

SENTIMENT ANALYSIS OF IPUSNAS REVIEWS USING NAIVE BAYES AND K-NEAREST NEIGHBOR ALGORITHMS

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Abstract

This study aims to analyze the sentiment of iPusnas application user reviews using the classification method with the K-Nearest Neighbor (KNN) and Naive Bayes algorithms. The data used are secondary data in the form of user reviews obtained from the Google Play Store in the period of January to December 2025 totaling 2415 reviews. This study uses a text mining approach with text preprocessing stages, feature extraction using the Bag of Words (BoW) method, and sentiment classification using the Naive Bayes and K-Nearest Neighbor (KNN) algorithms. Model evaluation uses Test and Score Confusion Matrix, and Word Cloud. The results show that the Naive Bayes method has better performance with an accuracy value of 0.705 compared to K-Nearest Neighbor (KNN) with an accuracy value of 0.615. Testing the K parameter in the KNN algorithm shows that the best K value is obtained at K = 6 with an accuracy of 0.615. This study shows that Naive Bayes is more effective in classifying sentiment in iPusnas application user reviews.

Keywords: sentiment; Naive Bayes; K-Nearest Neighbor; text mining; iPusnas

Abstrak

Penelitian ini bertujuan untuk menganalisis sentimen ulasan pengguna aplikasi iPusnas menggunakan metode klasifikasi dengan algoritma K-Nearest Neighbor (KNN) dan Naive Bayes. Data yang digunakan merupakan data sekunder berupa ulasan pengguna yang diperoleh dari Google Play Store dalam rentang waktu Januari hingga Desember 2025 sebanyak 2415 data. Penelitian ini menggunakan pendekatan text mining dengan tahapan preprocessing text, ekstraksi fitur menggunakan metode Bag of Words (BoW), dan klasifikasi sentimen menggunakan algoritma Naive Bayes dan K-Nearest Neighbor (KNN). Evaluasi model menggunakan Test and Score, Confusion Matrix, dan Word Cloud. Hasil penelitian menunjukkan bahwa metode Naive Bayes memiliki performa yang lebih baik dengan nilai akurasi sebesar 0.705 dibandingkan K-Nearest Neighbor (KNN) dengan nilai akurasi 0.615. Pengujian parameter K pada algoritma KNN menunjukkan bahwa nilai K terbaik diperoleh pada K = 6 dengan accuracy sebesar 0.615. Penelitian ini menunjukkan bahwa Naive Bayes lebih efektif dalam melakukan klasifikasi sentimen pada ulasan pengguna aplikasi iPusnas.

Kata kunci: sentimen; Naive Bayes; K-Nearest Neighbor; text mining; iPusnas

INTRODUCTION

The fast development of information technology has changed many parts of everyday life, including how people find information and reading materials. Libraries that used to be visited in person are now slowly moving towards digital services to make it easier and more convenient for users to access their resources. A good example of this change is iPusnas, which is a digital library app created by the National Library of the Republic of Indonesia. With this app, users can look at different

digital book collections online whenever they want and from wherever they are. Also, users can give ratings and write reviews based on how their experience was while using the app (Megawati, 2025).

The rising popularity of digital apps has led to more user reviews on sites like the Google Play Store. These reviews include thoughts, ideas, feedback, and experiences from users about how well the application works and the quality of the service. User reviews can be very useful for assessment because they show how happy users

are and what they expect from the app (Zuhdi & Prasetyo, 2025). From looking at the reviews for iPusnas on the Google Play Store, a lot of users shared good thoughts about how easy it is to get digital books and how helpful the app is. Many users also shared bad experiences, like problems logging in, the app crashing, slow speeds, and issues with the borrowing system. The presence of both good and bad reviews shows that how users feel about the iPusnas app is different and needs more detailed examination (Kiasati & Zulaikha, 2023).

The big volume of review data and its messy text format make it hard and slow to analyze by hand. Also, manual analysis can lead to personal opinions since each reviewer might understand views in their own way (Septiani & Budi, 2024). So, we need a way to automatically handle and sort review data better. One method that can be used is data mining. This is a way to find patterns and get helpful information from big sets of data to help with making decisions (Sudarsono & Leo, 2021)

In analyzing text-based data, data mining is often done using techniques from text mining. Text mining is about working with unstructured text data to get useful information from it (Andzar, 2023). A common method used in text mining is sentiment analysis. Sentiment analysis is a method that helps to find and sort opinions into different feelings, like positive, neutral, and negative (Tri, Doni, Susanti, & Mubarok, 2021). By using sentiment analysis, developers can gain a clearer understanding of how users feel about an app.

Many different classification methods are often used in sentiment analysis research, such as Naive Bayes and K-Nearest Neighbor (KNN). Naive Bayes is a classification algorithm based on probability theory and is effective for text classification because it can handle large feature dimensions with simple computational processes (Tri, Septiani, Kuncoro, & Subarkah, 2024). Meanwhile, K-Nearest Neighbor (KNN) classifies data based on similarity distance between data points and determines the category according to the closest neighboring data (Neighbor, 2021). Both algorithms are widely used in sentiment classification studies due to their good performance in processing text data.

Naive Bayes was selected in this study because it is effective for text classification and capable of handling high-dimensional text data with simple computation. Meanwhile, K-Nearest Neighbor (KNN) was chosen because it classifies data based on similarity distance between data points. Therefore, comparing these two algorithms is important to determine the most effective

method for sentiment classification on iPusnas user reviews. Earlier research has used Naive Bayes and K-Nearest Neighbor methods to analyze feelings in social media posts, online shopping reviews, and feedback on mobile apps. Research discussing sentiment analysis on digital library applications, particularly iPusnas, remains limited. Also, many earlier studies mainly looked at the classification results and did not talk about how well each algorithm worked for reviewing digital library applications.

This research compares the Naive Bayes and K-Nearest Neighbor algorithms to find out which one works better for classifying the feelings expressed in iPusnas user reviews. (Yos, No, Lubuklinggau, & Selatan, 2021). This study looks to understand how users feel about the iPusnas app and to compare how well the Naive Bayes and K-Nearest Neighbor algorithms perform. We will use various evaluation measurements like accuracy, precision, recall, F1-score, AUC, and MCC to do this. The findings from this research are likely to give helpful information to developers for enhancing the quality of applications and services by using feedback from users. Also, this study is anticipated to help in the growth of research on understanding feelings, especially in the use of digital libraries.

RESEARCH METHODS

Types of research

This research employs a quantitative method, employing a classification method with a data mining approach to text mining for sentiment analysis. This approach was used because the review text data was processed into numerical data using Bag of Words.

Time and Place of Research

This study employed quantitative research conducted in 2026. Data collection was conducted online using a personal computer with supporting software such as Google Colab and Orange. This process took place from April 3 to April 20, 2026.

Research Target / Subject

This study uses user reviews of the iPusnas application obtained from the Google Play Store (<https://play.google.com/store/search?q=iPusnas&c=apps>). The data were collected using web scraping techniques from the beginning to the end of 2025, totaling 2,415 reviews. These reviews served as the primary data for the sentiment analysis process, using purposive sampling with specific criteria.

Procedure

The exploration procedure includes several stages such as data collection, data preprocessing, feature extraction, modeling using the classification process with the K-Nearest Neighbor (KNN) and Naive Bayes algorithms, data evaluation, and data visualization.

Data, Instruments, and Data Collection Techniques

The data used in this study is secondary data in the form of user reviews and comments from the iPusnas application. These reviews were obtained from the Google Play Store from January, 2025, to December 2025.

Data collection was carried out using web scraping, a process that automatically extracts information from websites into data that can be analyzed and utilized according to user needs (Chrisinta & Simarmata, 2024). The data is in the form of text containing public opinions accompanied by numerical ratings, such as scores reflecting the level of user satisfaction with the iPusnas application (Siregar et al., 2025) (Subarkah, Risma, & Aditya, 2022).

After collection, the next step is the labeling process to analyze the data, as each sentence can have multiple meanings (Ayuningtyas & Yustanti, 2024). The scraped review data was then automatically labeled using Google Colab using a keyword-based labeling method into three sentiment categories: positive, neutral, and negative. After the labeling process was completed, the labeled data were directly used for sentiment classification using the Naive Bayes and K-Nearest Neighbor (KNN) algorithms (Fristtikasari, Alam, & Kurniawan, 2024). The labeled data is then used for sentiment analysis using the Naive Bayes classification algorithm and K-Nearest Neighbor (KNN) (Ikhsan, Subarkah, & Alifian, 2023).

To conduct the sentiment analysis, this study used Orange Data Mining, an open-source software that allows users to easily perform data mining without the need for direct programming (Rahmah, Modeling, & Goreng, n.d.) (Darmayanti, Subarkah, Anunggilarsa, & Suhaman, 2021). This study also utilized text preprocessing in Orange Data Mining, which includes transformation, tokenization, and filtering, to enable text analysis by Orange Data Mining.

The data collection technique used in this study was a documentation method, which involved collecting and storing user reviews of the iPusnas application by examining the documented data (Maret, Tindakan, Teknik, & Saádi, 2025).

Data analysis technique

The data analysis technique in this study used a text mining approach to analyze sentiment on user reviews of the iPusnas application. This analysis process involved several stages, as follows:

1. Data Preprocessing

The obtained text data was initially processed using the Preprocess Text feature in Orange Data Mining. This process includes transformation, tokenization, and filtering. Transformation involves changing all uppercase letters to lowercase using the lowercase method (Ariqoh et al., 2023). Tokenization is the step of separating words in each sentence using Word & Punctuation (Cetak & Online, 2023). Meanwhile, filtering is a method of removing stopwords by selecting words deemed unimportant using the Indonesian stopword list and removing numbers (Albab, P, & Fawaiq, 2023).

Table 1. Data Preprocessing

Before Preprocessing	After Preprocessing
Aplikasi yang berguna untuk menurunkan minat baca 🧐 Ahli apa yang kamu gunakan buat aplikasi ini kawan? ahli nujum? Baru dibuka, nutup sendiri	aplikasi, berguna, menurunkan, minat, baca, ahli, aplikasi, kawan, ahli, nujum, dibuka, nutup

2. Feature Extraction

This process converts text data into numerical form using the Bag of Words method. Bag of Words is used to calculate the frequency of word occurrences and is used in the classification process (Firdaus, Hadiana, & Ningsih, 2024).

3. Application of Classification Algorithms

The classification process was carried out using two algorithms: Naive Bayes and K-Nearest Neighbor (KNN).

- Naive Bayes is a process that utilizes probability calculations and future statistics based on previous data (Pebdika et al., 2023).
- Meanwhile, the algorithm classifies data by considering the similarity or distance between data points based on proximity to other data and produces high accuracy in the testing process (Untuk, Seleksi, & Beasiswa, 2021).

4. Model Evaluation

Model evaluation was conducted using Test and Score in Orange Data Mining to determine

the performance of each algorithm. This study used 5-fold cross validation in Orange Data Mining to evaluate the performance of the Naive Bayes and K-Nearest Neighbor (KNN) algorithms. In this method, the dataset was automatically divided into training and testing data during the validation process. The evaluation metrics used include AUC (Area Under Curve), accuracy, F1-score, precision, recall, and MCC (Matthews Correlation Coefficient). Additionally, a Confusion Matrix was used to view the classification results in more detail.

5. Data Visualization

The analysis results can be viewed using a Word Cloud, which displays words or topics that frequently appear in user reviews (Journal & Information, 2025).

Based on Figure 1, the sentiment analysis process in this study was conducted using Orange Data Mining software, which consists of several stages. The process begins with file input and continues to the Corpus stage to read the text data.

Next, the data goes through a text preprocessing stage, including transformation, tokenization, and filtering to clean the data. The processed data is converted into numeric values using Bag of Words.

Afterward, the classification method uses the K-Nearest Neighbor (KNN) and Naive Bayes algorithms. The classification results are evaluated using the Test and Score widget and the Confusion Matrix. Additionally, a Word Cloud is used for data visualization to display frequently occurring words or topics in iPusnas app reviews.

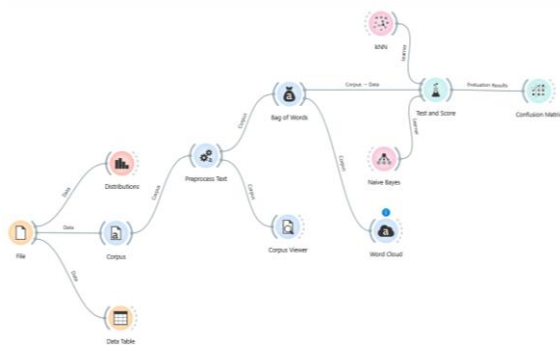


Figure 1. Orange Data Mining

RESULTS AND DISCUSSION

The results of this study will be used as evaluation material for the iPusnas application developers, thus providing a basis for decision-

making. This will allow them to improve service quality and refine application features based on user satisfaction.

Data Distribution

Based on Figure 2, the distribution of sentiment data in iPusnas user reviews can be seen in three categories: negative, neutral, and positive. This classification includes 2415 reviews, with 984 negative, 866 neutral, and 565 positive. This number of sentiment data points indicates that the majority of users provided negative reviews.

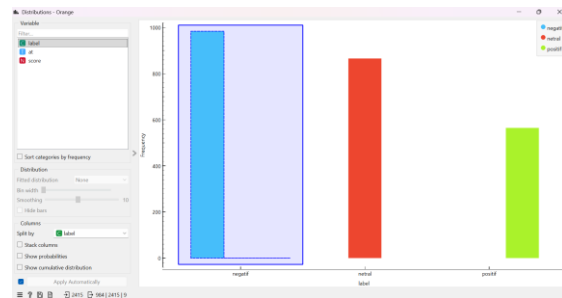


Figure 2. Data Distribution

Test & Score

According to Figure 3, the model evaluation results using the Test and Score widget show that the Naive Bayes algorithm performed better than the K-Nearest Neighbor (KNN) algorithm.

It can be seen that the AUC (Area Under Curve), Naive Bayes algorithm also obtained higher evaluation results of 0.874 with a CA (Classification Accuracy) value of 0.705, F1-Score of 0.702, Precision of 0.717, Recall of 0.705, and MCC (Matthews Correlation Coefficient) of 0.558. Meanwhile, the AUC (Area Under Curve), K-Nearest Neighbor (KNN) algorithm obtained a value of 0.788 with a CA value of 0.615, F1-Score of 0.608, Precision of 0.635, Recall of 0.615, and MCC of 0.414.

These results indicate that the Naive Bayes algorithm is more effective in classifying sentiment analysis on iPusnas user reviews. These findings are consistent with previous research conducted by (Tri, Septiani, Kuncoro, & Subarkah, 2024) which also showed that Naive Bayes achieved better performance than K-Nearest Neighbor (KNN) in sentiment classification.

This is because Naive Bayes performs well on high-dimensional text data and can process word probability efficiently. In contrast, the K-Nearest Neighbor (KNN) algorithm tends to be sensitive to large feature dimensions and

imbalanced data distribution, which may reduce classification performance.

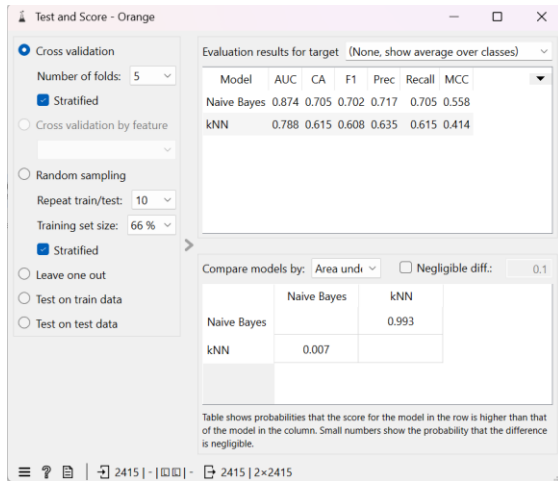


Figure 3. Test & Score

Confusion Matrix

1. Naive Bayes Algorithm

According to Figure 4, the Naive Bayes algorithm's confusion matrix indicates that the data performed quite well.

In the negative label, 604 data points were correctly classified, but there were still 242 misclassifications in the neutral class and 138 in the positive class.

In the neutral label, 741 data points were correctly classified, but there were still 74 misclassifications in the positive class and 51 in the negative class.

Meanwhile, in the positive label, 357 data points were correctly classified, but there were still 95 misclassifications in the negative class and 113 in the neutral class.

This indicates that the Naive Bayes algorithm performed quite well, although there were still some misclassifications, especially between sentiment classes.

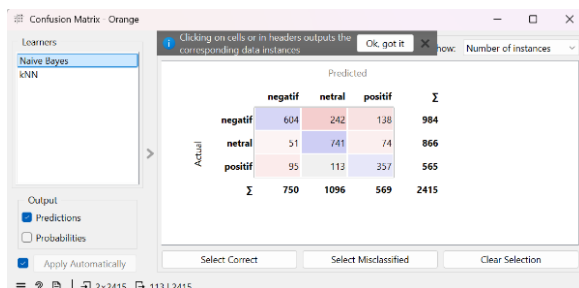


Figure 4. Naive Bayes Algorithm

2. K-Nearest Neighbor (KNN) Algorithm

According to Figure 5, the confusion matrix of the K-Nearest Neighbor (KNN) algorithm shows that the data performs poorly in sentiment classification.

In the negative label, 620 data points were correctly classified. 300 were in the neutral class and 64 were in the positive class.

From the Neutral label, there are 667 correct data, but there are still errors in the negative class of 118 data and the positive class of 81 data.

Meanwhile, the positive label has 198 correct data, but there are still errors in the negative class of 80 data and in the neutral class of 287 data.

This indicates that the K-Nearest Neighbor (KNN) algorithm tends to be biased toward certain classes, resulting in a relatively high classification error rate. The lower performance of the K-Nearest Neighbor (KNN) algorithm may also be influenced by the large amount of text data and the high number of features generated from the Bag of Words method. Since KNN calculates the distance between data points, high-dimensional text data can reduce its classification effectiveness.

In addition, several K values were tested in the K-Nearest Neighbor (KNN) algorithm to determine the best accuracy level. The K values tested were 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10. Based on the test results, the best performance was obtained at K = 6 with an accuracy value of 0.615. Meanwhile, at higher K values, the accuracy level decreased.

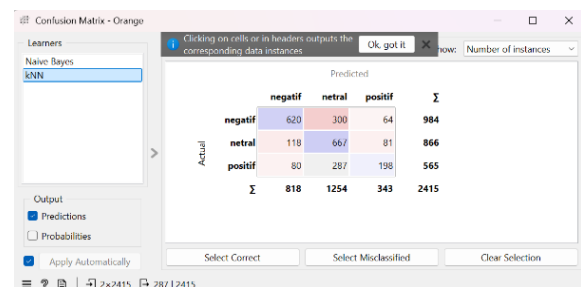


Figure 5. K-Nearest Neighbor (KNN) Algorithm

Word Cloud

Based on Figure 6, the Word Cloud shows frequently occurring words or topics in iPusnas app usage. Words such as "book," "update," "read," and "app" are the most frequently used in reviews, indicating that users actively discuss the main features of the application as a digital library platform.

Furthermore, words like "fixed," "please," "error," and "cannot" indicate that user reviews contain not only appreciation for the app but also

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