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Sensitivity Of Obtaining Errors In The Combination Of Fuzzy And Neural Networks For Conducting Student Assessment On E-Learning

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ABSTRACT
Utilization of information technology in the midst of the covid-19 pandemic, including in the field of education, namely by holding On-line Classes. The development of information technology is also growing rapidly, especially in the field of education. Distance learning facilities via the Internet allows maha students undertake independent learning so as to facilitate the learning process. In addition, with the development of the system, it is hoped that this facility will be able to direct the ongoing learning process, so that the learning process that occurs resembles the learning process in the classroom. In conducting an assessment, a lecturer/teacher must pay attention to the rules of assessment. However, because there are no clear rules in conducting the assessment, the assessment process must be designed adaptively to adjust its calculations to the assessment rules of the lecturers / instructors who use the system. In this study, the fuzzy logic method approach and the artificial neural network method were used in calculating the assessment of learning outcomes.

Keywords : **Covid-19, fuzzy neural network clone Logic, Class Online, the internet**

INTRODUCTION

Pandemic covid-19 that occurs at this time has an impact on the movement of people due to lack of social distancing and physical distancing, which makes information technology has a very important role, as well as solutions untu k overcome such restrictions. Utilization of information technology in the midst of this covid-19 pandemic, including in the field of education, namely by holding On-line Classes . Use of information technology is urgently needed in mass outbreaks covid-19. This is one of the factors that requires the development of information and communication technology in the world of education. The development of information technology is also growing rapidly, especially in the field of education. Almost all levels of education utilize information technology available during the COVID-19 pandemic, from elementary school to university level. The rapid development of information technology, especially the internet, allows the development of better information services in an educational institution . Through the internet, it is very supportive of education, so that universities can provide better information service education to their communities, both inside and outside universities. Education services are carried out through internet facilities, by providing online learning facilities and can be accessed by anyone who needs it.

Learning facilities through internet media allow students to do independent learning so that they can facilitate and expand the teaching and learning process. In addition, with the development of the system, it is hoped that this facility will be able to direct the ongoing learning process, so that the learning process that occurs resembles the learning process in the classroom. In order for our wishes to be realized, this facility must provide a system that can play the role of a lecturer (teacher). Including one of them is conducting an assessment of student learning outcomes. By calculating the assessment, a lecturer / teacher has rules in conducting an

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assessment that must be considered. To help lecturers / lecturers, a system is designed, so as to provide flexibility for lecturers / lecturers to determine the assessment rules that will be used by the system. In giving judgment, a lecturer / instructor can use some fa ktor, for example, the value of final exams , midterm grades semesters , quiz grades, grading assignments, attendance, and liveliness. To avoid a lot of rules, the rules made by the lecturer/teacher must be symbolic rules/ fuzzy rules.

METHODS

Design *of Fuzzy Logic Method*

Fuzzy logic method has advantages in the learning process. This is possible considering that the reasoning in this method uses linguistic/symbolic variables. The reasoning process is very close to the reasoning done by humans, because basically a human will tend to use symbolic variables in reasoning.

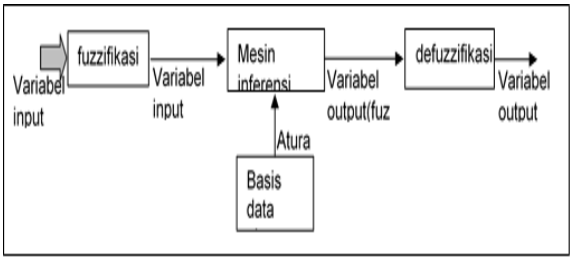

Figure 1. Fuzzy Logic Reasoning

From Figure 1, to form a fuzzy reasoning system, the steps that must be taken are:

1. Determine the variables, both input variables and output variables.
2. Determine the fuzzification step, which is to transform the form of the input variable from the crisp form to the fuzzy form. In this step, a fuzzy membership function is created for each variable.
3. Determine the rules that apply to the system
4. Determining the defuzzification step is to transform the form of the output variable from fuzzy form to crisp form. Menentukan aturan-aturan yang berlaku pada sistem

Fuzzy Membership Function Design

The system designed has two input variables, namely a quantitative value, hereinafter referred to as value , and a qualitative value, hereinafter referred to as absent (activity). For the design of the fuzzy membership function, a triangular graph is used with three criteria : small, medium, and large.

Fuzzy Membership Function For Quantitative Value (Value)

The value factor is designed to have a value range from 0 to 100, then a membership function graph is designed as shown in Figure 2. below :

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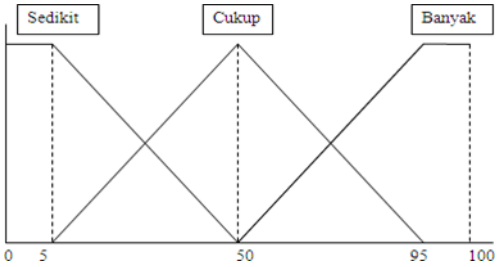

Figure 2. Fuzzy membership function for the value of

Fuzzy Membership Function For Qualitative Value (Absence)

The absent factor is designed to have a range of values from 0 to 10, then a membership function graph is designed as shown in Figure 3.

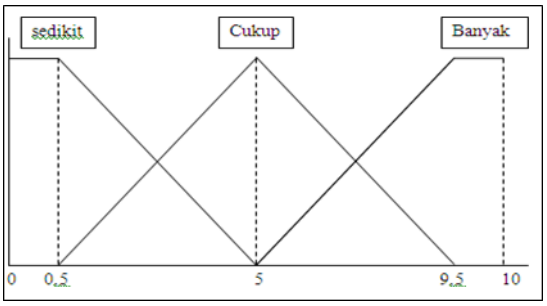

Figure 3. Fuzzy membership function for absent

Fuzzy Membership Function For Results

The result variable is designed to have a value range of 1 to 4, then a membership function graph is designed as shown in figure 4 below :

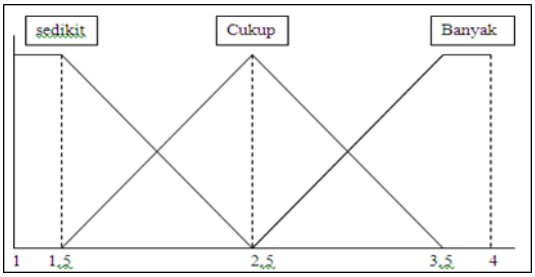

Figure 4. Fuzzy membership function for results

The rules stored by the system are generally in the form of "If condition 1 AND condition 2 then results". For condition 1 and condition 2 can be added with the function "very".

Neural Network Method Design

Imitation

The input to the artificial neural network system is the same as the input to the fuzzy logic system. As for the output value in the fuzzy logic system, the value is between 0 - 4, so the activation function selected for the "result (output)" neuron in Figure 5 is a sigmoid function

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which has a value between 0 - 1. To adjust to the output value system, then the output value of the "result (output)" neuron in Figure 5 is mapped first with the formula:

System output = value "yield" x 4

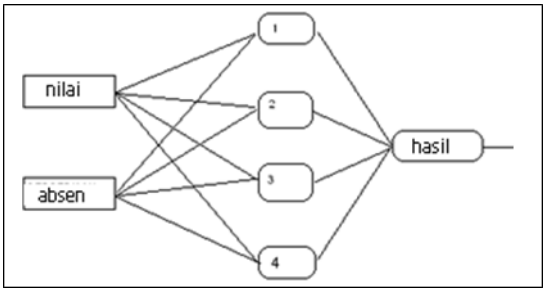

Figure 5 . JST network structure

System Learning Mechanism (Learning)

Learning using the backpropagation method with an error factor calculated by the *mean absolute percentage error (MAPE)* method which is a measure of relative error, in addition to the mean absolute deviation (MAD) and root mean squared error (RMSE). MAPE is usually more meaningful than MAD, because MAPE expresses the percentage of error in the estimation results against the actual results over a certain period which will provide information on the percentage of error that is too high or too low. MAPE is the average absolute error over a certain period which is then multiplied by 100% to get a percentage result.

MAPE is a relative determination measure used to determine the percentage deviation of the estimation results. This approach is useful when the size or magnitude of the estimation variable is important in evaluating the accuracy of the estimate . MAPE indicates how big the error in guessing is compared to the real value. D IMANA mathematical formulation is:

$$\text{MAPE} = \sum_{t=1}^{n} \left| \frac{y_i - \hat{y}_i}{\hat{y}_i} \right| \times 100\%$$

And the MAPE tolerance in learning is set at 0.001.

III. RESULT AND DISCUSSION

Algorithm and Research Steps

In this study, the algorithm used is a fuzzy logic algorithm and an artificial neural network algorithm. The fuzzy logic algorithm uses an S-curve calculation, while the artificial neural network algorithm that will be used is back propagation. The research steps that will be carried out to make predictions on computer-based assessments are as follows:

1. Determining the scoring rules
2. Entering the scoring rules into the system

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3. The value is calculated using the percentage of student absenteeism and activity
4. Determining the assessment input data
5. The assessment input data is converted into fuzzy values by calculating the S-curve
6. The assessment data is entered into the back-propagation neural network architecture for an assessment of the assessment inputs and assessment targets
7. The assessment input data is converted into fuzzy values by calculating the S .-curve
8. The test data is fed into the back-propagation neural network architecture
9. The output of the test will be obtained

The following is theinitial network architecture that will be used to test the computer - based assessment system :

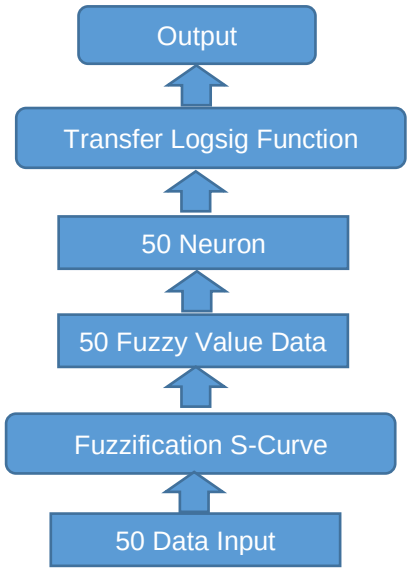

Figure 6. Network Architecture Built

System Test

In this study to evaluate the test results by way of comparing the value of the output results of the tests in the system with real value assessment of the rules that have been determined manually and calculates the difference between the value of the output of the test results.

Fuzzy Logic

The study was conducted on 70 assessment data by a teacher in a particular subject. By using the fuzzy membership function, the comparison of the results used in the experiment can be seen as the graph in Figure 7 below :

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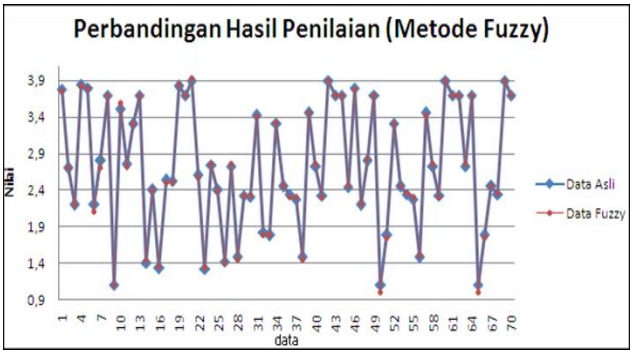

Figure 7 . Comparison of fuzzy assessment results with actual assessment results from a teacher

And the results of the assessment comparison as shown in Figure 7 , in general it can be concluded that the results of the assessment using fuzzy logic have been able to approach the results of the actual assessment carried out by a teacher. This conclusion can be confirmed by looking at the error graph that occurs in the 70 experimental data used. Figure 8 is an assessment error graph using the fuzzy logic method when compared with the actual assessment results from a teacher.

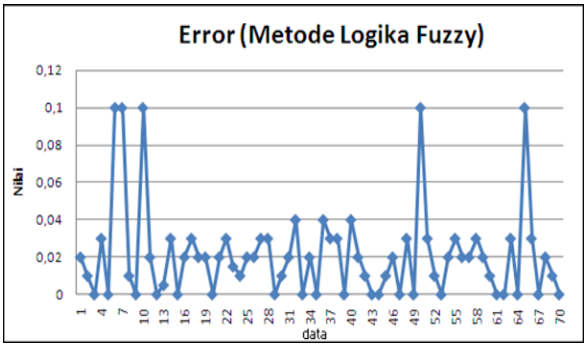

Figure 8 . Error graph on 70 experimental data using fuzzy logic method

The average error in Figure 8 is 0.028571, the biggest error is 0 , 1 .Rata-rata error pada gambar 8 adalah 0,028571, dengan error terbesar adalah 0,1.

Artificial Neural Network

Furthermore, the same research data was also used to test the scoring system using the artificial neural network method. The first time the network was used to study 40 experimental data taken randomly from 70 existing assessment data, then the network that had been formed was used to reassess 70 student data on the experimental data.
Figure 9 is a comparison of the results of the assessment using the artificial neural network method compared to the data from the actual assessment results from a teacher.

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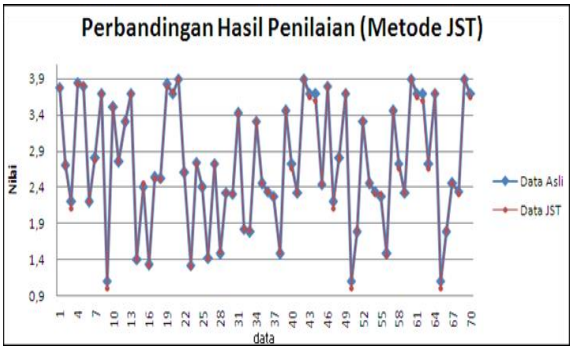

Figure 9 . Comparison of the results of the JST method assessment with the actual assessment results from a

Based on the comparison graph in Figure 9 , it can be seen that the results of the assessment using the artificial neural network method are able to approach the actual assessment results of a teacher. Figure 10 is an error that occurs in the 70 experimental data used.

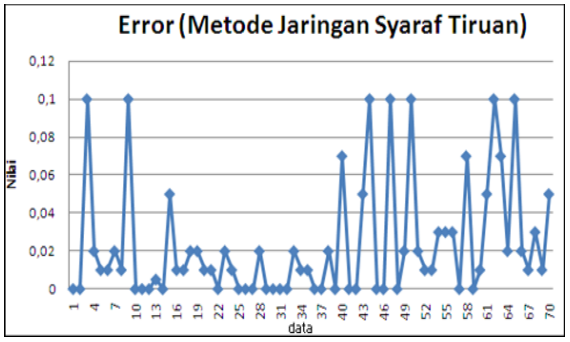

Figure 10 . Error graph on 70 experimental data using the JST method

The average error that occurred in the chart Figure 14 is 0.023214 with the largest error is 0 , 1.

CONCLUSION

The combination of artificial neural network backpropagation with fuzzy logic using the S-curve membership function can produce satisfactory results. The scoring system using fuzzy logic or neural network method as the basis for calculation allows an assessment system assessing learning outcomes is most students in accordance with the rules of assessment which is owned by a teacher. So that the system can be considered to be able to assess student learning outcomes like a teacher.

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