R, 2019) Many students stumble upon what to choose as their career. Plethora of courses available in these days and students get confused easily. Academics can't clearly decide what they're interested on. This paper discusses about a career recommendation system for guidance counsellor as well as the higher secondary students. Numerous factors were considered as student attributes and a feature selection method is used to remove the irrelevant data that affects the system they developed. Many attributes were considered as crisp input but then it has filtered using filter method and only the relevant inputs were taken as crisp inputs. The author has collected the data from students of a particular region through survey and eliminated the irrelevant data and processed the data through Weka. The become the data fuzzified a fuzzification process has done. Generated 72 rules using 4 input variables and the defuzzification method used is centroid. Root mean square error and mean absolute error have done to check the performance of the developed fuzzy system. The paper concluded with a result that the system developed is timely and will help the students to determine the career path based on the attributes.

(Ahmet & Oguzhan, 2016) This paper describes about fuzzy logic which evaluates the presentation skills of the pre service teachers. The results obtained are undergone the Wilcoxon test which in turn showed variance in the results obtained. Some of the results remained same, some showed the difference in the results obtained. This research is limited to the course Operating System and Application course and is not extended to find the presentation skills of pre-service teachers who opted for other subjects. This paper taken the parameters like communication, interaction as input parameters and the output parameters as skill of presentation.

(Nelson M. E. & Benjamin, 2018) Acquiring technical knowledge and skills are important in developing a career. When students focus on their academics they forget to pay attention to their professional development skills. After the life in college or university they have to sell themselves to the top MNCs what they are looking in the candidates are technical skills and communication or professional development skills. Companies require a candidate who is good in technical skills and who is able to convey his work to the client or to the assigned personals. These paper discusses about a virtual reality for developing professional skills in students who are in undergraduate courses. Leadership, communication skills, ethics and teamwork are the main areas they are focusing on. Students will be divided into group and

they will be given a problem statement they have to work on that problem which will help them to improve their analytical skills. This paper has used a development platform, a free development software for games that comprises tool for operating with virtual reality. They use both virtual and physical props to interact with the students, so that they can interact with multiple users at a time. Low cost and increasing portability are the two advantages of this system. The entire research has partitioned into three types. First is a science fiction environment which is an original puzzle game. This is a simple puzzle and suitable for the beginners. This helps the students to know better how things work on virtual environment and props. The expected outcome is that the students could effectively work as a team and to help them to communicate each other easily. This activity will help them to increase their problem solving skills. The second activity is encouraged by a famous movie called The Martian which uses a mars rover. One of the students will be in simulation and will be translocated to mars. The objective is that how the students will communicate to Earth. Building leadership, teamwork and communication skills are the targeted improvement area of this problem. Third activity is similar to the second one, in which, the main aim is to improve the communication skills and building leadership quality. This research has clearly stated the importance of the development skills like communication, ethics, leadership and teamwork in undergraduate students.

(Jyoti, 2014) In this paper a model of Fuzzy Expert System is proposed to evaluate overall performance of the teachers on the basis of various related activities. Paper deals with both the numeric system and the expert system to evaluate the performance of the system. Input parameters of the system were teaching quality, factors in learning, assessment in learning, mentoring/counselling and is scaled using excellent, good, average, low and very low. The output parameter which was taken in consideration was performance value of the teacher. The study was also tested among the 50 teachers to prove the accuracy of the system.

(Lie, 2018) IT professional are good and master in completing a project technically but once the project is ready they are unable to deliver the idea of their project and the work they did. Many IT professional with cent percent technical skills says they are not confident on speaking their views and ideas while they are in a discussion panel. This problem should be identified and tackled during the school or college level education. While the schools and universities focus on developing a career to their students they must focus on developing their communication skills as well. This paper deals a study on comprehensive communication

strategy which is implemented among students to check their communication skills and the result turned out the graph which shows the improvement in students have become higher. Author in total discusses about two main questions in the paper. One is to find the type of activities that can be applied in classrooms which will increase the communication competence in students and the other one is to find the effects of active learning strategies on students. The solution to both these questions were defined clearly on the paper. After the problem identification, the author has designed a series of learning activities which helps the students to interact each other and to get rid of the communication apprehension (the state of fear and anxiety of talking to other or even to the team members). Students were divided into three groups and were told to discuss to about the theories in their class. More exercises were designed in game based pattern and activity based, allowing the students to give their full potential and to engage them in the program in a better way. This study shows the level of communication apprehension before and after taking the above program/class This program helped the author to know that to a higher level, the students were willing to communicate which was a prerequisite for developing the effective communication.

(Macwan, 2013) This paper discusses about the fuzzy evaluation method for the performance appraisal of employees in an organization. It additionally examines parameters that impact the performance evaluation alongside fuzzy membership functions and system architecture for Fuzzy methodology. Created mamdani functions for the parameters like punctuality, attendance, self-control, innovation etc. This system will help the higher authorities to evaluate the employees which are of low scale.

(Yadav, Saurabh, & A K Soni, 2014) In this paper, they introduced a new fuzzy expert system which helps to improve the students' performance based on fuzzy logic techniques. This expert system is different from other types because this expert system takes into consideration the pace of learning of students and says what kind of training they need in the next level. In this paper they have compared various other techniques and also checked the variation of results with statistical method. The results clearly showed a difference between the results in the classical method and the results found on expert system as the classical method sticks on usual mathematical rule while the expert system has a great reliability.

(Kaur & Simran, 2017) In this paper, author proposed a new expert system which takes in consideration various external factors which affects the placement of a student. If these

factors are identified earlier, then the chances of getting placed could get higher. In this system, they calculate the chances of getting placed of a student on the basis of different parameters. Environment in home, learning environment, personal traits and individual skills are the parameters which were taken into consideration. The data were collected from 3rd and 4th year students and the intention of developing such expert system is to only improve the chances of placement.

(Suvarna, Ayesha Mulla, & R R , 2012) Schools entertain students by giving various appreciations like best student award in order to bring a competitive spirit in students. In most of the cases the award doesn't reach to the deserving students, the feedbacks from teachers were taken into consideration before awarding. The information thus collected wouldn't be genuine as each teacher has different opinions about each student. So, this expert system evaluates students on different parameters like their punctuality, sincerity, hardworking, communication skills and so on. There is a range assigned to each of these variables that is from 0 to 10. Teachers mark the range according to their knowledge about the student. And the final grade will be given as good, bad and excellent. Using such system will remove the human tendency of qualitative nature.

(Sirigiri Pavani, P V S S , & Gulhare, 2012) These days, schools and colleges use performance appreciation techniques to find the teachers' performance. Performance of teachers' is significant for the management and for moulding students. In this paper they proposed a new expert system which takes into consideration various parameters to find the expert system. This paper also describes the contrast of two membership functions in order to get two different shapes of membership functions to determine whether it lays any role in finding the performance in positive or negative direction.

(Semerci, 2002) The main motive of this research is to find whether there's any difference between the results in traditional way of finding the performance and the fuzzy based way. An experiment was conducted with a group of students and the parameters like university entrance examination marks and academic achievement marks of the year 2001 and 2002. This paper concluded that the applications of fuzzy logic makes student very active and takes away the examination anxieties.

(Farooq, A, & G, 2011) This paper makes a detailed study about the parameters which affects the performance of the students. This has been taken on a small population in Lahore. Samples were taken from students and their 9th marks were taken into consideration. Data

regarding the occupation of their parents, status etc. were taken through a questionnaire. The data collected were undergone an A Test which shows the comparative results of male or female students are better. This paper concludes that there are several other factors outside the school which affects the performance of their students.

(Parwinder Kaur, Prateek Agrawal, Singh, & Leena Jain, 2014) The expert system proposed in this paper helps to analyse the performance of the students by considering the factors which affects their performance. Various factors which affects the academics have to be found in the earlier stages in order to improve the performance. In this paper, the factors were listed with the help of higher authorities of Lovely Professional University, Punjab and interaction with the ach students helped to know what factors affect their studies. Out of all the factors, mainly 5 factors were taken as the input and in turn expert system says whether the students' performance increase, decrease or will remains constant and based on that counselling can be given in order to improve the academic performances.

3. CONCLUSION AND FUTURE WORK

Expert system is an intelligent system which has the ability to solve the complex problems in a very decent time. This paper is a literature review of few different expert systems which is developed so far. It has been concluded that expert systems are much needed and they are tending to build expert orientation. Expert system has the capability to modify and undergo any changes and can attain new knowledge any time and this ability can be implemented in the upcoming works in this field.

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