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# Prediction of Evaluation Result of E-learning Success Based on Student Activity Logs With Selection of Neural Network Attributes Base on PSO

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**Abstract.** Evaluation of learning systems based on e-learning is very important to determine learning success. The purpose of this study is to obtain predictive results from evaluating students who follow e-learning based learning systems. The data used is the result of logs of student learning activities taken from the LMS. The data used in this study were 641 user logs of student activity. In predicting the evaluation results based on the learning system on e-learning we use a neural network method based on swarm particle optimization. Neural Network has a problem in optimizing very large data so using swarm particle optimization can solve this problem. From the data testing we have done, the results obtained by the Neural Network method get an accuracy value of 95.47%, and the results of the AUC value of 97.90%. The observation of variables C,  $\epsilon$  and population of Neural Network and particle swarm optimization use the K-Fold Cross Validation method. Then the researchers tested several choices on the attributes used. By using the Neural Network method based on the swarm particle optimization attribute, there are 9 predictor variables so that as many as 6 attributes are used, namely sports, chat, discussion, messages, Quiz exercises and total logs. The results show an accuracy rate higher than 97.50%, and an AUC value of 98.20%. So the accuracy value increased by 2.03% and the AUC increased by 0.3%. With accuracy and AUC values, the Artificial Neural Network algorithm based on particle optimization is very well categorized.

**Keywords :** NN-PSO, Evaluation of E-learning, Student Aktivty Logs.

## 1. Introduction

In this study, we conducted a discussion to look for results from the evaluation of learning evaluations with e-learning based on student log activities, using several attributes to determine how successful, the data we used were 641 student data from the results of teaching and learning activities. Results Student academic achievement is the most important benchmark for comparing student quality. This serves as a basic criterion for universities to monitor the quality of teaching and learning for universities to evaluate and choose students [1]. Predicting a student's learning performance becomes more challenging because of the large volume of data contained in the education database [2]. At present the use of the internet in computer-based education systems can encourage an educational environment to use web-based systems such as e-learning systems [3]. E-learning is a learning process that uses technological devices that require an internet connection. Developing e-learning based learning systems is currently showing a significant increase, namely the presence of most universities that use learning systems base



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on e-learning. Besides that e-learning has a contribution to the achievement and satisfaction of the experience of students who implement e-learning learning systems [4]. The results also show that the use of e-learning that is facilitated properly can increase student motivation and self-improvement [5].

E-learning has become a public online service that supports teaching and learning in education [6]. To determine the results of evaluations of learning base on e-learning , it is of course necessary to need monitoring of teaching and learning activities, namely by monitoring the results of the activity logs of students and lecturers in what activities I do in the teaching and learning process. The log of learning based e-learning is analyzing deeper than just counting and visualizing the number of posts clicked on. Another key feature is to avoid using entries by students and as input. The purpose of the log here is to measure the status of activities in the online course as much as possible without distortion, 'objective', by relying exclusively on log file data or planning data provided by the administrator [7]. Thus, the evaluation of learning systems base on e-learning is very important to ensure successful delivery, effective use, and positive impact on students. The data we will process is 641 data, there are 9 attributes that will be tested in determining the level of accuracy and selection of what attributes have an influence in predicting the results of evaluating the success of learning using e-learning. Based on an intensive review of the literature, a comprehensive model has been developed that provides a holistic picture and identifies various levels of success associated with various determinants of success [8].

However, we found the problem of difficulty in managing such large data in determining predictions of the results of learning evaluations with e-learning and determining attributes. Therefore to determine the evaluation results of e-learning learning and determine the attributes of the student activity log, we use the Neural Network algorithm as the solution. Because the neural network algorithm can increase the speed of computation, and optimize the architecture of the neural network through reducing the number of neurons used in each network, the results achieved can sustain the performance of these types of predictors, so the error rate collected is very low [9]. Besides that the Neural Network algorithm is a realistic and relevant algorithm to obtain interesting results in the context of the diversity of ways students learn [10]. In addition, the use of neural network algorithms is also often used as a basic classification in some classification systems to create a model that predicts the value of variables [11].

From the discussion above it can be seen that the Neural Network (NN) method is an effective algorithm for analyzing student learning outcomes using the e-learning platform [12]. however the performance of the model depends on parameter settings. In this research, we use the direct search method to optimize it. The success of the Neural Network depends on an adequate choice of features and parameters. Thus it can be said that feature selection and parameter selection in Neural Networks significantly affect classification accuracy .

Feature selection acts as an important role in identifying irrelevant features and excessive features of large datasets. Feature selection is a preprocessing action process that is used universally for large amounts of data [13]. The problem is that excessive attributes and information are included in the evaluation model of the results of an e-learning based learning system, resulting in a lot of time spent and even a higher level of accuracy and complexity. Based on these problems it can be seen that the Neural Network has a very good generalization ability to solve problems even with limited examples. However, the number of attributes in the data can reduce the level of accuracy and increase the complexity of the Neural Network algorithm.

Therefore we need an attribute selection method on data sets with a large number of attributes to improve accuracy. How the Particle Swarm Optimization (PSO) algorithm known as performance can show the optimization of particles, Optimization of the crowd of particles that is applied to structural design problems [14]. Particle swarm optimization (PSO) can solve this problem because Particle Swarm Optimization (PSO) is a collection of intelligence-based

and stochastic algorithms to solve optimization problems [15]. Swarm Optimization Particles (PSO) is a solution to a method used to implement attribute selection features[16]. By selecting the attributes on the Neural Network can improve the accuracy of the results of the prediction of learning systems based on e-learning based on the activity log. Therefore, if the Neural Network and Particle Swarm Optimization (PSO) algorithm are combined, the results can improve the accuracy of the predictions[17], rather than only using the Neural Network algorithm

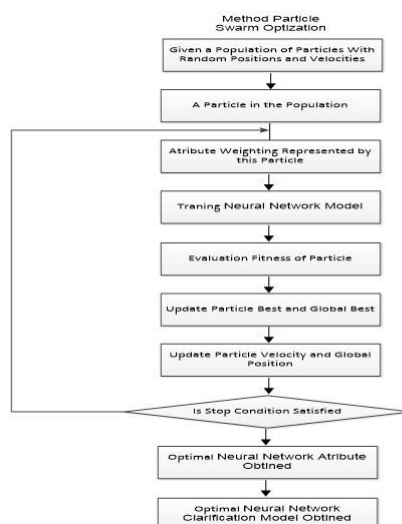
## 2. RESEARCH METHODS

The method we use is neural network and Particle swarm optimization, neural network is a non-linear statistical data modeling, neural network can be used to model complex relationships between inputs and outputs to find patterns in the data. While the Particle Swarm Optimization Algorithm (PSO) one of the optimization algorithms that can be used to make decisions, and can improve achievement results. To achieve the results of the research we have done to solve this problem, we have chosen the right algorithm used in data management, the data we will use is 641 with 9 attributes issued are Gender, Training, Forum, Chat, Discussion, Upload Assistance, Message, Quiz Training, and Total Login . Then to predict the results of evaluation of learning systems based on e-learning. And we have taken steps to get the expected results using the method discussed in the introduction as follows.

### Data Collection

#### (i) Experiment

We identify a hypothesis theoretically by setting a number of variables that will be used to determine the accuracy of the evaluation results of the e-learning-based learning system, and determine what attributes will be used in selecting attribute selection. Then the results of the collection of student activity log data that follows the e-learning based learning system with the best sample data that we chose, the data obtained as many as 641 user e-learning, and the number of attributes that we chose as many as 9 attributes will be used as a determinant of the evaluation results predictions in e-learning based learning system.



**Figure 1.** The Proposed Model

To get higher accuracy results, the following model that we propose is to use the Neural Network method based on Particle Swarm Optimization

## (ii) Observation

To produce good student activity log data, we monitor by looking at student activities contained in the activity log menu on the Learning Management System (LMS) based on e-learning system at Bina Sarana Informatika University, so that we can get user activities in learning activities during one period, which is every semester.

## (iii) Structured Query Language(SQL)

To obtain activity logs for users who use e-learning based learning systems, we use the Structured Query Language (SQL) technique that can be accessed directly from the e-learning database. we do the data processing in the form of Excel which is easy to read and understand by the reader, besides that it is also easy to calculate the accuracy value of the rapid miner software

### 3. RESULTS AND ANALYSYS

To be able to find out the results of testing with Neural Network and Neural Network based on Particle Swarm Optimization are as follows.

#### 3.1. Test results using the Neural Network method

After we do the testing using the Neural Network (NN) method of the confusion matrix can be seen in table 2. The results of the True Positive (TP) value of 399 are classified as 1 according to predictions made by the Neural Network (NN) method, and the results False Negative (FN) of 16 data is predicted as 1 but it turns out to be 2, then the results of True Negative (TN) of 213 data as 2 are in accordance with predictions, and False Positive (FP) of 13 data is predicted 2 turns out 1. The level of accuracy generated by Neural Network algorithm is 95.47%, with AUC value of 0.9790 and can be calculated to get the value of accuracy, sensitivity, specificity, ppv, and npv in the calculation below:

**Table 1.** Testing and Data Processing Results 2020

Classification	Predicted Class	
	Class=1	Class = 2
Class= 1	399	16
Class= 2	3	213

$$\begin{aligned}
 Accuracy &= \frac{TP+TN}{TP+TN+FP+FN} = \frac{399+213}{399+213+13+16} = 0,9547 \\
 Sensitivity &= \frac{TP}{TP+FN} = \frac{399}{399+16} = 0,9927 \\
 Specificity &= \frac{TN}{TN+FP} = \frac{213}{213+13} = 0,9424 \\
 PPV &= \frac{TP}{TP+FP} = \frac{399}{399+13} = 0,9684 \\
 NPV &= \frac{TN}{TN+FN} = \frac{213}{213+16} = 0,9301
 \end{aligned}$$

From the results obtained using the Neural Network (NN) algorithm produces a value with an accuracy level of 95.47% and has been calculated to get the value of accuracy, specificity, ppv, and npv.

### 3.2. Test Results using the Neural Network (NN) method based on Particle Swarm Optimization (PSO)

After we do the testing using the Neural Network (NN) method based on Particle Swarm Optimization (PSO) from the confusion matrix can be seen in table 3. The results of the True Positive (TP) of 408 are classified as 1 according to predictions made with Neural Networks (NN), and False Negative (FN) results of 217 data predicted as 1 but it turns out to be 2, then True Negative (TN) results of 4 data as 2 as predicted, and 12 False Positive (FP) of data predicted 2 turns out to be 1. The accuracy level generated by the Neural Network (NN) algorithm is 97.50%, with an AUC value of 0.982 and can be calculated to get the accuracy, sensitivity, specificity, ppv, and npv values in the calculation below:

**Table 2.** Testing and Data Processing Results 2020

Classification	Predicted Class	
	Class=1	Class = 2
Class= 1	408	12
Class= 2	4	217

$$\begin{aligned}
 \text{Accuracy} &= \frac{TP+TN}{TP+TN+FP+FN} = \frac{408+217}{408+217+4+12} = 0,9750 \\
 \text{Sensitivity} &= \frac{TP}{TP+FN} = \frac{408}{408+12} = 0,9714 \\
 \text{Specificity} &= \frac{TN}{TN+FP} = \frac{217}{217+4} = 0,9333 \\
 \text{PPV} &= \frac{TP}{TP+FP} = \frac{408}{408+4} = 0,9819 \\
 \text{NPV} &= \frac{TN}{TN+FN} = \frac{217}{217+12} = 0,9475
 \end{aligned}$$

From the results obtained using the Neural Network (NN) algorithm based on Particle Swarm Optimization (PSO) produces a value with an accuracy rate of 97.50% and has been calculated to get accuracy, specificity, ppv, and npv values.

### 3.3. Evaluation Results from Neural Network (NN) Test Results with Particle Swarm Optimization (PSO)-based Neural Network (NN)

From the test results using the Neural Network (NN) and Neural Network (NN) based on Particle Swarm Optimization (PSO) can be seen in Table 3 as follows:

**Table 3.** Comparison Results 2020

Algorithm	AAccuracy	AUC	Comparison
NeuralNetwork(NN)	95,47%	97,90%	Akurasi 2,03%
NNwith Partical Swarm Optimization (PSO)	97,50%	98,20%	AUC 0,3%

#### 4. CONCLUSION

The results we have done in testing are using the Support vector machine method and the Particle Swarm Optimization (PSO) based Neural Network (PSO) method, with student log data following an e-learning based learning system, it can be concluded that the algorithm can be used for testing with produce accuracy numbers and AUC. In testing using the Neural Network (NN), the accuracy value is 95.47% while the AUC value is 0.9790. Whereas by testing conducted using the Neural Network (NN) method based on Particle Swarm Optimization (PSO) which is done by using attribute selection and adjustments to the parameters C,  $\epsilon$  and population with a total of 9 attribute predictor variables that are carried out by selecting attributes so as to get as many as 6 the attributes used are exercise, chat, discussion, message, exercise quiz and total log, which will be used. Obtained an accuracy value of 97.50% and the AUC value is 0.9820. So it can be concluded from testing student activity log data using Neural Network (NN) algorithm and using Particle Swarm Optimization for the selection of attributes produced that the method has a higher accuracy value in determining the results of the elearning student graduation level selection based on attributes, compared to only using Neural Network (NN) without comparison with the Particle Swarm Optimization method, which is characterized by an increase in the results of the accuracy value of 2.03% and AUC value of 0.3%, then the results are included in the category of very good accuracy classification (excellent).

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