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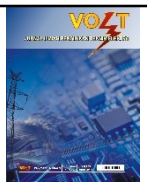

DESIGN MODELING SYSTEM OF ACHIEVEMENT MOTIVATION OF VOCATIONAL STUDENT USING RADIAN BASIS FUNCTION NETWORK ALGORITHM

Bety Etikasari[1]✉, Khafidurrohman Agustianto[1], Trismayanti Dwi Puspitasari[1], Nanik Anita Mukhlisoh[1]

[1]Department of Information Technology
Politeknik Negeri Jember, Jember 68121, Indonesia
✉Corresponding author e-mail: bety.etikasari@gmail.com

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Abstract

Achievement motivation is one of factor that can influence a person perform to doing their best activities for achieve the goal that have been set. Achievement of learning outcomes that is student ability skills determine from student involvement in learning process, so student must be active during their study process. Because of that, by knowing the achievement motivation level is important for the teacher to create the learning environment which suitable to student characteristic so the achievement motivation can be empowered during the learning process. This study, implemented the Radian Basis Function Network (RFBN) to develop the modeling system of student achievement motivation that are high, middle, and low achievement motivation. The study result showed the system accuracy value of 93,09%. Modeling resulted that this student achievement motivation level can be used in education as reference in determining the learning process for vocational student so that the learning becomes effective and the learning goal can be achieved.

Keywords: machine learning, RBFN, student motivation modeling

INTRODUCTION

Vocational education aims to prepare the graduates student which directed in specific skill according with business and industry world (Ocampo, Esparragoza, & Rodríguez, 2017). The learning process in higher education demands the student direct involvement in the learning activities, where the situation and condition of learning environment are set up like in business and industry (Ocampo, Esparragoza, Rodríguez, 2017). One of the importance factor which influence the student in-

volvement in learning activities is internal factor that comes from the student self (Debdi, Paredes-Velasco, & Velazquez-Iturbide, 2016). That factor is achievement motivation.

Working requires a good life skill in order to be able to compete and survive in the work of both business and industry (Barge, 2010). Because this day, the business development is more competitive and jobs field is narrowest. Because of that, achievement motivation is importance to be empowered in the learning process of vocational education for involve the student directly in the learning process so the student performance becomes maximal (Purwaningsih & Suwarno, 2016; Ergül & Kargın, 2014). Achievement motivation will encourage the student to always work hard in maintaining and improving their best achievement and to be afraid of failure (Chin, Lee, & Chen, 2015; Litzinger, Lee, Wise, & Felder, 2007).

Based on the importance of empowerment of achievement motivation in vocational education learning (Jumaat & Tasir, 2013; Purwaningsih & Suwarno, 2016), so it is necessary to describe the student achievement motivation level before the learning process takes place. This study aims to create a system that is able to accommodate these needs, that is a system that can modeling the student achievement motivation. This system is built using the Radian Basis Function Network (RFBN) algorithm (McCormick, 2013) that is proven the high accuracy.

RFBN is one of the branches of artificial intelligence, especially in the Artificial Neural Networks (ANNs) (Xie, Yu, & Wilamowski, 2011). Figure 1 illustrates the general architecture of RBF Network. This consists of an input vector, a layer of RBF neurons, and output with each one node in every categories or classes. RBF networks have three layer architecture shown by Figure 2 which consists of input layer, hidden layer, and output layer. Input layer is used for network inputs; hidden layer is used for alter the adjusted input data to be categorized according to the output class; output layer requires a linier separation. The process in RBF networks consists of several steps: (1) looking for the suitable network size; (2) looking for the suitable parameters (center and width); and (3) train the networks (Xie, Yu, & Wilamowski, 2011).

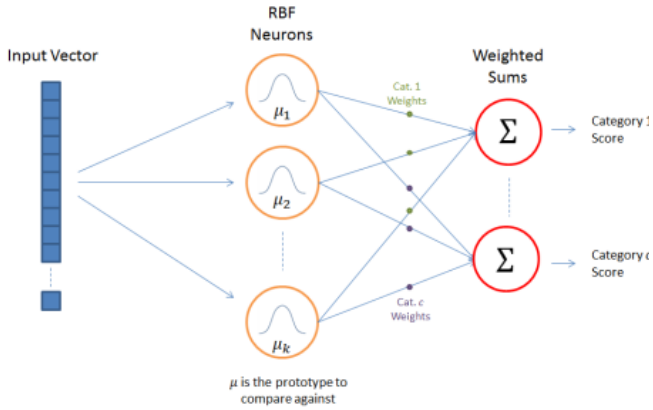

Figure 1. *Typical Architecture* from RBF Network (McCormick, 2013)

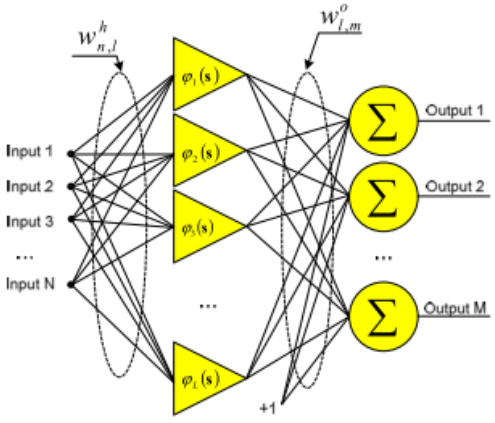

Figure 2. RBF network with N inputs, L hidden units, and M outputs (Xie, Yu, & Wilamowski, 2011)

The base computing in RBF Network as neural network shown by Figure 2:

Input layer Computing

$$\boldsymbol{sl} = \left|X_1 W^h{}_{1,j}, X_2 W^h{}_{2,j}, \ldots\ldots, X_n W^h{}_{n,j}\right| \quad (1)$$

Hidden Layer Computing

$$\varphi_l(s_l) = exp\left(-\frac{\|s_l - c_l\|^2}{\varphi_l}\right) \quad (2)$$

Output Layer Computing

$$\hat{\sigma}^2{}_{GCV} = \frac{p\hat{y}^T P^2 \hat{y}}{(trace\ (P))^2} \quad (3)$$

Based on the level of student achievement motivation that generated by system, then it can be used as a reference for action that will done to improve the level of student achievement motivation in order to the implementation learning process becomes maximal. The action undertaken by teacher can be either counseling or method innovation in the learning process.

METHOD

This study uses several stage shown by Figure 3, that stage are literature study as a basis of experiment and instrument development, instrument testing, data collection, data testing using cross validation fold 10, and modeling student achievement motivation.

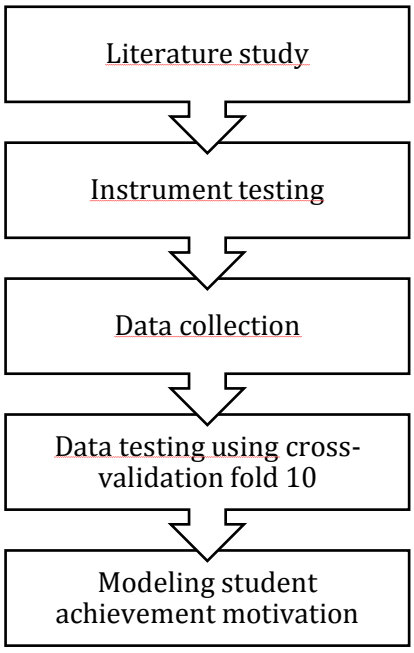

Figure 3. Experiment method

The literature study is the first stage in this study, the main function of this stage is to see the research position. By knowing the research position, then it can be used to basis for determining the novelty of the research. The literature study was also used as the basis of instrument developing which then tested the instrument feasibility through the instrument testing stage.

The instrument used in this study is a questionnaire that has been changed accordance with the needs of modeling student achievement motivation. The developed instrument is tested for validity and reliability to ensure that every questionnaire item is valid and can be used to describe the respondent actual situation. This validation process is included in the pilot project from the research. The mapping of motivational instrument is shown by Table 1.

Table 1. The mapping of student achievement motivation

Indicator	Predictor	Item Number
Work hard	Doing every task	1
	Confidence to ask	2
	Rise up when it fail	3
	Trying to reach the goal	4
Responsibility	Make preparation before learning process	5
	Independent in learning process	6
	Complete the task on time	7
	Set the goals	8
	Learn regularly according to schedule	9
Feedback needed	Feeling happy to see the test value	10
	Willing to accept criticism	11
	Improve the quality of self	12
Feeling worried about failure	Like task which completed surely	13
	Have a readiness mentality to act	14
	Always have preparation an another plan	15

Data collection which done by this study is using the application of student motivation level, this web application will display a questionnaire which will filed online by respondent. Data result of achievement motivation questionnaire by respondent is used to measure the student achievement motivation level.

Data testing done using cross-validation fold 10, it is used to see the accuracy rate of the data, testing of this research is using Weka application. After knowing the accuracy rate from the algorithm, then this is used as the basis for implementation.

Implementation which has done, will give a result that is class. Classes generated from this testing process are called student modeling which classify into three classes that are low, medium, and high.

RESULT AND DISCUSSION

Implementation of this system shown by Figure 4. Figure 4 show the interaction between the user (teacher and student) to the system, user in this system is required to login first, it is useful for monitoring the logs of system user. This system has two output with the aim that teacher and student, be able to determine behavior against their motivation level.

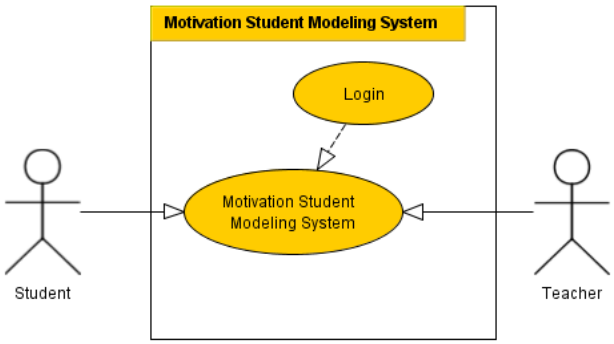

Figure 4. Use Case Motivation Student Modeling System

The output of the network consists of a set of nodes, one per category that we are trying to classify. Each output node computes a sort of score for the associated category. Typically, a classification decision is made by assigning the input to the category with the highest score (Xie, Yu, & Wilamowski, 2011). The network output m is calculated by (Equation 4):

$$O_m = \sum_{l=1}^{L} \varphi_1 (S_1) W_{l,m}^{o} + W_{0,m}^{o} \quad (4)$$

From the basic computations (1), (2) and (3), RBFN performs classification by measuring the input's similarity to examples from the training set. Each RBFN neuron stores a "prototype", which is just one of the examples from the training set. When we want to classify a new input, each neuron computes the Euclidean distance between the input and its prototype. Roughly speaking, if the input more closely resembles the class A prototypes than the class B prototypes, it is classified as class A (Xie, Yu, & Wilamowski, 2011).

In this research used Generalized Cross-Validation (Place, 1996), then the data divided into two parts – one part for training and one part for testing (Equation 3). Tests using 10 fold cross-validation to produce results as shown in Table 2.

Figure 5, shown the classify result with 10 fold method, the resulting classification shows a low error, this is evidenced by an accuracy of 93,09% with an error rate of 6,914% as shown by Table 2.

Table 2. RBFN testing result

Correctly Classified Instances	175	93.09%
Incorrectly Classified Instances	13	6.914%
Mean absolute error	0.0676	
Root mean squared error	0.2599	
Relative absolute error	13.498%	
Root relative squared error	51.923%	
Total Number of Instances	188	

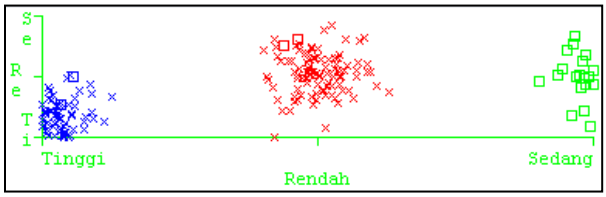

Figure 5. Testing Classification 10 Fold

The data distribution from this research shown by Figure 6. Where it show that the data is spread with enough separately, although there are data intersect, but the outline that the data is good enough, so it has good accuracy, shown by Figure 6.

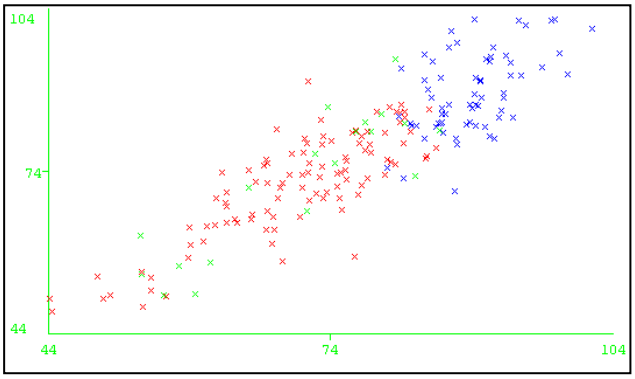

Figure 6. Visualization Data Test Achievement Motivation

Figure 6, show the data with the blue color mark show student with high motivation level, based on the result of classification that 66 person is in this category. While the data with the green color mark show student with middle motivation level, student in this classification is the most minimal from the total data test that are 19 person. Then the last is data with the red color mark show the student with low motivation level, the total of classification is the highest that are 103 person.

CONCLUSION

Achievement motivation is one of the factor that can influence the ability of vocational student. Learning process in the vocational school need the direct student involvement in order to the student get the learning experience from their learning environment that has been set up accordance with the work environment.

The success of student involvement is influenced by motivation factor, therefore this research develop an instrument to know the level of student achievement motivation (high, middle, and low achievement motivation). The system was developed using Radian Basis Function Network algorithm which show the resulted accuracy rate of 93,09% with 10 fold testing technique. Accuracy result show that this system can be used to know the level of student achievement motivation because the error value only 6,914% less than 10%, so from this result level of student achievement motivation, teacher can determine the learning environment which accordance with student characteristic so the student final ability can achieve maximal during the learning process takes place.

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