Analysis of Student Satisfaction Level on its Influence in Courses Using Fuzzy Logic

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Abstract. One of the soft computing technologies that has been widely developed is fuzzy logic. One of the research themes that uses fuzzy logic is the assessment system in research. To do this, an application that can be used to calculate and record the results of lecturers in learning. The purpose of this study is to apply fuzzy logic with the Mamdani method for lecturer research activities at the University of Graha Nusantara Padangsidimpuan. The steps of the research using the Mamdani method: generating input variables taken from Sinta accredited articles, Simlitabmas grant articles, and articles in international and national journals. generate input variables taken from Sinta accredited articles, Simlitamas grant articles, and articles in international and national journals. In higher education, teachers play an important role in producing skilled and qualified graduates. Therefore, it is necessary to measure student satisfaction with the performance of lecturers at the UGN Padangsidimpuan campus. To determine student satisfaction, observations and questionnaires were distributed to respondents. The questionnaire as a tool and data collection method to measure student satisfaction with lecturer performance is the Mamdani fuzzy logic method.

Keywords: Fuzzy Logic, Lecturer Research, Mamdani Method

1 Introduction

According to Junaidi et al (2020), teaching staff is an important component to enter high-quality lecturers, therefore to become teaching staff must have high abilities in accordance with these limitations. Meanwhile, Universitas Graha Nusantara (UGN) Padangsidimpuan has a vision of becoming a superior, independent and nationally competitive higher lecturer by 2030. To realize this vision, UGN has one of its missions, namely Organizing education, research and community service, as well as conducting studies and periodic studies. so that the UGN faculty can develop, dedicate and apply their knowledge in research so that it can be upgraded to the intermediate category[1].

In higher education, teachers play an important role in producing skilled and qualified graduates. Therefore, it is necessary to measure student satisfaction with the performance of lecturers at the UGN Padangsidimpuan campus. To determine student satisfaction, observations and questionnaires were distributed to respondents. The questionnaire as a data collection tool and as a method for measuring student satisfaction with lecturer performance is the Mamdani Fuzzy Logic method which is implemented with Matlab software[2]. The results show that students are quite satisfied with the performance of the lecturers at UGN Padangsidimpuan. Fuzzy logic can be used to generate information about the effectiveness of lecturers in teaching and can be used as an assessment to improve the effectiveness of lecturers in the future[3].

It should be noted that further dedication is required to develop common topologies, learning algorithms, and theoretical approaches for fuzzy neural models so that these models can be applied to schematic modeling and complex control systems[4]. Student satisfaction is one of the most important factors in the world of education as a form of evaluation of the services provided, with student satisfaction being a measure of effectiveness. Based on the results of the interviews there were differences in student satisfaction with the offer, so that statements of satisfaction with the offer could not be made[5]. One solution that can be useful in implementation analysis is the fuzzy method, which is a method for analyzing systems that contain implementations related to student services[6]. The purpose of this study is to be able to use the Matlab program to measure and demonstrate student satisfaction with academic achievement using the Mamdani fuzzy method.

For this reason, an application is needed that can be used to calculate the lecturer's performance score on the research he produces[7]. To make it easier to see the performance of lecturers from the research results they produce, the researchers use fuzzy logic applications. Various theories of the development of fuzzy logic show that fuzzy logic can be used to model various systems in general[8]. To evaluate research performance, researchers used 3 input variables, namely through Sinta, Simlitabmas, and the journal publication cluster. To get these results, we need to go through the stages of fuzzy set construction, application of implication functions, and compilation of rules[9]. The results obtained indicate that the evaluation of academic results using fuzzy logic can show differences in the final value of lecturer research activities. To obtain these results, it is necessary to carry out the stages of forming a fuzzy set, applying the implication function and compiling rules[10]. The results obtained indicate that the assessment of academic performance using fuzzy logic can show differences in the final value of lecturer research activities[11]. Based on the explanation contained in the background, a problem can be formulated, namely, how to determine the value of lecturer research using the Fuzzy Mamdani method as an alternative tool to calculate the value of lecturer research at Graha Nusantara Padangsidimpuan University[1].

The ability to handle verbal reasoning (linguistic reasoning) is an advantage of fuzzy logic theory. Thus, the mathematical equation of the guided object is not required in the design[12].

The systematic analysis of this service uses the Mamdani fuzzy logic method. There are four things that need to be known about fuzzy systems, namely fuzzy variables, fuzzy sets, universe of conversations, and domains. System analysis steps for this service are as follows:[13]

System analysis steps for this service are as follows:
1. Definition of fuzzy by defining fuzzy variables, fuzzy sets, universe of conversations and regions.
2. Determine the required fuzzy rules by implementing a fuzzy inference system (FIS).
3. Faru datumtraktadon blur this.

The aim is to reduce the complexity of the decision-making process due to the large number of choices using the Mamdani FuzzyLogic method and to reduce subjectivity in the decision-making process and replace it with the application of all criteria to all employees, with the hope that employees with the best skills and other considerations are selected[14].

2 Method

This PkM program is implemented at LPPM UGN Padangsidimpuan using the following method: The steps carried out in this study are shown in Figure 1 below. Based on the research steps in Figure 3, each step can be explained as follows[15]:
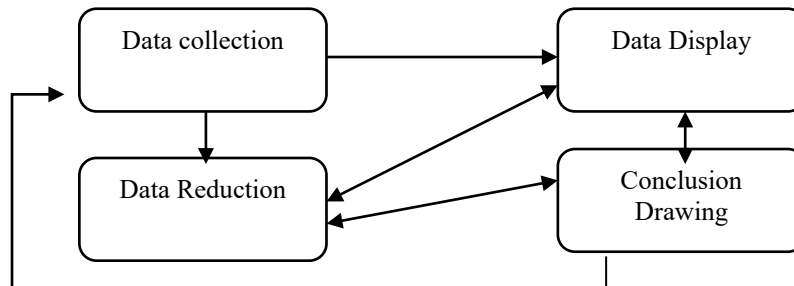
Figure 1. Component of Data Analysis

1. Data collection The data needed for this research is research data from the Faculty of Graha Nusantara University in 2020 and 2021 which is taken from data from the Sinta cluster, Simlitabmas and journal publications.
2. Data reduction Data identification is done to select the variables needed to perform calculations and analyze the problem. Therefore, data reduction is necessary to make the data clear and usable. To reduce the data, the researchers focused on a research question that addressed student processing in perceiving feedback, specifically through her implementation of blended learning in the ARW classroom. Irrelevant data has been isolated.
3. Data dsplay means an organized, condensed, and speculative compilation of information. Viewing data helps you understand what's going on and take action. In this study, data are presented with brief notes, tables, and legends.
4. Conclusion drawing Drawing conclusions is also called verification. From the very beginning of data collection, researchers begin to determine what they mean by tentative conclusions and downplay those

conclusions. We maintain openness and skepticism, but we may not reach final conclusions until data collection is complete. Data triangulation for this study was obtained from interviews, observational notes, and document analysis. Drawing inference, on the other hand, is the last step in data collection, and must be preceded by data reduction and data display.

3 Result and Discussion

This study examines the Mamdani fuzzy method in evaluating research activities of the Faculty of Graha Nusantara Padangsidimpuan University using an application built with Matlab R2013a software. In this study, it consists of 3 input variables, namely the variables that are used as evaluation materials, which include variables from Sinta, Simlitabmas and Klater Jurnal, which will provide 33 rules or 27 rules. The fuzzy set for the input and output variables is presented in Table 1 below[16]:

Table 1. Formation of fuzzy sets for variables Input and output variables

Function	Variable		Universe Of Talk	Fuzzy Set
Input	Sinta	C1-C3	0-41	a little
			42-83	Currently
			84-123	many
		4-C5	0-41	a little
			42-83	Currently
			84-123	many
		S6-S0	0-41	a little
			42-83	Currently
			84-123	many
	Bima	RAP	0-129	a little
			130-258	Currently
			259-388	many
		natural resources	0-129	a little
			130-258	Currently
			259-388	many
	Journal Cluster	national journal	0-41	a little
			42-83	Currently
			84-123	many
		International Journal	0-41	a little
			42-83	Currently
			84-123	many
Output	Cluster PT	built	0-41	a little
			42-83	Currently
			84-123	many
		intermediate	0-129	a little
			130-258	Currently
			259-388	many

In the mamdani method, the implication function used for each rule is a minimum function. After determining the membership function of a variable, fuzzy logic rules are formed. Based on the available data, fuzzy rules can be formed. Rules of analysis Evaluation of lecturers' scientific activities in terms of input variables and output variables As in table 2 below.

**Table 2.** Derivatives of Final Stage Evaluation Variables

Rule	Entrance		GO OUT		Final Score
1	A little	A little	$\rightarrow$		A little
2	A little	Currently	$\rightarrow$		A little
3	a little	many	$\rightarrow$		Currently
4	Currently	a little	$\rightarrow$		A little
5	Currently	Currently	$\rightarrow$		Currently
6	Currently	many	$\rightarrow$		many
7	many	a little	$\rightarrow$		Currently
8	many	Currently	$\rightarrow$		many
9	many	many	$\rightarrow$		many

In this study, the discussion process was carried out in several stages, namely:

1. Determine the input variables taken from the lecturer's research assessment data, where the variables used are the sinta variable, the simlitabmas variable, and the journal cluster variable.
2. Fuzzification: determining the degree of membership of the input and output variables.
3. Fuzzy logic operations must be performed if the previous part of more than one statement performs fuzzy logic operations. The final result of this operation is the degree of truth of the antecedent, which is a single number. Fuzzy operators to perform operations and and or can be made independently.
4. Implication: Apply the implication method to determine the final form of fuzzy set output. The consequence or inference of a fuzzy rule is determined by filling the output of the fuzzy set with the output variable. The implication function used is Min.
5. Aggregation: The process of combining the outputs of all if-then rules into one fuzzy set using the Max function.
6. DefuzzificationThe inference process in the application of fuzzy statements uses the MIN implication function. In addition, the composition of all fuzzy outputs is done using max. Then do validation or called defuzzification using Centroid. In this method, a crisp solution is obtained by taking the center point of the fuzzy area as follows :

Fuzzy statement analysis Using matlab

Validation of Graha Nusanatara University Lecturer's research evaluation data using the Mamadani method can also be performed using the Matlab Fuzzy Toolkit version R2013a. This software is used to interpret the variables of the lecturer's research activities.
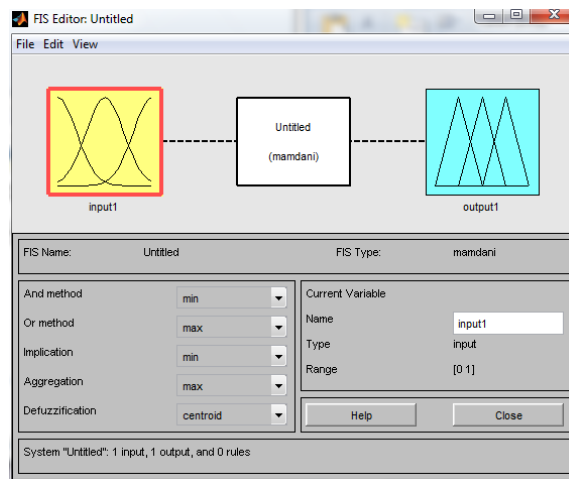

Figure 2. Fuzzy Statement Analysis Using Matlab

This study has 3 input variables and 2 output variables. The input variables consist of Sinta, Simlitabmas, and cluster. 2020 and 2021. While the minor and interim release variables. This can be seen in Figure 4.
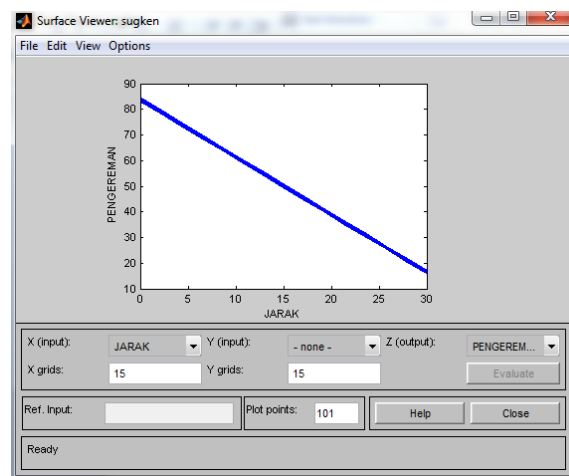
Figure 3. Defuzzification Grafic

Defuzzification fills the output variable with one number using the centroid or area center method. The last step in this implementation is the process of taking the input value to get the output value. In this study, the input value is 104, the initial output value is 103, and the final stage output is 324.
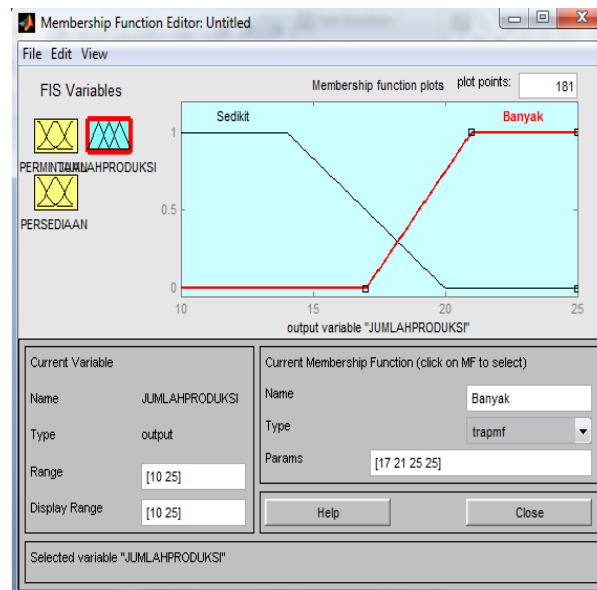
Figure 4. Defuzzification Calculation Process

The definition of accuracy is how close a measurement result is to the actual number. Since this study is so precise, we start with the number of measurements, which are the Y-values of the Mamdani method, which uses a standard set of values for correct results. The Mamdani method standard values are the values of the output variables for assessing the research activity of the lecturers and are determined using the membership function.

1. If the conclusion is the result of a fuzzy assessment, and the final assessment results are the same, then it is declared accurate.
2. If not, then the result is NOT ACCURATE
3. The result of the accuracy of the Mamdani method is 9 and the value of the fuzzy calculation is 16. Thus, the percentage of accuracy of the Mamdani method can be calculated.
4. To evaluate outstanding lecturers according to the following equation: % Akurasi=((Jumlah aturan akurat))/(Nilai Fuzzy) X100 % Akurasi=((9))/16 X100= 56.25%

4 Conclusion

Based on the results of the tests and discussions that have been described, the following conclusions can be drawn.

1. Fuzzy logic with the Mandani method can be used to predict the evaluation of a lecturer's research activities.
2. Based on the results of the comparison of manual calculations and using the Matlab program, there is no significant difference in results.
3. Based on the system that was built, it has a weakness, namely it can only evaluate the performance of lecturers in general, not providing detailed information at will.

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