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Implementation of Fuzzy Association Rule Mining for Student Performance Evaluation

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Abstract: *Association rule mining in a student performance data is an important research area. This provide support unity to deal with the uncertainty of data. The fuzzy association rule mining can be an important method in s tu d ent ' s a c ad e mi c data due to it's the completeness and able to handle the uncertainty. In this work, a fuzzy association rule mining is used for s t ud e nt 's a ca d e mi c data. Our experiment shows that fuzzy association rule mining in stu d ent ' s a c ad e mi c data a give better performance as non-fuzzy association rule mining. It performs in less time and generate less frequent set compare as existing algorithm.*
Keywords: *Association Rule Mining, FuzzySet.*

I. Introduction

Data mining techniques handles a very large database and it is useful to obtain meaningful and interesting information for the user. Among various techniques, fuzzy association rule mining is a powerful tool for dealing with uncertainty and offering a good representation of discovered knowledge. The education system is an important part for the economic and social growth of any country. Good education system is essential for the betterment of the society. The education system can be evaluated based on student performance. The performance of students depends on several parameters such as time spending for study, extra circular activities etc. Therefore, assess the performance of student become a challenging task. The better assessment management of student leads for further improvement the student performance [3].

The data mining researchers' utilized data mining techniques for effective course selection and providing the knowledge for supplementary classes where necessary. Data mining techniques are also used to predict the students' learning behaviour and to inform students before their final exams [2].

Data mining provides an opportunity to student's achievement assessment. The cause of affecting variation trend in students' achievement can be identified. The important information such as the implicit relationship between curriculum and student's learning interest can be explored, and these meaningful information can be applied in the service of education, reform in colleges and universities, and be taken as the reference to further enhance the quality of teaching, the competitiveness and so on [4].

Data mining methods are used in many organizations for exploring the enormous amounts of data and it helps in making potential decisions. Educational data mining concerns with finding methods for exploring the continuously increasing amount of data in the educational domain to extract significant information and new knowledge to guide the students' learning and improve the process of learning. Student performance prediction is an important aspect to provide quality education. The educational institutes are introducing student performance prediction into their educational processes for better students' support. It helps to assist the lower performing students. Data mining methods can be applied in educational institutes to advance the student's performance and the quality of education [5] [6] [7].

The researchers used data mining task for online and collaborative learning to facilitate students learning. The results revealed satisfactory because the existing technology aids and addresses the aspects of automated learning, practicing and evaluations of an academic cycle. It has been used for understanding and monitoring student's performance. At that time, there is no perfect usage of data mining techniques to facilitate Students Learning. So a better system is required to monitor and analyze student's performance based on a knowledge base constructed from automated learning, practicing and evaluations of the academic cycle [8].

The aim of the present study is to identify the hidden relationships that exist between the student's preadmission academic profile and their academic performance. This will reveal the characteristics of students who are most admitted in a session and students that performed better. Also, the result will be helpful in determine the academic profile of students who are likely to repeat or may be advised to withdraw at the end of the first years and to determine the characteristic of students who are likely to have a high rating academic performance. At large this can serve as a predictor for admission committee to enhance the quality of the new in-take and guide for the academic advisers [9].

II. Related Study

It is widely recognized that many real world relationships are intrinsically fuzzy. Therefore, the theory of fuzzy sets can help data miners discover novel and meaningful patterns from data. Fuzzy set theory is primarily concerned with quantifying and reasoning using natural language, where words can have ambiguous meanings. Delgado et al. considered fuzzy sets as an optimal tool for modeling the imprecise terms and relations commonly employed by humans in communication and understanding [12]. This section presents various existing works in the area of Fuzzy Association Rule Mining.

Fuzzy logic is an approach of data mining that involves computing the data based on the probable predictions and clustering. In the traditional approach it is done based on "true or false". Algorithms that use fuzzy logic are increasingly being applied in several disciplines to help in mining databases [1]. The raw student's academic data need to be efficiently managed and transformed in to usable information through data mining. Association rule mining have received lots of attention due to their importance.

The concept of fuzzy association rule mining approach generated from the necessity to efficiently mine quantitative data frequently present in databases. Algorithms for mining quantitative association rules have already been proposed in classical association rule mining. Dividing an attribute of data into sets covering certain ranges of values, engages the sharp boundary problem. To overcome this problem fuzzy logic has been introduced in association rule mining [10].

III. Methodology

Research Method

The fuzzy association rule mining is divided into three steps. First, Fuzzy sets are generated, followed by discovering fuzzy frequent Item sets form the newly constructed database. Finally, fuzzy association rules are generated and evaluated. Figure 1 shows the schematic view of frequent closed item set discovery. Defining the fuzzy set Data Transformation in Fuzzy Domain Fuzzy Normalization Frequent Item set Mining Knowledge Discovery Analysis of Result [2].

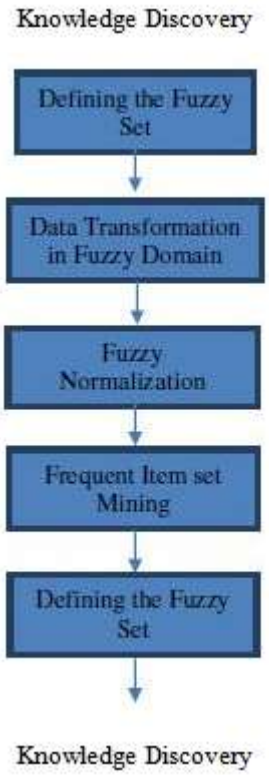

Figure 1 Schematic view of frequent closed item set discovery [2]

Fuzzy Set Theory is used in applications involving educational assessment and performance as it is regarded as efficient and effective in uncertain situations involving performance assessment. It is known that Expert Fuzzy scoring systems noted; help teachers make assessment in less time and with a level of accuracy that compares favorably to the best teacher examiner [11].

Framework for Fuzzy Association Rule

The standard approach to evaluate the significance of fuzzy association rules in student data is to extend the definition of support and confidence measures to fuzzy association rules [13]. The degree of support of the rule $A_f \Rightarrow B_f$ for the whole SD_f is defined as:

where $|SD_f|$ is the total number of transactions in SD_f , which is equal to N, the number of transactions in the quantitative database SD. $A_f(x)$ and $B_f(y)$ denote the degree of membership of the elements x and y with respect to the fuzzy set A_f and B_f, respectively, $\otimes$ is a t-norm

[13]. Based upon the notations of SDsupp and SDconf, a rule $A_f \Rightarrow B_f$ is the interesting fuzzy association rule if

1. $SDsupp(A \Rightarrow B) \geq min\_supp$;
2. $SDconf(A \Rightarrow B) \geq min\_conf$;

Where min_supp and min_conf are the thresholds defined by users.

IV. Experiment And Results

Both the association rule mining algorithms fuzzy and non- fuzzy for student data were implemented in a Java program language. It experimented on a 1.60 GHz i5 processor, 8 GB RAM and 64 bit window 10 operating system. The student performance data set was obtained from UCI machine learning repository [15]. The data attributes include student grades, demographic, social and school related features and it was collected by using school reports and questionnaires. The data set contains total 32 attributes [14]. The experiments were conducted with this dataset. These dataset also earlier used to compare the performance of pattern mining by other authors [16]. Fuzzy ARM experimented with these data sets and Table 1 shows generated number of association rule from the fuzzy ARM. The experiments were conducted with constant confidence value 80% with variable minimum support values. Figure1 shows a comparison between ARM and Fuzzy ARM basis number of rule generated. The experiments show that the Fuzzy ARM produces better results. It can be observed that fuzzy ARM refine the rules and generate less rules when the support values decreases as compare to ARM.zy Association Rule mining for student Performance Evaluation

Table 1 Experiment Result of Fuzzy ARM And Non Fuzzy ARM on student data set

Support %	No. of Rules	
	Fuzzy ARM	ARM
80	5	4
75	15	14
70	33	34
65	102	110
60	230	232
55	430	536
50	800	1178
45	2200	2757
40	5760	6327
35	8747	14785
30	16342	32172
25	25345	78909
20	45340	216464

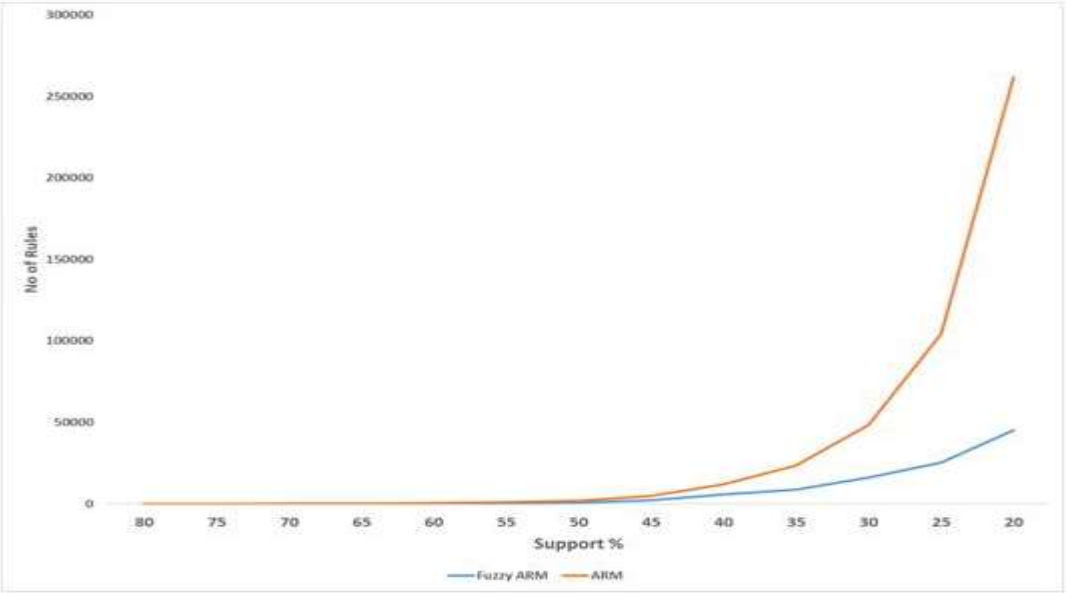

Figure 2. Comparison based on the number of rules of Fuzzy ARM and ARM

V. Conclusion

In this paper, we presented a framework of fuzzy ARM algorithm to mine the student data. The fuzzy ARM was implemented and test with data sets. The experiment illustrated that fuzzy ARM produces refined rules as ARM. Further, it incorporated the features of fuzzy set such handle the uncertainty of data. It is assumed from the experimental result that this fuzzy technique will be an alternative technique to generate patterns and association rule from student data.

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