Jurnal Media Teknik Elektro dan Komputer
Vol. 02, No.02 (July - December, 2025)
E-ISSN: 3063-2927

Classification of Palm Oil Seed Quality Using the Naïve Bayes Method at PPKS Marihat

Qisti Azraladiba Batubara[1], Mhd. Ikhsan Rifki[2],

[1]Universitas Islam Negeri Sumatera Utara; qistibatubara10@gmail.com
[2]Universitas Islam Negeri Sumatera Utara; rifki.mhdikhsan@uinsu.ac.id

ABSTRACT

Oil palm is one of the important plantation commodities in Indonesia, so seed quality is a major factor in production success. The main problem in the field is that seed quality determination is still done manually, which takes a long time and is prone to human error. Therefore, this study aims to minimize human error and support decision-making in determining planting priorities for superior seeds through the classification of oil palm seed quality using the Naïve Bayes algorithm. The model was built based on three main parameters, namely moisture content, storage room humidity, and seed storage duration. The results were labeled as low, medium, and high quality categories. Testing results using an 80% of data training (130 data) and 20% of data testing (32 data) model splitting, that the Naïve Bayes model produced an accuracy of 91% from 162 dataset. The classification results showed that 38 data points fell into the low quality category, 55 into the medium category, and 56 into the high category. The research results should be more oriented towards statements regarding the ability of Naïve Bayes to classify palm oil seed types, so that it can be used as a model recommendation in palm oil determination.

Keywords: Naïve Bayes, Classification, Seeds, Oil Palm, Confusion Matrix, PPKS Marihat

Corresponding Author:
Qisti Azraladiba Batubara
Universitas Islam Negeri Sumatera Utara; qistibatubara10@gmail.com

1. INTRODUCTION

Oil Palm (*Elaeis guineensis* Jacq) is one of Indonesia's leading agricultural commodities, playing a crucial role as a contributor to the country's foreign exchange (Rahmawati, 2023). Seed quality is a key determining factor for successful production. To break dormancy, seeds need several stages, like soaking, drying, heating, airing, and incubation (Ernita et al., 2023).

Palm Oil Seeds have a hard shell, making them dormant. In general, dormancy breaking is carried out through sequential stages of soaking, drying, heating, airing, and incubation. The soaking and drying stages are performed more than once to ensure gradual water absorption and moisture stabilization within the seed, while the heating and airing stages aim to stimulate physiological activity and improve oxygen circulation. Environmental factors such as temperature, light, and water play an important role in the germination process (Nadarajah & Nawi, 2023). Water plays an important role in softening the seed coat, facilitating oxygen entry, diluting the cytoplasm to increase cell activity, and as a means of transporting nutrients (Hasibuan et al., 2025).

Seed quality is greatly influenced by seed moisture content, storage room humidity, and storage duration (Muharis et al., 2022). However, in the field, the assessment of sprout quality, particularly sprout germination rate (the percentage of seeds that successfully germinate), has not been systematically analyzed using a data-driven approach. In fact, based on data from Dormancy Breaking Unit (PDB) of the Palm Oil Research Center, the average germination rate varies, and there are often significant differences between batches, making it difficult to ensure consistent quality (Erumwenbibi et al., 2022).

Seed quality determinations currently mostly done manually through physical inspection by experts or through laboratory testing. This conventional method is time-consuming and prone to subjective errors. With increasing amount of seed test data each year, a faster, more objective analysis method capable of managing large volumes of data is needed. Modern approaches such as machine learning can be utilized to facilitate the automatic classification of seed quality (Mawaddah et al., 2022).

Several previous studies have attempted to apply classification methods in data evaluation across various domains. Naïve Bayes has been widely used in sentiment analysis due to its simplicity and efficiency (Jefri & Fatah, 2025), while other approaches such as Convolutional Neural Networks and Decision Tree algorithms have been applied in product classification and pattern recognition tasks. More recent studies (2023–2025) show that Naïve Bayes and other machine learning classifiers remain effective when applied to structured datasets of varying sizes, particularly in agricultural and quality assessment contexts.

Recent studies have confirmed the strong performance of classification algorithms, especially Naïve Bayes, across a wide range of applied classification cases. Widiastuti et al. (2023) employed the Naïve Bayes algorithm to classify watermelon quality using a dataset of several thousand records with an 80:20 data training-testing split, resulting in an accuracy of 76% based on confusion matrix evaluation. Fauzia & Dana (2023) demonstrated the consistent performance of Naïve Bayes when applied to classification tasks involving moderately sized datasets, highlighting its effectiveness for structured data with a limited number of attributes. Similarly, Ratih et al. (2022) reported stable classification results using Naïve Bayes, evaluated through accuracy and confusion matrix metrics. Suendri et al. (2025) further showed that Naïve Bayes performs well on datasets with relatively few attributes, producing results that are both interpretable and reliable. In addition, Agustina et al. (2022) applied Naïve Bayes to sentiment classification with an 80:20 data split and achieved an accuracy above 80%, reinforcing its applicability in real-world classification scenarios.

Based on field conditions and previous results, this study uses the Naïve Bayes algorithm, which is known for datasets with relatively small amounts and simple patterns (Gumi et al., 2022). The model was created with three main variables at the field practice location, namely seed moisture content, heating room humidity, and storage duration.

This study aims not only to develop a palm oil seed quality classification model using the Naïve Bayes algorithm, but also to minimize human error in seed quality assessment and support decision-making processes, particularly in determining planting priorities for superior seeds. The expected outcome of this research is an objective and data-driven classification approach that can assist seed quality selection officers at the PDB PPKS Marihat Unit as an alternative to the conventional manual assessment method.

2. LITERATURE REVIEW

2.1. Palm Oil Seed Quality

Oil palm (Elaeis guineensis Jacq.) is a plantation crop that produces vegetable oil and plays an important role in the agricultural sector, particularly in Indonesia and Malaysia (Marcelina et al., 2022). The quality of oil palm seeds is a critical factor in determining plantation productivity, as it directly affects germination success and plant growth.

Seed quality is generally evaluated based on the germination rate, which represents the percentage of seeds that successfully germinate under controlled conditions. High-quality seeds exhibit a high germination rate, uniform sprout growth, and strong vigor, while low-quality seeds tend to have poor germination performance and uneven growth (Zakwan et al., 2024). Factors influencing oil palm seed quality include moisture content, storage temperature, storage room humidity, and storage duration. Oil palm seeds are classified as orthodox seeds, meaning their quality is strongly affected by moisture and storage conditions.

2.2. Naïve Bayes Classification Method

Classification is one of the main techniques in data mining used to assign data into predefined categories based on specific features (Sarang, 2023). One widely used classification algorithm is Naïve Bayes, which is a probabilistic method based on Bayes' Theorem and assumes independence between features.

The Naïve Bayes algorithm has been widely applied in various classification problems due to its simplicity, computational efficiency, and ability to perform well on datasets with limited samples and mixed data types (Handayani & Purnomo, 2024). In agricultural applications, Naïve Bayes has demonstrated reliable performance in classifying seed quality and supporting data-driven decision-making processes (Purnomo et al., 2023). Therefore, this method is considered suitable for classifying oil palm seed quality based on multiple influencing factors.

3. RESEARCH METHOD

The research method used is a quantitative descriptive method. Quantitative research aims to test the established hypothesis using statistical analysis.

3.1. Data Collection

The data used was historical secondary data. The data source was obtained from the Seed Dormancy Breaking Unit (PDB), Production Division, Palm Oil Research Center (PPKS) Marihat. The data period was taken from the dormancy breaking process from July to September 2025. The variables used (moisture content, storage room humidity, and storage duration) were determined based on the results of interviews and field observations at the PDB unit, Production Division, PPKS Marihat, because these variables are considered to have the most influence on seed quality.

Based on observations and interviews, the number and type of samples for the study were determined. The dataset consisted of 810 palm oil seed samples of various varieties (Dumpy, Yangambi, DxP Simalungun, PPKS 540, AVROS, and others) taken from the 2025 production batch. Seed samples were taken by random sampling from the seed population produced.

3.2. Pre-processing and Data Input

The data input is presented in Excel (.xlsx) format, containing 810 rows of data. The dataset includes several variables such as variety name, seed arrival date at the PDB unit, PDB number, delivery number, number of seeds, heating chamber number, average seed moisture content, heating chamber temperature and humidity, seed storage duration, germination rate, non-germination rate, and seed quality label (High, Medium, and Low).

The variables used in this study include seed arrival date at the PDB unit, PDB number, delivery number, number of seeds, heating chamber number, average seed moisture content, heating chamber temperature and humidity, and seed storage duration. The seed arrival date at the PDB unit serves as a time reference for the dormancy-breaking process and supports the calculation of storage duration. The PDB number and delivery number function as identification codes for seed batches and are used to ensure data traceability rather than as classification features. The number of seeds and heating chamber number provide contextual information related to batch size and processing location, which may indirectly influence storage conditions.

The average seed moisture content is a key indicator of seed physiological condition, as inappropriate moisture levels may reduce germination capacity or accelerate seed deterioration. Heating chamber temperature and humidity represent environmental conditions during the dormancy-breaking process and play an important role in maintaining seed viability and uniform germination. Seed storage duration indicates the length of time seeds are stored before testing, where prolonged storage may lead to a decline in seed vigor and overall quality.

The data pre-processing steps performed in this study include:

1. Data cleaning, removing missing values to standardize the format.
2. Data Normalization, adjusting the range of values for each feature so that is ready for use in model training.
3. Data Labeling, determining the quality class (target/output) into three categories, namely high, medium, and low. The determination of labels is based on the germination rate threshold.
   a. High, if germination rate ≥ 65%
   b. Medium, if germination rate is 36% ≤ germination rate < 65%
   c. Low, if germination rate is in the range < 36%
4. The processed data is divided into training and testing datasets using an 80%:20% data splitting scheme.

Table 1. Oil Palm Seed Dataset

NO.	Batch	Number of Seed	Moisture Content (%)	Humidity (%)	Storage Duration (day)	Germination Rate	Label
212	DxP Yangambi	130.596	16	66	53	71,53	High
213	DxP Simalungun	120.198	18	66	53	81,25	High
214	DxP Langkat	198.428	17,8	55	54	41,95	Medium
215	DxP SP-1	33.547	18,1	53	60	53,34	Medium
216	DxP PPKS 540	52.308	17,9	55	55	80,58	High

3.3. *Implementation of the Naïve Bayes Algorithm*

This study uses a machine learning approach, specifically classification with the Naïve Baes algorithm. Naïve Bayes is probability-based classification method that uses Bayes'theorem with the assumption that the featires are independent. This algorithm calculates the probability of a data point falling into a particular class based on its feature values.

3.4. Classification Model Flow

The classification model flow using the Naïve Bayes method can be described as follows:

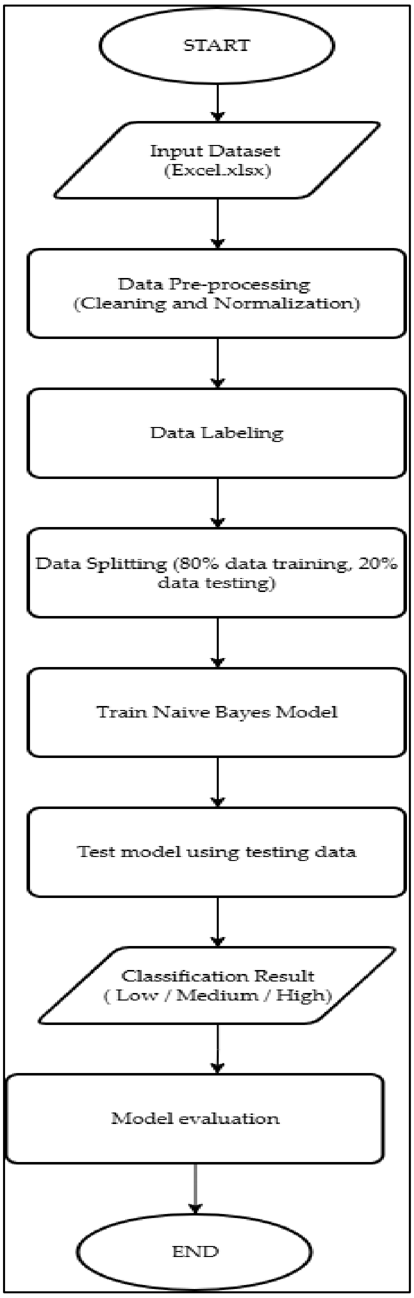

Figure 1. Classification Model Flow

The workflow for Research on Palm Oil Seed Quality Classification using Naïve Bayes can be described as follows:

1. The initial input dataset is an Excel file (.xlsx) containing 810 rows of data with columns for variety name, seed arrival date, PDB number, shipment number, number of seeds, heating chamber number, seed moisture content (), heating chamber humidity, storage duration, germination rate, and non-germination data.
2. The data pre-processing stage involves checking data completeness by checking for missing values, data duplication, and data types for each column to ensure consistency. Second, data

cleaning involves removing rows with empty values (missing values) using pandas, as well as standardizing the data format. Third, seed quality labels are determined using conditional functions.
3. Data splitting into 80% training data and 20% test data using the Scikit-Learn library. The result is 162 test data samples.
4. Model training with input features of moisture content, humidity, and storage duration with target results (quality labels).
5. Classification of test data, using the trained model to predict quality labels on test data. Predictions were made by calculating the probability of each class using Bayes' theorem.
6. The classification results are predictions of quality labels (high, medium, low).

3.5. Basic Formulas of Bayes' Theorem

The Naïve Bayes classification process in this study applies Bayes' Theorem as stated in the following equation

$$P(H|X) = \frac{P(X|H) \cdot P(H)}{P(X)} \quad (1)$$

Where P(H|X) is the posterior probability of hypothesis H given evidence X, P(X|H) denotes the likelihood of observing X given H, P(H) represents the prior probability of hypothesis H, and P(X) is the probability of the observed evidence. In this study, H refers to the seed quality class (low, medium, or high), while X represents the feature variables consisting of moisture content, storage room humidity, and storage duration. The final classification result is determined by selecting the class with the highest posterior probability (Senika et al., 2022).

3.6. Model Evaluation Confusion Matrix

Model evaluation is performed using the Confusion Matrix as the basis of classification performance analysis. The Confusion Matrix provides the basis for calculating a number of evaluation matrices, namely Accuracy, Precision, Recall, and F1-Score (Syahril et al., 2023).

Table 2. Performance Analysis

Actual (True)	Positive Prediction	Negative Prediction
Positive	True Positive (TP)	False Negative (FN)
Negative	False Positive (FP)	True Negative (TN)

1. Accuracy indicates the percentage of correct predictions from the entire data.

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN} \quad (2)$$

2. Precision indicates the accuracy of the model in predicting a class. This value shows how much of the data predicted as positive is actually positive.

$$Precision = \frac{TP}{TP+FP} \tag{3}$$

3. Recall or sensitivity indicates how well the model captures data form the target class. This value indicates how much of the actual positive data is predicted.

$$Recall = \frac{TP}{TP+FN} \tag{4}$$

4. F1-Score is the harmonic mean between precision and recall. This value describes the balance between prediction accuracy and the model's ability to recognize actual data.

$$F1 - Score = 2 \cdot \frac{Precision \cdot Recall}{Precision+Recall} \tag{5}$$

Description :

TP (True Positive)	: Number of instances that are correctly classified into the corresponding seed quality class.
TN (True Negative)	: Number of instances that are correctly classified as not belonging to a specific seed quality class.
FP (False Positive)	: Number of instances that are incorrectly classified into a seed quality class
FN (False Negative)	: Number of instances that belong to a specific seed quality class but are incorrectly classified into another class.

4. RESULT AND DISCUSSION

This study used a palm oil seed quality dataset from the PDB unit, Production Division, PPKS Marihat. The dataset included three main variables as classification features, namely moisture content, humidity, and storage duration The Naïve Bayes algorithm was applied to predict seed quality based on these three input variables. In this study, the Classification Report and Confusion Matrix model evaluations were tested on 20% of the dataset (162 sample).

The total number of seed samples used after the cleaning and normalization process was 810 data rows. The total data used for testing was 162 data points. This model used an 80% training data and 20% test data split. The total test data of 20% of 810 was 162 samples. Meanwhile, the total training data, which was 80% of the dataset, was 648 samples. Seed quality data labeling was done manually based on seed germination thresholds :

1. High, if germination rate ≥ 65%
2. Medium, if germination rate is 36% ≤ germination rate < 65%
3. Low, if germination rate is in the range < 36%

4.1. The Results and Confusion Matrix

Naïve Bayes classification was tested using 162 test samples, which is 20% of the total dataset of 810 data. The model was evaluated using a confusion matrix to determine which seeds fell into each quality category: low, medium, and high.

Based on the test results, the Naïve Bayes model produced an accuracy of 86%. Of the 162 test data, there were 23 error data, and 189 data were successfully classified into the correct class. These classification errors occurred in each seed quality category.

```
Accuracy: 0.9197530864197531

Classification Report:
              precision    recall  f1-score   support

        High       0.90      0.93      0.92        60
         Low       0.90      0.88      0.89        43
      Medium       0.95      0.93      0.94        59

    accuracy                           0.92       162
   macro avg       0.92      0.92      0.92       162
weighted avg       0.92      0.92      0.92       162
```

Figure 2. Confusion Matrix Accuracy Results

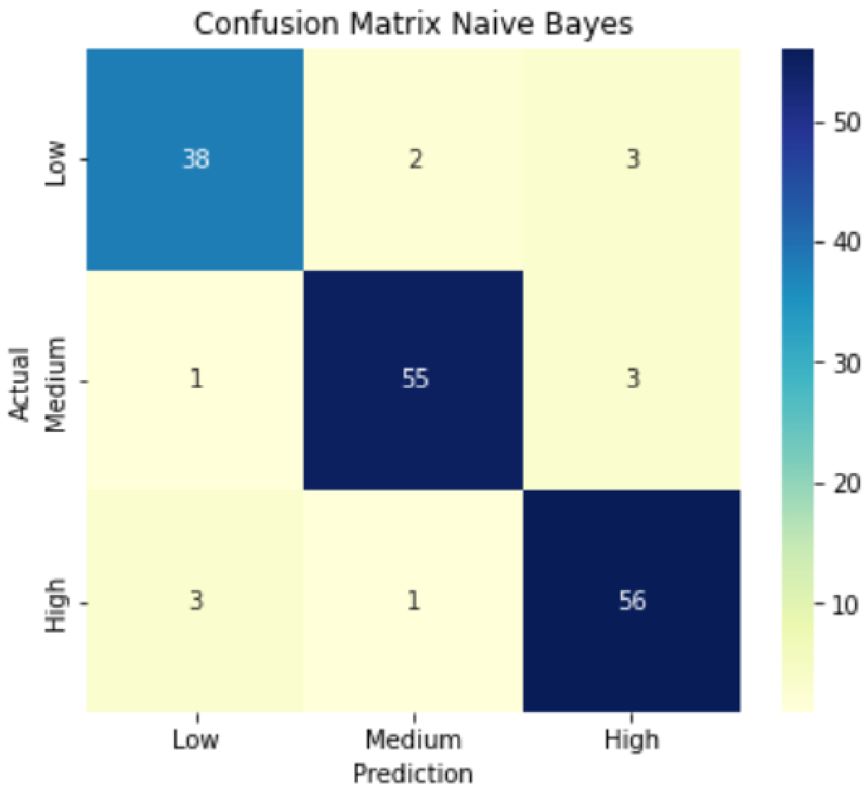

Figure 3. Naïve Bayes Confusion Matrix Results

The test results were analyzed using a Confusion Matrix that compares the actual class with the predicted class. The following is an explanation of the Confusion Matrix Results.

1. Low Class

   The low class has 43 original samples. A total of 38 samples were correctly classified (True Positive). A total of nine samples were misclassified. Four samples were classified as medium, and five samples were classified as high.

2. Medium Class

The medium class has 59 original samples. A total of 55 samples were classified correctly (True Positive). Five samples were misclassified.

3. High Class

   High class with 60 original samples. A total 56 samples were classified correctly (True Positive). Eight samples were misclassified. Three samples were classified as low, and five samples were classified as medium class.

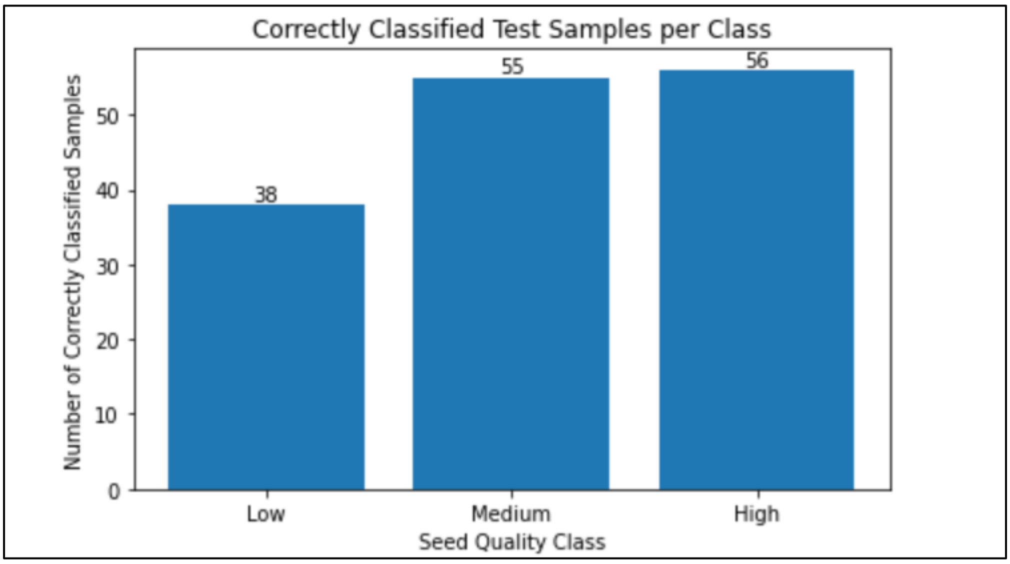

Figure 4. Class Comparison Diagram

The following bar diagram shows that most of the test data was predicted to fall into the medium (63 samples) and high (60 samples) classes. In this case, the model identified that seed samples were dominated by medium and high quality.

5. CONCLUSION

Oil palm is one of the most important plantation commodities in Indonesia, where seed quality plays a crucial role in determining production success. However, seed quality assessment at the research location is still predominantly conducted manually, making the process time-consuming and prone to human error. Therefore, this study aimed to develop an objective seed quality classification model to support decision-making in seed quality selection using a data-driven approach.

This study applied the Naïve Bayes algorithm to classify oil palm seed quality into low, medium, and high categories based on three key parameters, namely seed moisture content, storage room humidity, and seed storage duration. The classification process involved data preprocessing, model training using 80% of the dataset, and testing using 20% of the data. The evaluation results showed that the proposed model achieved an accuracy of 91% on 162 test samples, with 38 samples classified as low quality, 55 as medium quality, and 56 as high quality. These results demonstrate that the Naïve Bayes algorithm is effective in providing a fast and objective assessment of oil palm seed quality. It is expected that the implementation of this model can help reduce human error and improve the consistency of seed quality evaluation at the PDB PPKS Marihat Unit, thereby supporting better decision-making in the selection of superior seeds.

.

REFERENCES

Agustina, N., Citra, D. herlina, Purnama, W., Nisa, C., & Kurnia, A. R. (2022). *The Implementation of Naïve Bayes Algorithm for Sentiment Analysis of Shopee Reviews on Google Play Store Implementasi Algoritma Naive Bayes untuk Analisis Sentimen Ulasan Shopee pada Google Play Store*. *2*(April), 47–54. https://doi.org/https://doi.org/10.57152/malcom.v2i1.195

Ernita, M., Utama, M. Z. H., Muarif, J., Agroteknologi, D., Pertanian, F., & Padang, U. T. (2023). Ernita et. al. Pengaruh Zat Pengatur Tumbuh Alami dan Sintetik terhadap Pertumbuhan Bbit Kelapa Sawit (Elaeis guineensis Jacq) di Pre Nusery. *AGROTEK: Jurnal Ilmiah Ilmu Pertanian*, *7*(2), 186–194. https://doi.org/10.33096/agrotek.v7i2.356

Erumwenbibi, I., Yakubu, Ubara, & Eke. (2022). Breaking Seed Dormancy : Effect of Heat and Vimpel ® on Oil Palm Seed Germination (EIaeis guineensis Jacq). *Journal of Applied Sciences and Environmental Management*, *26*(September), 1463–1466. https://doi.org/https://dx.doi.org/10.4314/jasem.v26i9.1 Open

Fauzia, N. S., & Dana, R. D. (2023). Implementasi Algoritma Naive bayes dalam Klasifikasi Status Kesejahteraan Masyarakat Desa Gunungsari. *Blend Sains Jurnal Teknik*, *1*. https://doi.org/https://doi.org/10.56211/blendsains.v1i4.234

Gumi, I. P. Wi. K. G., Hartatik, & Syafrianto, A. (2022). *Perbandingan Algoritma Naïve Bayes dan Decision Tree Pada Sentimen Analisis*. *1*, 1–15. https://doi.org/https://doi.org/10.59095/ijcsr.v1i2.11

Handayani, R., & Purnomo, A. S. (2024). *Penerapan Teorema Bayes Untuk Mendiagnosa Hama dan Penyakit Pada Tanaman Kelapa Sawit*. *4*(2). https://doi.org/https://doi.org/10.58794/jekin.v4i2.737

Hasibuan, A. Z., Putri, H. A., & Purba, F. N. (2025). *Effect of Heating and Soaking Time with KNO 3 on Breaking Dormancy of Oil Palm Seeds (Elaeis guineensis Jacq .)*. *158*, 8. https://doi.org/https://doi.org/10.1051/bioconf/202515803004

Jefri, & Fatah, Z. (2025). KLASIFIKASI DATA MINING UNTUK MEMPREDIKSI KELULUSAN MAHASISWA. *Jurnal Ilmiah Multidisiplin Ilmu*, *2*(1), 29–37. https://doi.org/https://doi.org/10.69714/mhjq1v85 KLASIFIKASI

Marcelina, D., Yulianti, E., & Mair, Z. R. (2022). Penerapan Metode Forward Chaining Pada Sistem Pakar Identifikasi Penyakit Tanaman Kelapa Sawit. *Jurnal Ilmiah Informatika Global*, *13*(Agustus 2022). https://doi.org/10.36982/jiig.v13i2.2299

Mawaddah, W. J., Gunawan, I., & Sari, I. P. (2022). Implementasi Algoritma Data Mining untuk Klustering Data Hasil Panen Kelapa Sawit Implementation of Data Mining Algorithm for Clustering of Palm Oil Harvested Data. *JOMLAI: Journal of Machine Learning and Artificial Intelligence*, *1*(1), 43–54. https://doi.org/10.55123/jomlai.v1i1.163

Muharis, A., Faisal, Nasruddin, Jamidi, & Rafli, M. (2022). Pematahan Dormansi Benih Kelapa Sawit (Elaeis guineensis Jacq .) dengan Skarifikasi Mekanik dan Kimia Pendahuluan Metode Penelitian Hasil dan Pembahasan. *Jurnal Ilmiah Mahasiswa Agroekoteknologi*, *1*(2), 43–48. https://doi.org/10.29103/jimatek.v1i2.8465

Nadarajah, U. M., & Nawi, I. A. M. (2023). Heat treatment application on oil palm seed- a review. *Tropical Agriculture*, *100*(2 SE-Review Papers), 127–135. https://journals.sta.uwi.edu/ojs/index.php/ta/article/view/8439

Purnomo, N., Riko Muhammad Suri, Devi Yuliana, & M. Rasyid. (2023). Sistem Pakar Identifikasi Penyakit Kulit Melanoma dengan Metode Teorema Bayes. *Jurnal KomtekInfo*, *10*(2 SE-Articles), 56–63. https://doi.org/10.35134/komtekinfo.v10i2.368

Rahmawati, A. (2023). Keragaman Genetik Varietas Kelapa Sawit (Elaeis guineensis Jacq .). *Jurnal Kridatama Sains Dan Teknologi*, *05*(1), 35–40. https://doi.org/10.53863/kst.v5i01.677

Ratih, I. D., Retnaningsih, & Dewi. (2022). Klasifikasi Kualitas Tanah Menggunakan Metode Naive Bayes Classifier. *JAMS (Jurnal Aplikasi Matematika Dan Statistik*, *1*(1), 11–20. https://doi.org/https://doi.org/10.53625/jams.v1i1.4227

Sarang, P. (2023). Naive Bayes, A Supervised Learning Algorithm for Classification. In *Thinking Data*

Science: A Data Science Practitioner's Guide (pp. 143–152). Springer International Publishing. https://doi.org/10.1007/978-3-031-02363-7_7

Senika, A., Rasiban, & Iskandar, D. (2022). Implementasi Metode Naïve Bayes Dalam Penilaian Kinerja Sales Marketing Pada PT . Pachira Distrinusa. *Jurnal Media Informatika Budidarma*, *6*, 701–709. https://doi.org/10.30865/mib.v6i1.3331

Suendri, Aprilia, R., Br. Rambe, R., & Zakaria, N. H. (2025). Machine Learning-Based Naïve Bayes Classification of Pineapple Productivity : A Case Study in North Sumatra. *INTENSIF: Jurnal Ilmiah Penelitian Dan Penerapan Teknologi Sistem Informasi*, *9*(2), 315–327. https://doi.org/https://doi.org/10.29407/intensif.v9i2.24034 Machine

Syahril, D. P., Shofa, S. H., & Fitri, N. (2023). Analisis Sentimen Relokasi Ibukota Nusantara Menggunakan Algoritma Naïve Bayes dan KNN. *Jurnal KomtekInfo*, *10*(1 SE-Articles), 1–7. https://doi.org/10.35134/komtekinfo.v10i1.330

Widiastuti, N., Hermawan, A., & Avianto, D. (2023). Implementasi metode naïve bayes untuk klasifikasi data blogger. *JIPI (Jurnal Ilmiah Penelitian Dan Pembelajaran Informatika)*, *8*(3), 985–994. https://doi.org/https://doi.org/10.29100/jipi.v8i3.3713

Zakwan, Mahyunis, Faisal, B., Sembiring, A. S., & Noor, F. (2024). PENGARUH SUHU PEMANASAN PADA STASIUN KERNEL SILO DRYER TERHADAP MUTU KERNEL DI PABRIK KELAPA SAWIT PT. XYZ. *Jurnal Teknik Pengolahan Hasil Perkebunan Kelapa Sawit Dan Karet*, *6*(1). https://doi.org/https://doi.org/10.47199/jaf.v6i1.246