

# COMPARISON OF NAÏVE BAYES AND LIWC FOR SENTIMENT ANALYSIS OF GOJEK (GOTO FINANCIAL) USER SATISFACTION

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## ABSTRACT

Customer satisfaction impacts customer retention. Thus, it is important for the service provider's business development including for GoTo Financial which has a very large number of subscribers. Current technological advances have provided customers with many channels to submit complaints, criticisms, compliments, and all kinds of opinions to service providers. Not only through customer service agents, but social media like Twitter are also frequently used by customers to reach out to the provider. Google Play Store also has an Application Review feature that customers often use to express their experience using the application. This study analyzes the customer satisfaction level of GoTo Financial. Two methods namely Naive Bayes and Lexicon (LIWC) are employed to obtain three sentiment classes i.e., negative, neutral, and positive, with data obtained from Twitter and Google Play Store based on the most frequently complained topic through the company's customer service. With one topic and a limit of 1000 data, the results show that this company is proven to have many daily active customers. The results also suggest that Lexicon's accuracy is low at 7.43% due to the large number of false negatives. In contrast, the Naive Bayes multinomial consistently shows high accuracy at 87.76% over Twitter data and 71.25% over Google Play Store data, making it a better method than Lexicon.

**Keywords:** *GoTo Financial; Naive Bayes; LIWC; Sentiment Analysis, User Satisfaction*

## 1. INTRODUCTION

Customer satisfaction is a supporting factor in forming loyalty. Customer satisfaction is gained when the provided services meet the customers' expectations. If the results do not meet customers' expectations, then they are not satisfied [1]. Therefore, companies or service providers must pay attention to customer satisfaction to retain their customers and increase customer loyalty. The level of customer satisfaction influences the development of an industry. When customers are unsatisfied or harmed, they will consider leaving and sharing their dissatisfaction with other customers. This will be quite a high risk for service providers [2]. According to McKnight, there are two important elements of consumer trust, namely Trusting Belief and Trusting Intention [3].

These studies suggest that the quality of a company's service or product greatly influences the

level of satisfaction of its users. This is where the role of sentiment analysis is useful for improving service by collecting opinions from customers which can be used to determine positive, negative, or neutral responses.

Customer Service is a means of communication media between users and service providers; with customer service, customers can convey all their experiences including questions and complaints. Nowadays, customer service is not limited to human-to-human interaction, but also AI and robots. Some studies show that people are encountering bad experiences with customer service. For instance, people give some negative feedback for AI customer service [4] and complain about Chat Bot's inflexibility [5]. This implies that customers need wide options of customer service, so many customers submit their complaints in open places such as social media, with the hope that these complaints will attract the attention of many people and can become

viral. Viral things always succeed in making service providers move quickly to respond to these complaints to maintain the quality of their services. Today's social media is very popular like Twitter, not only social media, but customers also often express their opinions directly through application stores such as the Google Play Store.

Twitter is widely used by the public. Its popularity causes people to use this service as a media to express various things such as for protests, political campaign, and others.

Unlike Twitter, Google Play Store is used by Android users to download applications and game. This service also has a Review feature where users can write feedback for the application or game. The reviews then become a reference for the potential users to see if the application is good and right for them. Good re-views certainly lead the potential users to download the application. This makes user-review analysis very interesting for application owners to find out customer opinions and improve their services.

One of the analytical sentiments has been used to find out public opinion regarding the performance of the House of People's Representatives [6]. It has also been used to determine public opinion over the relocation of the capital city [7]. Then there is an analysis of the level of user satisfaction, as was done with the Shopee company [8], [9]. GoTo Financial is a company, member of the PT GoTo Go-Jek Tokopedia Tbk group, that provides financial services such as GoPay, Go-Paylater, Gobiz and so on. GoPay is one of the most popular payment methods in Indonesia that is used even for zakat or donation [10]. Although society trust GoPay for payment [11], [12] as a good impact from the social media marketing [13], there is a study showing that GoPay gains a low level of trust in its Top Up features [14].

Sentiment analysis using the right algorithms will produce the expected results. For this type of sentiment analysis which includes classification then Naïve Bayes is one of the algorithms that can make classification quickly. Besides that, Naïve Bayes is also very efficient and effective even when used to analyze large-scale data. This algorithm has been used in many studies. For instance, it was used to analyze the satisfaction over Indonesia House of Representatives performance, which shows a fairly high accuracy at 80% [6]. Another former research was conducted upon the review of beach tourism in Karawang at the Google Maps site. Two out of five beaches received negative reviews. They are

Cibendo beach which got 0.550 and Tanjung Baru beach which got 0.650. The other three beaches got more positive reviews [15]. Same algorithm was used for online transportation sentiment too [16]. Furthermore, it was also employed for the Covid-19 vaccination research which shows that 92% of Twitter users' sentiment is positive, and the most impactful account in sharing the information is @jokowi [17].

In addition, the LIWC method can also be used for sentiment analysis, because Lexicon is a language vocabulary or science. In linguistics, a lexicon is an inventory of language lexemes. Research using the LIWC lexicon has also been used to analyze racial, ethnic, and religious issues happening in Twitter with excellent accuracy for positive sentiment [18].

This study analyzes the customer satisfaction level of GoTo Financial. Two methods namely Naive Bayes and Lexicon (LIWC) are employed to obtain three sentiment classes i.e., negative, neutral, and positive, with data obtained from Twitter and Google Play Store based on the most frequently complained topic through the company's customer service.

## 2. THEORETICAL BACKGROUND

### 2.1 Sentiment Analysis

The process of detecting text polarity contextually, namely determining text with a positive, negative, or neutral meaning based on sentiment score. It can also be called opinion mining because the results of the analysis are obtained from the opinions or attitudes concerned [19]. Interest in this field has also increased, both for academic and industrial needs because there is a lot of easily available data. Also, can be applied to many fields such as data mining, natural language processing and machine learning [20].

### 2.2 Naïve Bayes Classifier

This algorithm is used to obtain the highest probability value in classifying the right category test data. One of the advantages of using this method is that it only takes small data to estimate what parameters are needed [9], [21], [22].

### 2.3 Linguistic Inquiry and Word Count (LIWC)

LIWC is a text analysis application developed to analyze the emotional, cognitive, and structural components of a text. It works by finding each word in the text and then matching it to a word in the lexicon. The lexicon contains words and categorizes them linguistically, psychologically, and socially, such as pro-nouns, positive emotions, social

processes, and so on. If LIWC finds the category, it will provide the percentage value. If all words in the text document have been categorized, the results will be presented in the form of a table containing the category percentage values for the text document [23], [24].

#### 2.4 Twitter

This social media facilitates its users to send messages to other users and to post information known as tweets in the form of text, images and even videos. This media is quite different from other media in terms of writing text as it has a text limit of 280 characters in one tweet [25]. Because of its popularity, many data scientists used this as the data source. Many research topics with Twitter as the object can be found such as cryptocurrency [26], KRI Nanggala 402 incident [27], projecting the online commerce transaction [28], and others

#### 2.5 Google Play Store

This application is only available for the Android operating system and is specifically for the Google market, where Android users can download applications through this application [29]. Since Android is very popular with around 70% of users in the world, this media can be a good source for research. Hence, so many research used this source in so many study area, such as gender [29], telco provider – by.U Telkomsel (one of Indonesia telco providers) [30], digital traffic application [31], online transportation - Grab [32], and others

### 3. RESEARCH METHODOLOGY

#### 3.1. Research Stage

The following are the stages of the research:

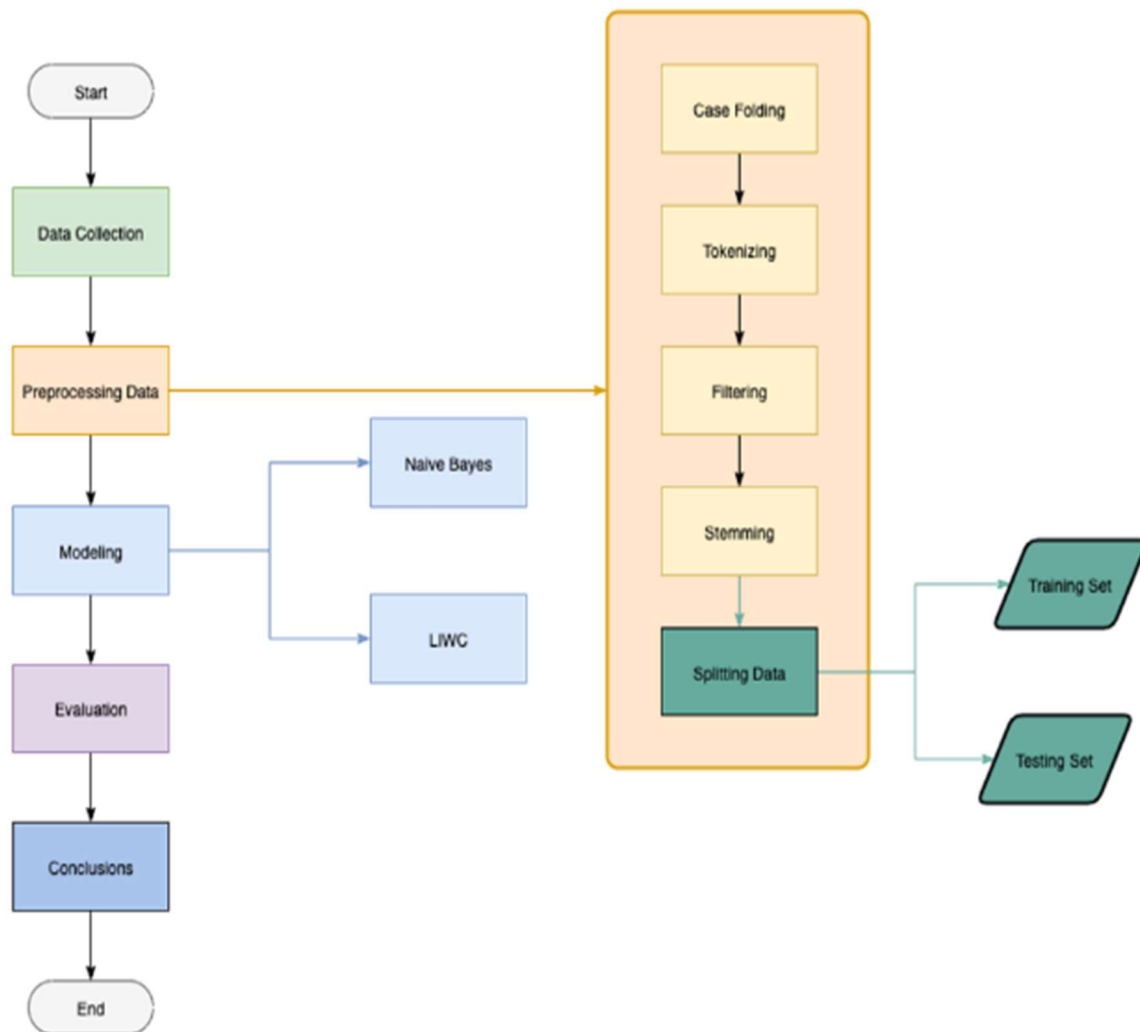


Fig. 1. Diagram Of Research Stages

**3.1.1. Data Collection**

The first stage in this research is data collection which is explained in the data collection method above. The following is the flow of data collection:

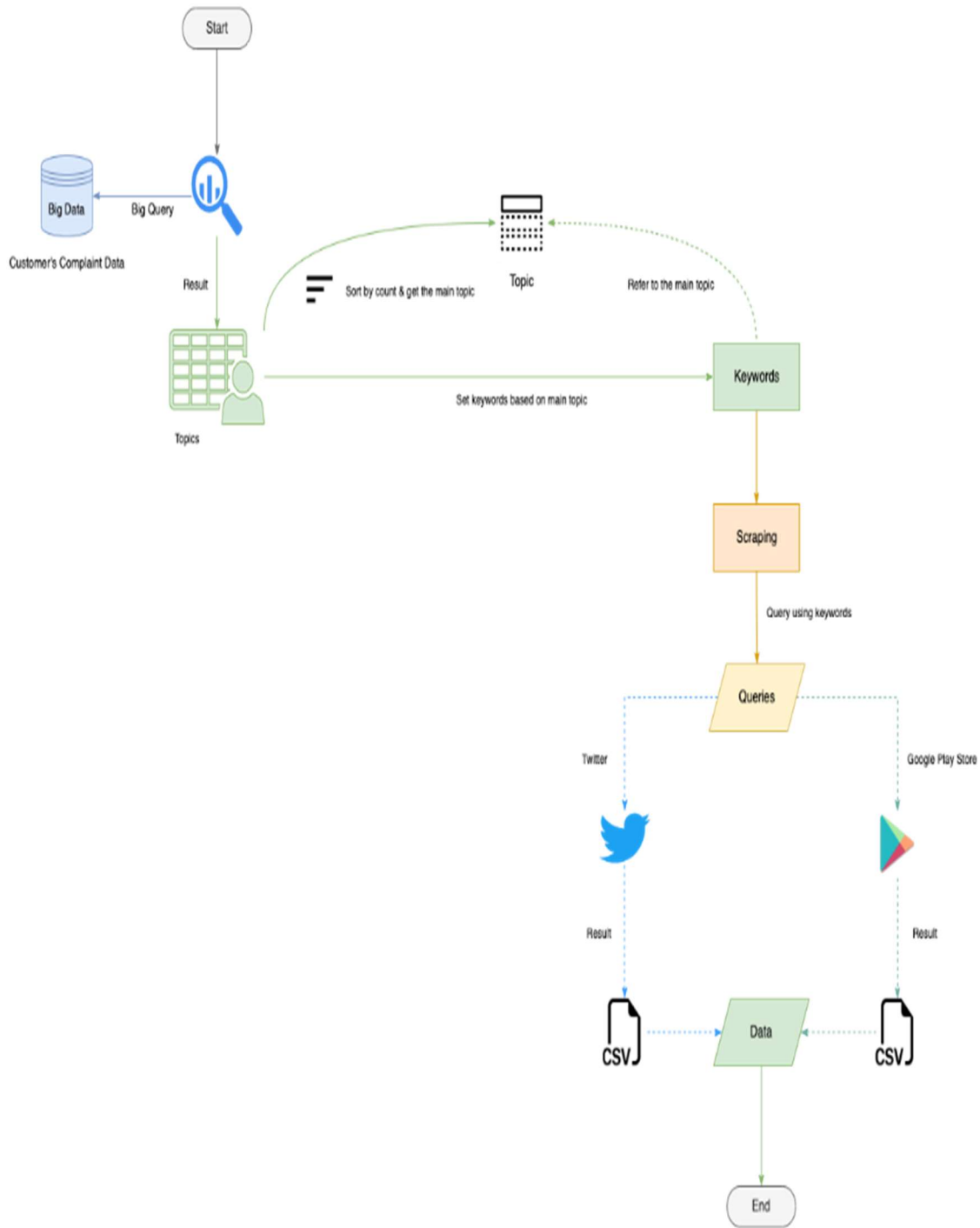


Fig. 2. Data Collection Flowchart

The initial data is in the form of complaints topic from customers along with the total number from the beginning of 2020 to the end of 2021. The data is collected from Big Query results to GoTo Financial company Big Data directly. Furthermore, the topic selected is the most frequently mentioned in the complaints that are considered appropriate. Then the topic determines the keywords used for scraping two external sources – Twitter and Google Play Store. The data scraping employs python programming.

Because this research analyses sentiment from Twitter and Google Play Store, the attributes used are only the contents of tweets and reviews.

### 3.1.2. Data Preprocessing

- *Case Folding*

At this stage, the sentence is changed to lowercase and characters other than a-z are removed. Figure 3 is an example of case folding:



Fig. 3. The case folding stage

- *Tokenizing*

At this stage, words are extracted, and punctuation and spaces are removed. Figure 4 an example of tokenization:

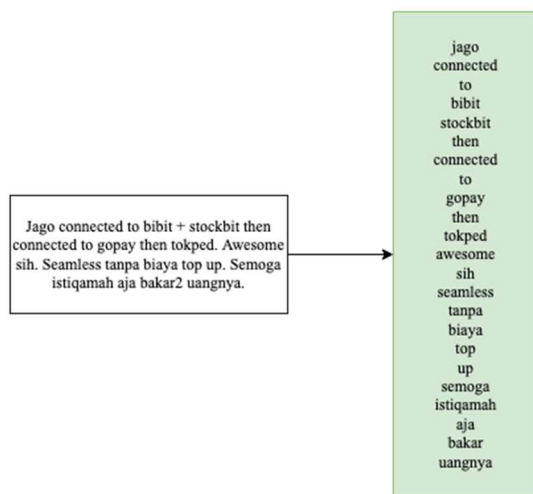


Fig. 4. The Tokenizing Stage

- *Filtering*

At this stage remove stop words. Here's an example filter:

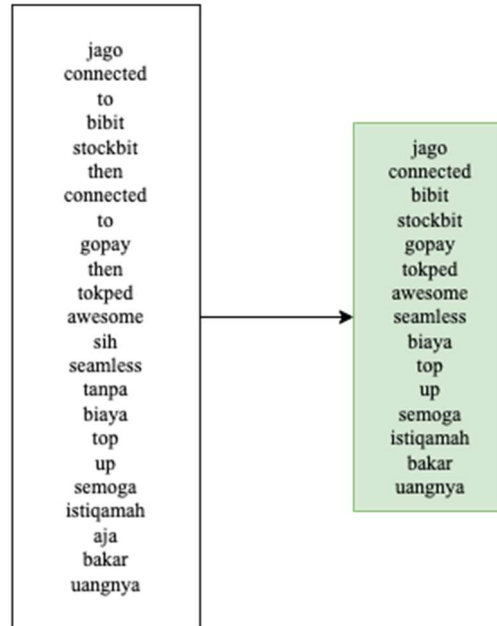


Fig. 5. The filtering stage

- *Stemming*

At this stage the words are changed to their basic form. Here's an example:



Fig. 6. The Stemming Stage

- *Splitting Data*

At this stage, data is divided into training data and testing data for model testing.

3.1.3. Modeling

After pre-processing, the dataset is ready to be used for the modelling stage, namely using the Naive Bayes and LIWC methods. At this stage, the labelling of negative, positive, and neutral sentiments is obtained.

3.1.4. Evaluation

The next stage is evaluation. Evaluation is used to get the level of accuracy of the two models.

3.1.5. Conclusions

Based on the evaluation results, it is then used to draw conclusions which make it the final stage in this research.

4. RESULTS AND DISCUSSION

Tests on both models use the polarity generated from the model and compare it with manual classification and use train and test data. To determine the level of accuracy, it is necessary to compare the sentiment results from the model with the sentiment results that have been determined manually (human). In the Naive Bayes test, data that has been split into train and test data (X\_train, X\_test, y\_train, y\_test) and has been modelled, is tested by making predictions on the test data. This process applies to all three Naive Bayes models, namely complement, multinomial and Bernoulli.

The following are the results of the accuracy and confusion matrix from the lexicon on Twitter data:

Model accuracy is 17.43%				
	precision	recall	f1-score	support
Negative	0.17	0.04	0.06	26
Neutral	0.87	0.13	0.23	198
Positive	0.07	0.88	0.14	17
accuracy			0.17	241
macro avg	0.37	0.35	0.14	241
weighted avg	0.74	0.17	0.20	241

Fig. 7. Accuracy of lexicon on twitter data

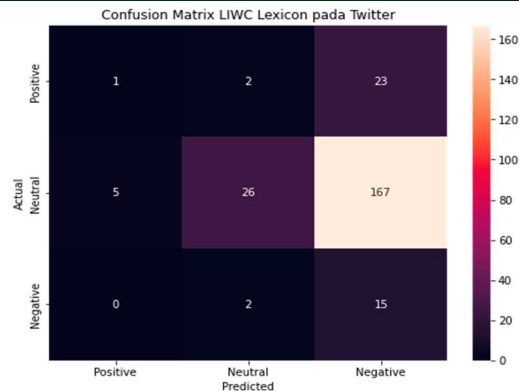


Fig. 8. Confusion Matrix Of Lexicon On Twitter Data

The results show that the accuracy level and confusion matrix from the lexicon on Twitter data is 17.43%. This is because of false negatives relatively high. The following are the results of the accuracy and confusion matrix from the lexicon on the Google Play Store data:

Model accuracy is 75.39%				
	precision	recall	f1-score	support
Negative	0.69	0.44	0.54	41
Neutral	0.75	0.97	0.85	532
Positive	0.79	0.26	0.39	203
accuracy			0.75	776
macro avg	0.74	0.55	0.59	776
weighted avg	0.76	0.75	0.71	776

Fig. 9. Accuracy Of Lexicon On Google Play Store Data.



Fig. 10. Confusion Matrix Of Lexicon On Google Play Store Data.

The results show that the accuracy level and confusion matrix from the lexicon on Google Play Store data is 75,39%, that's relatively high. Following are the results of the accuracy and confusion matrix from Naive Bayes on Twitter data:

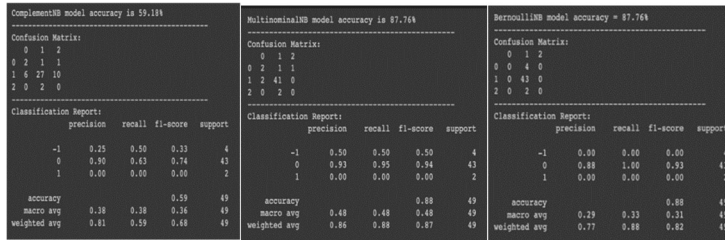


Fig. 11. Accuracy of naïve bayes on twitter data

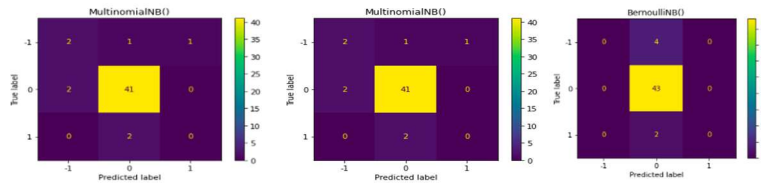


Fig. 12. Confusion Matrix Of Naïve Bayes On Twitter Data

The results show that the accuracy and confusion matrix from Naive Bayes on Twitter data, especially for multinomial & Bernoulli has the same level, 87.76%, that's relatively high and higher quite than complement.

The following are the results of the accuracy and confusion matrix from Naive Bayes on Google Play Store data:

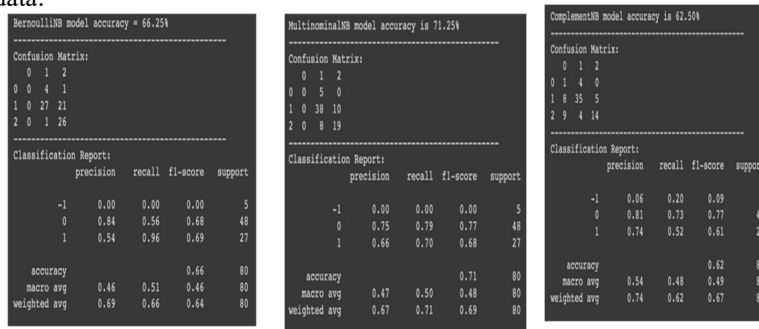


Fig. 13. Accuracy of naïve bayes on google play store data.

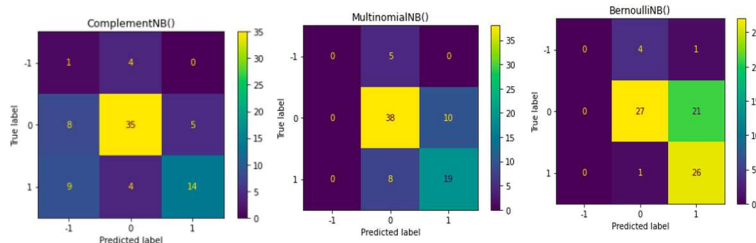


Fig. 14. Confusion Matrix Of Naïve Bayes On Google Play Store Data

The results show that accuracy and confusion matrix from Naive Bayes on Google Play Store data, same like Twitter data, multinomial & Bernoulli has higher accuracy than compliment. The highest one is multinomial with accuracy level is 71.25%.

## 5. CONCLUSION

Table 1. Comparison Of Accuracy

No	Source	Method	Accuracy
1	Twitter	Lexicon	7.43%
		Naive Bayes Complement	59.18%
		Naive Bayes Multinomial	87.76%
		Naive Bayes Bernoulli	87.76%
2	Google Play Store	Lexicon	75.39%
		Naive Bayes Complement	62.50%
		Naive Bayes Multinomial	71.25%
		Naive Bayes Bernoulli	66.25%

The results show that the accuracy level of the two methods is relatively high. However, Twitter lexicon data accuracy is low due to the large number of false negatives caused by the large number of negative sentiments i.e., offenses and irrelevant topic. For example, is the discussion about failure in topping up GoPay balance due to an error of Livin Mandiri, separate fintech app. This is an issue in Mandiri Livin App and not Gopay, thus the sentiment should be interpreted as neutral, but according to Lexicon, this case is classified as negative.

Whereas in Naive Bayes, of the three types of the method, multinomial type consistently shows the highest accuracy. Compared to Lexicon, Naive Bayes' multinomials method is more representative. In terms of data, there is a balancing data between negative, positive, and neutral polarity. Twitter is 85.06% positive and Google

Play Store is 91.75% neutral. Due to the high number of neutrals on the Google Play Store, Twitter is a more relevant resource on this specific topic. In addition, the data collected from Twitter and Google Play Store shows that the number of subscribers is quite active. It is seen that on average, in each month and on the same topic, there are 2624 active subscribers in 2020 and 23721 in 2021. In Google Play Store, there are 1000 data available within 6 days, so it can be estimated to be around 5000 within a month. Meanwhile for Twitter, under this specific topic, it reaches 300 within a month, especially if the topic addresses a specific service provider company such as Gojek. The number becomes quite high. From this explanation, it can be concluded that the two media can be used by service providers as the most reliable media to collect customer satisfaction data besides the customer care unit. This also recommends that service providers provide immediate response to complaints submitted through those three media. In addition, data from the customer care unit clearly shows that customers trust and are comfortable conveying their complaints directly through customer care agents too. This implies that the customer care unit has performed good service too.

## REFERENCES:

- [1] A. S. Lubis And N. R. Andayani, "Pengaruh Kualitas Pelayanan (Service Quality) Terhadap Kepuasan Pelanggan Pt. Sucofindo Batam," *J. Appl. Bus. Adm.*, Vol. 1, No. 2, Pp. 232–243, Jan. 2018, Doi: 10.30871/Jaba.V1i2.619.
- [2] N. W. W. Premayani And G. A. D. M. Yoga, "Pengaruh Kewajaran Harga Dan Kualitas Produk Terhadap Kepuasan Konsumen Wina Rumah Kebaya," *Widya Manaj.*, Vol. 1, No. 2, Pp. 113–157, Aug. 2019, Doi: 10.32795/Widyamanajemen.V1i2.360.
- [3] Yulianingsih, N. Limakrisna, And H. Muharam, "Purchasing Decisions Based On Consumer Trust In Halal Topical Cosmetic Products," *Int. J. Bus. Appl. Econ.*, Vol. 2, No. 5, Pp. 753–770, Sep. 2023, Doi: 10.55927/Ijbae.V2i5.6043.
- [4] T. Zhao, J. Cui, J. Hu, Y. Dai, And Y. Zhou, "Is Artificial Intelligence Customer Service Satisfactory? Insights Based On Microblog Data And User Interviews," *Cyberpsychology Behav. Soc. Netw.*, Vol. 25, No. 2, Pp. 110–117, Feb. 2022, Doi: 10.1089/Cyber.2021.0155.



- [5] I. K. F. Haugeland, A. Følstad, C. Taylor, And C. A. Bjørkli, "Understanding The User Experience Of Customer Service Chatbots: An Experimental Study Of Chatbot Interaction Design," *Int. J. Hum.-Comput. Stud.*, Vol. 161, P. 102788, May 2022, Doi: 10.1016/J.Ijhc.2022.102788.
- [6] D. Duei Putri, G. F. Nama, And W. E. Sulistiono, "Analisis Sentimen Kinerja Dewan Perwakilan Rakyat (Dpr) Pada Twitter Menggunakan Metode Naive Bayes Classifier," *J. Inform. Dan Tek. Elektro Terap.*, Vol. 10, No. 1, Jan. 2022, Doi: 10.23960/Jitet.V10i1.2262.
- [7] P. Arsi, B. A. Kusuma, And A. Nurhakim, "Analisis Sentimen Pindah Ibu Kota Berbasis Naive Bayes Classifier," *J. Inform. Upgris*, Vol. 7, No. 1, Jun. 2021, Doi: 10.26877/Jiu.V7i1.7636.
- [8] J. S. Suroso, E. R. Kaburuan, D. Lee, N. S. Tama, And K. Tee, "Analysis Of E-Commerce System In Marketplace (Shopee Indonesia)," In *2020 8th International Conference On Orange Technology (Icot)*, Daegu, Korea (South): Ieee, Dec. 2020, Pp. 1–4. Doi: 10.1109/Icot51877.2020.9468783.
- [9] E. R. Kaburuan, Y. S. Sari, And I. Agustina, "Sentiment Analysis On Product Reviews From Shopee Marketplace Using The Naïve Bayes Classifier," *Lontar Komput. J. Ilm. Teknol. Inf.*, Vol. 13, No. 3, P. 150, Nov. 2022, Doi: 10.24843/Lkjiti.2022.V13.I03.P02.
- [10] A. Ichwan, "Pengaruh Technology Acceptance Model Terhadap Keputusan Muzakki Membayar Zakat Melalui Fintech Gopay," *J. Ilm. Ekon. Islam*, Vol. 6, No. 2, Jun. 2020, Doi: 10.29040/Jiei.V6i2.1011.
- [11] B. N. Tri Anggono, . I., And S. H. A B, "Persepsi Kemudahan, Resiko Dan Kepercayaan Terhadap Keputusan Penggunaan Gopay," *Fokus Ekon. J. Ilm. Ekon.*, Vol. 15, No. 1, Pp. 144–153, Jun. 2020, Doi: 10.34152/Fe.15.1.144-153.
- [12] E. R. Kaburuan, G. T. Gayatri, Moh. F. Rizqon, And N. Legowo, "Analysis Of Factors Affecting The Use Of Go-Pay Feature As A Means Of Payment," In *2019 International Conference On Informatics, Multimedia, Cyber And Information System (Icimcis)*, Jakarta, Indonesia: Ieee, Oct. 2019, Pp. 141–146. Doi: 10.1109/Icimcis48181.2019.8985203.
- [13] C. Ponarwan And M. Tjokrosaputro, "Pengaruh Social Media Marketing Dan Trust Terhadap Minat Menggunakan Gopay Di Jakarta," *J. Manajerial Dan Kewirausahaan*, Vol. 2, No. 2, P. 520, May 2020, Doi: 10.24912/Jmk.V2i2.7946.
- [14] W. Sinclair, L. Maulia, And T. N. Sitang, "Analisis Faktor-Faktor Yang Mempengaruhi Penerimaan Dan Penggunaan Mobile Payment Pada Teknologi Pembayaran Gopay," *Owner*, Vol. 5, No. 1, Pp. 229–239, Feb. 2021, Doi: 10.33395/Owner.V5i1.357.
- [15] W. Khofifah, D. N. Rahayu, And A. M. Yusuf, "Analisis Sentimen Menggunakan Naive Bayes Untuk Melihat Review Masyarakat Terhadap Tempat Wisata Pantai Di Kabupaten Karawang Pada Ulasan Google Maps," *J. Interkom J. Publ. Ilm. Bid. Teknol. Inf. Dan Komun.*, Vol. 16, No. 4, Pp. 28–38, Jan. 2022, Doi: 10.35969/Interkom.V16i4.192.
- [16] E. Dwianto And M. Sadikin, "Analisis Sentimen Transportasi Online Pada Twitter Menggunakan Metode Klasifikasi Naïve Bayes Dan Support Vector Machine," *Format J. Ilm. Tek. Inform.*, Vol. 10, No. 1, P. 94, Feb. 2021, Doi: 10.22441/Format.2021.V10.I1.009.
- [17] E. Nurhazizah, R. N. Ichsan, And S. Widiyanesti, "Analisis Sentimen Dan Jaringan Sosial Pada Penyebaran Informasi Vaksinasi Di Twitter," *Swabumi*, Vol. 10, No. 1, Pp. 24–35, Mar. 2022, Doi: 10.31294/Swabumi.V10i1.12474.
- [18] A. E. Karyawati, P. A. Utomo, And I. G. A. Wibawa, "Comparison Of Svm And Liwc For Sentiment Analysis Of Sara," *Ijccs Indones. J. Comput. Cybern. Syst.*, Vol. 16, No. 1, P. 45, Jan. 2022, Doi: 10.22146/Ijccs.69617.
- [19] N. A. M. Razali *Et Al.*, "Opinion Mining For National Security: Techniques, Domain Applications, Challenges And Research Opportunities," *J. Big Data*, Vol. 8, No. 1, P. 150, Dec. 2021, Doi: 10.1186/S40537-021-00536-5.
- [20] Y. Wang, G. Huang, J. Li, H. Li, Y. Zhou, And H. Jiang, "Refined Global Word Embeddings Based On Sentiment Concept For Sentiment Analysis," *Ieee Access*, Vol. 9, Pp. 37075–37085, 2021, Doi: 10.1109/Access.2021.3062654.
- [21] N. T. Romadloni And Hilman F Pardede, "Seleksi Fitur Berbasis Pearson Correlation Untuk Optimasi Opinion Mining Review Pelanggan," *J. Resti Rekayasa Sist. Dan*

- Teknol. Inf.*, Vol. 3, No. 3, Pp. 505–510, Dec. 2019, Doi: 10.29207/Resti.V3i3.1189.
- [22] Binus University, Indonesia And R. R. Putra, “A Naïve Bayes Sentiment Analysis For Fintech Mobile Application User Review In Indonesia,” *Int. J. Adv. Trends Comput. Sci. Eng.*, Pp. 1856–1860, Oct. 2019, Doi: 10.30534/Ijatcse/2019/07852019.
- [23] J. W. Pennebaker, R. L. Boyd, K. Jordan, And K. Blackburn, “The Development And Psychometric Properties Of Liwc2015”.
- [24] Y. R. Tausczik And J. W. Pennebaker, “The Psychological Meaning Of Words: Liwc And Computerized Text Analysis Methods,” *J. Lang. Soc. Psychol.*, Vol. 29, No. 1, Pp. 24–54, Mar. 2010, Doi: 10.1177/0261927x09351676.
- [25] F. Arolfo, K. C. Rodriguez, And A. Vaisman, “Analyzing The Quality Of Twitter Data Streams,” *Inf. Syst. Front.*, Vol. 24, No. 1, Pp. 349–369, Feb. 2022, Doi: 10.1007/S10796-020-10072-X.
- [26] A. Prasetya, F. Ferdiansyah, Y. N. Kunang, E. S. Negara, And W. Chandra, “Sentiment Analisis Terhadap Cryptocurrency Berdasarkan Comment Dan Reply Pada Platform Twitter,” *J. Inf. Syst. Inform.*, Vol. 3, No. 2, Pp. 268–277, Jun. 2021, Doi: 10.33557/Journalisi.V3i2.124.
- [27] M. A. Djamaludin, A. Triayudi, And E. Mardiani, “Analisis Sentimen Tweet Kri Nanggala 402 Di Twitter Menggunakan Metode Naïve Bayes Classifier,” *J. Jtik J. Teknol. Inf. Dan Komun.*, Vol. 6, No. 2, Pp. 161–166, Jan. 2022, Doi: 10.35870/Jtik.V6i2.398.
- [28] E. R. Kaburuan, A. S. Lin Lindawati, Surjandy, Siswantini, M. R. Putra, And D. N. Utama, “A Model Configuration Of Social Media Text Mining For Projecting The Online-Commerce Transaction (Case: Twitter Tweets Scraping),” In *2019 7th International Conference On Cyber And It Service Management (Citsm)*, Jakarta, Indonesia: Ieee, Nov. 2019, Pp. 1–4. Doi: 10.1109/Citsm47753.2019.8965417.
- [29] E. Noei And K. Lyons, “A Study Of Gender In User Reviews On The Google Play Store,” *Empir. Softw. Eng.*, Vol. 27, No. 2, P. 34, Mar. 2022, Doi: 10.1007/S10664-021-10080-8.
- [30] S. Fransiska And A. I. Gufroni, “Sentiment Analysis Provider By.U On Google Play Store Reviews With Tf-Idf And Support Vector Machine (Svm) Method,” *Sci. J. Inform.*, Vol. 7, No. 2, 2020.
- [31] E. R. Kaburuan And N. R. Setiawan, “Sentimen Analisis Review Aplikasi Digital Korlantas Pada Google Play Store Menggunakan Metode Svm,” *J. Sisfokom Sist. Inf. Dan Komput.*, Vol. 12, No. 1, Pp. 105–116, Mar. 2023, Doi: 10.32736/Sisfokom.V12i1.1614.
- [32] R. Wahyudi And G. Kusumawardana, “Analisis Sentimen Pada Aplikasi Grab Di Google Play Store Menggunakan Support Vector Machine,” *J. Inform.*, Vol. 8, No. 2, Pp. 200–207, Sep. 2021, Doi: 10.31294/Ji.V8i2.9681.