**ANALYSIS OF APPLICATION OF BACKPROPAGATION METHODS IN DECISION MAKING OF LECTURER PERFORMANCE DETERMINATION ON THE UTILIZATION OF ONLINE LEARNING IN CREATIVE MEDIA POLYTECHNIC**

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Abstract

The use of online learning at the Creative Media State Polytechnic during the Covid-19 pandemic has had a social impact on the campus community, especially students and lecturers. Learning that is not face-to-face does it have the same effectiveness or increases with face-to-face learning or does it actually decrease. So that in this study has analyzed the performance assessment of lecturers in the use of online learning using the Backpropagation method. The data source comes from the results of a questionnaire which has 20 questions and refers to 4 criteria, namely performance, opportunity, kabsensik and integrity. A total of 142 respondent data have been collected that can be processed. The processing results show a high level of accuracy using the Backpropagation method based on the correlation coefficient value of r = 0.9135. This result is close to 1 which indicates a good match between the network output and the target. So, it can be concluded that this method can be used to determine the performance of lecturers in online learning.

1. **Introduction**

The Covid-19 events that emerged in early 2019 until 2021 have directly or indirectly changed the system in almost all aspects of life. In this condition, the acceleration of the use of technology almost occurs in all fields. This is no exception with teaching and learning activities at the Creative Media Polytechnic campus which organizes online learning during the pandemic. Of course, the use of online learning has a social impact on the campus community, especially students and lecturers. As in direct face-to-face learning, does it have the same effectiveness or increase with face-to-face learning or does it decrease.

In the world of education, the impact of the industrial revolution is forcing educational institutions to apply technological advances (Dalimunte, 2014). With the presence of the industrial revolution, learning can be done not only in the classroom but can be carried out online. Halkinik also forces teachers to be creative in delivering their teaching materials (Utami, 2011).

The success of the learning objectives that have been set or that will be achieved previously depends on the skills of human resources (lecturers) in carrying out the tasks that have been given and targeted. To be able to recognize the ability and potential of a lecturer for his work, a university must have an assessment system to support decisions in determining lecturer performance so that if there is a lack of professionalism of a lecturer, then it is the obligation of the university to facilitate lecturers can take part in training to improve professionalism or what we usually know as lecturer performance (Khasanah et al., 2019).

Based on the background of the problem above, so the author is interested in analyzing the accuracy level of one of the artificial neural network methods, namely backpropagation on the problem of evaluating the performance of case study lecturers in the animation study program with the title "Analysis of the Application of Backpropagation Methods in Decision Making in Determining Lecturer Performance on the Utilization of Online Learning in Creative Media Polytechnic”.

## Research methods

## Research stages.

Globally, the main stages of this research method are divided into four stages, namely, the preparation stage, the data collection stage, the data processing stage, and the data testing stage. The following is the flow of the research stages:

Figure 2. Research phase flow

From the picture of the flow of the research stages above, it can be described at each stage as follows:

1. **Preparation Stage**

This stage starts from the problem assessment, as well as conducting a literature study on similar research that has been done.

1. **Data Collection Stage**

In this research, data collection was carried out by interviewing the Head of the Animation Center and observing the online learning process in the Animation study program as well as filling out questionnaires.

1. **Data Processing Stage**

The data processing stage is divided into three stages, among others: determining the value of the input (input), determining the result or output (output), and data processing methods.

1. Determine the Input Value (input)
2. Determine the Result/Output (Output)
3. Data Processing Method
4. **Data Testing Phase**

In this step, the data is tested, namely the data from the assessment results by the lecturer's supervisor and student questionnaires represented by the four criteria above. Before testing the data (data testing), data training (data training) is carried out which has already been determined directly by the input and output values. Then the data is trained by data processing methods, namely Backpropagation.

Then, the data is tested by taking data samples that have never been a training data sample. The results of the testing data will be adjusted to the conditions of the criteria that have been set. In the method that has a high level of accuracy, recommendations will be made on the method that will be used to determine the performance of the lecturer.

1. **Results and Discussion**

## Data

Data collection has been carried out using a google form with the link address: https://bit.ly/KuisionerPenelitianKompetif2021. With the number of respondents as many as 142 people in the Animation Study Program students of all D4 and D3 classes as shown in Figure 3.

## 

Figure 3. Percentage of Respondents Per Class

* 1. **Working manually**

From the above conditions, the Backpropagation method can be developed to determine the assessment of lecturer performance results. There are 20 initial and target data inputs taken from the first data (first row) of the training data and a hidden layer which has 5 units of neurons. Then determine the initial weight at random, determine the activation function, namely sigmoid and the rate of understanding (Learning Rate) = 0.2. Here are the steps for the construction of the Backpropagation method.

1. The first step is to determine the weights randomly.

There are two weights, namely the initial weight of the input and bias randomly from the input layer to the hidden layer and the weight from the hidden layer and bias to the output layer. Here are the weight values ​​at random.

* + 1. Weight from input layer to hidden layer.

At this stage the number of weights of course adjusts to the needs of the number of inputs and biases to the number of hidden layers. So if the input in the pattern above is 20 which has 5 neuron units in the hidden layer, the total number of weights is 105 weights obtained from 20 (input) + 1 (bias) \* 5 (neuron units in the hidden layer). The following is a table of initial input weights and random bias from the input layer to the hidden layer. Then the value is as shown in the table below.

* + 1. Weight from hidden layer to output layer.

In the weighting from the hidden layer to the output layer, it takes 6 weight values ​​based on 5 neuron units in the hidden layer and a bias that leads to one output unit so that a total of 6 weights are determined randomly. Here are the six weights that have been determined.

1. In the second stage, which is to calculate the hidden unit output based on the input unit using the function below:

* +2(-0,09)+2(-0,93)+5(0,16)+4(-0,89)+4(-0,86)+4(0,52)+4(-0,43)+4(0,91)+4(-0,29)+4(0,28)+4(0,31)+4(0,48)+4(-0,36)+3(-0,98)+4(-0,63)+4(0,89)+4(-0,75)+4(-0,89)+4(0,59) =
* (0,59)+2(0,03)+2(-0,30)+5(0,89)+4(-0,96)+4(-0,97)+4(-0,34)+4(-0,46)+4(0,09)+4(0,42)+4(-0,96)+4(-0,65)+4(-0,98)+4(0,23)+3(-0,34)+4(-0,07)+4(0,32)+4(-0,86)+4(0,26)+4(0,24)
* 4(-0,33)+2(-0,74)+2(-0,34)+5(0,18)+4(-0,09)+4(-0,88)+4(-0,24)+4(-0,47)+4(0,01)+4(-0,91)+4(-0,06)+4(0,88)+4(-0,54)+4(-0,02)+3(0,04)+4(-0,89)+4(0,92)+4(0,33)+4(-0,15)+4(0,23) =
* (-0,56)+2(-0,33)+2(0,94)+5(0,48)+4(0,79)+4(0,52)+4(0,04)+4(-0,73)+4(0,16)+4(0,54)+4(-0,12)+4(-0,73)+4(0,69)+4(0,48)+3(0,07)+4(-0,04)+4(-0,24)+4(0,44)+4(0,28)+4(0,51) =
* 4(-0,52)+2(0,60)+2(0,55)+5(-0,74)+4(0,10)+4(0,65)+4(-0,02)+4(0,68)+4(-0,02)+4(0,41)+4(-0,27)+4(-0,32)+4(0,14)+4(0,21)+3(-0,61)+4(-0,65)+4(-0,29)+4(0,27)+4(-0,28)+4(-0,33) =

Then calculate the results above using the sigmoid activation function.

* **3,2E-06**
* **4,0E-07**
* **0,002**
* **0,99**

1. After knowing the output of the unit in the hidden layer, the next step is to calculate the value of the output unit , using the function below.

Then the value of the output unit is as follows

= -0,19+(3,2E-06)( 0,15) +(4,0E-07)( 0,71) +(0,002)( 0,71) +(0,99)( 0,22) +(0,13)( 0,86)

= **1,5E-01**

Then the above results are entered into the sigmoid activation function

1. The next step is to calculate the factor in the output unit

In this network only has one output unit so,

Weight change rate (with ) :

1,2E-01

4,0E-07

4,9E-08

2,8E-07

1,2E-01

1,7E-02

1. Next is to calculate the sum of the errors of the hidden units (=)

In this network also has an output unit then,

Error factor in hidden units:

**3,0E-07**

**1,7E-07**

**9,8E-07**

**1,6E-07**

**6,2E-02**

Weight change rate to hidden units:

1. After knowing the error of the hidden unit, the next step is to determine the weight change in both the output unit and the hidden unit.
   1. Output units weight change :
   2. Hidden units weight change :
2. The next step is to repeat the process as above with the new input contained in the next line.
   1. **Working using MATLAB**

In determining the performance of lecturers with the Backpropagation method using the Matlab application, it can be seen the level of the percentage of the accuracy of the results. The higher the percentage, the higher the level of accuracy. The Backpropagation neural network method includes 1 input layer, 2 hidden layers, and 1 output layer. The input layer has 20 neurons that represent the input of the lecturer's performance indicator questionnaire. Meanwhile, the first hidden layer has 10 neurons with a tangig activation function, the second layer has 5 neurons with a logsig activation function. In the output layer which has 1 neuron using the purelin activation function. Here are the steps to do it:

* + 1. **Conversion data**, in the first step, data conversion is carried out, namely preparing initial data in the form of an assessment of the results of the lecturer's performance questionnaire in the form of a spreadsheet obtained from Google Form. Of the 142 data divided for training data and test data, it is found that each has 71 data. In addition, it also transposes data so that it can be built on the Backpropagation neural network. Here is the programming:

1. Import excels data as main data

data=xlsread("Published/Matrix Kuisioner Kinerja Dosen Oleh Mahasiswa PerDosen.xlsx")

1. Divide the training data (P) and the target (T) by determining odd rows in the main data and transpose the data:

P=data(:,1:20)’

T=data(:,21)’

1. Divide the test (Q) and target (QT) data by determining even rows in the main data and transpose the data:

Q=data(:,1:20)’

QT=data(:,21)’

* + 1. **Preprocessing**, the next step is to do preprocessing by normalizing using the mean and standard deviation normalization before the network is built.

[pn,mean,stdp,tn,meant,stdt] = prestd(P,T)

From the above preprocessing will produce the initial weight of the network.

* + 1. Build a feedforward neural network with the gradient descent momentum learning method (traingdm).

netBP=newff(minmax(pn),[10 5 1],{‘tansig’ ‘logsig’ ‘purelin’},’traingdm’)

From the construction of a feedforward neural network, it will produce the final weight of the network.

* + 1. Next do the training.

netBP=train(netBP,pn,tn)

From conducting network training on the training data above, it can be seen that network processing in the form of Epoch, Time, Performance, and Gradient. In the picture below, it is known that it requires 1000 epochs or repetitions to get the maximum weight so that the Mean Squared Error (mse) level is 1.12. Because in this step we do not limit the epoch or mse it is automatically determined. But we can also set limits on epoch and mse.

Graphical user interface, application

Description automatically generated

Figure 4. Result of data training

* + 1. Then test the data that was trained

ujiDatalatih=sim(netBP,pn)

udl=poststd(ujiDatalatih,meant,stdt)

In this step will generate network output. This result will be the determination of the lecturer's performance assessment on the training data.

* + 1. This step is to find out the error value by looking at the difference between the target and the network output. So that it can be seen the smallest and largest errors from the test results on the training data.

errorDatalatih=T-udl

By ignoring the minus results, the error value or the maximum distance difference in the training data above was found to be 0.9053, while the minimum error was 0.0043 in the training data.

* + 1. See the correlation coefficient of the network output with the target which is analyzed by linear regression using postreg.

[m1,a1,r1]=postreg(udl,T)

In determining the feasibility of this method, it is possible to use the value of the correlation coefficient which is the level of correlation of the overall compatibility of the inputted data between the network output and the target in this step the compatibility of the network training with the training data, the value of r1 = 0.9135 as shown below. These results are close to 1 which indicates a good match between the network output and the target.

Graphical user interface, chart, line chart

Description automatically generated

Figure 5. Result of comparison of output and target data training

* + 1. The next step is to test the test data, that is, the data is not trained. At this stage, denormalization is also carried out first with trastd. While the simulation results are denormalized with poststd.

Qx=trastd(Q,mean,stdp)

ujiDatauji=sim(netBP,Qx)

udu=poststd(ujiDatauji,meant,stdt)

This process will produce network output data which is the result in determining the lecturer's performance assessment on the test data.

* + 1. See the smallest and largest errors from the test results on the test data.

errorDatauji=QT-udu

By ignoring the minus results, the error value or the maximum distance difference in the training data above was found to be 0.9053, while the minimum error was 0.0021 in the training data.

* + 1. Look at the correlation coefficient of the network output with the target which is analyzed by linear regression using postreg.

[m1,a1,r1]=postreg(udu,QT)

Graphical user interface, chart, line chart

Description automatically generated

Figure 6. Result of comparison of output and target data testing

In network training with test data the value of r1 = 0.9135 as shown above. These results are close to 1 which indicates a good match between the network output and the target. So it can be concluded that the method on the Backpropagation neural network for decision making in determining the performance of lecturers gets results with a high level of accuracy.

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