

SENTIMENT ANALYSIS OF USER REVIEWS BRI MOBILE APPLICATION WITH GRADIENT BOOST METHOD

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Abstract

BRI Mobile application is a digital banking service launched in 2019 by Bank Rakyat Indonesia, which provides facilities such as mobile banking, internet banking, and electronic money. The presence of this application aims to facilitate customers in accessing and managing financial services efficiently through mobile devices. Reviews have become a very important source on platforms such as Google Playstore become a very important source of information to evaluate and improve service quality. However, manually identifying sentiment representations from thousands of reviews is a time-consuming and inefficient process. This research aims to perform sentiment analysis automatically on BRI Mobile application user reviews by utilizing text mining methods. The sentiment classification process is carried out using the Gradient Boosting algorithm approach and initial analysis using the VADER Sentiment method to provide initial data labelling. Based on the classification results, 344 data with positive sentiment, 333 data with negative sentiment, and 333 data with neutral sentiment were obtained. The model built was then evaluated using the accuracy metric, and an accuracy value of 97% was obtained. The results of this research are expected to be a strategic input for application developers in understanding user perceptions more objectively and efficiently.

Keywords: BRI Mobile, Review, Sentiment, Gradient Boost

Abstrak

Aplikasi BRI Mobile merupakan layanan digital perbankan yang diluncurkan pada tahun 2019 oleh Bank Rakyat Indonesia, yang menyediakan fasilitas seperti mobile banking, internet banking, serta uang elektronik. Kehadiran aplikasi ini bertujuan untuk memudahkan nasabah dalam mengakses dan mengelola layanan keuangan secara efisien melalui perangkat seluler. Seiring meningkatnya penggunaan, ulasan dari pengguna di platform seperti Google Playstore menjadi sumber informasi yang sangat penting untuk mengevaluasi dan meningkatkan kualitas layanan. Namun, mengidentifikasi representasi sentimen dari ribuan ulasan secara manual merupakan proses yang memakan waktu dan tidak efisien. Penelitian ini bertujuan untuk melakukan analisis sentimen secara otomatis terhadap ulasan pengguna aplikasi BRI Mobile dengan memanfaatkan metode text mining. Proses klasifikasi sentimen dilakukan dengan menggunakan pendekatan algoritma Gradient Boosting dan analisis awal menggunakan metode VADER Sentiment untuk memberikan label awal data. Berdasarkan hasil klasifikasi, diperoleh 344 data dengan sentimen positif, 333 data dengan sentimen negatif, dan 333 data dengan sentimen netral. Model yang dibangun kemudian dievaluasi dengan menggunakan metrik akurasi, dan diperoleh nilai akurasi sebesar 97%. Hasil penelitian ini diharapkan dapat menjadi masukan strategis bagi pengembang aplikasi dalam memahami persepsi pengguna secara lebih objektif dan efisien.

Kata kunci: BRI Mobile, Ulasan, Sentimen, Gradient Boost

INTRODUCTION

Banks are used as a place to store and manage money for some people. Although there is an admin fee every month, it is not a problem for customers. This is because the balance that is

deducted each month for the admin is used as a guarantee that the money stored in a bank can be guaranteed security as long as the bank is protected by the Financial Services Authority (OJK).

The use of electronic money has been widely applied by MSME players and shopping

stores. Some examples of electronic money transactions in Indonesia are OVO, GOPAY, DANA, etc. The application of electronic money has many advantages, both for sellers and buyers, including more practical and secure transactions, transaction speed, and can be used for all services (Hadisantoso et al. 2023; Ismamudi, Hartati, and Sakum 2023; Multhazam et al. 2021).

BRI is one of the banks that is often used by the public because of its easy access and ATM locations throughout Indonesia. With the development of technology, the BRI Mobile application was launched in 2019 with facilities in the form of mobile banking, internet banking, and electronic money to facilitate customers in accessing and managing their finances (Yulia Nur Afifah et al. 2024a). BRI Mobile registration can be done online by completing personal data and account data, so there is no need to visit the branch office. This certainly makes it very easy for customers who want to have a BRI Mobile account safely and quickly. The security level of the application is quite good, where the application does not directly display details about the customer's balance, but the application user must enter a username, password, and cellphone number and account pin so that it cannot be used by others.

Every application needs reviews to determine the level of user satisfaction. These reviews can include positive reviews that are useful for application owners to remain consistent in serving users, and there are negative reviews that can be used for application owners to improve their services (Moh Hasan Basri 2024). Reviews of an application can be obtained from various sources, such as Google Playstore which is a direct source and comments from other applications or websites such as Twitter.

It is difficult to know the representation of BRI Mobile application user reviews on Google Playstore. Therefore, research was conducted in the form of sentiment analysis to produce quality information from user reviews. This research was conducted to generate sentiment information to determine the distribution of sentiment values regarding user reviews of the BRI Mobile application.

Text mining is the process of extracting information using machine learning algorithms. The processing stages are the same as in data mining, the difference is that text mining uses text data. Text mining will extract unstructured information and then process and analyze it to produce structured information and produce informative data (Hasibuan and Heriyanto 2022).

Sentiment analysis is a process that aims to extract and analyze opinions and then classify them into a certain sentiment class, such as positive, negative, and neutral sentiments (Nurfadila, Ariyanti, and Trianasari 2023; Ridwansyah 2022; Zelina and Afiyati 2024). This process involves a machine learning algorithm method that will classify the data. Data scraping is a technique used to obtain data from a website or application. This technique utilizes the HTML code on the website that you want to use as a research data source which will later be extracted into a file format (Yuniar, Utsalinah, and Wahyuningsih 2022).

Banks are used as a place to store one's money to make it safer [5]. Apart from being used as a place to deviate money, currently banks are also used in payment methods. Therefore, to make it easier for account holders to make payments, the BRI Mobile application was launched to access and use their balance. In research (Yulia Nur Afifah et al. 2024b), the BRI Mobile application has a quality of service for account holders and increases user satisfaction with various service features and increases efficiency in making transactions.

Case Folding is a stage in data pre-processing that is done by changing the type of capital letters to all lowercase letters (Imam and Informatika 2023). This stage is carried out to eliminate differences in uppercase and lowercase letters so that the data has a uniform word type. Tokenization is also a stage in data pre-processing that is useful in separating sentences into words (Imam and Informatika 2023). This stage is useful in analysis because each word will be analyzed specifically.

The punctuation removal stage is a stage in data pre-processing that is carried out to remove punctuation marks such as periods, commas, or certain symbols such as exclamation marks, question marks. Punctuation marks must be removed because they do not generate information in the analysis. Stopwords function to eliminate words that are not important so that they do not affect the information in the research (Imam and Informatika 2023; Mulyadi and Lestari 2022)[7]. Stemming is done by removing the initial and final affixes in a word so that it returns to its basic word (Imam and Informatika 2023). Vader Sentiment is a special tool in conducting sentiment analysis which consists of a dictionary of basic word sets (Efendi and Noviana 2021). In its use, it uses a score of 0 to classify neutral sentiment, a score of less than 0 to classify negative sentiment, and a score of more than 0 for positive sentiment.

In research (Umair and Sutanto 2024) , sentiment analysis of BRI mobile application user reviews using the Naïve Bayes method has been carried out. In the study, the data used was only a small amount of 199 data. This research does not use the stemming stage in data pre-processing, which is one of the important stages in sentiment analysis to remove affixes from a word. The results of his research are positive sentiments as many as 47, negative as many as 125 and neutral as many as 27, but the accuracy value is quite low at only 65%. Then in research (Arminda, Sulistiyowati, and Nur Padilah 2023) , using the naïve bayes method also with data as many as 1011 reviews. The study produced only two sentiments in the form of positive sentiment as much as 670 data and negative sentiment as much as 341 data. The data modeling results are accuracy value of 98.02%, precision of 97.06%, recall of 97.06%, and f1-score of 97.06%. Next in research (Astuti, Alam, and Jaelani 2022) , a comparison of the support vector machine algorithm method with naïve bayes has been carried out with data totaling 5000 reviews. The result of the research is that the svm algorithm has a higher accuracy value than naïve bayes, which is 97.56%. However, the study did not describe the sentiment results, and the data modeling only focused on the accuracy value.

These three studies did not use a specific tool used for sentiment analysis. Therefore, this research uses a specialized tool on sentiment analysis, namely Vader Sentiment. Vader sentiment has a structured approach to perform sentiment analysis by using scores to determine three sentiments including positive sentiment, negative sentiment, and neutral sentiment.

In sentiment analysis, the selection of the right classification algorithm is crucial to obtain accurate and reliable results. Although algorithms such as Naive Bayes and Support Vector Machine (SVM) have been widely used in various previous studies, the Gradient Boosting algorithm offers several advantages that make it more suitable for sentiment analysis of BRI Mobile app user reviews. Gradient Boost algorithm is one of the supervised learning algorithm methods used for modeling data that has labels or classes. This algorithm uses increased predictor accuracy and uses a loss function to minimize errors (Arum Prabowo, Rahmat, and Endah Wahanani 2024; Utomo 2024). Ability to Handle Complex Data: Gradient Boosting is an ensemble method that builds predictive models through a combination of several weak learners, usually in the form of decision trees. This approach allows Gradient Boosting to capture complex patterns in data that may not be captured

by other algorithms such as Naive Bayes or SVM. In this research (Hendrawan 2022) , **A performance evaluation of sentiment classification** using Naive Bayes, Support Vector Machine (SVM), and XGBoost (a variant of Gradient Boosting) algorithms on public sentiment toward local products in Indonesia revealed that the combination of Word2Vec and XGBoost yielded the highest F1 score of 0.941. This was closely followed by the TF-IDF and XGBoost combination, with an F1 score of 0.940. Additionally, SVM combined with TF-IDF and Word2Vec achieved F1 scores of 0.938 and 0.939, respectively. In contrast, Naive Bayes combined with TF-IDF and Word2Vec recorded F1 scores of 0.915 and 0.900, respectively.

This research aims to apply the Gradient Boosting method in sentiment analysis of BRI mobile application user reviews obtained from the Google Play Store. Review data will be collected using web scraping techniques, then processed through pre-processing stages such as case folding, tokenization, punctuation removal, stopword removal, and stemming. Next, the data will be analyzed using VADER Sentiment Analysis to determine sentiment polarity, and the results will be used to train the Gradient Boosting model. Model performance evaluation will be done by measuring accuracy, precision, recall, and F1-score. With this approach, it is hoped that a deeper understanding of user sentiment towards the BRI mobile application can be obtained, which in turn can be used by the developer to improve service quality and user satisfaction.

RESEARCH METHODS

The type of research conducted is quantitative research using the Gradient Boosting algorithm method. This study uses 1000 data reviews of BRI Mobile application users obtained from Google Playstore with the url id.co.bri.brimo. which has been done using data scraping techniques.

Types of research

This research uses a quantitative approach by applying the Gradient Boosting algorithm to classify the sentiment of BRI Mobile application user reviews. This approach was chosen due to its ability to handle complex text data and provide high accuracy in sentiment classification.

Time and Place of Research

Data collection was carried out in June 2024 through a web scraping process of BRI Mobile application user reviews on the Google Play Store. The data analysis and model development process

was carried out in Depok, West Java during the period June to July 2024.

Research Target / Subject

The target of this research is user reviews of the BRI Mobile application available on the Google Play Store. A total of 1,000 reviews were collected as research samples. The sampling technique was carried out by simple random sampling to ensure data representativeness of the available review population.

Procedure

This research procedure includes several stages, first data collection. Using web scraping techniques to collect 1,000 user reviews of the BRI Mobile application from the Google Play Store. After the data was successfully obtained, data pre-processing was carried out by removing special characters, numbers, and punctuation marks, converting text to lowercase, and removing common words (stopwords). This process is done using the Natural Language Toolkit (NLTK) library in Python. Next is to perform feature extraction using the Term Frequency-Inverse Document Frequency (TF-IDF) method to convert the review text into a numerical representation that can be used in machine learning models. Next, perform sentiment labeling using a lexicon approach with the VADER (Valence Aware Dictionary and Sentiment Reasoner) tool to label the sentiment (positive, negative, neutral) on each review. After the data has been cleaned, model training is carried out by applying the Gradient Boosting algorithm to train sentiment classification models based on data that has been processed and labeled. The last stage is to evaluate the model by measuring the performance of the model using accuracy, precision, recall, and F1-score metrics to assess the effectiveness of sentiment classification performed by the model.

Data, Instruments, and Data Collection Techniques

Text review data from BRI Mobile application users taken from Google Play Store. The instruments used are computers with adequate specifications for data processing and model training, as well as Python software with NLTK and scikit-learn libraries. Data Collection Techniques using web scraping techniques using Python libraries such as BeautifulSoup and Requests to access and extract reviews from application pages on the Google Play Store.

Data analysis technique

Data analysis was conducted through several stages. First is text pre-processing performed using NLTK to clean and prepare text data before

analysis. Next is feature transformation using TF-IDF to convert text data into numerical features that can be used in machine learning models. After that, perform sentiment labeling using VADER to label the sentiment in the review data. Next, perform model training by applying the Gradient Boosting algorithm to build a sentiment classification model and perform model evaluation using accuracy, precision, recall, and F1-score metrics to evaluate model performance in classifying user review sentiment.

RESULTS AND DISCUSSION

This research uses scraping techniques to obtain BRI Mobile application user review data from the Google Playstore website. Figure 2 below is the syntax for installing several Python libraries that will be used in research.

```
[1] pip install google-play-scraper
Collecting google-play-scraper
  Downloading google_play_scraper-1.2.7-py3-none-any.whl (28 kB)
Installing collected packages: google-play-scraper
Successfully installed google-play-scraper-1.2.7

[2] from google_play_scraper import app
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import nltk
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
from wordcloud import WordCloud
```

Figure 2. Import Library

After installing the Python library, The data scraping was conducted by entering the HTML code in the form of id.co.bri.brimo. as in Figure 3 below.

reviewId	userName	screenName	comment	score	timestamp	reviewCreatedTime	at	replyCount	replyCreated	appVersion
1	15134000000000000000	Realistik	Siapa yang mau pakai aplikasi ini?	4	171	2024-06-09 12:21:55	2024-06-09 12:21:55	0	2024-06-09 12:21:55	2.01.0
2	15134000000000000000	Subandrio pri	Tampilan aplikasi bagus, tapi...	3	17	2024-06-09 12:21:55	2024-06-09 12:21:55	0	2024-06-09 12:21:55	2.01.0
3	15134000000000000000	Adik Adik	Siapa yang mau pakai aplikasi ini?	1	68	2024-06-09 12:21:55	2024-06-09 12:21:55	0	2024-06-09 12:21:55	2.01.0
4	15134000000000000000	MR Siskandi	Siapa yang mau pakai aplikasi ini?	1	31	2024-06-09 12:21:55	2024-06-09 12:21:55	0	2024-06-09 12:21:55	2.01.0
5	15134000000000000000	Fadhul Esham	Siapa yang mau pakai aplikasi ini?	2	19	2024-06-09 12:21:55	2024-06-09 12:21:55	0	2024-06-09 12:21:55	2.01.0
6	15134000000000000000	Geny Mawardi	Siapa yang mau pakai aplikasi ini?	5	0	2024-06-09 12:21:55	2024-06-09 12:21:55	0	2024-06-09 12:21:55	2.01.0

Figure 3. The Result of BRI Mobile Reviews from Google Plyastore

The scraped data as shown in Figure 3, consists of 11 attributes. Therefore, it is necessary to select the attributes that will be used in the research, namely the review and rating attributes, as shown in Figure 4 below.

ulasan	rating
0 KENAPA BRIMO sering keluar sendiri,sesion tela...	4
1 Tampilan oke bagus semua, kalo bisa tambahn ...	3
2 setelah update versi 2.61.0 tidak bisa login p...	1
3 Apanya yg di update, malah lebih optimal yg v...	1
4 Akun brimo ke blokir,ga bisa login,udah reset ...	2
...	...
995 Pelayanan sangat baik dan mudah untuk di meng...	5
996 Masih dlm masa percobaan pakai. Semoga gak ada...	4
997 Mantap, pembayaran apapun lebih mudah dan praktis	5
998 Tolong dong pemberitahuan tentang iklan dan pr...	5
999 Sangat berkesan. Sangat membantu dan memudahk...	5

Figure 4. Feature Importance

After selecting data attributes, the next step is to pre-process the data with the stages of case folding, tokenization, punctuation, stopwords, and stemming as shown in Figure 5 below.

ulasan	rating	case folding	tokenisasi	Tanda Baca	Stopwords	Stemming
0 KENAPA BRIMO sering keluar sendiri,sesion tela...	4	kenapa brimo sering keluar sendiri,sesion tela...	kenapa, brimo, sering, keluar, sendiri, sestion, tela...	kenapa, brimo, sering, keluar, sendiri, sestion, tela...	kenapa, brimo, sering, keluar, sendiri, sestion, tela...	kenapa, brimo, sering, keluar, sendiri, sestion, tela...
1 Tampilan oke bagus semua, kalo bisa tambahn ...	3	tampilan oke bagus semua, kalo bisa tambahn ...	tampilan, oke, bagus, semua, kalo, bisa, tambahn ...	tampilan, oke, bagus, semua, kalo, bisa, tambahn ...	tampilan, oke, bagus, semua, kalo, bisa, tambahn ...	tampilan, oke, bagus, semua, kalo, bisa, tambahn ...
2 setelah update versi 2.61.0 tidak bisa login p...	1	setelah update versi 2.61.0 tidak bisa login p...	setelah, update, versi, 2.61.0, tidak, bisa, login, p...	setelah, update, versi, 2.61.0, tidak, bisa, login, p...	setelah, update, versi, 2.61.0, tidak, bisa, login, p...	setelah, update, versi, 2.61.0, tidak, bisa, login, p...
3 Apanya yg di update, malah lebih optimal yg v...	1	apanya yg di update, malah lebih optimal yg v...	apanya, yg, di, update, malah, lebih, optimal, yg, v...	apanya, yg, di, update, malah, lebih, optimal, yg, v...	apanya, yg, di, update, malah, lebih, optimal, yg, v...	apanya, yg, di, update, malah, lebih, optimal, yg, v...
4 Akun brimo ke blokir,ga bisa login,udah reset ...	2	akun brimo ke blokir,ga bisa login,udah reset ...	akun, brimo, ke, blokir,ga, bisa, login,udah, reset ...	akun, brimo, ke, blokir,ga, bisa, login,udah, reset ...	akun, brimo, ke, blokir,ga, bisa, login,udah, reset ...	akun, brimo, ke, blokir,ga, bisa, login,udah, reset ...

Figure 5. Pre-Processing Data

The next step is to label the data using a special tool called vader sentiment. Figure 6 below is the process of installing the vader sentiment library.

```

pip install vaderSentiment

from vaderSentiment.vaderSentiment import SentimentIntensityAnalyzer

analyzer = SentimentIntensityAnalyzer()

```

Figure 6. Installation of VADER Sentiment Library

After the vader sentiment library is successfully installed, the next step is to determine the score to classify the data into positive sentiment, negative sentiment, and neutral sentiment as shown in Figure 7 below.

ulasan	rating	Case folding	Tokenisasi	Tanda Baca	Stopwords	Stemming	Compound_Score	Sentiments
0 KENAPA BRIMO sering keluar sendiri,sesion tela...	4	kenapa brimo sering keluar sendiri,sesion tela...	kenapa, brimo, sering, keluar, sendiri, sestion, tela...	kenapa, brimo, sering, keluar, sendiri, sestion, tela...	kenapa, brimo, sering, keluar, sendiri, sestion, tela...	kenapa, brimo, sering, keluar, sendiri, sestion, tela...	0.0000	Netral
1 Tampilan oke bagus semua, kalo bisa tambahn ...	3	tampilan oke bagus semua, kalo bisa tambahn ...	tampilan, oke, bagus, semua, kalo, bisa, tambahn ...	tampilan, oke, bagus, semua, kalo, bisa, tambahn ...	tampilan, oke, bagus, semua, kalo, bisa, tambahn ...	tampilan, oke, bagus, semua, kalo, bisa, tambahn ...	0.0000	Netral
2 setelah update versi 2.61.0 tidak bisa login p...	1	setelah update versi 2.61.0 tidak bisa login p...	setelah, update, versi, 2.61.0, tidak, bisa, login, p...	setelah, update, versi, 2.61.0, tidak, bisa, login, p...	setelah, update, versi, 2.61.0, tidak, bisa, login, p...	setelah, update, versi, 2.61.0, tidak, bisa, login, p...	-0.4404	Negatif
3 Apanya yg di update, malah lebih optimal yg v...	1	apanya yg di update, malah lebih optimal yg v...	apanya, yg, di, update, malah, lebih, optimal, yg, v...	apanya, yg, di, update, malah, lebih, optimal, yg, v...	apanya, yg, di, update, malah, lebih, optimal, yg, v...	apanya, yg, di, update, malah, lebih, optimal, yg, v...	0.3818	Positif
4 Akun brimo ke blokir,ga bisa login,udah reset ...	2	akun brimo ke blokir,ga bisa login,udah reset ...	akun, brimo, ke, blokir,ga, bisa, login,udah, reset ...	akun, brimo, ke, blokir,ga, bisa, login,udah, reset ...	akun, brimo, ke, blokir,ga, bisa, login,udah, reset ...	akun, brimo, ke, blokir,ga, bisa, login,udah, reset ...	0.2263	Positif

Figure 7. The Result of Sentiment Data

After that, data modeling is carried out using the Gradient Boosting algorithm method by separating the train data by 80% and the test data by 20%, as shown in Figure 8 below.

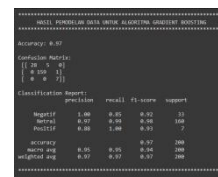


Figure 8. The Result of Modelling Data with Gradient Boost Algorithm

Data modeling has been successfully carried out as in Figure 8 above, then the next is a visualization in the form of a bar graph showing the distribution of data sentiment results as in Figure 9. In addition, there is also a visualization in the form of a word cloud of the results of the sentiment of BRI Mobile application user reviews in the form of positive sentiment in green, negative sentiment in red, and neutral sentiment in blue as in Figure 10 below.

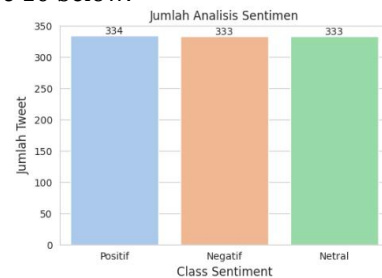


Figure 9. Bar Graph



Figure 10. Word Cloud

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the analysis that has been carried out, the sentiment vader special tool classifies positive sentiment as much as 334 data, negative sentiment as much as 333 data, and neutral sentiment as much as 333 data. It can be seen that there are more positive sentiments in BRI Mobile application reviews compared to negative sentiments and neutral sentiments. The words that appear most often in positive sentiments are 'transaction', 'easy', 'balance'. This shows that users are satisfied with the BRI Mobile application service. The results of data modeling with the Gradient Boost algorithm method show a high value, namely an accuracy value of 97%. Suggestions for further research are to use other special tools to classify data such as Text Blob and NLTK, as well as using other algorithm methods to

find out comparisons and produce sentiments with diverse distributions.

Suggestion

This research shows that the Gradient Boosting algorithm has good potential in classifying sentiment from BRI Mobile application user reviews automatically. However, there are several things that can be improved in future research. One of the main limitations in this study is that the number of datasets used is still limited, which is 1,000 review data. Therefore, it is recommended that future research use a larger and more diverse amount of data so that the model built can learn sentiment patterns more deeply and specifically. The use of a larger dataset allows the algorithm to capture variations in language, context, and more complex sentiment expressions, so that the accuracy and generalization of the model to new data can be significantly improved. In addition, combining with advanced feature engineering techniques, as well as exploring deep learning models such as LSTM or BERT can also be an alternative to achieve more optimal classification performance.

REFERENCES

- Armindia, Nanda Fibriyanti, Nina Sulistiyowati, and Tesa Nur Padilah. 2023. "Implementasi Algoritma Multinomial Naive Bayes Pada Analisis Sentimen Terhadap Ulasan Pengguna Aplikasi BRIMO." *Jurnal Mahasiswa Teknik Informatika* 7(3):1817–22.
- Arum Prabowo, Galih, Basuki Rahmat, and Henni Endah Wahanani. 2024. "Aspect-Based Sentiment Analysis Iphone 14 Pro Menggunakan Algoritma XGBoost." *JATI (Jurnal Mahasiswa Teknik Informatika)* 7(6):3947–52. doi: 10.36040/jati.v7i6.7831.
- Astuti, Anggi Puji, Syariful Alam, and Irsan Jaelani. 2022. "Komparasi Algoritma Support Vector Machine Dengan Naive Bayes Untuk Analisis Sentimen Pada Aplikasi BRIMO." *Bangkit Indonesia XI*(02).
- Efendi, and Rina Noviana. 2021. "Perancangan Web Sistem Analisis Sentimen Media Sosial Twitter Dengan Metode Valence Aware Dictionary And Sentimen Reasoner (Vader) Menggunakan PHP & MySQL Pada Pemerintah Kota Bekasi." *Jurnal Ilmiah Komputasi* 20(1). doi: 10.32409/jikstik.20.1.369.
- Hadisantoso, Erwin, Tuti Dharmawati, Muhammad Asdar, Muhammad Syaiful Saehu, and Sulfian Sulfian. 2023. "Faktor-Faktor Yang Mempengaruhi Minat Penggunaan Uang Elektronik (E-Money) Pada Aplikasi OVO (Studi Empiris Pada Mahasiswa Akuntansi Universitas Halu Oleo)." *Jurnal Akuntansi Dan Keuangan* 8(1).
- ibuan, Ernianti, and Elmo Allistair Heriyanto. 2022. "Analisis Sentimen Pada Ulasan Aplikasi Amazon Shopping Di Google Playstore Menggunakan Naive Bayes Classifier." *JTS Jurnal Teknik Dan Science* 1(3).
- Idrawan, Ivan Rifky. 2022. "Perbandingan Algoritma Naive Bayes, SVM, Dan XGBoost Dalam Klasifikasi Teks Sentimen Masyarakat Terhadap Produk Lokal Di Indonesia." *TRANSFORMASI* 18(1). doi: 10.56357/jt.v18i1.295.
- Im, Muhammad, and Syafii Informatika. 2023. "Sentimen Analisis Pada Media Sosial Menggunakan Metode Naive Bayes Classifier (NBC)." *Teknologipintar.Org* 3(2):1.
- Ismamudi, Ismamudi, Nani Hartati, and Sakum Sakum. 2023. "Peran Bank Dan Lembaga Keuangan Dalam Pengembangan Ekonomi: Tinjauan Literatur." *Jurnal Akuntansi Neraca* 1(2):35–44. doi: 10.59837/jan.v1i2.10.
- Hasan Basri. 2024. "Pemodelan Topik Dan Analisis Sentimen Pada Teks Ulasan Pengguna Aplikasi Perbankan Seluler Di Indonesia." *The Indonesian Journal of Computer Science* 13(4). doi: 10.33022/ijcs.v13i4.4200.
- Ithazam, Riana, Marhawati Marhawati, Muhammad Hasan, Mustari Mustari, and Muh. Ihsan Said. 2021. "Analisis Faktor-Faktor Yang Mempengaruhi Minat Penggunaan Uang Elektronik Pada Aplikasi OVO." *Business and Accounting Education Journal* 2(3):252–59. doi: 10.15294/baej.v2i3.55829.
- Iyadi, Achmad Hari, and Sri Lestari. 2022. "Analisis Sentimen Terhadap Sekolah Saat Covid-19 Pada Twitter Menggunakan Metode Lexicon Based." *JIKOM Jurnal Informatika Dan Teknologi Komputer* 3(1):17–23.
- Irfadila, Nida, Maya Ariyanti, and Nurvita Trianasari. 2023. "Analisis Kualitas Layanan Mobile Banking New Livin' By Mandiri Menggunakan Sentiment Analysis." *Journal of Indonesia Business Research* 1(1).
- Kawansyah, Tengku. 2022. "Implementasi Text Mining Terhadap Analisis Sentimen Masyarakat Dunia Di Twitter Terhadap Kota Medan Menggunakan K-Fold Cross Validation Dan Naive Bayes Classifier." *KLIK Kajian Ilmiah Informatika Dan Komputer* 2(5):178–85.
- Khair, Muhammad, and Erliyan Redy Sutanto. 2024. "Analisis Sentimen Ulasan Pengguna Pada Aplikasi BRIMO BRI Menggunakan Metode Klasifikasi Algoritma Naive Bayes." *JURNAL MEDIA INFORMATIKA BUDIDARMA* 8:1149–59. doi: 10.30865/mib.v8i2.7381.

- Utomo, Danang Wahyu. 2024. "Rekomendasi Produk E-Commerce Berbasis Klasifikasi Ulasan Menggunakan Ensemble Random Forest Dan Teknik Boosting." *INFOTEKMESIN* 15(2). doi: 10.25008/janitra.v2i1.145.
- Yulia Nur Afifah, Anisatul Kamilah, Ahmad Indriyanto Nugroho, and Ayyu Ainin Mustafidah. 2024a. "Optimalisasi BRI Mobile Sebagai Bentuk Privilege Kepada Nasabah Di BRI Unit Puger." *Journal Of Indonesian Social Society (JISS)* 2(2):64–68. doi: 10.59435/jiss.v2i2.232.
- Yulia Nur Afifah, Anisatul Kamilah, Ahmad Indriyanto Nugroho, and Ayyu Ainin Mustafidah. 2024b. "Optimalisasi BRI Mobile Sebagai Bentuk Privilege Kepada Nasabah Di BRI Unit Puger." *Journal Of Indonesian Social Society (JISS)* 2(2):64–68. doi: 10.59435/jiss.v2i2.232.
- Yuniar, Eka, Dwi Safiroh Utsalinah, and Dian Wahyuningsih. 2022. "Implementasi Scrapping Data Untuk Sentiment Analysis Pengguna Dompot Digital Dengan Menggunakan Algoritma Machine Learning." *Jurnal Janitra Informatika Dan Sistem Informasi* 2(1):35–42. doi: 10.25008/janitra.v2i1.145.
- ina, Nur, and Afiyati Afiyati. 2024. "Analisis Sentimen Ulasan Pengguna Aplikasi M-Banking Menggunakan Algoritma Support Vector Machine Dan Decision Tree." *Jurnal Linguistik Komputasional* 7(1).