

# Analysis of neural network algorithm in determining high school student department

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**Abstract.** In senior high schools, especially in the first class were required to place a department that is in accordance with the value produced. The application predicts student majors based on the value of students using artificial neural network algorithms using rapid miner to be able to produce more precise and faster accuracy results. The results obtained from the analysis carried out obtained an accuracy value of 71.86%. ANN has a network architecture that is a single layer net. Networks that have more than one layer are called multilayer net and competitive layer networks (competitive layer net). The shape of a multilayer net 1 or more has between the input layer and the output layer, which weighs between 2 adjacent layers. ANN architecture using 3 layers is 7 input layers, 6 hidden layers, and 2 output layers. 20 neurons are the number of neuron outputs to artificial neural networks

## 1. Introduction

Artificial Intelligent performs computational grouping called Artificial Neural Network or called Artificial Neural Network which is a highly developed method. In utilizing an increasingly developed machine and computer technology can be used as a tool in carrying out activities in encouraging direct research with a large amount of artificial intelligence. During this time the machine only works by receiving instructions made by the user and it is expected that the engine is also capable of making decisions like humans (Parker, 2006).

Artificial intelligence is one of the fields of computer science which is defined as intelligence made for a system using certain algorithms so that the system can think like a human (Coppin, 2004).

The field of Artificial Intelligence or the original Artificial Intelligence language strives not only to understand but also to build intelligent entities (Ratnawati et al., 2012). Artificial intelligence is about making computers perform tasks like tasks done by humans.

First created in 1956 by McCarthy, artificial intelligence in computer science that studies a computer or machine that can do work like human intelligence. Generally what we can do through AI includes planning, recognition of an object or sound, learning and problem solving. To do this, there are at least three methods developed.

### 1. Fuzzy Logic (FL)

This technique is used by machines adapt to how living things adjust conditions by giving decisions that are not rigid 0 or 1. So that a fuzzy logic system that is not rigid is raised.

### 2. Evolutionary Computing (EC)

This approach uses an evolutionary scheme that uses a large number of individuals and gives a test to select the best individuals to raise up generations. Furthermore, the selection is used to find solutions to a problem. An example of this approach is The Genetic Algorithm that uses the idea of mutation and interbreeding,

### 3. Particle Swarm Optimization (PSO)

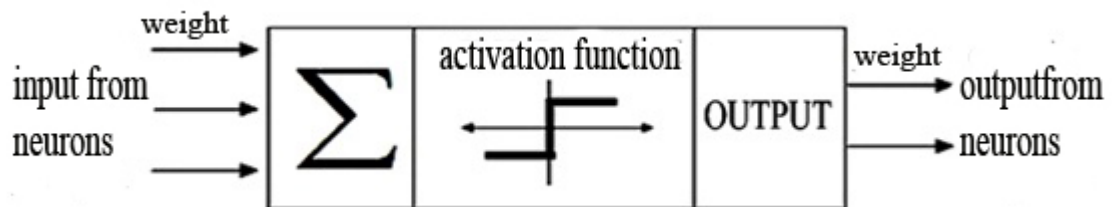
Imitation is like a collection of animals such as birds and prey, Simulated Annealing imitates how metal is forged, and much more.

### 4. Machine Learning (ML)

Machine learning is the most popular technique because it is widely used to replace or mimic human behavior to solve problems. According to its name, ML tries to imitate how human processes or intelligent beings learn and generalize. (Ahmad, 2017)

Although actually it is still far from human intelligence in fact, but AI is getting better and better to be able to complete tasks that can be done specifically by humans. The progress of AI development is based in part on existing data, large data taken from various devices that are connected and save everything.

The type of neural network has several types that have almost the same components. Just like the human brain, neural networks have several neurons, and are interconnected between these neurons. These neurons carry information that is obtained through an exit to the other neurons. In this network, the weight is the link. The information obtained is then stored at a value contained in that weight. Figure 1 shows the structure of neuronal neurons.



**Figure 1.** Structure of Neural Network Neurons

When viewed artificial neurons are actually similar to biological neuron cells. Artificial neurons work in the same process as biological neurons. Information obtained through input is then sent to neurons with the weight of arrival. This input is then processed through the propagation of future values, the weight is summed. The results of the amount are then compared to a threshold through the activation function of each neuron. If the input has passed a certain threshold value, then the neuron is activated, otherwise the neuron is not activated. If a neuron is activated it will send output through its output weights to all related neurons.

Neurons are collected at layers by the term layer of neurons (neuron layers) in nerve tissue. In general neuron neurons in one layer are connected to the layers before and after. The information given to the neural network is then propagated to the layer, starting from the input layer to the output layer through another layer, called the hidden layer (hidden layer).

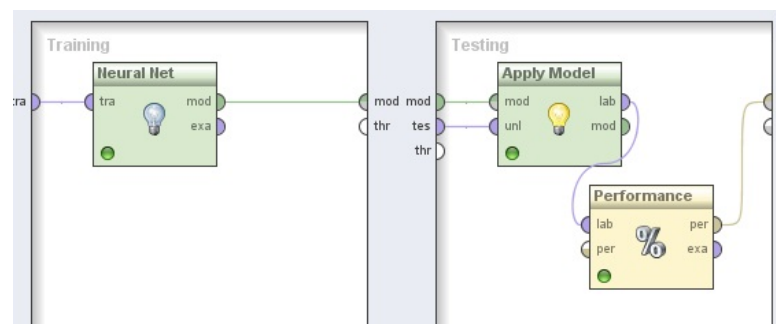
In various neural networks there are networks that do not have hidden layers, and there are also neural networks whose neurons are arranged in the form of a matrix. (Lesnussa, 2015)

Artificial Intelligent performs computational grouping using artificial neural networks, which can make different criteria well to find predictive results by making patterns with large data. Therefore, researchers conducted research on student data to predict high school level student majors.

## 2. Research Methods

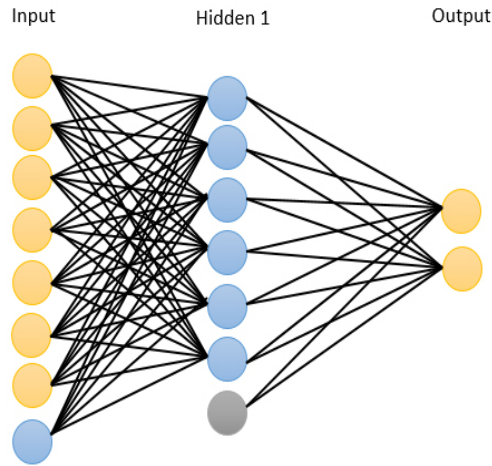
Tests conducted by researchers are using data sets in the direction of high school students with data covering: Number, Class, ID, Mathematics, Biology, Physics, Economics, Geography, Chemistry, Sociology. In the research conducted, it takes steps to get results from the research objectives. This research was conducted for the first time, namely collecting raw data. Then determine the architecture design by determining the input and output patterns for training needs and testing the method used. Furthermore, in the data training steps normalized and determined by the model, the initial training uses an artificial neural network algorithm.

In the picture above shows the working procedure of the Neural Network on Rapid miner. The first step is to enter a dataset that has the .excel (Read Excel) format, before doing the data validation, it is first given a category for each attribute to facilitate analysis and improve data accuracy. The results of data validation are then entered into the Neural network method for training data and the Apply Model which is a Neural Network model for test data and the last calculation of accuracy using Performance operators.



**Figure 2.** Neural Network Model on Rapid miner

ANN has a network architecture that is a single layer net. Networks that have more than one layer are called multilayer net and competitive layer networks (competitive layer net). The shape of a multilayer net 1 or more has between the input layer and the output layer, which weighs between 2 adjacent layers. ANN architecture using 3 layers is 7 input layers, 6 hidden layers, and 2 output layers. 20 neurons are the number of neuron outputs to artificial neural networks.



**Figure 3.** Network Architecture

### 3. Results and Discussion

In evaluating the effectiveness of this method, I conducted an experiment on the student value dataset which predicted the number of students entering the Department of Natural Sciences and social sciences using artificial neural network methods. All of these experiments were carried out using a personal computer, which uses an Intel Atom Core 2 Duo 1.66 GHz CPU. The computer runs using the Windows 7 operating system, by installing Rapid Miner 5.3.0. The following are the results of the hidden layer, bias, and output values in the student value dataset:

**Table 1** Test Results

Node	X1	X2	X3	X4	X5	X6	X7	Bias	Y0	Y1
Node 1	3.561	5.403	3.053	0.269	1.351	1.19	2.997	2.671	4.287	4.286
Node 2	2.695	5.841	0.824	4.165	1.443	0.004	7.631	3.582	6.828	6.831
Node 3	0.954	3.624	0.174	0.635	2.215	0.341	7.041	2.967	3.752	3.752
Node 4	6.309	7.179	0.508	3.702	4.687	5.32	0.789	2.133	4.909	4.909
Node 5	0.283	3.577	0.48	0.919	4.432	2.401	8.798	4.286	5.307	5.311
Node 6	5.039	10.227	0.471	2.678	6.714	4.901	0.828	2.231	6.583	6.586

At this stage, performance testing of artificial intelligence on the Neural Network is carried out.

**Table 2** Confusion Matrix Metode Neural Network

Classification Performance	Predicted Class	
Actual Class	Predicted. Natural Science	Predicted. Social Science
Actual. Class Natural Science	54 (True Positive)	22 (False Negative)
Actual. Class Social Science	25 (False Positive)	66 (True Negative)

Based on the table above, it is continued by calculating the Accuracy value of the Neural Network model using the Student Value Dataset. The following are the results of the calculation:

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN} = \frac{54+66}{54+66+25+22} = \frac{120}{167} = 0.71856*100\% = \mathbf{71.86\%}$$

Level of closeness between the predictive value of the class and the actual class value or the number of correct class predictions from the Neural Network model of the Student Value is 71.86%.

#### 4. Conclusion

In the research that has been done, the authors produce several conclusions as follows:

1. In the research carried out on the Student Value dataset is done by generating predictions from artificial neural networks by finding the highest level of accuracy that is good.
2. Success in predicting using artificial neural network methods to predict accuracy of 71.86%.

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