Sentiment Analysis of the Skyscanner Application on Google Play Store with a Comparison of *Naive Bayes* and *Support Vector Machine*s

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ABSTRACT

The digital world is growing rapidly and has a significant impact on the tourism sector. Therefore, technology must adapt to developments to meet human needs. Travel booking services such as Skyscanner allow users to book flights, accommodation, and transportation online through the app. With the large number of Skyscanner user reviews on the Google Play Store. The majority of data reviews use Indonesian languanges; sentiment analysis is needed to determine user sentiment towards the app. This study aims to analyze user sentiment towards the Skyscanner app using collected user comment review data. The data is then classified into two sentiment classes: positive and negative. The classification results using a comparison of two algorithms*, Naive Bayes* and *Support Vector Machine*, SVM produced a higher accuracy of 89.74%. Naive Bayes achieves lower accuracy 82.08% than SVM**.** This concludes that the SVM algorithm is more effective in producing optimal classification accuracy than its comparison algorithm*, Naive Bayes*.

Keyword : Sentiment analysis; Naive Bayes; Support Vector Machine; Altair AI Studio.

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1. INTRODUCTION

In today's digital age, media has become a massive platform used by people to express their opinions, feelings, and thoughts widely. Skyscanner is a metasearch application that acts as an aggregator platform, combining, organizing, and integrating various products or services from different providers into a single integrated system. As the Skyscanner application has grown, so has the volume of reviews and public opinion on various aspects of the Skyscanner application. This makes it difficult for developers and management to analyze input manually and in real-time. Developers can also obtain important information on how to improve service quality or address current issues by analyzing sentiment (Fahriza & Riza, 2023).

In recent years, sentiment analysis has become a major focus in the fields of text mining and natural language processing, particularly for identifying public opinion from social media and online media. Sentiment analysis is used to measure the feelings contained in a text with the aim of understanding, absorbing, and manipulating it automatically so that information about the emotions in a sentence can be identified, including sentences that have positive, negative, or neutral sentiments (Sihombing & Sitorus, 2022). Thus, sentiment analysis is used as a reference in organizational policy-making, service improvement, or as business evaluation material (Rifky, Arifiyanti, & Permatasari, 2023).

Another study (Zahra, Mayasari, & Pernamasari, 2024). Implemented the KDD (*Knowledge Discovery in Databases*) algorithm and Naive Bayes for classifying user reviews of the M-Passport application without comparing it to other methods. In contrast to earlier research, this study used two algorithms at the same time: the CRISP-DM (*Cross-Industry Standard Process for Data Mining*) approach and the *Naive Bayes* algorithm to assess the Skyscanner application.

Thus, this study not only replicates the existing analytical framework but also extends the existing research by presenting a more comprehensive comparative evaluation of the algorithms' effectiveness in different data contexts.

The aim of this study is to assess the impact of both the Naive Bayes and Support Vector Machine classification algorithms. This study is also expected to provide objective impacts on user satisfaction levels and identify areas for improvement. This research is expected to provide feedback regarding user feedback on the Skyscanner application and provide useful insights in selecting the right algorithm for sentiment analysis, helping service providers improve their service quality.

2. LITERATURE REVIEW

This study was conducted with the aim of analyzing sentiment from Skyscanner user review data found on Google PlayStore. This study will compare two algorithms, namely *Naive Bayes* and *Support Vector Machine*, in classifying sentiment in review data, to obtain the most accurate classification results from both algorithms. Several previous studies have applied a comparative approach using two classification algorithms in sentiment analysis. One study (Baihaqi, Magdalena, & Fahrudin, 2025) compared the performance of the *Naive Bayes* algorithm *and Support Vector Machine* on DeepSeek Assistant AI app review data on the Google Play Store.

The Research conducted (Fathurahman Bei, 2021; Herlinawati, Yuliani, Faizah, Gata, & Samudi, 2020; Sulistiawati & Kamayani, 2024; Yusril, Fuadi, & Afrillia, 2025) Sentiment analysis research using data sourced from the Google Play Store application has been conducted extensively and implemented widely.The purpose of this study is to analyze data related to Skyscanner application reviews. The stages include collecting data from comments on Google PlayStore. The majority of data reviews use Indonesian.

Preprocessing data to eliminate inconsistencies and data noise. Another study (Rukmana, Pratiwi, & Fakhrurroja, 2023) compared sentiment analysis of the Traveloka and Tiket.com apps on Twitter using the Support Vector Machine method as a single algorithm. This study successfully demonstrated the performance of SVM in classifying user opinions, but was limited to a single algorithm approach and therefore did not provide a comparative overview with other methods.

Altair AI Studio software was used as the primary tool for data management and processing in sentiment analysis in this study. Each algorithm is placed in its own operator, and each operator has many settings that can be changed to improve the performance and accuracy of the model(Kumari, Singh, Srinivas, Katira, & Salunkhe, 2025). This method allows researchers to systematically group sentiments more easily, transforming raw data into more structured knowledge. This research is also supported by the data mining method, namely CRISP-DM (*Cross-Industry Standard Process for Data Mining*). This method is often used for research purposes. The CRISP-DM method has several stages, including Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, and Deployment.

2.1 Research Design

Figure 1. illustrates that the research pipeline commences with problem identification, followed by a literature study to contextualize the research within sentiment analysis, naive Bayes, and support vector machines. The analyzed data is gathered through the CRISP-DM phases, which encompass business understanding, data understanding, data preparation, modeling, assessment, and implementation. The research report is thereafter assembled and finished.

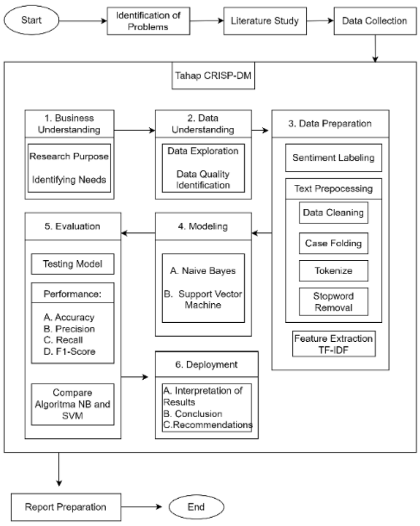


Figure 1. Research workflow

2.2 CRISP-DM Framework

The CRISP DM data mining process, illustrated in Figure 2, explains the stages involved in implementing the CRISP-DM method, including:

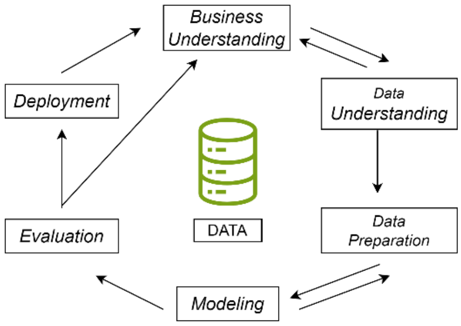


Figure 2. CRISP-DM Phases

1) Business Understanding
   Business understanding is the process of understanding business problems, choosing ways to solve them, knowing what kind of data is needed, and designing a management project (Destaria Wilandini, 2022). The dataset in this study is the result of crawling the Google Play Store via Google Colab for user reviews of the Skyscanner app.
2) Data Understanding
   The dataset consists of 4 predictor attributes and 1 explanatory label found in Table 1.

Table 1. Dataset Attributes

No	Attribute Name	Description
1.	*Username*	Identity of the user who posted the comment. The username is used as a foreign key.
2.	*Score*	Scores serve as indicators of application quality and are often used in sorting algorithms to display the most relevant comments.
3.	*At*	It is represented to store information about the time of publication of comments.
4.	*Content*	Save the content of comments made by users.

3) Data Preparation
   This stage is the process of preparing clean data that is ready to be used for research (Iskandar & Nataliani, 2021).
4) Modeling
   Modeling using *Naive Bayes* and *Support Vector Machine* algorithms will be compared to measure model performance.
5) Evaluation
   At the evaluation stage, testing was conducted using the Cross Validation method, which involved dividing the data 10 times. In the validation process for data training, there were two sub-processes, namely the training sub-process and the testing sub-process.

$$accuracy = \frac{TP+TN}{TP+TN+FP+FN} \times 100\% \quad (1)$$

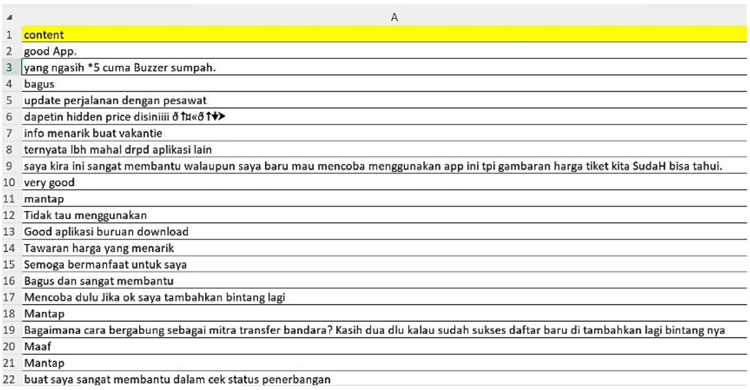
$$precision = \frac{True\ Positive\ (TP)}{True\ Positive\ (TP) + False\ Positive (FP)} \quad (2)$$

$$recall = \frac{True\ Positive\ (TP)}{True\ Positive\ (TP) + False\ Negative\ (FN)} \quad (3)$$

$$f\text{-}measure = 2 \times \frac{Precision \times Recall}{Precision + Recall} \quad (4)$$

6) Deployment
The implementation phase offers suggestions for using Skyscanner platform in conjunction with the sentiment analysis findings. Future development is based on the model evaluation's conclusions.

2.3 Data Acquisition
Data for this study were collected from user reviews on Google Play Store using a crawling system implemented in the Python programming language on the Google Colab website. The data crawling process was carried out by creating a program that collected user review data from Google PlayStore. The dataset obtained consisted of 1029 reviews, which were used in this study. Data was collected from January 2020 to November 2025, with 1029 comment reviews obtained from the Google Play Store. After cleaning, 994 reviews were ready to be processed in Altair AI Studio software.



	A
1	content
2	good App.
3	yang ngasih *5 cuma Buzzer sumpah.
4	bagus
5	update perjalanan dengan pesawat
6	dapetin hidden price disiniiii ð Ÿ¤«ð Ÿ↑♦>
7	info menarik buat vakantie
8	ternyata lbh mahal drpd aplikasi lain
9	saya kira ini sangat membantu walaupun saya baru mau mencoba menggunakan app ini tpi gambaran harga tiket kita SudaH bisa tahui.
10	very good
11	mantap
12	Tidak tau menggunakan
13	Good aplikasi buruan download
14	Tawaran harga yang menarik
15	Semoga bermanfaat untuk saya
16	Bagus dan sangat membantu
17	Mencoba dulu Jika ok saya tambahkan bintang lagi
18	Mantap
19	Bagaimana cara bergabung sebagai mitra transfer bandara? Kasih dua dlu kalau sudah sukses daftar baru di tambahkan lagi bintang nya
20	Maaf
21	Mantap
22	buat saya sangat membantu dalam cek status penerbangan

Figure 3. Data *Crawling*

Figure 3. displays the crawling results on the Google Play Store application. This data collection process uses the Google-play-scraper library method.

2.3 Data Preparation (Prepocessing)
In the data preparation phase, there is a pre-processing stage that involves collecting raw data, which is then processed so that it can be used in the next stage (Subowo, 2024). The method is implemented through the following systematic steps:

a. Data Cleaning
Data cleansing is performed by removing unnecessary characters, eliminating duplicates, and filtering out irrelevant information (Daryanti, 2024).
b. Case Folding
Changes all letters in the dataset to lowercase and removes other characters that are considered letters and used as separators.
c. Tokenize
Changing review sentences into fragment of words or tokens.
d. Stopword Removal
Removing unnecessary words in a sentence by referring to a stopword list.

3. RESULTS AND DISCUSSION

The analysis results are explained in the form of CRISP-DM method steps as follows:

3.1 Business Understanding

This study aims to conduct a sentiment analysis of the Skyscanner application in order to determine public opinion regarding the application. The data collected includes the username, score, publication date, and review text content columns. At this stage, an initial exploration of sentiment patterns and data characteristics is also conducted (Amalsyah, Kurniawan, Rifai, & Sari, 2025).

3.2 Data Understanding

Understanding the Google Play Store review dataset for this research uses a crawling process carried out in Google Colab using the Python programming language. The dataset is then imported into Altair AI Studio software as the main data management tool. Altair AI Studio has various types of operators for data processing. There are repositories and canvases for carrying out the process. After the data was imported, it was exported to an xls file to facilitate data processing. The dataset obtained consisted of approximately 994 reviews. The select attribute operator was then needed to select the attributes to be used. The attributes used were sentiment and role as labels.

3.3 Data Preparation

After the data is collected, the text pre-processing stage continues to process the data. This process begins with data cleaning, which is done using the replace operator to remove excessive punctuation, symbols, and characters from the content column data.

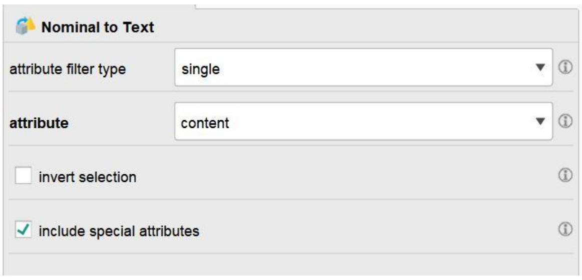


Figure 4. Parameter Nominal to Text

Figure 4, the parameter nominal to text are data type conversion is performed using the Nominal to Text parameter. The selected attribute is a single attribute, namely the content column, so that review data that was originally of a nominal type can be converted to a text type for further analysis.

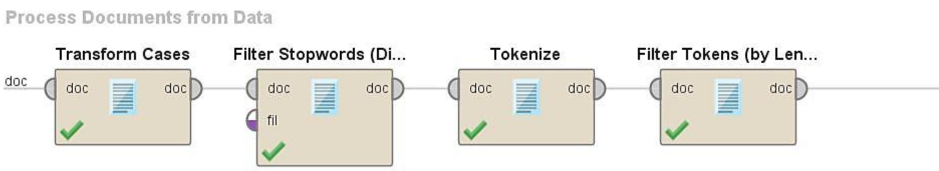


Figure 5. Process Preprocessing

Figure 5, the preprocessing includes four stages, namely transform case, which converts reviews to lowercase or sentences to lowercase letters; filter stopwords, which removes unnecessary words by obtaining a stopword dictionary from Kaggle; tokenize, which breaks sentences into small fragments or tokens; and filter tokens by length, which aims to remove tokens that are too short and tokens that are too long more than 25 letters. Thus, only tokens with reasonable word lengths are retained for further analysis. The stages of the preprocessing process include:

1. Transform Cases
   Transform case stage all letters will be converted to lowercase letters. Table 2 explains the process before and after the transform cases process.

Table 2. Before and After the Case Folding Process

Before	After
WAHH APLIKASI INI SANGAT MEMBANTU, DAN BERGUNA SEKALI UNTUK PERGI BERLIBUR HAHAHAH TERIMAKASIH.	wah aplikasi ini sangat membantu dan berguna sekali untuk pergi berlibur hahahah terimakasih

2. Tokenize
   The tokenisation stage aims to break sentences down into pieces of words. Pieces of words are also known as tokens. Table 3 shows the tokenisation process.

Table 3. Data Table From The Tokenization Process

Before	After
suka sekali sama aplikasi ini sangat membantu semua orang terutama saya sekeluarga ketika membutuhka tiket murah, tks ya Skyscanner udah bantu kami selama ini, usahakan kasih harga murah lagi dibawah kompetitor	‘suka’, ‘sekali’, ‘sama’, ‘aplikasi’, ‘ini’, ‘sangat’, ‘membantu’, ‘semua’, ‘orang’, ‘terutama’, ‘saya’, ‘sekeluarga’, ‘ketika’, ‘membutuhka’, ‘tiket’, ‘murah’, ‘tks’, ‘ya’, ‘Skyscanner’, ‘sudah’, ‘bantu’, ‘kami’, ‘selama’, ‘ini’, ‘usahakan’, ‘kasih’, ‘harga’, ‘murah’, ‘lagi’, ‘dibawah’, ‘kompetitor’.

3. Filter Stopword
   The filter stopword stage involves removing common words that appear frequently and have no significant meaning. Using the dataset from Kaggle Indonesian Stoplist in csv format, there are 756 words. Kaggle dataset: "Indonesian Stoplist" contains a list of common Indonesian words. Table 4 explains the process before and after the filter stopword process.

Table 4. Filter Stopword

Before	After
‘gampang’, ‘banget’, ‘pake’, ‘aplikasi’, ‘ini’, ‘bisa’, ‘book’, ‘hotel’, ‘ato’, ‘tiket’, ‘tanpa’, ‘perlu’, ‘repot’	‘gampang’, ‘banget’, ‘pake’, ‘aplikasi’, ‘book’, ‘hotel’, ‘tiket’, ‘repot’

4. Filter Tokens (by Length)
   Filter Tokens by length is a preprocessing operator step that filters tokens or words based on their character count. Figure 6 are parameters with settings selecting a minimum of 3 words and a maximum of 25 words.

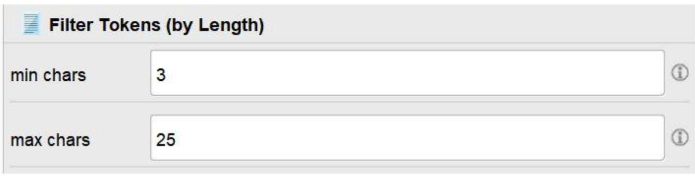


Figure 6. Parameter *Filter Tokens*

3.4 Modeling

In the modeling stage, two algorithms are used, namely Naïve Bayes and Support Vector Machine. For SVM, this is a modeling process in cross validation.

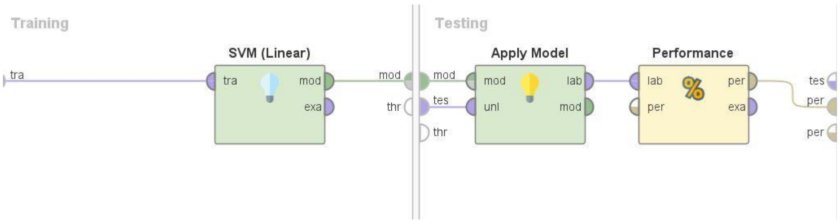


Figure 7. Cross Validation

Figure 7, cross validation is carried out in two stages, namely training and testing. The training stage is used to select the model, namely SVM, and the right side shows the testing process, namely applying the model to apply the trained model to the testing data. Applying the model produces predictions which are then compared with the original labels.

After applying the model to the test data, prediction results were obtained and then evaluated using performance operators. The evaluation was carried out by calculating various metrics such as accuracy, precision, recall, and F1-score, as well as validation using the 10-fold cross validation method to ensure that the model results remained consistent and reliable.

3.5 Evaluation

The result of the performance achieved show that figure 8, the SVM *accuracy* rate reached 89.74%. Meanwhile, in the figure 9 *Naïve Bayes* algorithm *accuracy* rate reached 82.08%.

accuracy: 89.74% +/- 3.32% (micro average: 89.74%)

	true positif	true negatif	class precision
pred. positif	863	97	89.90%
pred. negatif	5	29	85.29%
class recall	99.42%	23.02%	

Figure 8. *Accuracy Support Vector Machine*

accuracy: 82.08% +/- 3.23% (micro average: 82.09%)

	true positif	true negatif	class precision
pred. positif	716	26	96.50%
pred. negatif	152	100	39.68%
class recall	82.49%	79.37%	

Figure 9. *Accuracy Naïve Bayes*

Table 5. *Confusion Matrix Result*

Algoritma	*Accuracy*	*Precision*	*Recall*	*F-Measure*
Naive Bayes	82.08%	40.17%	79.23%	52.94%
Support Vector Machine	89.74%	90.38%	23.43%	35.67%

Table 5 shows the results of the analysis and testing that has been carried out with accuracy as the main priority, it can be concluded that Support Vector Machine is superior in this study compared to Naive Bayes.

3.6 Deployment

The purpose of deployment method in this study is to provide strategic insights into user perceptions of the Skyscanner application and to determine relevant development priorities. Although not yet implemented in real time, this study can be used as a basis for future development, thereby supporting data-driven decisions.

4. CONCLUSION

This study shows that the application of the CRISP-DM framework effectively analyzes user sentiment in Skyscanner app reviews. Utilizing the Naive Bayes and Support Vector Machine models. User sentiment was successfully classified with an accuracy rate of 89.74%. Meanwhile, the Naive Bayes algorithm achieved an accuracy rate of 82.08%. This method has been proven capable of accurately identifying user perceptions.

The limitations of this study include the absence of specific variables regarding reviews such as price, service, and ease of access. Future research is recommended to use Aspect-Based Sentiment Analysis and expand the scope of data sources from various social media platforms as well as explore other algorithms. These results conclude that machine learning and the CRISP-DM framework can be used as strategic tools for Online Travel Agent application developers in determining user review priorities based on data.

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