



## Evaluation of the Accuracy of the Naive Bayes Method in the Classification of Key Performance Indicators (KPIs) for Employees: Systematic Literature Review

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### Abstract

This study aims to evaluate the accuracy of Naive Bayes' method in classifying employee Key Performance Indicators (KPIs) through the Systematic Literature Review (SLR) approach. By collecting and analyzing reputable journals published between 2019 and 2024, this study examines the effectiveness of Naive Bayes in evaluating employee performance. The results of the study show that Naive Bayes is able to achieve a fairly high accuracy, which is between 84% to 90%, in classifying employee KPIs. However, this accuracy can vary depending on the complexity of the data used. Some research suggests that other methods such as Support Vector Machine (SVM) or Decision Tree may be superior in certain situations, especially when the data used is more complex or non-linear. In general, Naive Bayes remains a popular choice due to its ease of implementation and speed in delivering results. This study concludes that the selection of classification methods should be adjusted to the characteristics of the data and the purpose of the analysis to ensure optimal results.

**Keywords:** *Naive Bayes, Key Performance Indicators (KPI), Classification; Performance Evaluation, Systematic Machine Learning, Literature Review (SLR).*

### Abstrak

Penelitian ini bertujuan untuk mengevaluasi keakuratan metode Naive Bayes dalam mengklasifikasikan Key Performance Indicator (KPI) karyawan melalui pendekatan Systematic Literature Review (SLR). Dengan mengumpulkan dan menganalisis jurnal-jurnal bereputasi yang diterbitkan antara tahun 2019 hingga 2024, penelitian ini menguji keefektifan Naive Bayes dalam mengevaluasi kinerja karyawan. Hasil dari penelitian tersebut menunjukkan bahwa Naive Bayes mampu mencapai akurasi yang cukup tinggi, yaitu antara 84% hingga 90%, dalam mengklasifikasikan KPI karyawan. Namun, akurasi ini dapat bervariasi tergantung pada kompleksitas data yang digunakan. Beberapa penelitian menunjukkan bahwa metode lain seperti Support Vector Machine (SVM) atau Decision Tree mungkin lebih unggul dalam situasi tertentu, terutama ketika data yang digunakan lebih kompleks atau non-linear. Secara umum, Naive Bayes tetap menjadi pilihan yang populer karena kemudahan implementasi dan kecepatannya dalam memberikan hasil. Penelitian ini menyimpulkan bahwa pemilihan metode klasifikasi harus disesuaikan dengan karakteristik data dan tujuan analisis untuk memastikan hasil yang optimal.

Kata kunci: Naive Bayes, Key Performance Indicators (KPI), Klasifikasi; Evaluasi Kinerja; Systematic Machine Learning (SLR).



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## 1. Introduction

Measuring and evaluating employee performance is a crucial component of human resource management, especially in the digital age that demands data-driven decisions. *Key Performance Indicators* (KPIs) have become the main tool for assessing employee performance objectively and measurably. According to research by Smith et al. (2020) published in the *Journal of Management Studies*, KPIs not only assist organizations in monitoring individual performance but also in identifying areas that need improvement [1]. They stress that effective KPIs should be designed based on the SMART principle: specific, measurable, achievable, relevant, and time-bound to make sure that organizational objectives are reached. This study proved that the accurate classification of KPI is a very vital step in employee performance evaluation.

A recent study from Johnson and Lee (2021) published in the *International Journal of Human Resource Management* proposed the use of technology with machine learning algorithms to classify KPIs [2]. They then concluded from their research that comprehensive data analysis can be carried out appropriately and appropriately in the context of employee performance evaluation; especially in organizations that have a lot of data. This study also suggests that the integration between quantitative and qualitative holds an important position in KPI measurement, so that an organization can display a complete picture of employee performance in a unit. These findings suggest that technology has an important role to play in transforming traditional performance evaluation systems into more dynamic and adaptive ones.

In addition, Chen et al. (2022) in their research published in *Decision Support Systems* emphasized that KPI classifications must be able to handle complex and unstructured data, such as performance data coming from various sources. They suggest the use of a classification algorithm that can process heterogeneous data, such as text, numerical and categorical data. This study shows that effective classification methods should be flexible and adaptable to any type of data. In other words, KPI classification requires an approach that is not only accurate but also a way that can integrate various forms of data in providing a comprehensive evaluation. One of the widely used methods in KPI classification is *Naive Bayes*, a probability-based algorithm known for its simplicity and its ability to handle large amounts of data [3]. Research by Zhang et al. (2023) published in *Expert Systems with Applications* shows that *Naive Bayes* has a fairly high accuracy in classifying employee performance data, especially when the data used is relatively simple and not very complex. They view that this approach provides faster results by high level of efficiency. Although it may be a little less accurate like the approach method on

SVM or *Decision tree*. This paper shows that *Naive Bayes* is quite good because organizations need classification solutions that are easy and quick to implement [4].

Regardless, this is still being reviewed for *Naive Bayes* accuracy in the context of KPI classification only. Wang and Li (2024) in their study published in the Journal of Artificial Intelligence Research found that *Naive Bayes* has limitations when faced with highly complex or non-linear data [5]. They suggest that this method is better suited for relatively simple and well-structured datasets. Therefore, this literature review is directed at assessing the extent to which *Naive Bayes* can be relied upon in classifying employee KPIs, by comparing the results of recent research. By understanding the advantages and disadvantages of these methods, organizations can make more informed decisions in choosing the appropriate classification method for their needs.

## 2. Method

Systematic Literature Review (SLR) is a research method that aims to synthesize scientific evidence in a transparent and structured manner to answer specific research questions. This method involves explicit measures, such as the formulation of research questions, the search for relevant literature, the assessment of study quality, and the synthesis of data, thereby minimizing bias and improving the validity of results (Williams et al., 2021). According to Hariyati (2023), SLR allows researchers to understand key problems, build research frameworks, and identify gaps in the existing literature [6]. In addition, SLR is also used to strengthen the knowledge foundation of a topic by compiling a thorough review of various interrelated primary studies [7]. Thus, SLR not only makes a significant contribution to the development of science but also becomes an important tool in evidence-based decision-making.

This study uses the Systematic Literature Review (SLR) approach to systematically and in-depth examine the application of the Naive Bayes method in classification. In order for the review process to be structured and focused, the author sets several classification criteria to choose the journal to be reviewed. First, the selected journal must be published in a reputable journal to ensure the quality and validity of the research. Second, the journal must be published within the period of 2019 to 2024, so that the reviewed research remains relevant to the latest developments in the field

Classification. Third, the theme of the journal should be related to classification, especially in the context of grouping text or opinion data, which is the main focus of classification. Finally, the main method used in the study should be Naive Bayes, although other methods may be used as a comparator. With these criteria, it is hoped that the reviewed research can provide a comprehensive and accurate picture of the application of Naive Bayes in classification.

The stages of the research are as follows:



**Figure 1.** Method Reserach

It begins with the formulation of a research theme, a research question that covers the effectiveness of the use of *Naive Bayes* in classification. Furthermore, literature searches were conducted from various reliable sources such as IEEE Xplore, SpringerLink, ScienceDirect, ACM Digital Library, and Google Scholar with keywords such as "classification", "*Naive Bayes*", "*Key Performance Indicators*", and "machine learning" [6]. This process follows structured SLR guidelines to ensure the validity and reliability of the research findings.

### 3. Results and Discussion

No	Title	Method	Conclusion	Accuracy
1	Penggunaan Metode <i>Naive Bayes Classifier</i> untuk Mengevaluasi Kinerja Akademik Mahasiswa di Perguruan Tinggi [7]	This study used the Naive Bayes Classifier (NBC) method to evaluate student academic performance based on GPA (Grade Point Average) data.	The Naive Bayes Classifier method is effective as a tool for evaluating student academic performance in higher education. The method can be used to determine student success in completing their studies on time.	The model's accuracy was 79.82%. Accuracy on-time graduation status was 82.81%, while for late graduation status it was 76.00%.

No	Title	Method	Conclusion	Accuracy
2	Classification of Citizens with Low Economic Level Using <i>Naive Bayes</i> Classification Method [8]	This study used the Naive Bayes Classification method to classify citizens with a low economic level based on income, occupation, and number of dependents.	The Naive Bayes method is effective in classifying citizens with a low economic level. The high accuracy produced shows that this method can be used to determine aid recipients appropriately.	The accuracy obtained was 100%. Precision and recall also reached 100%, indicating very good performance in classification
3	Penerapan Algoritma <i>Naive Bayes</i> Untuk Klasifikasi Penilaian Kinerja Pegawai Di Kedai XYZ [9]	The method used in this study is the Naive Bayes algorithm for classifying employee performance assessments at XYZ Coffee Shop.	The conclusion of this research is that by conducting performance assessment, management can get a clear picture of individual performance, identify employee strengths and weaknesses, and provide a basis for better decision-making.	The total accuracy of the model used in this study is 84%.
4	Perbandingan Akurasi Algoritma <i>Naive Bayes</i> dan Algoritma <i>Decision tree</i> dalam Pengklasifikasian Penyakit Kanker Payudara [10]	This study used the Naive Bayes and Decision Tree methods to classify breast cancer using data obtained from the Kaggle site. Data was divided into 70% for training and 30% for testing using the hold-out technique.	The Decision Tree algorithm shows higher accuracy compared to Naive Bayes. Decision Tree is more effective in modeling complex patterns and non-linear relationships in the breast cancer dataset and provides easier interpretation. However, this algorithm is more prone to overfitting.	Naive Bayes: 91.15% Decision Tree: 92.04%
5	Penerapan Algoritma <i>Naive Bayes</i> Untuk Prediksi Penerimaan Karyawan [11]	The method used in the study is the Naive Bayes algorithm to predict employee recruitment, with primary data collection from the company and evaluation using MSE, RMSE, and R2 Score.	The conclusion from the research is that although the accuracy produced is very good, the MSE and RMSE results are quite large, which indicates that the prediction model using Naive Bayes is not accurate	The accuracy achieved in this study is 80%.

No	Title	Method	Conclusion	Accuracy
6	Analisis Perbandingan Kinerja Algoritma Naïve Bayes, <i>Decision tree</i> J48 dan Lazy-IBK [12]	This study used the Naive Bayes, <i>Decision tree</i> -J48, and Lazy-IBK algorithms for classification of the Breast Cancer and Thoracic Surgery datasets taken from the UCI Machine Learning Repository. Testing was conducted with cross-validation mode using Weka 3.8.5 software.	The <i>Decision tree</i> -J48 algorithm has the best accuracy performance compared to Naive Bayes and Lazy-IBK. This shows the ability of <i>Decision tree</i> -J48 to capture patterns better.	Breast Cancer: <i>Naive Bayes</i> : 74,82% Lazy-IBK: 75,52% <i>Decision tree</i> -J48: 75,87%  Thoracic Surgery: <i>Naive Bayes</i> : 78,51% Lazy-IBK : 77,23% <i>Decision tree</i> -J48: 84,47%
7	Klasifikasi Kelayakan Pegawai Kontra Menjadi Pegawai Tetap Menggunakan Metode Naive Bayes [13]	The method used in the research is the Naive Bayes algorithm for classifying employee eligibility.	The conclusion of this study is the creation of a foundation employee classification system that can determine classification results based on eligible and not yet eligible to be appointed as permanent employees.	The accuracy obtained from testing using the MATLAB application is 86.7%.
8	Opinion Mining Fungsi KPI (Key Performance Indikator) Dengan Algoritma Naïve Bayes Classifier Dan Support Vector Machine (SVM) [14]	The method used in the study is data mining analysis with the Naïve Bayes and Support Vector Machine (SVM) algorithms to classify KPI (Key Performance Indicator) using data from Twitter.	The conclusion of the study shows that the SVM algorithm with SMOTE has an accuracy of 72.32%, higher than Naïve Bayes which has an accuracy of 60.95%.	The SVM algorithm with SMOTE has an accuracy of 72.32%, higher than Naïve Bayes which has an accuracy of 60.95%.
9	Bayes Classification Using Approximation To The Joint Probability Distribution Of The Attributes [15]	The method used in the study is a comparison of three classifiers, namely C4.5, CART, and Naïve Bayes to analyze personal loans.	The conclusion of this study is that C4.5 is better than CART and Naïve Bayes in terms of accuracy.	The average accuracy for C4.5 is 77.5%, for CART is 74%, and for Naïve Bayes is 72.1%.
10	Implementasi Algoritma Naïve Bayes Classifier Untuk Memprediksi Tingkat Produktivitas Kinerja Karyawan [16]	The method used in this study is the Naïve Bayes Classifier algorithm to predict the productivity level of employee performance at PT. Focon Indo Beton, with data collection through observation, questionnaires, and literature study.	The conclusion of the study shows that the information obtained is very accurate and can be useful for readers and future researchers.	The accuracy of the Naïve Bayes Classifier model reached 90.80%.

The discussion in the table that correlates with the classification of employee Key Performance Indicators (KPI) using the Naive Bayes method can be seen from several studies that use this method to evaluate employee performance. One of them is a study in 2025 titled "APPLICATION OF THE NAÏVE BAYES ALGORITHM FOR EMPLOYEE PERFORMANCE ASSESSMENT CLASSIFICATION AT XYZ COFFEE SHOP". This study used the Naïve Bayes algorithm to classify employee performance appraisals and produced an accuracy of 84%. The conclusion of this study shows that the Naïve Bayes method is effective in providing a clear picture of individual performance, identifying employee strengths and weaknesses, and being a basis for management decision-making.

A study in 2024 titled "Classification of Employee Performance Assessment Using the Naïve Bayes Algorithm (Case Study of PT. As Sabar Sukses Berkah)" used the Naïve Bayes algorithm for classifying employee performance. A high accuracy of 90% was generated in this study. Based on the analysis shown using a black box, it yielded a 100% success rate. This indicates that the Naïve Bayes algorithm is capable of providing accurate performance and classification for employee performance value classification. However, another study in <https://www.google.com/search?q=2023>, with the title "Mining Opinion of KPI Function using Naïve Bayes Classifier and Support Vector Machine (SVM)", showed a lower precision value than the accuracy precision of SVM, which was 72.32%, for its classification for KPI with a value of 60.95% for Naïve Bayes. This indicates that although Naïve Bayes is effective in some contexts, other methods may be superior in certain situations, especially when the data used is more complex or non-linear

#### 4. Conclusion

Based on the tables and discussion above, it can be concluded that the Naive Bayes method is an effective and efficient tool for the classification and evaluation of employee Key Performance Indicators (KPI). Several studies show that Naive Bayes is capable of providing a fairly high accuracy, ranging from 84% to 90%, in assessing employee performance. However, the accuracy achieved by Naive Bayes can vary depending on the dataset and the context of its use. In some cases, such as classification of KPIs, other methods like Support Vector Machine (SVM) with SMOTE show higher accuracy (72.32%) compared to Naive Bayes (60.95%). This

indicates that although Naive Bayes is effective, other methods may be superior in certain situations, especially when the data used is more complex or non-linear.

In general, Naive Bayes remains a popular choice in the classification of employee KPIs due to its ease of implementation and speed in delivering results. However, it is important to consider the characteristics of the data and the purpose of the analysis before choosing the most suitable method. If high accuracy is the main priority, other methods such as Decision Tree or SVM might be more suitable. Therefore, the choice of method should be adapted to the specific needs and context of the research or evaluation being conducted.

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