Measurement of activeness lecturers in SmartLecturer based learning using fuzzy Mamdani and Sugeno

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Abstract. The success of learning in a classroom that uses supporting media demands lecturer activity. The level of activity of lecturers in class and using learning media such as Smart lecturer can be measured using a fuzzy logic approach. This study aims to measure the level of active lecturers using the approach, namely: Mamdani and Sugeno method. Stages of lecturer activity measurement by forming a fuzzy set, composition rules as many as 24 rules and the defuzzification process using the centroid method that produces the level of activity of each is low, medium and high. Based on 173 lecturer activity data, the results of the Mamdani method indicates low 66%, medium 31%, and high 3%. While the Sugeno method produces a level of activity low 75%, moderate 17%, and high 8%. Therefore, Mamdani method is more suitable for the calculation because the spread of results is relatively evenly distributed at each level.

1. Introduction

At higher education institutions the role of management, lecturers, students, and other academics become a major factor for the success of the learning process. The role of the lecturer in learning can be seen from their activeness in encouraging students to continue learning both at the time of lecture, and the end of their college period [1] [2]. Therefore, the level of activity of the lecturer needs to be measured, so that the institution can maintain and continue to improve their activity. The institution is expected to reward lecturers with a high level of activity and guidance for lecturers who have a low level of activity.

Assessment of teaching activities is understood as an internal evaluation of universities to ensure the achievement of teaching objectives [3]. This assessment, based on the desire of universities to create effectiveness in the learning process [4]. In Blended learning, assessment of teaching activities must consider the activities of a lecturer, such as teaching in class [5], teaching through online learning media [6] [7], and uploading learning material on online learning media [8][9].

On the other hand, the use of fuzzy logic has been widely used in various fields, including optimization of the production of goods [10], controlling or monitoring [11] [12] [13], analyze diabetes [14], and other. In the field of education, fuzzy logic has also been

applied for various purposes, such as: evaluating student performance in learning [15] [16], identification of learning in online learning [17] [18], evaluate the use of an e-Learning [19], optimizing student engagement in online learning [20], prediction of student learning style in e-learning [21], assessment of knowledge and attitudes of students in blended learning etc. Therefore, lecturer activeness in learning supported by learning applications such as Smartlecturer should be able to be measured using the fuzzy logic Mamdani and Sugeno methode. The method requires stages in the form formation of fuzzy sets, a composition of rules, and defuzzification from the results of the fuzzification process.

2. Research Method

The method used to determine the activeness of lecturers is fuzzy Mamdani and Sugeno. The Mamdani method is a Fuzzy Inference System (FIS) which can be applied to data input in the form of linguistic variables (variables that are natural or obtained from humans) and obtained in the form of fuzzy sets [15]. Fuzzy Sugeno is a FIS method for rules that are represented in the form of IF - THEN and output in the form of constants or linear equations [15]. Both of these methods consist of fuzzy set formation stages, rule composition and defuzzification.

The formation of fuzzy sets is the first step when using fuzzy mamdani and sugeno logic. The fuzzy set of activeness in classroom, application login and upload material consists of three namely LOW, MEDIUM and HIGH. Table 1 shows the set of lecturer activeness using three sets of functions.

Table 1. Set of Fuzzy Lecturer Activity

Function	Variable	Fuzzy Set	Range	Parameter
Input	Activeness in classroom	LOW	[50 - 100]	[50 - 70]
		MEDIUM		[60 - 85]
		HIGH		[80 - 100]
	Application login	LOW	[0 - 500]	[0 - 200]
		MEDIUM		[100 - 350]
		HIGH		[300 - 500]
	Upload material	LOW	[0 - 24]	[0 - 7]
		MEDIUM		[5 - 15]
		HIGH		[13 - 24]
Output Mamdani	Lecturer activity level	LOW	[0 - 100]	[0 - 40]
		MEDIUM		[30 - 85]
		HIGH		[80 - 100]
Output Sugeno	Lecturer activity level	LOW	[0 - 100]	0
		MEDIUM		50
		HIGH		100

Research data was obtained through the SmartLecturer application system owned by the Polytechnic of LP3I Jakarta. SmartLecturer of Polytechnic LP3I Jakarta is made specifically to facilitate lecturers in carrying out the teaching and learning process and uploading learning material. Figure 1 shows the SmartLecturer application user interface that can be accessed by the lecturer at http://dosen.plj.ac.id/.

Figure 1. User Interface SmartLecturer

There are 137 lecturer activity data in the class, application login, and uploading material which in the odd semester of 2017/2018 was used to support this research. The lecturers' activeness in the class was obtained based on the results of the Feedback Evaluation (EUB) questionnaire given by students on lecturer learning. Lecturer login data to smart lecturer system either through the web version or the mobile application version and upload material that is carried out by the lecturer through the application and in the form of class activities. Table 2 presents examples of lecturer activity data obtained from EUB and applications.

Table 2. Sample EUB result data and application usage

Lecturer	Activeness in classroom	Application Login	Upload material
D1	82.69	2	1
D2	50	1	0
D3	76.69	18	10
D3	84.95	13	2
D4	80.28	175	2
D5	77.44	1	1
D6	76.11	59	4
D7	81.37	1	0
D8	81.3	3	0
.....	.....	.....	.....
D137	85.21	3	2

3. Result and Analysis

The results of the fuzzy mamdani and sugeno methods for determining 173 activeness of lecturers are grouped into three levels, namely low, medium, and high. Each level of activity is obtained by calculating the minimum value, maximum value, average and total for activity in the class, application login, upload material, and final results. Table 3 presents the results of measuring the level of activity of the lecturer using the fuzzy mamdani and sugeno methods.

Table 3. Analysis of research results

Method	Activity Level	Calculation	Activeness in classroom	Application login	Upload material	Results
Mamdani	LOW	Min value	65	2	0	13,04
		Max Value	100	110	5	27,31
		Average Value	83,64	17,46	2,78	16,72
		Amount of data	115	115	115	115
	MEDIUM	Min value	50	1	0	40,08
		Max Value	94,25	440	24	77,77
		Average Value	82,42	144,21	8,26	55,04
		Amount of data	53	53	53	53
	HIGH	Min value	77,15	350	15	91,07
		Max Value	95,21	400	24	91,82
		Average Value	86,60	365,40	21,20	91,43
		Amount of data	5	5	5	5
Sugeno	LOW	Min value	65	1	0	0
		Max Value	100	400	24	45,76
		Average Value	83,73	34,10	3,98	1,38
		Amount of data	130	130	130	121
	MEDIUM	Min value	50	7	0	50
		Max Value	92,22	400	14	50
		Average Value	80,93	103,55	7,97	50,00
		Amount of data	29	29	29	29
	HIGH	Min value	79,07	110	0	50,54
		Max Value	94,25	440	20	90,91
		Average Value	84,92	288,71	8,21	66,04
		Amount of data	14	14	14	14

Based on Table 3 above, the results of the comparison between the mamdani and Sugeno methods. The Mamdani method produces a low lecturer activity level of 66% (115 of 173 data). Medium or Moderate lecturer activity is 31% (53 out of 173 data). High lecturer activity level is 3% (5 out of 173 data).

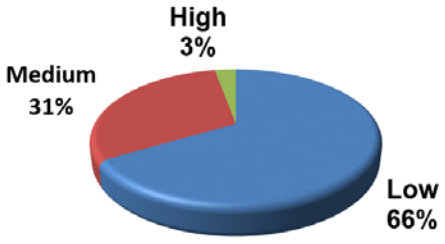

Figure 2. Activeness of Lecturers of the Mamdani Method

While Sugeno method produces a low lecturer activity level of 75% (130 of 173 data). Moderate lecturer activity is 17% (29 of 173 data). The level of high lecturer activity is 8% (14 of 173 data).

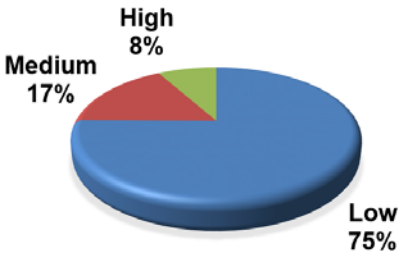

Figure 3. Activeness of Lecturers of the Sugeno Method

4. Conclusion

This study has measured the activeness of lecturers in SmartLecturer-based learning at the XYZ Polytechnic using Fuzzy Mamdani and Sugeno. The level of lecturer activity measured is the activeness in classroom, the login application, and uploading material in the SmartLecturer application. Activeness in classroom and the active use of the Smart Lecturer application are still in the low range, that is 66 % using the Mamdani method and 75% using the Sugeno method. The results of this measurement are more likely to be low and uneven categories; hence it is recommended that the Polytechnic of XYZ Jakarta should increase the activeness of lecturers in the teaching and learning process in class and the use of the SmartLecturer application. For future research research it is recommended to add lecturer activity data variables.

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