# SENTIMENT ANALYSIS OF THE GOPAY APPLICATION USING THE *NAIVE BAYES METHOD* BASED ON USER REVIEWS

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**Abstract**
The development of financial technology, particularly digital wallet applications, has made significant progress in Indonesia. One of the most widely used applications is GoPay, which offers various conveniences in conducting financial transactions. However, despite GoPay 's many advantages, user responses to this application are not always positive. Some users provide negative comments reflecting their less than satisfactory experiences. In this context, this study aims to analyze sentiment from user reviews of the GoPay application using the Naive Bayes method, which is known to be effective in text classification. This method was chosen because of its ability to classify data well, even in large and diverse datasets. This study involved data collection from platforms Using Kaggle, 1,000 reviews were randomly selected for further analysis. The analysis revealed that positive comments predominated among the reviews. This indicates that the majority of users had a positive experience with the GoPay app, although there were also a number of negative reviews worth noting.

## I. INTRODUCTION

Fintech has experienced tremendous progress over the years, expanding the range of innovative solutions accessible to people from all walks of life. Advances in financial administration have significantly increased convenience for the public, particularly in the area of financial transactions. As a result, e-wallets have become one of the most popular and widely used fintech products among the Indonesian population.

According to [1] The use of e-wallets in Indonesia has seen an impressive increase, especially among the younger generation. A recent survey conducted by the Opinion Poll ( *JakPat* ) in 2024 found that 96% of users reported using or accessing e-wallets. This surge in e-wallet use is driven by a combination of government initiatives and advances in the private sector. Many *online stores now* offer payment options through e-wallets, increasing their accessibility. Among these options, *GoPay* has become known as a leading e-wallet

application, gaining significant traction among the public.[2] *GoPay* is part of the Gojek application and one of the most popular *fintechs* .

According to detik *finance* [3] [4], *GoTo Budgetary*, a business unit owned by PT *GoTo* Gojek Tokopedia Tbk ( *GoTo* ), launched the *GoPay application* in July 2023. During this period, the *GoPay application* has been downloaded by 30 million users. Detik *finance* Ayuningrum (2024) *Head of GoPay Wallet Kelvin Timotius stated that GoPay* currently has over 30 million users, placing *it* among the top 3 financial apps. Since its launch a year ago, *GoPay* has had 30-40 million users, and this number continues to grow with the addition of the latest feature, *Split Bill*. Some of the most widely used features include transactions, top-up payments, bill payments, and *the Indonesian Standard Quick Response Code (QRIS)*.

*GoPay* offers convenience, but user reactions and comments on the app aren't always positive. Some may leave negative comments about *GoPay*. However, manually analyzing all user assumptions and comments is no easy task, given the sheer number of conclusions or comments that can hinder the feedback process. Potential users and the public face a challenge in making informed decisions about specific products, services, or issues. The primary obstacle is the lack of accurate information before purchasing a product or selecting a service. Potential users need clear and accurate information, but the sheer volume of public opinion makes it difficult for them to filter out truly relevant information. The manual workload of analyzing public opinion collecting and analyzing user reviews manually is time consuming and labor-intensive, hindering quick and *efficient decision-making* . With the abundance of reviews available *online* , the public needs automated methods that can help them quickly understand public opinion. Using methods such as *Naive Bayes* in sentiment analysis can be a solution to this problem.

Previous research has used the *Support method Vector Machine Learning* (SVM) to analyze sentiment on other applications, however, there has been no research that specifically analyzes the sentiment of *GoPay user reviews* using the *Naive method. Bayes* Therefore, this study aims to analyze user sentiment towards the *GoPay application* using the *Naive Bayes classification method*. This approach will classify user reviews into two main categories: positive and negative. [5] *Naive Bayes Classifier* is the most commonly used classification algorithm in machine learning. It is based on *Bayes' Theorem*, which assumes that each feature in a data set operates independently of each other, which may not be true in reality. *Naive Bayes* utilizes *posterior probability* , which measures the probability of a particular class based on observed features. The advantage of using *Naive Bayes* lies in the fact that this strategy requires a relatively small amount of processing information to determine the parameters needed for classification. Because it is assumed to be an *independent variable, only the variance of a variable within a class is needed to determine the classification, not the entire covariance* matrix . Reasons for using *Naive Bayes* Its simplicity, speed, and effectiveness in many cases, have the highest probability or opportunity values for classifying data. [6] Advantages of *Naive Bayesian* means handling quantitative and qualitative data effectively, requiring minimal *datasets*, and requiring limited training data.

Sentiment analysis results can provide potential users with insights about a particular product, service, or issue before making a decision, such as purchasing a product or choosing a service. Understanding public opinion on issues can help shape personal views, reducing the manual workload of analyzing user reviews by utilizing *naive calculations. Bayesian algorithms*, making sentiment analysis faster and more efficient. Furthermore, the analysis results will serve as a foundation for further research in sentiment analysis and other data analysis strategies in the context of mobile applications and digital financial services, using or combining various analytical methods. This will create a broader field of informatics.

## II. LITERATURE REVIEW

### 2.1. Classification Theory

[7], [8] Data classification is a method of collecting information into various categories or classes based on certain qualities or characteristics. [5][9], [10]Classification can be an efficient approach procedure for building a classification view of data. Each strategy used uses learning calculations to obtain the best view so that it can fulfill the relationship between the set of properties and lesson labels in the information that has been entered. [6] Rahayu et al., (2024:41) Classification is a major strategy in the field of Machine Learning, which is designed to organize information into certain categories or classes based on its characteristics or qualities. Based on various expert perspectives, it can be concluded that classification serves as an effective method for managing data by systematically grouping it according to similar attributes. This handling involves the use of learning and calculation techniques to build efficient classification displays, so that they can fulfill the relationship between the set of properties and names in the information.

### 2.2. *Naive Bayes Classifier* (NBC)

[10], [11], [12] describe *Naive Bayes* as a computational method used to classify certain variables through the application of probability and statistical techniques. This approach uses principles from probability theory to determine the most likely classification by analyzing the frequency of each classification in the given data. According to [13], the *Naive Bayes* method functions as a data mining strategy that aims to predict future events by comparing them with historical data or validated examples. According to [15] *Naive Bayes* is a classification technique that utilizes probability and statistical methodology, named after the *British researcher Thomas Bayes*. This technique predicts future probabilities based on past experience, summarized in what is known as *Bayes' Theorem*. [16][16]*Bayesian* classification is a statistical method capable of estimating the probability of membership in a particular class. This simple form of classification, often referred to as *a Naive Bayesian Classifier*, operates on the assumption that the value of one attribute in a particular class is independent of the other attributes. This assumption, known as *class conditional independence*, simplifies calculations. It is called "*naive*" because it implies that the occurrence of a word in a sentence is unaffected by the presence of other words, although there is an understanding that the relationship between words can significantly influence their occurrence.

*Naive Bayes Classifier* Algorithm is a statistically driven classification tool. This algorithm estimates the probability of an object's membership in a particular class based on its characteristics, using *Bayes' probability theorem*. The underlying assumption of the *Naive Bayes classification algorithm* is that the presence or absence of a particular characteristic in a class operates independently of the characteristics of other classes. Models frequently used in this framework include *Gaussian Naive Bayes, Multinomial Naive Bayes, and Bernoulli Naive Bayes*. *Bayes' theorem* states that probability is based on belief or trust, which allows it to project future probabilities based on previous experience. Based on the expert opinions above, it can be concluded that *Naive Bayes* is a classification strategy that uses probability guidelines to determine the likelihood of classifying variables based on repeated information. This strategy uses data from past information to predict future events and is based on a hypothesis developed by *Thomas Bayes*.

### 2.3. Understanding Analysis

According to [17]analysis is an action in considering and assessing a framework of a problem or case that occurs. [18] analysis involves a series of activities, including describing, isolating, and sorting information to reorganize it based on certain criteria. This process also

requires examining relationships and interpreting underlying meanings. [19] defines analysis as an action that includes the same activities of description, separation, sorting, regrouping according to established standards, and exploration of relationships and meanings. Based on the expert opinions above, it can be concluded that analysis serves as a comprehensive guide consisting of a series of tasks. It involves detailing, isolating, and organizing data according to specific criteria, while also considering the relationships and meanings inherent in the data.

### 2.4. Understanding System Analysis

According to [20], sentiment analysis, often referred to as opinion mining, is the process of determining users' feelings and conclusions about various topics or texts they submit. According to [21] *Sentiment* analysis can be defined as a method used to extract assumption information, obtain it, and process literary information sequentially to see the value contained in a sentence, whether positive or negative. According to [22] sentiment analysis, also known as opinion mining, includes various methods in natural language processing, computational linguistics, and text mining. Its main purpose is to assess the opinions, conclusions, judgments, behaviors, evaluations, and emotions expressed by an individual, both speaker and writer, regarding a particular subject, product, service, organization, person, or activity. Based on the expert opinions above, it can be concluded that sentiment analysis is a method used to extract and analyze individual conclusions, suspicions, and sentiments surrounding a subject, item, or benefit. This strategy involves preparing data to determine the positive or negative values contained in reviews and encompasses the perspectives of general language analysis and review mining.

### 2.5. GoPay

According to [23] *GoPay* is an electronic wallet included in the Gojek app. You can use *GoPay* to pay for various transactions, including using Gojek services and purchasing phone credit. [24] *GoPay* is a digital payment *platform* integrated with the Gojek app, allowing users to perform various financial transactions such as payments, money transfers, and purchases of various services and goods. *GoPay* is designed to make it easy to manage accounts across various mobile devices. [8] *GoPay* is one of the most popular mobile payment methods in Indonesia. *It* 's part of the Gojek app, which offers a variety of services, including food delivery, *online motorcycle taxis*, installment payments, and more. *GoPay users* can make payments at various business partners that partner with Gojek. Based on the expert opinions above, it can be concluded that *GoPay* is a digital payment *platform* integrated with the Gojek app. This allows users to conduct various financial transactions, including installment payments, cash transactions, and access to various services. As a popular e-wallet in Indonesia, *GoPay* supports various Gojek services and can be used with various merchant partners, making it easier to manage transactions via mobile devices.

### III. RESEARCH METHODS

### 3.1. Data Used

According to [25] secondary data is information obtained indirectly by analysts through various intermediary sources. In this context, the analyst acts as a secondary party because the data is not obtained directly. According to [26] secondary data is information collected for purposes or reasons other than those currently of interest to the researcher/consultant. Analysts must evaluate the extent to which information collected for other purposes or specific purposes is appropriate and relevant to the researcher's circumstances or problems. According to [27], secondary data refers to a compilation of information collected and documented by parties unrelated to the research problem at hand. This data can be accessed from various

sources, including censuses, government reports, internal organizational records, publications, journal articles, websites, and more. Based on the expert opinions above, it can be concluded that secondary data is data obtained indirectly by investigators from sources that have been collected by other parties for specific purposes, and its relevance to the research problem being handled must be assessed. The following secondary data sources used are the percentage of *e-wallet* users in 2024 from the *Goodstats data website, and data on GoPay* application user reviews for months 6-7, 2024 from *the Kaggle website*.

### 3.2. Data collection technique

The technique used in data collection is the document method. According to the Big Indonesian Dictionary (KBBI), a document refers to sound recordings, images in films, and various other forms that can serve as evidence. Documentary studies are an important complement to interviews and observations. One of the advantages of document studies is their ability to provide authentic and real data [28]. In this stage, the data obtained was from *Kaggle* as many as 123,253 data, and the data taken was 10,000 review data, from June-July 2024. The research data contains the latest reviews given by users for the *GoPay application* on *Google. Play Store* in Indonesian, this review includes information about performance, bugs, features, and general user experience related to the use of the *GoPay application* . Data mining was obtained from *Kaggle* through the website https://www.Kaggle.com/ , the reason for using *Kaggle* is that it is a very practical data science *platform , Kaggle* provides various *datasets* , competitions, and communities that support collaboration and knowledge sharing. According to [7] *Kaggle* is a site or *platform* that organizes competitions in the field of Information Science. *Kaggle* is one of the common sources of Information Science learning (for all intents and purposes).

### 3.3. *Sampling* Techniques

The technique in sampling uses the *random sampling technique*, [29] random *sampling* is the most basic sampling approach, which is characterized by its fair nature, namely ensuring that each unit has an equal opportunity to be selected. [30] if the number of subjects is less than 100, it is recommended to include all subjects, so this study is categorized as population research. Conversely, if the number of subjects exceeds 100, researchers can select samples ranging from 10% to 15% or even 20% to 25%. In this particular study, the selected sample consists of 10% of the 10,000 review data, resulting in 1,000 user review data, collected from user reviews in June and July 2024.

### 3.4. Data processing

Data processing is a series of processes aimed at transforming, manipulating, and analyzing raw data into more meaningful and useful information. The primary goal of data processing is to prepare data for use in decision-making, statistical analysis, or as input for *machine learning models. learning* . To explain the role of the *Naive Algorithm Bayes* in sentiment analysis classification, the following will show a *Flowchart design* :
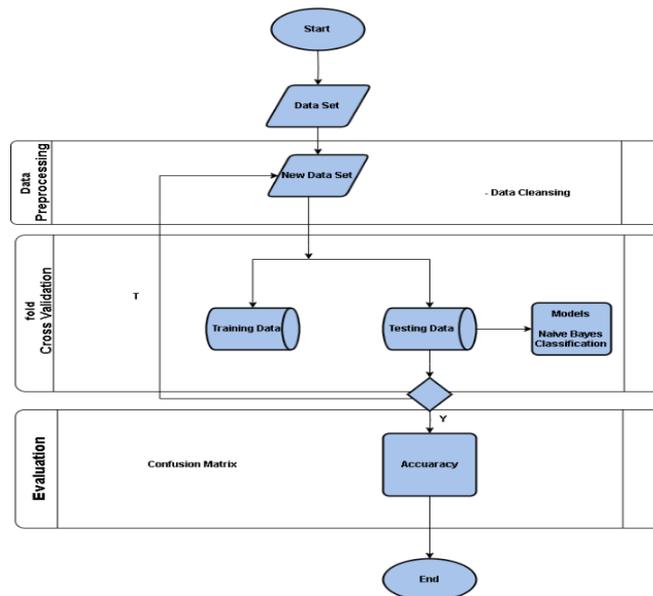
Figure 1. *Flowchart Naive* Algorithm *Bayes*

Explanation:
1. The workflow begins with a start or *start*.
2. *Dataset:* The process begins by *importing a dataset* containing the information to be analyzed. This *dataset is in the form of a, Excel*.
3. *Preprocessing*: After *the dataset* is *imported*, the next step is *preprocessing*. In this stage, the data is cleaned and prepared for analysis. This includes removing missing values, converting data formats, normalizing, and coding categorical variables. The goal is to ensure that the data is in good condition for further analysis.
4. *New Dataset*: After *preprocessing*, the data that has been cleaned and prepared will form *a new dataset*. This *dataset* is ready to be used in model training.
5. *Training* Data: *New The dataset* is then divided into two parts: *training data* and *testing data*. The *training data* is used to train the model. At this stage, the *Naive Bayes algorithm* is applied to build a model based on the patterns in the *training data*.
6. *Testing* Data: After the model is trained, *testing data* is used to test its performance. *Testing data* is a subset of *the dataset* not used during training, providing a more accurate picture of how well the model can predict new data.
7. *Naive Bayes* Method: The *Naive Bayes method* is a classification algorithm used to predict the category of data based on probability. In this context, a model trained on the *training data* will be used to classify the *testing data*.
8. *Accuracy*: After testing the model with the *testing data*, the final step is to calculate the model's accuracy. Accuracy measures how many correct predictions the model makes compared to the total number of predictions made. This provides an indication of how well the *Naive Bayes model* classifies the data.
9. End: The workflow ends with a final step, which signals the completion of the process.

## IV. DISCUSSION

Stages in data processing in *orange* first step *corpus* Then *select columns*, then *preprocess text* that is doing text processing such as removing *stopwords, stemming, tokenization,* and others to prepare for further analysis. *Word Cloud*, then *sentiment* analysis, *Naive Bayes (machine learning model)* that is to create a classification model based on *the corpus* that has been processed. Next *test and score,* evaluate the performance of the model created with evaluation metrics such as accuracy, *precision*, *recall*, and *F1-score*. Visualization of the

evaluation results consists of: *Confusion Matrix*, then the data *table* displays the classification results in tabular form. *Distributions* show the distribution of predicted results. *Scatter Plot* displays a visualization of data distribution based on model predictions.

### 4.1. Manual Data Processing

Manual data processing is the process of managing, analyzing, and interpreting data without the use of digital tools such as computers or specialized software. This process is performed physically or with simple tools such as paper, pens, calculators, and tables.

Table 1. *Training Data*

| Users | Comment | Class |
|---|---|---|
| 1 | Good application, I like it | Positive |
| 2 | bad | Negative |
| 3 | Very bad app | Negative |
| 4 | Good | Positive |
| 5 | bad | Negative |
| 6 | Good, very helpful | Positive |
| 7 | like | Positive |
| 8 | The application is good. | Positive |
| 9 | Very good, brother. | Positive |
| 10 | Good already. | Positive |
| 11 | very good | Positive |
| 12 | good | Positive |
| 13 | help | Positive |
| 14 | *GoPay* Easy | ? |

Calculate the prior probability of the positive and negative classes with equation 2

Y (positive) $=\frac{10}{13}$

Y (negative) $=\frac{3}{13}$

Count the frequency of words in each class

Table 2. Word Frequency

| SAY | POSITIVE | NEGATIVE |
|---|---|---|
| Good | 8 | 0 |
| application | 2 | 1 |
| I | 1 | 0 |
| Like | 2 | 0 |
| bad | 0 | 3 |
| Very | 2 | 1 |
| help | 2 | 0 |
| very | 1 | 0 |
| Already | 1 | 0 |
| *GoPay* | 0 | 0 |
| easy | 0 | 0 |

Word cities in each class:

Total words in Positive = 19

Total words in Negative = 5

Calculate the probability of a word using the equation formula 3

Probability of words in the positive class

Y (*GoPay* | Positive)$\frac{0+1}{19+13} = \frac{1}{32}$

Y (easy | Positive)$\frac{0+1}{19+13} = \frac{1}{32}$

Probability of words in negative class

Y (*GoPay* | Negative)$\frac{0+1}{5+13} = \frac{1}{18}$

Y (easy | Negative)$\frac{0+1}{5+13} = \frac{1}{18}$

Calculate the posterior probability with equation 4

Y (Positive | p $_{14}$)$\frac{10}{13} \times \frac{1}{32} \times \frac{1}{32} = 0,000751$

Y (Negative | p $_{14}$)$\frac{3}{13} \times \frac{1}{18} \times \frac{4}{18} = 0,000712$

Since Y(Positive | p $_{14}$) >Y (Negative | p $_{14}$), then the comment " *GoPay* is easy" is classified as "positive"

### 4.2. *Orange* **Data Processing**

The data obtained from *Kaggle* totaled 123,253, consisting of 10,000 reviews. The sample used in this study was 10% of the 10,000, namely 1,000 user reviews, taken from user reviews collected in June and July 2024.
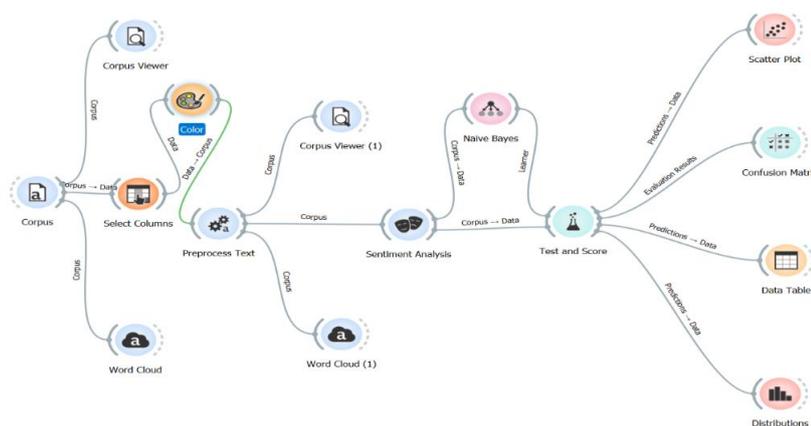


Figure 2. Research System Design

The design of the data mining system in the research scenario that will be carried out in this study is shown in Figure 3. using the help *of Orange* Data *Mining software*. The stages in data processing in *Orange,* the first step is *Corpus* (Data *Input* ), which is loading the collection of texts to be analyzed ( *Corpus* ). Then *select Columns* , which is selecting relevant columns from the text *dataset* to be used in the analysis.

Next, *Preprocess Text* is to perform text processing such as removing *stopwords, stemming, tokenization,* and others to prepare for further analysis. *Word Cloud* is to display a visual representation of words that frequently appear in *the corpus*. Then, *Sentiment Analysis* is to perform sentiment analysis on the text to classify whether a text is positive or negative. *Naive Bayes (Machine Learning Model)* is to create a classification model based on the processed *corpus* . *Next, Test and Score,* evaluate the performance of the model created with evaluation metrics such as accuracy, *precision, recall*, and *F1-score* . Visualization of the evaluation results consists of: *Confusion Matrix*, which displays a confusion matrix to see classification performance. Data *table* displays classification results in tabular form. *Distributions* show the distribution of predicted results. *Scatter Plot* displays a visualization of data distribution based on model predictions.

*The Word Cloud* displays the words appearing in user reviews. However, these words still appear unstructured and contain symbols such as commas, periods, and other punctuation. Therefore, *text preprocessing* will be performed to remove irrelevant symbols or sentences.



Figure 3. *Word Cloud*

*The word cloud* shown in this image contains various words that frequently appear in user reviews or comments regarding a particular service or application. Larger words indicate that they appear more frequently in reviews, while smaller words appear less frequently. In this *word cloud*, some prominent words are: "good" and "steady," which indicate that many users gave positive reviews; "very" and "good," which reinforce positive sentiment toward the application; "*GoPay*," which indicates that the reviews are most likely related to digital wallet or payment services; and "easy" and "fast," which highlight the ease and speed of service as key added values.

## V. CONCLUSION

Based on the research conducted, it can be concluded that sentiment analysis of GoPay app user reviews using the Naive Bayes method successfully provided significant insights into user perceptions. The process involved collecting 1,000 samples from the Kaggle platform for testing. Preprocessing steps, including data cleaning, removing irrelevant words, and sentiment labeling, were carried out thoroughly to ensure the quality of the data used in the analysis. The analysis results showed that the majority of user reviews, 873, were positive, while 126 were negative.

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