

## Classification of Productive Subject Value with Vector Machine Support Method



Khusni Mubarak<sup>1</sup>, Totok Chamidy<sup>2</sup>, Suhartono<sup>3</sup>

<sup>1</sup>Student of Postgraduate Magister Informatics, Maulana Malik Ibrahim State Islamic University, Indonesia

<sup>2</sup>Postgraduate program, Maulana Malik Ibrahim State Islamic University, Indonesia

<sup>3</sup>Postgraduate program, Maulana Malik Ibrahim State Islamic University, Indonesia

**ABSTRACT:** This research aims to determine student competency obtained from productive subjects, one of the subjects that has an important role in measuring student quality. With the development of technology, student evaluations of productive subject grades can use data mining methods, one of which uses the Support Vector Machine approach. This method aims to build a classification of students' productive subject scores by identifying the variables that influence them. Based on the research results, it can be concluded that the value of productive subjects at Public Vocation High School 1 Pasuruan can be predicted and evaluated using data mining techniques that utilize the Support Vector Machine algorithm. It aims to predict student grades in productive subjects by utilizing a logistic regression algorithm. The classification results illustrate that student grades in productive subjects are influenced by learning media variables, teacher teaching quality, classroom/laboratory facilities, interest, and motivation to learn. Apart from that, the Support Vector Machine algorithm has an accuracy value of 64.5001, precision of 56.0279, recall = 86.9952, and F1-Score = 67.882.

**KEYWORDS:** Data Mining, Algoritma Support Vector Machine, Vocation High School,

### I. INTRODUCTION

Education plays an important role in building the nation and improving the welfare of society. Therefore, every country tries to design its education to achieve that goal. According to a study conducted by Bappenas, Indonesia's education development strategy until 2045 includes, among other things: increasing educational access and participation, equal distribution of educational services, and improving vocational education. (Rahman et al., 2022). Educational institutions that have a role in creating human resources with abilities, skills, and expertise and can develop these abilities when entering the world of work are Vocational High Schools (Musthofa et al., 2017). Vocational high schools are different from high schools, where for vocational high schools, students are required to have knowledge and skills in accordance with the skills competencies taken by the students. The skills in question are skills demonstrated by students through direct practice. Vocational secondary education functions to prepare graduates who have adequate skills to become ready-to-use and skilled workers (Putra et al., 2020).

Understanding concepts is an important factor in learning activities in Information and Communication Technology (ICT) expertise. Conceptual understanding has a close relationship with students' interest in learning and problem-solving. Students at vocational schools need a proper understanding of concepts in each lesson. It is important for students to master a concept so that they can communicate appropriately and group ideas, ideas, and events experienced or encountered in everyday life. The level of student understanding of concepts can be determined through the results of the final evaluation or assessment which can be used as a way for teachers to determine the level of understanding of concepts that students have. The achievement of student understanding is adjusted to the learning objectives, namely student learning outcomes. In reality, good learning results cannot be obtained easily. Still, there needs to be planning, guidance and direction from the teacher so that students are able to understand the material being taught. However, this can also be influenced by various factors including internal and external factors.

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Internal factors are factors within the students themselves that have a big influence on the level of students' understanding of knowledge. Internal factors are influenced by: (1) Physiological factors related to an individual's physical condition. This factor is influential because it is one of the students' readiness when receiving learning which will ultimately influence student learning outcomes. (2) Psychological factors include intelligence, attention, interests and talents, motivation, and cognitive abilities. Meanwhile, external factors are factors influenced from outside the student. External factors that influence learning outcomes are (1) environmental factors in the form of the physical environment and social environment, such as the state of the environment where students study. Meanwhile, the social environment can be in the form of humans or other things, such as the hustle and bustle of traffic, the sound of people crowding around, factory machines, and so on. (2) Instrumental factors, namely factors that are designed in accordance with the expected learning outcomes in the form of curriculum, tools and facilities, and teachers (Anggraeni et al., 2022).

Vocational Schools have many areas of expertise, one of which is the Information and Communication Technology (ICT) area of expertise, one of the areas of expertise which consists of Multimedia (MM), Computer and Network Engineering (TKJ), and Software Engineering (RPL) skills competencies. To improve the skills of prospective intermediate technicians in the field of ICT expertise, efforts are needed to hone students' abilities in the form of adequate knowledge and skills according to their development (Ulinnuha Musthofa et al., 2017). Learning at vocational schools is divided into 2 groups of subject areas, namely productive and non-productive. Productive subjects study material related to vocational fields according to their respective skill competencies, while non-productive subjects study material that is the basis for productive subjects. The obstacles that students face in productive subjects are often experienced due to limitations in everything caused by many factors, thus affecting the grades obtained in these productive subjects.

In this research, students' grades in productive subjects at Public Vocational High School One Pasuruan were influenced by internal (interest, talent, intelligence, and cognitive abilities) and external factors (environment, teaching methods, tools, and facilities that support students). These things can influence students' level of understanding of learning in productive learning materials with different background conditions. Judging from the results of the scores obtained by students in productive subjects, some students are smart in one subject but less interested in other productive subjects.

## II. LITERATURE REVIEW

### a. Machine Learning

Machine Learning is a technique for inferring data using a mathematical approach to create models that reflect data patterns (Wira & Putra, 2020). Machine Learning (ML) or Machine Learning is a branch of Artificial Intelligence (AI) that focuses on learning from data (learn from data), namely on developing systems that are able to learn "independently" without having to be repeatedly programmed by humans. ML requires valid data As learning material (during the training process) before being used during testing for optimal output results, it is hoped that the results of Machine Learning development will provide convenience and can be directly applied in the wider community or even enter the industry on a national and international scale (Cholissodin & Soebroto, 2021). There are two important terms in building a Machine Learning model, namely: training and testing. Training is the process of model construction, and testing is the process of testing the performance of the learning model. A dataset is a collection of data (samples in statistics). Generally, datasets are divided into three non-intersecting types.

### b. Data Mining

Arhami and Nasir (2020) explain that data mining is the process of extracting useful information and patterns from very large data. The data mining process consists of data collection, data extraction, data analysis, and data statistics. It is also commonly known as knowledge discovery, knowledge extraction, data/pattern analysis, information harvesting, and others. These four processes in data mining will produce very useful models/knowledge. According to Muflikhah (2018), data mining can be defined as extracting and analyzing using automatic or semi-automatic equipment from large amounts of data with the aim of finding patterns that have meaning or purpose. Data mining is included in database knowledge discovery (Amna et al., 2023).

## III. METHODS

This research uses a positive paradigm as a line of thought that uses deductive reasoning and quantitative methods to obtain the truth. The primary data used in this research is a questionnaire and the secondary data used in this research is subject grades from ten to twelve grade. The research sample uses a non-probability sampling method for 775 students, which consists of ten to twelve grade and productive subject matter, learning motivation, student learning media at home, classroom/laboratory facilities, learning environment at school, and teacher teaching quality.

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### IV. RESULTS AND DISCUSSION

#### a. RESULT TESTING

The results of testing 5 scenarios by dividing the data using the K-Fold Cross Validation method with a value of k (number of folds) = 5 into Training data and Testing data and testing the data alternately presented in Table 1.

**Table 1: Recapitulation of Training Data and Testing Data Values**

Scenario	Data	Accuracy	Presisi	Recall	F1-Score
1	Training	62,742	53,392	93,130	67,872
1	Testing	67,742	66,316	77,778	71,591
2	Training	60,484	52,527	89,179	66,113
2	Testing	67,097	55,446	90,323	68,712
3	Training	61,129	52,225	85,769	64,920
3	Testing	67,097	57,983	98,571	73,016
4	Training	56,290	49,451	84,586	62,413
4	Testing	63,226	54,217	70,313	61,224
5	Training	67,581	58,537	81,818	68,246
5	Testing	71,613	60,185	98,485	74,713
<b>Average</b>		<b>64,5001</b>	<b>56,0279</b>	<b>86,9952</b>	<b>67,882</b>

Table 2 shows the results of training data and testing data in the form of Accuracy, Precision, Recall, and F1-Score, which are the results of the classification values. From this data, the results are averaged, and it can be observed that the model performance is relatively stable with variations in the k value. However, there are fluctuations in the Accuracy, Precision, Recall, and F1-Score values between different K values. The model generally has below-average values with Accuracy = 64.5001, Precision = 56.0279, Recall = 86.9952, and F1-Score = 67.882.

The 5th scenario in the Testing data has the highest value results among the other scenarios, namely Accuracy = 71.613, Precision = 60.185, Recall = 98.485, and F1-Score = 74.713.

#### b. Variables that affect Subject Grades

**Table 2: Variable Weight**

	W1	W2	W3	W4	W5	W6	W7
Training 1	0,00435	0,00365	0,00365	0,00185	0,0034	0,0035	0,00415
Testing 1	0,00385	0,0265	0,00435	0,0025	0,00355	0,005	0,0035
Training 2	0,0039	0,0027	0,0044	0,0025	0,0036	0,005	0,0035
Testing 2	0, 0078	0, 0063	0, 0055	0, 0032	0,0065	0,0065	0,0065
Training 3	0,0039	0,0027	0,0044	0,0025	0,0036	0,005	0,0035
Testing 3	0,0034	0,00285	0,003	0,00285	0,0034	0,00335	0,0035
Training 4	0,0039	0,0027	0,0044	0,0025	0,0036	0,005	0,0035
Testing 4.1	0,0031	0,0037	0,0034	0,0029	0,0034	0,004	0,0042
Testing 4.2	0,0071	0,0073	0,00735	0,005	0,00665	0,0075	0,00815

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	W1	W2	W3	W4	W5	W6	W7
Training 5	0,0039	0,0027	0,0044	0,0025	0,0036	0,005	0,0035
Testing 5.1	0,0029	0,0034	0,0032	0,0024	0,0029	0,0034	0,003
Testing 5.2	0,00775	0,008	0,00765	0,0052	0,0071	0,00835	, 0,008
<b>Average</b>	<b>0,00437</b>	<b>0,00602</b>	<b>0,00456</b>	<b>0,00297</b>	<b>0,00428</b>	<b>0,00513</b>	<b>0,00427</b>

Based on the results of calculations with 5 scenarios, a weight (w) is obtained, which has a big influence on the value of productive subjects with an average weight value of W4 = 0.00297 on the learning media variable, followed by W7 = 0.00427 on the teaching quality variable teacher, W5 = 0.00428 on the classroom/laboratory facilities variable, W1 = 0.00437 on the interest variable and W3 = 0.00456 on the learning motivation variable.

## V. CONCLUSIONS

Based on the results of trials that have been carried out in classifying productive subject grades using the Support Vector Machine method, the following conclusions can be drawn up:

- This research succeeded in building a classification of productive subject scores for students at Public Senior Vocational High School One Pasuruan using questionnaire data and average scores for productive subjects, which were divided into 2 data, namely Training and Testing, which were processed using data mining techniques with the Support Vector Machine method.
- The classification results using the Support Vector Machine method obtained quite good results with an average value of Accuracy = 64.5001, Precision = 56.0279, Recall = 86.9952, and F1-Score = 67.882.
- Students' productive subject scores are influenced by learning media variables, teacher teaching quality, classroom/laboratory facilities, interest, and motivation to learn.

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