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Sentiment Analysis Towards the KitaLulus Application Using the Naive Bayes Method from Google Play Store Reviews

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ABSTRACT

Job search apps like KitaLulus are essential in helping graduates find jobs based on their skills and interests. Sentiment analysis is needed to understand user opinions about the KitaLulus application. The Naive Bayes method is used in this analysis because of its high efficiency and accuracy. This research used 597 data and achieved an accuracy rate of 91%. The evaluation results show positive sentiment values for precision, recall, and f1-score of 0.99, 0.94, and 0.97 respectively. On the other hand, the model performance is low for negative and neutral sentiments. This research aims to increase user understanding of the Kita Lulus application and provide valuable assistance to developers in their efforts to improve the quality of the application. Conclusion The classification results revealed a model accuracy of 91%. The "positive" sentiment category shows exemplary performance metrics with a precision of 0.99, a memory of 0.94, and an F1 score of 0.97. In contrast, the "neutral" category displays a lower f1-score of 0.46, despite a relatively high memory level of 0.75. In contrast, the "negative" category shows a consistent precision, recall, and f1-score value of 0.56. In summary, it can be concluded that the KitaLulus app has a beneficial impact on the community, effectively identifying and presenting the majority of positive reviews.

Introduction

In the era of digital technology that continues to advance, mobile applications have become an important component of everyday existence. Among the categories of applications that are increasingly preferred are those dedicated to job search and CV creation. Given the increasing competitiveness in the job market, such apps provide a new and effective avenue for job-seeking individuals to identify job openings that align with their abilities and preferences.

Unfortunately, in recent times, many graduates have faced challenges in identifying relevant job opportunities, leading to a situation where most graduates choose to switch career paths in pursuit of job openings, prioritizing securing a job rather than aligning with their skill set. As a result, this trend results in scenarios where the skills acquired during their education remain underutilized and fail to reach their full potential. This job vacancy problem poses significant challenges for individuals from various backgrounds (Suprastiyo & Airlangga, 2021). It is important to find effective ways to support new graduates in securing job opportunities that align with their skills and passions. Therefore, there is an urgent need for proactive measures to address the mismatch between job seekers and available positions in the workforce.

The KitaLulus app is designed to assist individuals in the job market in identifying job opportunities that align with their unique skills and interests. In addition, the app not only facilitates the exploration of job openings but also allows users to create and customize their resumes through an online platform. Serving as an important intermediary between job seekers and potential employers, it is essential to understand user feedback and engagement with this app. Recognizing the importance of user response and interaction can greatly contribute to improving the effectiveness and user experience of those platforms.

In this particular context, sentiment analysis emerged as an important tool to explain the perspectives, emotions, and encounters of users about the Kitalulus app. Sentiment analysis is believed to be a technique of mastering and processing datasets directly to obtain information. Sentiment analysis is used as a detector of opinions about a topic and an object (such as an individual, organization, or product) in a data set (Hasri & Alita, 2022). Accurate sentiment analysis can provide in-depth insights into user satisfaction, allowing developers to take appropriate actions to improve the quality and competitiveness of their applications, as well as respond to dynamic market demands (Gumilar et al., 2024).

The Naive Bayes method applied to sentiment analysis classifies a review of an app into sentiment categories such as positive, negative, or neutral. The Naive Bayes classification method is meant to be a method that utilizes simple statistics based on Bayes' theorem, which assumes the existence or absence of classes with other characteristics (Azhar et al., 2022). When conducting sentiment analysis, many people use the Naive Bayes method as method. The Naive Bayes classification suspects that the chances of membership in a class are based on the assumption of independent prediction. Therefore, the chances of the coming time can be determined according to experience at the beginning. The advantage of the Naive Bayes method is that it is efficient because it can shorten the sentiment analysis process. In addition, the Naive Bayes method often has high accuracy despite the scant training data (Tanggraeni & Sitokdana, 2022).

The Naive Bayes method is famous for its ability to achieve high-accuracy results. In a study researched by Fikri et al. in 2020 entitled "Comparison of Naive Bayes Method and Support Vector Machine in Twitter Sentiment Analysis", it was found that both methods have good performance, but the Naive Bayes method outperforms the SVM

method in terms of accuracy, precision, recall, and f1-score (Fikri et al., 2020). Another study reviewed by Pattiiha and Hendry in 2022 compared the K-Nearest Neighbor, Naive Bayes, and Decision Tree methods to analyze sentiment expressed in Twitter tweets regarding responses from PT PAL Indonesia . The results of the study prove that the Naive Bayes method has a high accuracy value among the three methods, namely achieving an accuracy value of 84.08% with a standard deviation of +/- 1.28% (Pattiiha & Hendry, 2022).

Considering the results of previous studies that confirm the good performance of the Naive Bayes method in sentiment analysis. The hope of this study is not only to provide deeper insight into user satisfaction with the Kitalulus application but also to provide additional input for developers to improve the quality of the application.

Method

The methodology of this research is used to ensure accuracy and consistency in the process of data collection and analysis.

Data Collection

The data collection process is used as the beginning of the process of this research, where KitaLulus application user data is obtained from the Google Play Store. The data was collected using web scraping, which allowed researchers to automatically download user reviews from the Google Play Store app page. By utilizing a web scraping method that uses one of the libraries in the Python programming language, google-play-scraper, the review data is automatically extracted and compiled into CSV form (Firmansyah & Lestariningsih, 2024).

Dataset Labeling

Data labeling is the process of ranking individual user reviews on the KitaLulus application based on the sentiment expressed. In this study, reviews were judged based on their emotional value. Comments with ratings 1 and 2 are marked as "negative", with 3 ratings as "neutral" and "positive" for the other scores. Accuracy and consistency in labeling are important in this way to ensure that the data is organized and then used as intended (Wijaya et al., 2024).

Preprocessing

Data preprocessing is an important action in sentiment analysis, where texts are prepared for human review to be used in building Naive Bayesian models. The process is carried out first to process data, therefore researchers will avoid the problem of irregular data. The purpose of technical information is a classification that has a high level of accuracy (Anwar, 2022). The stages of preprocessing to process the data in this study are word normalization, case folding, cleansing, tokenizing, stopword removal, and stemming. In the context of word normalization, the process of word processing is carried out, including the conversion of words that deviate from standard language norms into words that comply with linguistic conventions and are considered normal (Yutika et al., 2021). Case folding is the process of changing the shape of words so that they have the same meaning, either by changing everything to lowercase or uppercase. Cleansing is the

process of removing unnecessary words to reduce clutter or clutter in the data. Tokenizing is used to separate a series of words into segments separated by spaces or special characters. The stopword removal task removes words that are frequently seen and generic, indicating that the text being analyzed is less important. Stemming is the process of returning words containing suffixes to their basic or original form (Mastan & Toni, 2020).

TF-IDF Weighting

TF-IDF (Term Frequency-Inverse Document Frequency) is a technique used to convert text into numerical representations that can be understood by the Naive Bayes model. The TF-IDF technique can be described as a technique used to assign a frequency that is only visible to each word or token, where each word is weighted based on its importance in the document. This weight is calculated based on the number of times a word appears in a document and evaluates the word relative to the existence of all documents (Rozi et al., 2021). Here's the TF-IDF equation:

$$TF - IDF(d,t) = TD(d,t) * IDF(t) \quad (1)$$

where:

$$TF(d,t) = \frac{Jumlah\ kata\ t\ pada\ dokumen\ d}{total\ kata\ pada\ dokumen\ d} \quad (2)$$

$$IDF(t) = log\ \frac{total\ dokumen}{Jumlah\ dokumen\ yang\ mengandung\ kata\ t} \quad (3)$$

and:
t = word
d = document

Model Creation

After weighting TF-IDF, the next stage is the application of the model using *the Naive Bayes* method to classify the sentiment of user reviews. Model creation is an important stage in sentiment analysis, where *Naive Bayes'* model is trained to classify the sentiment of Kitalulus app user reviews. The implementation is carried out using the Python programming language. *Naive Bayes* classifier is a classification technique that uses probability as the basis for predicting a data class. This method refers to *Bayes' theorem* and is considered very effective in classifying (Muflih et al., 2023). The general equation of *the Naive Bayes* classification algorithm is as in (4).

$$P(H|X) = \frac{P(X|H) \times P(H)}{P(X)} \quad (4)$$

Information:
H: Make data assumptions for a specific category.
X: Data whose layers are not yet known.
P(H): Peluang H.
P(X): Peluang X.
P(H|X): The chance of an assumption based on circumstances.
P(X|H): Odds are based on circumstances and assumptions.

Evaluation and Visualization

The final step is a very important evaluation because it aims to measure the accuracy, recall, precision, and f1-score of the model being built. Then in the visualization stage, it uses a confusion matrix to get a more detailed picture of the model's performance in classifying each label. To provide a clearer visual representation of the prediction distribution and model performance, we'll use a pie chart to show the percentage of each label.

Results and Discussion

This research collects data by utilizing Google Collab to download data in the form of reviews on the Kitalulus application from the Google Play store and then save it in CSV form. In the process of accumulating this data, the researcher managed to get data in the form of reviews from 597 review data that were considered relevant in the form of comments and review scores. The data obtained is then downloaded into a .csv file. Below is Figure 2 which is the data sweeping process.

```
[4]  from google_play_scraper import Sort, reviews_all
     import pandas as pd

     app_reviews = reviews_all(
         'com.kitalulus',  # ID aplikasi KitaLulus
         lang='id',  # Bahasa ulasan
         country='id',  # Negara

     )

     # Konversi hasil ke DataFrame
     reviews_df = pd.DataFrame(app_reviews)

     # Simpan ulasan ke dalam file CSV
     reviews_df.to_csv('kitalulus_reviews.csv', index=False)

     print("Ulasan telah disimpan ke dalam file kitalulus_reviews.csv")

     Ulasan telah disimpan ke dalam file kitalulus_reviews.csv
```

Figure 2. Scraping Data

Figure 2 contains a data accumulation process program in the form of a review of the KitaLulus application from the Google Play Store using google_play_scraper, converting it to a DataFrame with pandas, and saving it to a CSV file named 'kitalulus_reviews.csv'.

Dataset Labeling

The data labeling phase involves classifying each user review on the KitaLulus app into positive, negative, or neutral sentiment, which is used to train Naive Bayes' model in measuring sentiment.

	userName	content	score	label
0	Gunawan Arikusuma	Aplikasi yang mempermudah untuk mencari pekerjaan dengan fitur-fitur yang muda	5	positif
1	Aku Emmai	Aplikasi yang sangat membantu! Dengan fitur yang lengkap dan antarmuka yang intu	5	positif
2	Irwansyah Ramadan	Aplikasi yg mempermudah mencari pekerjaan sesuai pengalaman dalam bidang apa	5	positif
3	Iin Kamini	Aplikasinya sangat membantu dalam mencari pekerjaan. Diaplikasi ini selalu update	5	positif
4	Fitria Hasti	Aplikasi yg sangat membantu untuk mencari pekerjaan. Ada banyak pilihan jenis pek	5	positif
5	Nurul Aulia	Aplikasi paling terbaik di antara aplikasi2 pencaker yang lain di kelasnya semacam jo	5	positif
6	Mirna Aja	Aplikasi yang sangat membantu dalam mencari pekerjaan,kita juga bisa memilih pek	5	positif
7	Adinda Pujiwati	Apk sangat membantu dan rekomended sekali.. Terbantu banget untuk buat CV cepa	5	positif
8	Rafni Rizqi Amelia	Aplikasi yang sangat membantu untuk mencari pekerjaan. Tampilannya menarik dan	5	positif
9	Nazwa Salsabila	Aplikasi yang sangat berguna dan membantu banyak orang. Bisa menyesuaikan peke	5	positif
10	Luwi Van Steve	Aplikasinya sangat simple, tidak lemot karena fiturnya sangat sederhana...hanya unt	5	positif
11	Lutvia Hapsiana	Gokil banget sihh sama aplikasi ini karena menyediakan loker sesuai dengan kriteria	5	positif
12	Fitri Noviantika	Aplikasinya sangat membantu dalam mencari pekerjaan. Tersedia berbagai macam b	5	positif
13	angga permana	Gimana sih ini aplikasinya,udah coba sampai 4 hp tapi tetap aja nggak mau di akses a	1	negatif
14	Anis Mu'awanah	Termasuk Aplikasi yang baik dan bagus serta mempermudah untuk mencari pekerjaa	4	positif

Gambar 3. Pelabelan Data

Based on the score value, it is labeled as a modified sentiment, namely "negative" for score values 1 and 2, "neutral" for score 3, and "positive" for other score values.

Preprocessing

The first step in preprocessing is the normalization of the text. In this step, the text is normalized in the data frame to standardize abbreviations, for example changing "yg" to "who", "with" to "with", "us" to "I've", "tp" to "but", etc. In addition, words such as "already" and "already", as well as "no" and "no", are considered to have the same meaning (Nehe et al., 2024).

	userName	content	score	label
0	Gunawan Arikusuma	Aplikasi yang mempermudah untuk mencari pekerjaan dengan fitur-fitur yang muda	5	positif
1	Aku Emmai	Aplikasi yang sangat membantu! Dengan fitur yang lengkap dan antarmuka yang intu	5	positif
2	Irwansyah Ramadan	Aplikasi yang mempermudah mencari pekerjaan sesuai pengalaman dalam bidang a	5	positif
3	Iin Kamini	Aplikasinya sangat membantu dalam mencari pekerjaan. Diaplikasi ini selalu update	5	positif
4	Fitria Hasti	Aplikasi yang sangat membantu untuk mencari pekerjaan. Ada banyak pilihan jenis p	5	positif

Figure 4
Text Normalization

After normalizing the text, the next action is case folding, where all letters in the user's review text are changed to lowercase, and then the cleansing stage is carried out.

	userName	content	score	label
0	Gunawan Arikusuma	aplikasi yang mempermudah untuk mencari pekerjaan dengan fitur-fitur yang mudal	5	positif
1	Aku Emmai	aplikasi yang sangat membantu! dengan fitur yang lengkap dan antarmuka yang intu	5	positif
2	Irwansyah Ramadan	aplikasi yang mempermudah mencari pekerjaan sesuai pengalaman dalam bidang a	5	positif
3	Iin Kamini	aplikasinya sangat membantu dalam mencari pekerjaan. diaplikasi ini selalu update	5	positif
4	Fitria Hasti	aplikasi yang sangat membantu untuk mencari pekerjaan. ada banyak pilihan jenis p	5	positif

Gambar 5
Case Folding

Text cleansing is carried out using a variety of techniques including duplicate data removal, blank text removal, character and punctuation removal, Uniform Resource Locator (URL), and HyperText Markup Language (HTML) removal, as well as the removal of unrelated symbols and references (Ramadhani & Suryono, 2024).

Model Creation

The next stage is model creation, where a machine-learning model is built to analyze the sentiment of user reviews. From this stage, the Naive Bayes model is used for text classification. The model is trained using TF-IDF processed and weighted data.

```
# Bagi data menjadi training dan testing set
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Terapkan SMOTE pada data training jika diperlukan
smote = SMOTE(random_state=42)
X_train_resampled, y_train_resampled = smote.fit_resample(X_train, y_train)

# Inisialisasi dan latih model Naïve Bayes
nb_model = MultinomialNB()
nb_model.fit(X_train_resampled, y_train_resampled)
# Prediksi pada data test
y_pred = nb_model.predict(X_test)
```

Figure 6
Model Making Process

In Figure 6, the process of creating a model is carried out by dividing it into training data and test data using an 80:20 ratio. The SMOTE method is then applied to the training data to deal with the problem of data asymmetry. SMOTE is an effective technique to address the problem of imbalance in data sets, ensuring a more even distribution between classes (Utami, 2022).

The evaluation is carried out at this stage using a confusion matrix and pie chart on the visualization. During the evaluation, Naive Bayes' algorithm measures accuracy, recall, precision, and f1-score.

Table 1
Evaluation Results

	Precision	Recall	F1-score	Support
Positive	0.99	0.94	0.97	107
Neutral	0.33	0.75	0.46	4
Negative	0.56	0.56	0.56	9

Accuracy	-	-	0.91	120
Macro avg	0.63	0.75	0.66	120
Weighted avg	0.94	0.91	0.92	120

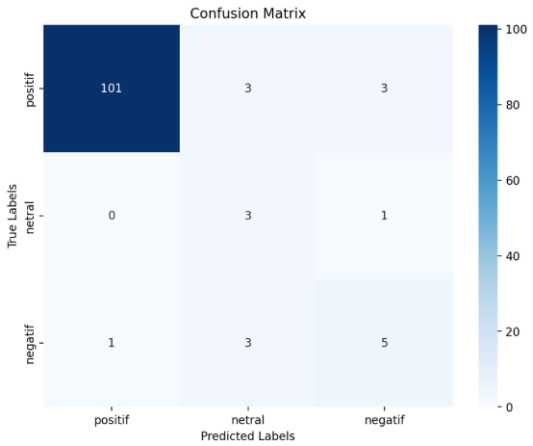

Figure 7
Confusion Matrix

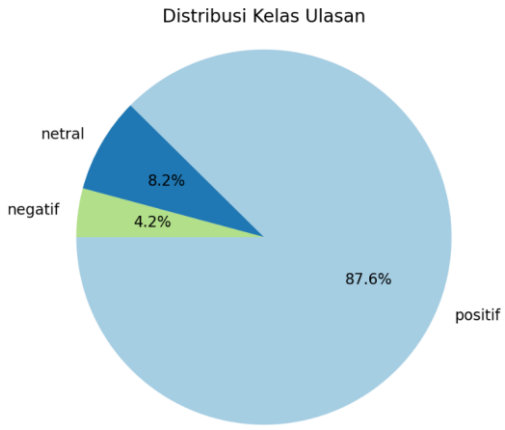

Figure 8
Pie Chart

Based on the classification results, it can be seen that the Naive Bayes model gets an accuracy score of 91%. Digging deeper into the results for each category, we found that the model excelled at accurately classifying positive classes, with a precision of 0.99, recall of 0.94, and an f1-score of 0.97. However, its performance is comparatively lower when classifying negative and neutral classes. The negative class showed precision, recall, and f1-score of 0.56 each, while the neutral class showed precision of 0.33, recall of 0.75, and f1-score of 0.46. Taking into account the average macro, it shows precision (0.63), recall (0.75), and f1-score (0.66). On the other hand, the weighted average shows that this model maintains its high-performance level (precision 0.94, recall 0.91, f1-score 0.92), mainly due to the dominant sample size in the positive class. The confusion matrix shows that the model is very good at classifying positive reviews with 101 correct predictions but less accurate at classifying neutral and negative reviews.

In this study, Naive Bayes' methodology was applied to examine the sentiment of Google Play Store reviews by utilizing scraping data. The results illustrate the use of TF-IDF to convert the review text into numerical representations. The SMOTE method is applied to the training dataset to increase the number of instances in underrepresented categories while maintaining the majority class. After this, the training and testing datasets are randomly shared to assess the model's performance. Classification analysis shows that the model shows a fairly high level of accuracy.

Conclusion

The findings of the study show that the Naive Bayes classification model shows effective performance in evaluating user sentiment towards the KitaLulus application

based on the latest review data. A total of 597 review data points were collected during the data collection phase, consisting of review comments and corresponding ratings. Each review is categorized as "negative" for rankings 1 and 2, "neutral" for rankings 3, and "positive" for the rest of the rating values. Furthermore, the TF-IDF weighting technique is used to convert the review text into a numerical format. To overcome the class imbalance, the SMOTE method was used on the training data. The classification results revealed a model accuracy of 91%. The "positive" sentiment category shows exemplary performance metrics with a precision of 0.99, a memory of 0.94, and an F1 score of 0.97. In contrast, the "neutral" category displays a lower f1-score of 0.46, despite a relatively high memory level of 0.75. In contrast, the "negative" category shows a consistent precision, recall, and f1-score value of 0.56. In summary, it can be concluded that the KitaLulus app has had a beneficial impact on the community, effectively identifying and presenting the majority of positive reviews.

Bibliography

Anwar, K. (2022). Analisa sentimen Pengguna Instagram Di Indonesia Pada Review Smartphone Menggunakan Naive Bayes. *KLIK: Kajian Ilmiah Informatika Dan Komputer*, *2*(4), 148–155.

Azhar, R., Surahman, A., & Juliane, C. (2022). Analisis Sentimen Terhadap Cryptocurrency Berbasis Python TextBlob Menggunakan Algoritma Naïve Bayes. *J-SAKTI (Jurnal Sains Komputer Dan Informatika)*, *6*(1), 267–281.

Fikri, M. I., Sabrila, T. S., & Azhar, Y. (2020). Perbandingan metode naïve bayes dan support vector machine pada analisis sentimen twitter. *SMATIKA Jurnal: STIKI Informatika Jurnal*, *10*(02), 71–76.

Firmansyah, D. R., & Lestariningsih, E. (2024). Analisis Sentimen Ulasan Aplikasi Smart Campus Unisbank di Google Playstore Menggunakan Algoritma Naive Bayes. *Jurnal JTIK (Jurnal Teknologi Informasi Dan Komunikasi)*, *8*(2), 498–507.

Gumilar, T. S., Astuti, R., & Wijaya, Y. A. (2024). Analisis Sentimen Ulasan Aplikasi Lita Di Play Store Menggunakan Algoritma Naive Bayes. *Jati (Jurnal Mahasiswa Teknik Informatika)*, *8*(1), 543–550.

Hasri, C. F., & Alita, D. (2022). Penerapan Metode Naïve Bayes Classifier Dan Support Vector Machine Pada Analisis Sentimen Terhadap Dampak Virus Corona Di Twitter. *Jurnal Informatika Dan Rekayasa Perangkat Lunak*, *3*(2), 145–160.

Mastan, I. A., & Toni, Y. (2020). Analisis Sentimen Terhadap Tempat Kuliner Ayam Gedebuk Dari Komentar Pengunjung Dengan Menggunakan Metode Naïve Bayes Classifier. *JBASE-Journal of Business and Audit Information Systems*, *3*(1).

Muflih, H. Z., Abdillah, A. R., & Hasan, F. N. (2023). Analisis Sentimen Ulasan Pengguna Aplikasi Ajaib Menggunakan Metode Naïve Bayes. *KLIK: Kajian Ilmiah Informatika Dan Komputer*, *4*(3), 1613–1621.

Nehe, P. H., Berutu, S. S., & Budiati, H. (2024). Analisis Sentimen Opini Masyarakat Terhadap Presiden Jokowi Sebelum Dan Sesudah Pilpres 2024 Menggunakan Metode Naive Bayes Classification. *Jutisi: Jurnal Ilmiah Teknik Informatika Dan Sistem Informasi*, *13*(1), 451–463.

Pattiiha, F. S., & Hendry, H. (2022). Perbandingan Metode K-NN, Naïve Bayes, Decision Tree untuk Analisis Sentimen Tweet Twitter Terkait Opini Terhadap PT PAL Indonesia. *JURIKOM (Jurnal Riset Komputer)*, *9*(2), 506–514.

Ramadhani, B., & Suryono, R. R. (2024). Komparasi Algoritma Naïve Bayes dan Logistic Regression Untuk Analisis Sentimen Metaverse. *JURNAL MEDIA INFORMATIKA BUDIDARMA*, *8*(2), 714–725.

Rozi, F., Sukmana, F., & Adani, M. N. (2021). Pengelompokkan Judul Buku dengan Menggunakan Algoritma K-Nearest Neighbor (K-NN) dan Term Frequency–Inverse Document Frequency (TF-IDF). *JIMP-Jurnal Informatika Merdeka Pasuruan*, *6*(3).

Suprastiyo, W. T., & Airlangga, P. (2021). Penyebaran Informasi Lowongan Pekerjaan Berbasis Website (Studi Kasus Mahasiswa Dan Alumni Unwaha). *Jurnal Tekinkom (Teknik Informasi Dan Komputer)*, *4*(2), 280–287.

Tanggraeni, A. I., & Sitokdana, M. N. N. (2022). Analisis Sentimen Aplikasi E-Government pada Google Play Menggunakan Algoritma Naïve Bayes. *JATISI (Jurnal Teknik Informatika Dan Sistem Informasi)*, *9*(2), 785–795.

Utami, H. (2022). Analisis Sentimen dari Aplikasi Shopee Indonesia Menggunakan Metode Recurrent Neural Network. *Indonesian Journal of Applied Statistics*, *5*(1), 31–38.

Wijaya, D., Saputra, R. A., & Irwiensyah, F. (2024). Analisis Sentimen Ulasan Aplikasi Samsat Digital Nasional Pada Google Playstore Menggunakan Algoritma Naïve Bayes. *KLIK: Kajian Ilmiah Informatika Dan Komputer*, *4*(4), 2369–2380.

Yutika, C. H., Adiwijaya, A., & Al Faraby, S. (2021). Analisis Sentimen Berbasis Aspek pada Review Female Daily Menggunakan TF-IDF dan Naïve Bayes. *Jurnal Media Informatika Budidarma*, *5*(2), 422–430.