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Study of Tools and Techniques Used to Analyzing Student's Database for Academic Growth in Higher Education: a Review

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Abstract

Now days, most of institutes and colleges of higher education are facing of challenges and problems regarding academic issues like student's admissions, academic performance and placements. In this regards, almost institutions and colleges of higher education collected and analysed vast dataset of their students by means of various tools and techniques to extract some useful and hidden information. This information can then used to make better and efficient policies related to various academic issues. Data mining is one of such powerful tool or technique for analysis big data. This tool and its techniques are also successfully applying in the field of education for analysing vast dataset of students in any higher educational institute. This application area is known as Educational Data Mining (EDM). This review based paper presents a comprehensive study of many tools and techniques of Data Mining which have been used to analyses student's database. This study conclude that there are considerable amount of work is done in this field and even nowadays, there is a wide scope of this tool in educational domain but still there are many untouched techniques which can be used in this field. This study, of course presents a clear approach among researchers to understand the scopes, opportunities and future prospects in this filed.

Keywords: Data Mining, Educational Data Mining, Academic data analysis.

Introduction

As the number of educational Universities, Institutes and Colleges are opening day by day, the size of database of student is also increased in proportion. A huge number of graduates and post graduates students have been passed every year but to maintain the quality of education and employability are main challenges for any higher educational institute. There is, of course now need to analyses the past and present information collected from the student's academic as well as personal behaviours so that colleges affiliated to higher education department can analysed and interpreted these information and make better policy regarding admission, academic quality and placements. Recently, many powerful tools and techniques have been used to analyses these big data of students from any educational institute. The resultant analysis can then be used to understanding the behaviour of student in perspective of their academic progression. This is why; many data mining tools and techniques have been used widely for analysing this type of information. In this, review paper author has presented and compared the work done in the field of educational data mining in perspective to tools and techniques used for that. In section-2, brief introduction about educational data mining has given and successive sections (from –2 to 5) include the review of work done in perspectives to tools and techniques used for analysis in predicting the academic performance of students, in admission or enrolment policy also placement policy of educational institute. The review study is completed by reading many research papers published in recent years (from 2012-2017) and compare them on the basis of the tools and techniques used in that researches.

Educational Data Mining

Data mining is one of most powerful analyzing tool which has nowadays been used to

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analyzed big data from many organizations. As this tool has many useful machine learning and statistical techniques in terms of algorithms, most of educational institutes and colleges are also using it for extracting useful and hidden information about their student [1]. This attractive young field in which techniques of data mining have involved to analyze large dataset of any educational institutes may be termed as Educational Data Mining [2]. EDM emphasized to discovering or extracting hidden and useful patterns or relationships among different academic and personal attributes of students from educational environment. Many educational institutes have usually huge amount of their

student's data in different formats. More than 80 % data are now in digital format so traditional approach cannot be applied for analyzing these types of data

Tools And Techniques of Data Mining In Predicting Academic Performance of Students

A brief literature review of various significant researches in the area of predicting academic performance of student ranging from Year 2012 to 2017 is presented below in Table-1.

Table-1: literature review in the field of EDM during 2012-2017(In perspective to Predicting Academic Performance of Students)

S.N.	Authors,Year	Ref. No.	Tool & Technique	Key Finding
01	Jyoti Bansode,2016	03	Classification using Decision Tree(WEKA)	Generate Prediction Model which help the teachers to identify the weak students and help them to improve their performance
02	T.M Lakshmikanth, B.K. Sangareddy,2014	04	Naïve Bayesian Classification Algorithm(Review)	Analyzed and assisted the low academic achievers in higher education.
03	E.Venkatesan S.Selvaragini,2017	05	classification algorithms ID3 and C4.5(Survey)	Identify the best suited structure of curriculum for the current environment.
04	Sheena Angra, Sachin Ahuja,2016	06	K-Means Clustering & Linear Regression(Rapid Miner)	Predict grades of students of one class by analyzing the grades of previous classes
05	Surjeet Kumar Yadav, Saurabh Pal,2012	07	The C4.5, ID3 and CART decision tree algorithms(WEKA)	Predicted the number of students who are likely to pass, fail or promoted to next year.
06	Fadhilah Ahmad, Nur Hafieza Ismail and Azwa Abdul Aziz,2015	08	Decision Tree, Naïve Bayes, and Rule Based classification techniques(WEKA)	Identify and profile the student to determine the students' level of success in the first semester.
07	Mashael A. Al-Barrak and Muna Al-Razgan,2016	09	Classification using J48 decision tree(WEKA)	Extracted useful knowledge for final GPA, and identify the most important Courses in the students' study plan based on their grades in the mandatory courses.
08	Karan Manchandia*, Navdeep Khare, Mohit Agrawal,2017	10	Naïve Bayes Classifier (WEKA)	The proposed system help in Analyzing Students Academic Performance
09	Sonali Agarwal, G. N. Pandey, and M. D. Tiwari,2012	11	Support Vector Machines (SVM) classifier (WEKA)	Predicting the performance, success of students in the examination as well as their overall personality development
10	Dorina Kabakchieva,2012	12	Rule learner, a decision tree classifier, a neural network and a Nearest Neighbor classifier.(WEKA)	Developed predictive models for Predicting student performance, based on their personal, preuniversity and university-performance characteristics.
11	Abeer Badr El Din Ahmed, Ibrahim Sayed Elaraby,2014	13	Classification using Decision Tree (WEKA)	Predict the student's performance on the basis of student's database and identify those students which needed special attention to reduce failing ration and taking appropriate action at right time.
12	Rakesh Kumar Arora, Dr.Dharmendra Badal,2014	14	Apriori algorithm,Association analysis (WEKA)	Determine set of weak students in current semester by comparing the performance of students of previous semesters on the basis of marks obtained at graduate and post graduate level.
13	P. Meena Kumari, SK.Abdul Nabi, Puppal Priyanka,2014	15	K-Means clustering (WEKA)	Students and Teachers performances are evaluated using past dataset

Tools And Techniques Of Data Mining In Admission /Enrollment Policy Of Educational Institutes

A brief literature review of various significant researches in the field of Admission /Enrollment policies of educational institute during Year 2012 to 2017 is presented below in Table-2.

Table-2: literature review in the field of EDM during 2012-2017(In perspective to admission policy in educational Institute)

S.N.	Year, Authors	Ref. No.	Tool & Technique	Key Finding
01	Olufunke O. Iadipupo, Olanrewaju. J. Oyelade and Dada. O. Aborisade.,2012	16	Fuzzy Association Rule Mining (ANOVA)	Determine the academic profile of students who are most admitted in the session.

02	Stephen Kahara Wanjau, George Okeyo, Richard Rimiru,2016	17	Logistic Regression algorithm and Decision Tree (CART) - WEKA	Predict enrollment of students in Science, Technology, Engineering and Mathematics (STEM) courses in higher educational institutions.
03	Wiwik Novitasari, Arief Hermawan, Zailani Abdullah, Rahmat Widia,2015	18	SLP_Growth algorithm, Association Rules Mining (C# PL)	Generated interesting rules which helps to make a decision in offering appropriate course for students.
04	Surjeet Kumar Yadav, Saurabh pal,2012	19	Prediction using Decision Tree (WEKA)	Identify student for enrollment in a particular course.
05	Boumedyen Shannaq1, Yusupov Rafael2, V. Alexandro3	20	Prediction using Decision Tree (WEKA)	Proposed model can be used to obtain a deep understanding of student's enrollment pattern in a University
06	Abdul Fattah Mashat, Mohammed M. Fouad, Philip S. Yu, Tarek F. Gharib,2013	21	Apriori algorithm for association rule mining.	Extract the rules and relations between admission system attributes for better analysis.
07	Rakesh Kumar Arora, Dr. Dharmendra Badal,2013	22	K-Means Clustering (WEKA)	Identify those admissions inquires which most likely to turn into actual admissions.
08	Dineshkumar B Vaghela, Priyanka Sharma,2015	23	Global Rule Binary Search Tree (GRBST) -WEKA	Developed an algorithm which is used in prediction of Students' admission to college

Tools And Techniques of Data Mining In Placement Policy of Educational Institutes

A brief literature review of various significant researches in

the field of Placement policies of educational institute during Year 2012 to 2017 is presented below in table-3.

Table-3: literature review in the field of EDM during 2012-2017(In perspective to Placement policy in educational Institute)

S.N.	Year, Authors	Ref. No.	Tool & Technique	Key Finding
01	Getaneh Berie,Dr. Vuda,2016	24	J48, Naïve Bayes and Random Forest-WEKA	Analyze students' entrance exam result to predict students' placement into departments.
02	Elakia,Gayathri, Aarthi, Naren J,2014	25	C4.5 Classification-(Rapid Miner)	Suggested career options for the high school students and also predicted the potentially violent behavior among the students by including extra parameters other than academic details.
03	Siddhi Parekh, Ankit Parekh,2016	26	ID3-Classification (PHP & MYSQL)	Generate query specific reports of the academic performance of a group of students or a student in particular which helps in evaluating student's potential strengths and weakness with respect requirements of various companies for placement.
04	Dr. Suganthi, G. and Mr. Ashok, M.V.,2017	27	Naive Bayes,X-Means, Support Vector Clustering, (PHP & MYSQL)	Solved placement chance prediction problems.

Discussion on Review Study

Author has reviews many research papers in the field of educational data mining. Some of important and useful researches during year 2012 to 2017 have summarized in Table-1 to Table-3. From Table-1, it is summarized that Most of the published research papers belong to educational data mining have focused on predicting academic performance of student using classification technique of Data mining. Many of such research work are done with the help of popular data miner tool called WEKA. In this way, in recent years WEKA is most common and popular tool to analyses various database related to student to enhance the academic quality or growth of any educational institute. Most of the researchers generate prediction models by analyzing big dataset of student's academic performances. These models help to predict the student's performance on the basis of student's past database, to identify the weak students and help them to improve their performance, to predict grades of students of one class by analyzing the grades of previous classes, to predict the number of students who are likely to pass, fail or promoted to next year, to identify and profile the student to determine the students' level of success in the first semester etc. These predictions pattern are then used to make better educational policies for the successive sessions in educational institute. Table-2 summarized the details about the research work done related to admission or

enrollment policy of any educational institute. As there are many private and government colleges and institutes have been opened in the same city, so they have a tough competition regarding admission in particular course. From this review study (table-2), it is clearly shown that Data mining is one of most commonly and widely used tool to analyzed past and existing dataset of student. These analyses are then use to extract hidden patterns or relationship among various attributes of student database. Again classification and clustering techniques are used to build a decision model which help to determine the academic profile of students who are most admitted in particular course in particular session, to generate interesting rules which helps to make a decision in offering appropriate course for students, to identify those admissions inquires which most likely to turn into actual admissions and to extract the rules and relations between admission system attributes for better analysis. In Table-3, author has briefly described the recent researches about application of educational data mining in placement policy for any educational institute. The academic quality of any educational institute is depends on placement records of their students so placement cells in higher education institute are focusing more on analyzing big dataset of student so that they can suggest better career option for their students.

Conclusion

This paper presents a review study on application of Data Mining in Educational field. The academic growth of any institute is depends on academic performance and placement of student and also on the admission policy of institute. So the author has present the significant research work done during 2012 to 2017 in these fields by summarizing the details about tools and techniques, authors and the key findings of the researches in tables. This review paper conclude that there are many examples of applications in educational domains that can be implemented through Data mining but among these, predicting students' performance is the oldest and most popular application of Data Mining in education and WEKA is most commonly and frequently used tool to analyses academic performance or progression of student. Among all techniques of Data Mining, Classification is most common technique to analyze the educational dataset. However, in recent years, many new tool and techniques have been applied to resolve the various problems in educational domain.

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