Classification Of Broiler Production Success Rate Using Algorithm Support Vector Machine (SVM)

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Abstract

Broiler production is one of the fastest growing livestock sectors in Indonesia. Assessing the success rate of broiler production is very important for farmers in evaluating performance and optimizing yields. However, the manual evaluation process often leads to subjectivity and potential errors. This study aims to develop a classification model of the success rate of broiler production using the Support Vector Machine algorithm based on three main indicators, namely chicken age, chicken weight, and feed amount. This research also implements the classification model into an interactive web application using the Streamlit framework built with the Python programming language. The data was obtained from Timan Farm and went through a normalization process and data division into training and test data. The results of model testing show that the Support Vector Machine algorithm is able to classify the success rate of production with sufficient accuracy. The web-based application developed with Streamlit allows users to perform classification automatically, quickly, and accurately without having to have an in-depth technical background.

Keywords: *Broiler Chicken, Support Vector Machine, Classification, Streamlit, Success Rate, Python.*

1. Introduction

Indonesia is one of the countries that raises broiler chickens. The broiler chicken business in Indonesia has now become a high potential for entrepreneurs and chicken farmers. Broiler chicken farming is a business that has great potential to be developed into a large and profitable business [1]. The development of broiler chickens is increasing significantly every day. However, the high production costs required in the broiler chicken farming business have prompted farmers to look for ways to increase broiler chicken production [2].

Broiler chickens have a relatively short growth period and high feed conversion efficiency, making them the primary choice in the commercial poultry industry. However, several factors influence the success of broiler chicken production, including breeding stock, feed, management, and genetics. An imbalance in any of these aspects can have a direct impact on the success rate of production, both in terms of quantity and quality of the harvest.

Timan Farm is a partnership of PT Charoen Pokphand Indonesia. In assessing the level of production success, farmers often rely solely on experience and manual observation. The success rate of broiler chickens can be measured by indicators such as chicken weight, feed intake, and chicken age. However, manual assessment can lead to errors, resulting in subjective and inaccurate decisions. Therefore, evaluating the success of broiler chickens is an important aspect of improving farm efficiency.

To overcome these problems, a more objective and systematic approach is needed. One approach that can be applied is through classification techniques in data mining. Classification is the process of evaluating data objects to assign them to specific classes from a number of available classes[3]. Classification was first applied to plants, classifying specific species, as done by Carolus von Linne, who first classified species based on physical characteristics[4].

Data mining is a process that uses statistical techniques, mathematics, artificial intelligence, and machine learning to extract and identify useful information and related knowledge from various large databases. The primary purpose of data mining is to discover, explore, or extract knowledge from data or information that may provide useful insights[5].

One of the methods used in data mining for classification is the Support Vector Machine (SVM) algorithm. SVM works by finding the optimal hyperplane that separates data into specific classes, thereby helping to identify patterns of success
in broiler chicken production based on available indicators. SVM also has the advantage of overcoming overfitting, especially when the number of features is greater than the number of samples.
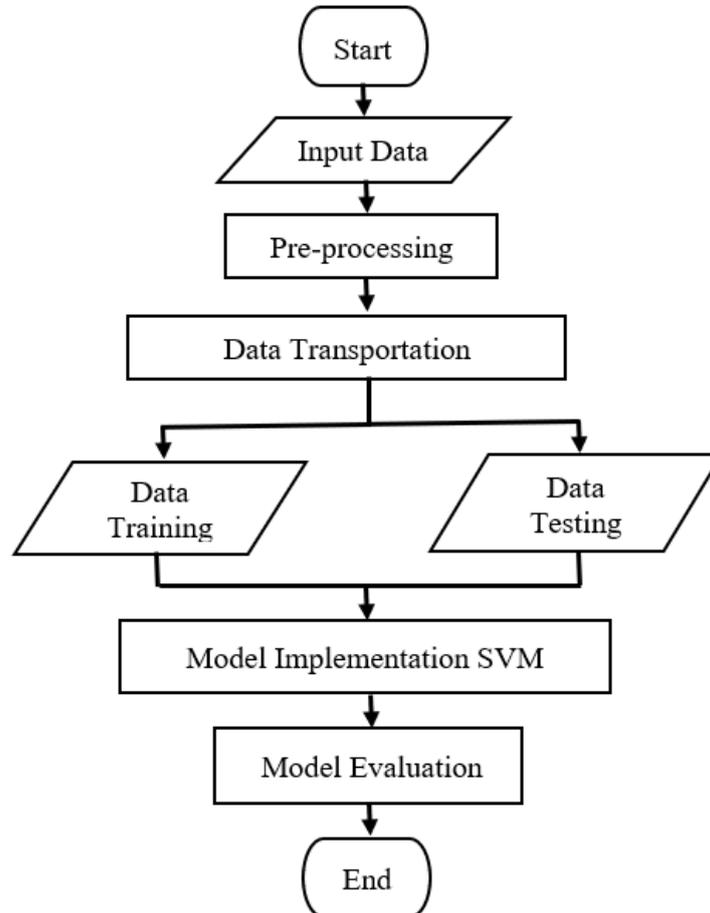
2. Research Metodology

Fig. 1: Flowchart Design

2.1. Type of Research

This study uses quantitative research that utilizes the SVM algorithm for classifying the success rate of broiler chicken production. The results can assist farmers in the process of assessing the success rate of broiler chicken production, which is carried out automatically and systematically to reduce potential errors, optimize care and feed, and increase broiler chicken productivity.

2.2. Data Collection

In this study, data was obtained through direct observation at Timan Farm using indicators such as chicken age, chicken weight, and amount of feed. A total of 100 data points were collected, with chicken ages ranging from 16 to 25 days.

2.3. Algorithm Design

The Support Vector Machine (SVM) algorithm was applied to build a classification model for broiler chicken production success rates. This application was carried out for automatic and systematic assessment of broiler chicken production success rates in order to reduce potential errors, optimize care and feed, and increase broiler chicken productivity. Streamlit was used to create an interactive web application.

2.4. Implementation

In training, Support Vector Machine (SVM) searches for the optimal hyperplane as the best separator between classes. If the data is linear, linear SVM is used; whereas for non-linear data, the kernel trick is used to map the data to a higher dimension so that it can be separated. After the model is trained, its performance is tested with test data, where the predicted labels are compared with the original labels to measure accuracy.

The designed algorithm is implemented in software applications to assess the success rate of broiler chicken production. The developed system is tested using real data from Timan Farm. Assessments are made to measure body weight, age, feed intake, and age of chickens.

3. Result and Discussion

3.1. Result

This study used 100 broiler chicken data with three main indicators, namely chicken age, body weight, and feed amount. The data was divided into 80% training data and 20% test data. The SVM model was trained using a preprocessing pipeline with feature normalization.

ID	Chiken Age	Chiken Weight	Amount Of Feed
Chiken 1	16	650	61
Chiken 2	16	639	61
Chiken 3	16	570	61
Chiken 4	17	709	64
Chiken 5	17	723	64
Chiken 6	17	720	64
Chiken 7	18	771	67
Chiken 8	18	740	67
Chiken 9	18	776	67
Chiken 10	19	839	69
Chiken 11	19	843	69
Chiken 12	19	838	69
Chiken 13	20	905	73
Chiken 14	20	903	73
Chiken 15	20	940	73
Chiken 16	21	988	75
Chiken 17	21	991	75
Chiken 18	21	997	75
Chiken 19	22	1066	77
Chiken 20	22	1072	77
Chiken 21	22	1081	77
Chiken 22	23	1140	80
Chiken 23	23	1201	80
Chiken 24	23	1157	80
Chiken 25	24	1229	83
Chiken 26	24	1248	83
Chiken 27	24	1250	83
Chiken 28	25	1303	84
Chiken 29	25	1300	84
Chiken 30	25	1313	84
Chiken 31	25	1292	84
Chiken 32	19	824	69
Chiken 33	25	1309	84
Chiken 34	25	1259	84
Chiken 35	20	892	73
Chiken 36	23	1164	80
Chiken 37	23	1196	80
Chiken 38	22	1074	77
Chiken 39	20	872	73
Chiken 40	23	1168	80
Chiken 41	20	970	73
Chiken 42	16	652	61
Chiken 43	19	846	69
Chiken 44	22	1087	77
Chiken 45	23	1184	80
Chiken 46	19	860	69

Chiken 47	19	879	69
Chiken 48	17	684	64
Chiken 49	23	1204	80
Chiken 50	16	681	61
Chiken 51	16	672	61
Chiken 52	23	1152	80
Chiken 53	20	893	73
Chiken 54	18	755	67
Chiken 55	19	812	69
Chiken 56	24	1253	83
Chiken 57	24	1215	83
Chiken 58	25	1366	84
Chiken 59	22	1041	77
Chiken 60	20	953	73
Chiken 61	21	961	75
Chiken 62	23	1185	80
Chiken 63	25	1323	84
Chiken 64	21	986	75
Chiken 65	21	1002	75
Chiken 66	17	725	64
Chiken 67	21	966	75
Chiken 68	18	789	67
Chiken 69	22	1111	77
Chiken 70	21	1008	75
Chiken 71	22	1043	77
Chiken 72	17	702	64
Chiken 73	23	1159	80
Chiken 74	17	717	64
Chiken 75	18	769	67
Chiken 76	16	536	61
Chiken 77	21	1018	75
Chiken 78	19	836	69
Chiken 79	23	1233	80
Chiken 80	17	726	64
Chiken 81	20	944	73
Chiken 82	22	1109	77
Chiken 83	22	1087	77
Chiken 84	23	1180	80
Chiken 85	19	836	69
Chiken 86	22	1061	77
Chiken 87	21	977	75
Chiken 88	19	865	69
Chiken 89	18	742	67
Chiken 90	18	800	67
Chiken 91	16	648	61
Chiken 92	25	1336	84
Chiken 93	25	1312	84
Chiken 94	17	726	64
Chiken 95	21	1003	75
Chiken 96	24	1224	83
Chiken 97	19	787	69
Chiken 98	23	1163	80
Chiken 99	18	724	67
Chiken 100	25	1290	84

Table 1 : Broiler Chicken Data

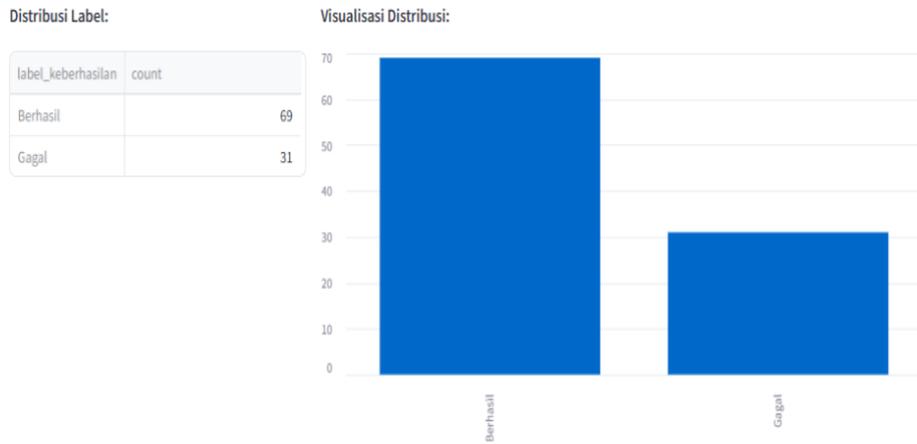The class distribution (success_label) of the data is displayed in the form of tables and bar charts.

Fig. 2: Analysis and Training Data Preparation Section

Correlation heatmap between features to show the relationship between numerical features in the dataset. The heatmap provides an overview of the extent to which features such as age, chicken_weight, and chicken_feed_amount correlate with the target success_label.
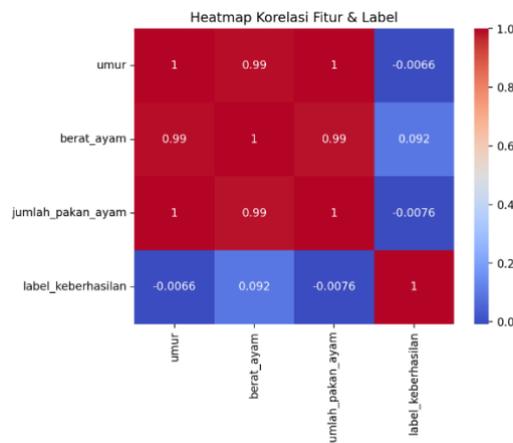

Fig. 3: Feature Correlation Heatmap

The training process begins by dividing the data into two sets: training data (80%) and test data (20%) using train_test_split. Next, the training pipeline is created by performing normalization using MinMaxScaler, followed by training the SVM model with the specified parameters. This training process runs automatically when the user presses the "Train & Validate Model with Best Parameters" button.

After the training is complete, the model evaluation results are displayed in detail. Accuracy on the training and test data is calculated to identify whether the model is overfitting, with a warning given if the training data accuracy is significantly higher than the test data. A complete classification report with precision, recall, and f1-score metrics is also displayed. In addition, a confusion matrix are provided to visualize the model's performance.
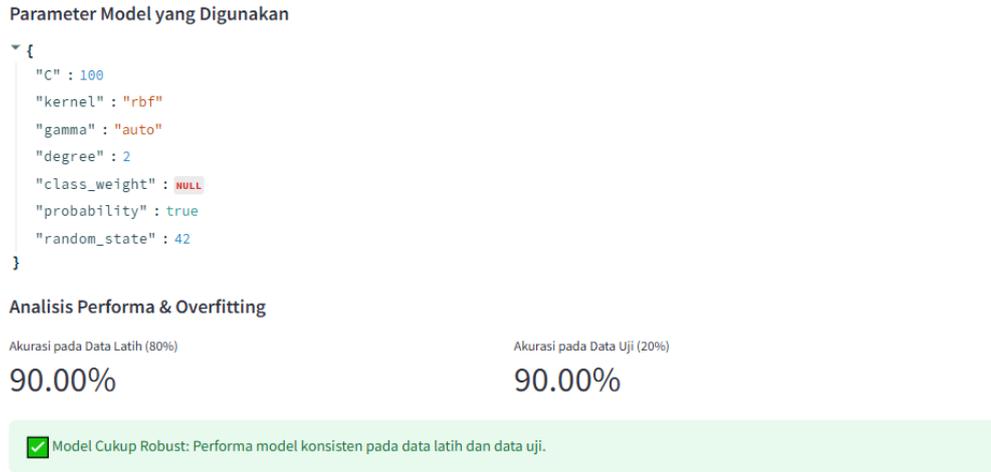
Parameter Model yang Digunakan

```json
{
  "C" : 100
  "kernel" : "rbf"
  "gamma" : "auto"
  "degree" : 2
  "class_weight" : NULL
  "probability" : true
  "random_state" : 42
}
```

Analisis Performa & Overfitting

Akurasi pada Data Latih (80%)

90.00%

Akurasi pada Data Uji (20%)

90.00%

✅ Model Cukup Robust: Performa model konsisten pada data latih dan data uji.

Fig. 4: Training Results and Model Evaluation

The image above shows the results of SVM model training and evaluation. The model uses parameters such as C = 100, kernel 'rbf', gamma = 'auto', and degree = 2. The model's accuracy on the training data and test data is 90% in both cases, which means that the model works well without overfitting, as the results are consistent on both data sets.
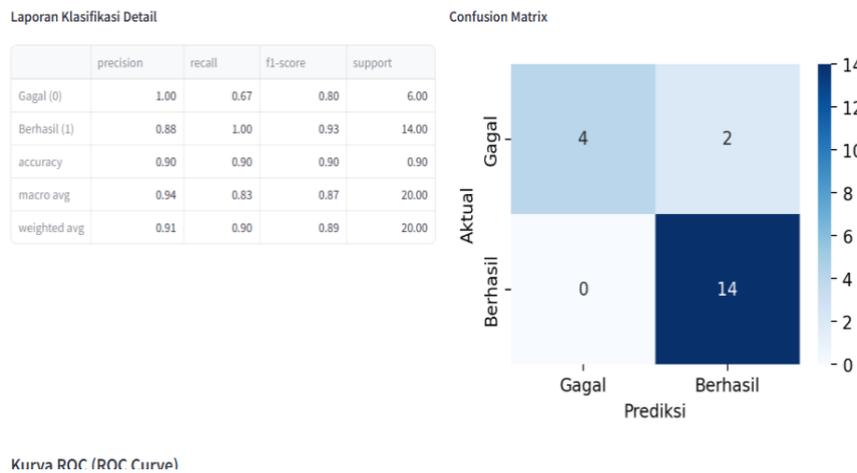
Laporan Klasifikasi Detail

	precision	recall	f1-score	support
Gagal (0)	1.00	0.67	0.80	6.00
Berhasil (1)	0.88	1.00	0.93	14.00
accuracy	0.90	0.90	0.90	0.90
macro avg	0.94	0.83	0.87	20.00
weighted avg	0.91	0.90	0.89	20.00

Confusion Matrix

Kurva ROC (ROC Curve)

Fig. 6: Classification Report Results

The image above shows the classification report and confusion matrix of the model. The detailed classification report shows metrics such as precision, recall, and f1-score for each class (Failed and Successful).

For the Failed class, precision is 1.00, recall is 0.67, and f1-score is 0.80 with 6 data examples. Meanwhile, for the Successful class, precision is 0.88, recall is 1.00, and f1-score is 0.93 with 14 data examples. The overall accuracy of the model is 90%.

The confusion matrix shows the model's prediction results: of the 6 data points that were actually Failed, the model predicted 4 as Failed and 2 as Successful. Of the 14 data points that were actually Successful, the model predicted all of them correctly as Successful (0 errors). This shows that the model is very accurate in predicting the Successful class but there are a few errors in identifying the Failed class.

3.2. System Implementation

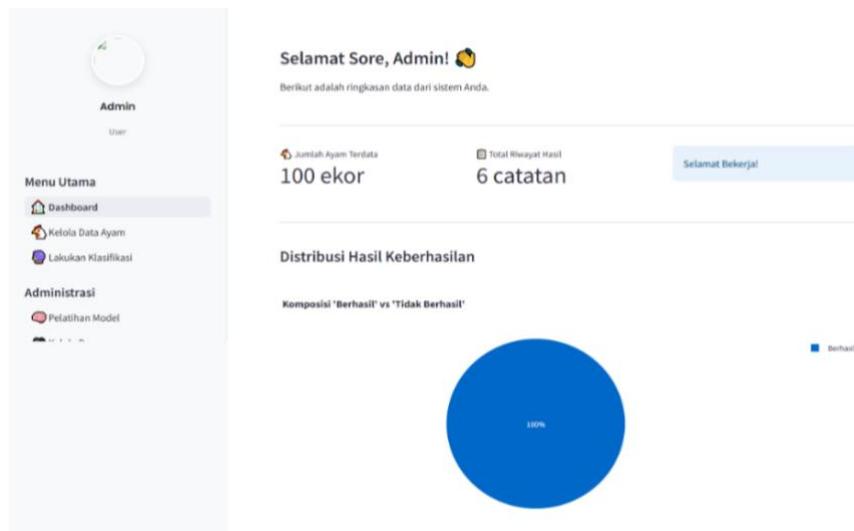The web-based application was developed using the Streamlit framework.

Fig .7: Dashboard Menu Display

The simple interface makes it easy for users without a technical background to perform more objective production evaluations.

4. Discussion

The results of this study prove that the SVM algorithm is effective for classifying the success rate of broiler chicken production. An accuracy rate of 90% shows that SVM is reliable in supporting decision-making at the farm level.

The advantage of this method is its ability to overcome overfitting in datasets with limited butvaried features. Additionally, the web-based system provides added value in the form of ease of access and time efficiency.

However, there are several limitations. The research dataset is relatively small (100 data points), which could potentially affect model generalization. Further research could expand the amount of data and compare SVM with other algorithms such as Random Forest or K-Nearest Neighbor to obtain more comprehensive results.

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