Improving Students' Experiences of Learning Environment Using Data Mining Techniques

I.N.M. Shaharanee, M.S.A. Bakar, S.Z. Saad, J.M. Jamil

Abstract: ***E-Course Evaluation System (e-CEvas) is an online academic course evaluation based in Universiti Utara Malaysia (UUM). This assessment gives opportunities for students in order to give feedback regarding the process of teaching and learning that they go through during each semester. Classifying lecturers' performances based on this course evaluation data is an intriguing yet challenging problem for any academic institution. This course evaluation offers lecturers/instructors to understand their strengths as well as the weaknesses in teaching and learning processes. Referring to the course evaluation data, there are many factors and variables involve in evaluating teaching and learning delivery processes. This research work proposed a decision tree model to classify lecturers' performances based on the course evaluation data to improve student learning experiences. We compared different data partitioning strategy and several measures of impurity to improve the classification accuracy while maintain satisfactory overall classification performance. The result indicates that, decision tree with two split combining with variable selection technique achieved the best classification performance with a 96.33% overall accuracy. We also identified the most important factors for accurate classify of lecturer performance in teaching and learning process that can improve student learning experiences. Application of these models has the potential to accurately classify under performing lecturer and help them to improve their teaching and learning thus improving student experiences in learning.***

Keywords: ***Students 'Experiences, Classification Model, Learning Environment, and Teacher Performances***

I. INTRODUCTION

E-Course Evaluation System (e-CEvas) is an online academic course evaluation based in Universiti Utara Malaysia (UUM) and this system was implemented at the end of the year 2008. This assessment of the courses which conducted by the University Teaching and Learning Centre (UTLC) aims to give opportunities for students in order to give feedback regarding the process of teaching and learning that they go through during each semester. Referring to the assessment report obtained, every lecturer is able to analyze the strengths as well as the weaknesses of each lesson. Starting from 2012/2013 of study session, rating e-CEvas is a compulsory for all students before they are allowed to sit for the final examination and receive their results, however, students who are doing their Research Paper and Dissertation are exempted from involving this process.

Basically, e-CEvas system comprises of six main functions which are students' evaluation, management of questions, management of evaluation form, management of evaluation session, users' management, and reports.

This e-CEvas system is accessible through the Student Portal and students have to follow several steps before being able to proceed with the evaluation. After accessing into the link of e-CEvas in the portal, students need to answer the first part of evaluation which is known as General Assessment which contains of general questions and must be answer for only once for each students. Furthermore, this evaluation system mainly uses a likert scale which is the most widely used approach in survey research to scaling responses. This likert scale in e-CEvas provides students with a 10-points of responses starting with "Not satisfactory" (1) and end with "Excellent" (10), thus they are allowed to freely answer all the questions with their own preferable answers by using the scale.

After completing the first part which is General Assessment, students go through the evaluation of each course that they are taking during the particular semester.

In short, student evaluation has given an abundance of benefit as it is a significant tool for modifying, planning, and re-designing the current courses into better structured courses in future. Therefore, the achievement of student is the crucial measurement from this evaluation as lecturers are exposed to know how much their students have gained from the teaching session in class and students are also allowed to give responses based on current teaching in order to get a better improvement on teaching from their lecturers. Besides, a good ambience for a learning session in future is also can be referred from the current student evaluation as their responses regarding the teaching environmental factors are also included in the evaluation.

As people live in a modern phase of life nowadays, hence the evaluation is also has evolved into a modern evaluation which is an online evaluation. In spite of that, e-CEvas system which currently implemented in UUM has been considered as a meaningful and easy-to-go system since it can monitor the teaching of every lecturer for the purpose of producing a well-structured course to be prepared for the new upcoming students.

II. RELATED WORKS

Student Evaluation Teaching (SET) ratings have been explored since the 1920s and have expanded throughout the USA in the late 1960s and early 1970s. This SET is mainly use for the purpose of evaluating the effectiveness of teaching within a faculty with an assumption stated that students gain more lesson from highly rated lecturers

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I.N.M. Shaharanee, School of Quantitative Sciences, Universiti Utara Malaysia, 06010Sintok, Kedah, Malaysia. Email: nizal@uum.edu.my

M.S.A. Bakar, School of Computing, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia. E-mail: shahbani@uum.edu.my

S.Z. Saad, School of Computing, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia. E-mail: sharhida@uum.edu.my

J.M. Jamil, School of Quantitative Sciences, Universiti Utara Malaysia, 06010Sintok, Kedah, Malaysia. E-mail: sharhida@uum.edu.my

(Murray, 2005). SET is normally conducted during the last few weeks of courses or before the students are assigned the final grades. Besides, students are typically have been asked in rating forms to evaluate their lecturers as well as their related courses, often by applying a 5-point Likert Scale which ranging from Strongly Disagree to Strongly Agree. The rating forms are basically comprises of the overall ratings of lecturer and course, plus evaluating the various kinds of characteristics on lecturers and courses such as knowledge, organization, fairness, availability, and approachability (Mortelmans, 2013). Meanwhile, the ratings for every course are summarized based on the calculation of average ratings involving all students for every rated item and within all rated items, hence all these calculated average ratings are compared and applied in order to evaluate the effectiveness of lecturers' teaching (Stark &Freishtat, 2014).

Nevertheless, there exists many assumptions regarding the factors which may affect the student evaluation and according to (Andrade & Rocha 2012), the random-effects model has been used in order to describe the factors which has been considered in rating lecturers. The data in this research was taken from Institute of Education and Research Academic Records Office that focused on 496 undergraduate courses within six semesters starting from the second semester of 2005 until the first semester of 2008 and 101 different lecturers were involved. The main findings obtained including the size of class contributed negatively to the SET score, the more experienced lecturers had better evaluation, the SET score did not increase because of participation in training programs, and lecturers seems to be able to marginally "buy" a good evaluation by inflating the grade of the students. One of the results provided stated that the higher the number of students in class the lower is the SET ratings, however an argument may arise, for instance students might want to choose their own preferable lecturers regardless the size of the class.

Based on the recent research by (Morgan et. al, 2016), the student evaluation on lecturer teaching has been explored based on factor of gender. In this research, clinical students in faculty physicians at one North American medical school in surgery, pediatrics, gynecology, obstetrics, and internal clinical medicine investigated the gender differences in teaching evaluations from 2008 to 2012. The students rated their lecturer teaching based on the overall quality of teaching by applying a 5-point scale of response, hence linear mixed-effects model has been referred to provide the estimated mean differences within the gender. Male doctors received significantly higher mean evaluation scores over all 5 years from the results obtained, which is 56 percent compared to female doctors who scored only 46 percent. Although factor of gender is a good factor to be considered in student evaluation on lecturer teaching but this research was only conducted within the small scope of students in North American medical school, thus the results produced were also just limited to that particular student and not represented the real life scenario. Therefore, this gender barrier could be improved in student evaluation by widen the scope of research in many kinds of different school in future.

As a conclusion, there has been a long tradition of research within the field of SET and many factors that have been considered in the process of evaluation as well as the method of figuring out the results of the evaluation. In spite of that, this research aims to firstly view the past data of student evaluation and to view the results from the evaluation in order to determine the performance of lecturer teaching.

III. METHODOLOGY

In this study, 2 popular classification me Student Evaluation of Teaching (SET) ratings have been explored since 1920s and has expanded across the USA in the late 1960s and early 1970s.This SET is mainly use for the purpose of evaluating the effectiveness of teaching within a faculty with an assumption stated that students gain more lesson from highly rated lecturers (Murray, 2005). SET is normally conducted during the last few weeks of courses or before the students are assigned the final grades. Besides, students are typically have been asked in rating forms to evaluate their lecturers as well as their related courses.

Data

Table. 1 Floating-point operations necessary to classify a sample

Name	Model Role	Measurement Level	Descriptions
No	Input	Nominal	The numbers of respondents (students)
PP	Input	Nominal	The type of school for each student.
CourseLevel	Input	Nominal	The courses level that is taken by the student
CourseCreditHour	Input	Nominal	The credit hour of the course taken by the student.
ClassroomType	Input	Nominal	The type of classroom taken by students
Term	Input	Nominal	The current semester that is taken by the student.
KPIStatus	Target	Binary	A value of 0 indicates that the teacher achieved a good performance. A value of 1 indicates that the teacher does not achieve a good performance.
Q1 until Q58	Input	Ordinal	The course evaluations' question. (Details explanation in Appendix I)

Decision Tree Classification Method

$$Entropy(t) = -\sum_{i=0}^{c-1} p(i|t)\log p(i|t)$$

$$Gini(t) = 1 - \sum_{i=0}^{c-1}[p(i|t)]^2$$

$$Classification\ Error(t) = 1 - \max\,[p(i|t)]$$

Table . 2 Floating-point operations necessary to classify a sample

No	Name	Description
1	Decision Tree 2 Splits	
2	Decision Tree 4 Splits	
3	Decision Tree 2 Splits	
4	Decision Tree 4Splits	
5	Decision Tree 2 Splits	
6	Decision Tree 4 Splits	
7	Decision Tree 2 Splits	
8	Decision Tree 4 Splits	
9	Decision Tree 2 Splits	
10	Decision Tree 4 Splits	
11	Decision Tree 2 Splits	
12	Decision Tree 4 Splits	
13	Decision Tree 2 Splits	
14	Decision Tree 4 Splits	
15	Decision Tree 2 Splits	
16	Decision Tree 4Splits	
17	Decision Tree 2 Splits	
18	Decision Tree 4 Splits	
19	Decision Tree 2 Splits	
20	Decision Tree 4 Splits	
21	Decision Tree 2 Splits	
22	Decision Tree 4Splits	
23	Decision Tree 2 Splits	
24	Decision Tree 4 Splits	

Nevertheless, there exists many assumptions regarding the factors which may affect the student evaluation and according to (Andrade & Rocha 2012), the random-effects model has been used in order to teaching.
Example of figure and its caption is shown in Figure 1.

Fig. 1 Method and Experimental Setup

Example of table and its caption is shown in Table1.

Evaluation Measures

The equations must use their typesetting equation editor and should be centered across the column, numbered consecutively with the respective number given in parentheses as follows:

$$accuracy = \frac{TP+TN}{TP+FP+TN+FN} \quad (1)$$

$$sensitivity = \frac{TP}{TP+FN} \quad (2)$$

$$specificity = \frac{TN}{TN+FP} \quad (3)$$

ISSC uses IEEE Citation Reference (for details, see this manual). Using the square bracket, references should be numbered and quoted in text as follows [1], [2-5]. The references section should contain a list of references. Examples of references:

Subsection Headings, Tables and Figures

In Arabic numerals such as 2.1,3.1, etc., the subsection headings should be numbered. Numbering the figures and tables consecutively and inserting them into the text. The figure captions should be placed below the illustrations, while the table captions should be placed above the table content. In Palatino Linotype, fontsize10, both captions should be typed.
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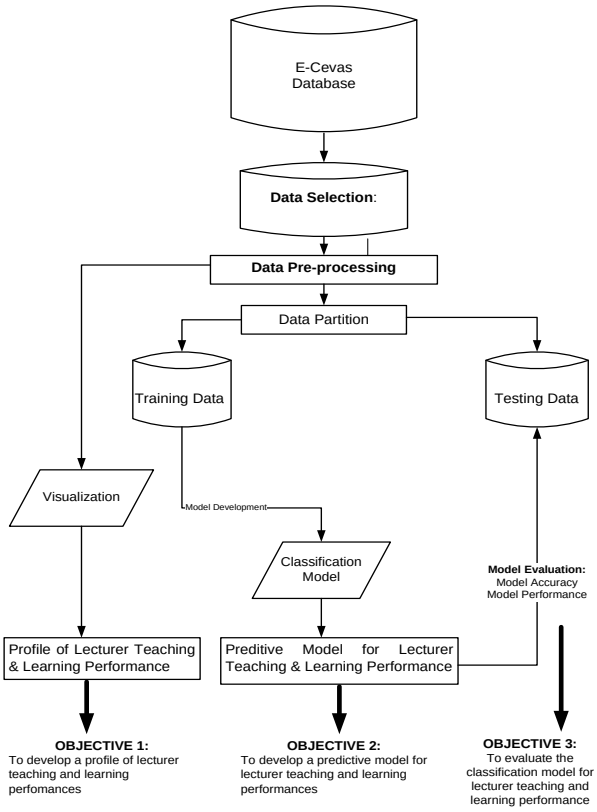

Fig. 2 The overview of the methodology employed in this study

Example of table and its caption is shown in Table1.

Table. 3 Semester eCevas Data

Semester	Achieved	Not Achieved	Total Records
A142			
A142			
A151			
A152			

Table. 4 Summary of Data Fields for the ECevas Data

Name	Type of Data	Mean/Mode	Median	Std Deviation	Descriptions
No	Nominal				The numbers of respondents (students)
PP	Nominal				The type of school for each student.
CourseLevel	Nominal				The courses level that is taken by
CourseCreditHour	Nominal				The credit hour of the course taken by the student.
ClassroomType	Nominal				The type of classroom taken by students
Term	Nominal				The current semester that is taken by the student.
Q1	Interval				The course evaluations' question. (Details explanation in Appendix I)
Q2	Interval				
Q3	Interval				
Q4	Interval				
Q5	Interval				
Q6	Interval				
Q7	Interval				
Q8	Interval				
Q9	Interval				
Q10	Interval				
Q11	Interval				
Q12	Interval				
Q13	Interval				
Q14	Interval				
Q15	Interval				
Q16	Interval				
Q17	Interval				
Q25	Interval				
Q26	Interval				
Q46	Interval				
Q47	Interval				
Q48	Interval				
Q49	Interval				
Q50	Interval				
Q51	Interval				
Q52	Interval				
Q53	Interval				
Q54	Interval				
Q55	Interval				
Q56	Interval				
Q57	Interval				
Q58	Interval				
KPIStatus	Binary	Target			A value of 0 indicates that the teacher achieved a good performance. A value of 1 indicates that the teacher does not achieve a good performance.

Photographs, Figures and Equations, Reference Style

All photographs and figures should have a good quality of resolution and contrast. For resolution, at least 300 dpi is applied.

The equations must use their typesetting equation editor and should be centered across the column, numbered consecutively with the respective number given in parentheses as follows:

$$E = mc^2 \quad (1)$$

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IV. EXPERIMENT RESULTS

Student Evaluation of Teaching (SET) ratings have been explored since the 1920s and have expanded throughout the USA in the late 1960s and early 1970s. This SET is primarily used to evaluate the effectiveness of teaching in a faculty with the assumption that students receive more lessons from highly educated students.

Table. 5 Floating-point operations necessary to classify a sample

Model	% of Data Partition	Variable Selection	Splitting Criteria	Testing Data		
				Accuracy	Sensitivity	Specificity
Decision Tree 2 Splits	70/30	Yes	Gini			
Decision Tree 4 Splits						
Decision Tree 2 Splits			Entropy			
Decision Tree 4Splits						
Decision Tree 2 Splits			Classification Error			
Decision Tree 4 Splits						
Decision Tree 2 Splits		No	Gini			
Decision Tree 4 Splits						
Decision Tree 2 Splits			Entropy			
Decision Tree 4 Splits						
Decision Tree 2 Splits			Classification Error			
Decision Tree 4 Splits						
Decision Tree 2 Splits	60/40	Yes	Gini			
Decision Tree 4 Splits						
Decision Tree 2 Splits			Entropy			
Decision Tree 4Splits						
Decision Tree 2 Splits			Classification Error			
Decision Tree 4 Splits						
Decision Tree 2 Splits		No	Gini			
Decision Tree 4 Splits						
Decision Tree 2 Splits			Entropy			
Decision Tree 4Splits						
Decision Tree 2 Splits			Classification Error			
Decision Tree 4 Splits						

As a conclusion, there has been a long tradition of research within the field of SET and many factors that have been considered in the process of evaluation as well as the method of figuring out the results of the evaluation. In spite of that, this research aims to firstly view the past data of student evaluation and to view the results from the evaluation in order to determine the performance of lecturer teaching.

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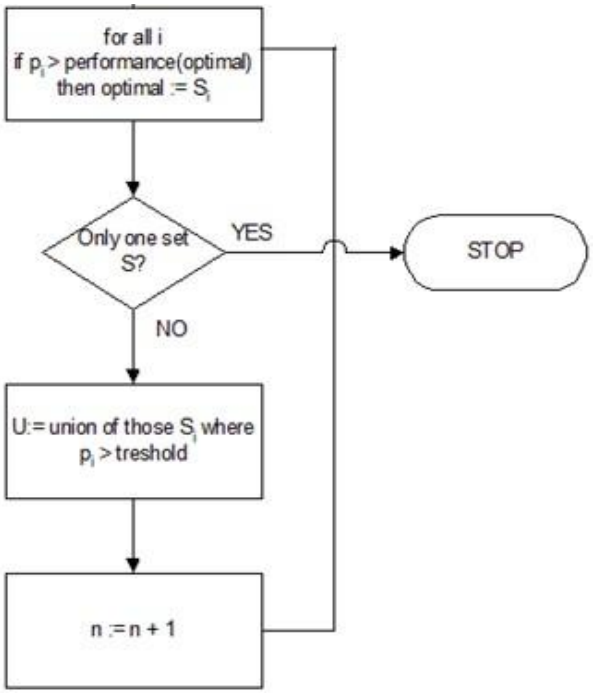

Fig. 3 A flow chart of the feature selection heuristic

Example of table and its caption is shown in Table1.

Table. 6 Floating-point operations necessary to classify a sample

Model	Feature extraction	Pre-processing	Classification
KKNN	>200,000flops	~10flops	~200flops
ffNN			~10,000flops

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$$E = mc^2 \quad (1)$$

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V. CONCLUSION

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ACKNOWLEDGMENTS

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