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Sentiment Analysis Of The Shopee Marketplace On Twitter Using The Naive Bayes Classifier Method

Nila Natalia[a], Ester Krisdianti Astikarani [b*], Muhammad Adi Khairul [b], Irfan Nafis Sjamsuddin [c]

[a] *Teknik Komputer, Politeknik Sukabumi, Sukabumi, Indonesia*
[b] *Informatika, Universitas Siliwangi, Tasikmalaya, Indonesia*
[c] *Sistem Informasi, Universitas Siliwangi, Tasikmalaya, Indonesia*
Corresponding author: 167006050@student.unsil.ac.id

Abstract*— Shopee is the number one most downloaded marketplace application on the App Store and Play Store. In its promotion, Shopee provides discounts on shipping costs, price discounts, and cashback for each transaction; however, not all of its users are satisfied with the service. There are criticisms and suggestions, one of which is conveyed via social media, Twitter. Sentiment analysis was conducted to extract information related to Shopee user reviews on Twitter. The stages of the research carried out followed the Cross Industry Standard Process for Data mining (CRISP-DM) method, namely Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, and Deployment. Data collection was carried out by scraping, and all classification processes were carried out using the RapidMiner tool. The data obtained tends to contain negative sentiment rather than positive; most reviews are made by buyers and discuss promos. Sentiment classification is carried out by applying the Naive Bayes Classifier and TF-IDF as feature extraction. Testing using 10-fold cross-validation and a Confusion Matrix resulted in an accuracy value of 84.20%, a precision value of 87.21%, and a recall value of 84.20%. The research results can be used as evaluation material and suggestions for improving user satisfaction with the Shopee marketplace app, categorized by objects or features. These objects include apps, features, policies, services, payments, shipping, and promotions. Recommendations for future research include developing an app for the preprocessing stage, allowing the classification process to be carried out in real-time.

***Keywords*— Cross Validation ; Naive Bayes Classifier ; Sentiment analysis ; TF-IDF**

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I. INTRODUCTION

The appeal to limit face-to-face activities during the COVID-19 pandemic has significantly impacted the increase in online shopping transactions, with sales on e-commerce platforms or marketplaces increasing by 25% [1]. Among the numerous marketplace platforms in Indonesia, Shopee is ranked number 1 for the most downloads on the App Store and Google Play Store, with a monthly visitation of 126.99 million visitors [2]. However, it cannot be denied that the Shopee marketplace continues to require development both in terms of applications and services. One thing that can be used as a consideration for the development of the Shopee marketplace is reviews from Shopee application users on social media, one of which is on Twitter. The number of tweets is too large and unstructured; it is quite difficult and time-consuming to read all of them. Therefore, a data mining technique is needed to present these reviews in a more informative way for application developers. One data mining technique that can be done is sentiment analysis. Sentiment analysis is a method used to extract opinion data, understand, and process textual data automatically to see the sentiment contained in an opinion [3]. In sentiment classification, specifically using a machine learning approach, there are several methods, and one of them is the Naive Bayes Classifier [4]. Naive Bayes is a classifier that predicts future opportunities based on previous experience [5]. Rustiana & Rahayu in 2017 implemented the Naive Bayes Classifier in analyzing automotive market sentiment and produced an accuracy value of 93% [6]. Harsono et al. (2020) stated that the Naive Bayes Classifier is more accurate in classifying haiDJPb service review data than the SVM method [7]. Sari & Wibowo (2019), through their research in analyzing sentiment towards JD.ID concluded that the Naive Bayes Classifier method with TF-IDF weighting has a higher accuracy value than the Naive Bayes Classifier without TF-IDF.

Based on the studies that have been presented, this study aims to conduct a sentiment analysis of the Shopee marketplace with a dataset of Shopee user reviews on social media, Twitter, and using the Naive Bayes Classifier method and the addition of TF-IDF feature extraction for the sentiment classification process and testing using 10-fold cross-validation. This study aims to analyze sentiment trends and measure the performance of the classification model;

thus, it is hoped that it can be a reference for business actors to maintain the quality and development of Shopee services, and can be used as a reference for other parties or researchers who have an interest in similar cases.

II. LITERATURE REVIEW

A. Text Mining

Text mining is a subset of data mining, the main process of which is extracting knowledge and information from patterns contained in a collection of text documents using specific analysis tools [8].

B. Sentiment Analysis

This field studies people's opinions, sentiments, evaluations, behaviors, and emotions toward an entity such as a product, service, organization, individual, issue, topic, event, and their attributes [8].

C. Term Frequency-Inverse Document Frequency (TF-IDF)

TF-IDF is used to weight the relationship of a word or term to the overall review. The frequency of a word's appearance in a review indicates its importance within the review, allowing the review to be classified into the appropriate class [9]. TF-IDF is calculated using the following formula:

$$TFIDF = TF \times IDF$$

$$TF = \frac{word\ frequency\ in\ the\ document}{number\ of\ words\ in\ the\ document}$$

$$IDF = log\ (\frac{total\ number\ of\ docs}{number\ of\ docks\ containing\ the\ word})$$

D. Naïve Bayes Classifier

The Naive Bayes Classifier is a simple probabilistic classifier that calculates a set of probabilities by counting the frequencies and combinations of values from a given dataset. This algorithm assumes all variables are independent by considering the values of the class variables [10]. The following is the Naive Bayes formula:

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

E. K-Fold Cross Validation

K-Fold Cross Validation splits the data into k-fold data sets of equal size, and training and testing are performed k-fold [11].

F. Confusion Matrix

The Confusion Matrix is a performance measure for machine learning classification problems [12]. In performance measurement using the Confusion Matrix, four terms represent the results of the classification process [13]. These four terms are as follows:

1) True Positive (TP): If the actual data is positive, it is predicted to be positive.
2) False Negative (FN): If the actual data is positive, it is predicted to be positive.
3) False Positive (FP): If the actual data is negative, it is predicted to be positive.
4) True Negative (TN): If the actual data is negative, the predicted data is negative.

From the values in these terms, accuracy, precision, and recall can be obtained [14]. The following is an explanation of each value:

a. Accuracy: The accuracy value is a percentage that indicates how accurately the system can correctly classify data.

$$accuracy = \frac{(TP + TN)}{(TP + TN + FP + FN)}$$

b. Precision, the level of accuracy between the information requested by the user and the answer given by the system.

$$positive\ precision = \frac{TP}{(TP + FP)}$$

c. Recall, the sensitivity value is the quality of how complete the relevant results are displayed by the class prediction system.

$$positive\ recall = \frac{TP}{(TP + FN)}$$

G. Rapid Miner

RapidMiner is open source software. RapidMiner is a solution for performing analysis on data mining, text mining, and predictive analysis [14].

III. RESEARCH METHOD

Data mining stages, in the form of a process to understand what must be done to process raw data into useful knowledge[15]. This study used the Cross Industry Standard Process for Data Mining (CRISP-DM) for data analysis and processing. The stages of the research are visualized in Figure 1 below.

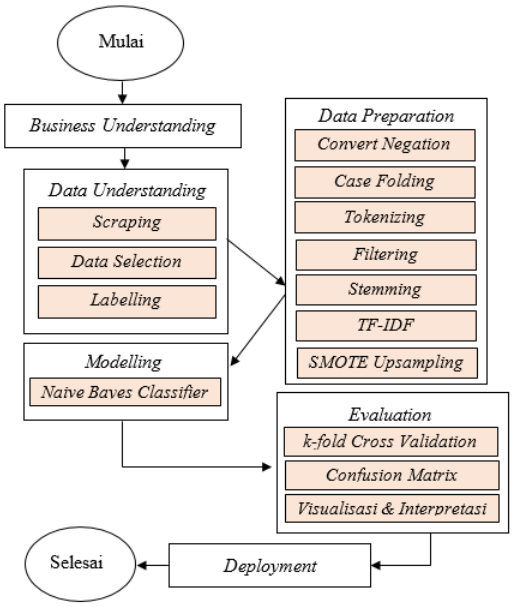

Fig. 1 Research Stages

This research was conducted in the following stages:

A. Business Understanding

This stage was conducted to identify the problem and objectives of the research, in this case, regarding Shopee user reviews on Twitter.

B. Data Understanding

This stage involved data collection on Twitter, data selection, and data labeling. Data collection was conducted using scraping techniques. The data used were Indonesian-language reviews of Shopee on Twitter, scraped using RapidMiner. The data was collected from January 12, 2021, to March 10, 2021. The collected data were then selected according to research needs and subject cleaning. Furthermore, it was labeled with sentiment labels (positive and negative), subject labels (buyer and seller), and object labels (shipping, promotions, applications, features, policies, payments, service, and product quality). Labeling was done manually using crowdsourcing methods, observing correct language guidelines.

C. Data Preparation

The data preparation stage involves text preprocessing, feature extraction using TF-IDF, and data balancing using SMOTE. Text preprocessing involves several steps, as follows:

1) Convert Negation: Changes the sentiment value if a negative word precedes a positive word or a negative word.
2) Case Folding: Converts the entire text in the document to a standard form, converting it to lowercase.
3) Tokenizing: Trims the input string based on each word.
4) Filtering: Removes high-frequency but meaningless words using a stopword removal algorithm.Stemming: Converts affixed words into base words according to correct Indonesian language rules.

D. Modeling

This process involves creating a data mining model using the Naive Bayes Classifier algorithm for data classification.

E. Evaluation

This stage involves testing the modeling results and visualizing the results. Testing is conducted to determine the effectiveness and ensure the system's performance. The Confusion Matrix and 10-fold Cross Validation are the testing methods that will be used.

F. Deployment

The deployment stage involves creating a final report on the knowledge and information obtained from all stages of the research.

IV. RESULT AND DISCUSSION

A. Business Understanding

The purpose of this research on Shopee marketplace sentiment analysis is to determine the pattern of user reviews of Shopee on Twitter and classify reviews into positive and negative sentiments, as well as to determine what needs to be improved for Shopee's development. The classification algorithm applied is the Naive Bayes Classifier with the addition of the TF-IDF feature. The data will be analyzed using the RapidMiner tool, and the results will be visualized using a word cloud for each sentiment, as well as providing suggestions based on the target category/review object.

B. Data Understanding

Data understanding is the stage of collecting and studying data. The data comprehension process is carried out to understand the data structure and how it is handled. Data understanding includes the following steps:

1) Collecting Dataset

The process of collecting Shopee review data on Twitter was carried out using a scraping technique using the Twitter API processed by RapidMiner. The data collected were Indonesian-language reviews from January 12 to March 10, 2022. Data collection was carried out based on the keywords '*old shopee*', '*fast shopee*', '*bad shopee*', '*good shopee*', '*discount shopee*', '*shopee admin*', '*shopeefood*', '*shopeepay*', '*difficult shopee*', and '*shopee shipping'*. The scraped data amounted to 55,586 review data.

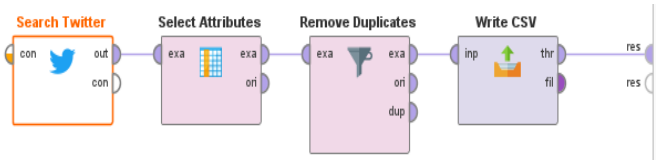

Fig. 2 Data Scraping Process in RapidMiner

Table. 1 Scraping Results Data

1	@yutaashin suka ada diskon juga kalau lewat shopee
2	Ini hape gue yg lemot apa sinyal gue yg jelek sih ?? Buka shopee daritadi loading banget ?? https://t.co/yLKgFA5aOw
3	@oceanwxvs aku beli sunset lamp, lama bener datengnya. ya kalo ga dikirim juga di shopee kan bisa ajukan pengembalian abang. jadi aku aman-aman aja sih. TAPI NUNGGUNYA ITU LOH GAK ENAK. ?
4	@shopeeid duh shopee express kenapa lama bgt sih kalo keluar kota? jarang update juga di app nya. niat mau nyoba ekspedisi baru tp malah zonk
5	RT @skincarecaca: Sebagai bucin hello kitty, udah lama lip tint somethinc ini ada di keranjang, akhirnya aku co deh, warnanya cakep dan cocok

2) Data Selection

Data selection was performed by removing data containing identical reviews or duplicate values, as well as data unnecessary for the research. The 55,586 scraped data still contained a number of duplicate values that needed to be removed to avoid disrupting the resulting data patterns. Before removing duplicate values, data cleaning was necessary by removing URLs, hashtags, mentions, symbols, and other unnecessary characters for more accurate results. The following is a screenshot of the data selection process in RapidMiner:

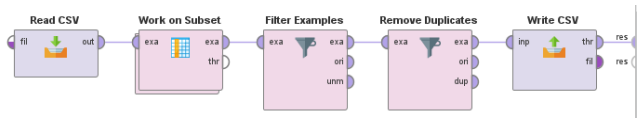

Fig. 3 Data Scraping Process in RapidMiner

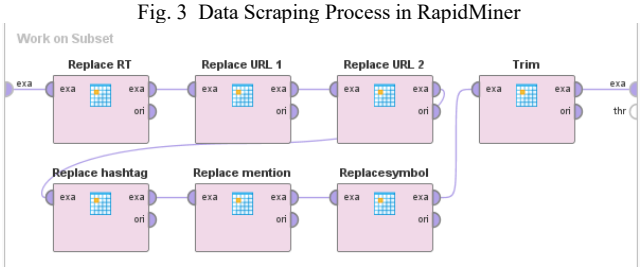

Fig. 4 Cleaning Process

3) Data Labelling

The dataset with a total of 1,629 data has been labeled with sentiment with the results of 420 positive data and 1,209 negative data, subject labels with the results of 1,405 data created by buyers and 224 data created by sellers, and object labels with the results of 220 reviews discussing applications, 134 reviews discussing features, 276 reviews discussing policies, 52 reviews discussing product quality, 91 reviews discussing service, 76 reviews discussing payment, 367 reviews discussing shipping, and 413 reviews discussing promotions.

C. Data Preparation

Because the data obtained is unstructured, text preprocessing will be performed at this stage to facilitate the classification and word weighting process using TF-IDF, as well as SMOTE upsampling to balance the data. The following are the steps in data preparation :

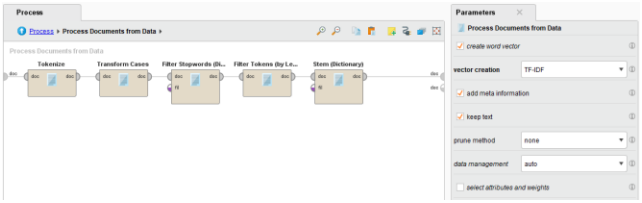

Fig. 5 Text-Processing

1) Convert Negation

Converting negation is done manually in Excel using the replace feature.

Table. 2 Convert Negation

gak bagus → gakbagus
gak suka → gaksuka
gak kecewa → gakkecewa
gak enak→ gakenak

2) Case Folding

The case folding stage converts the dataset to lowercase, and Table 3 below shows the results of the case folding process.

Table. 3 Case Folding

Data Input	Case Folding Result
Pengalaman yang terbaik jelas ada di SHOPEE dengan berbagai Promo	pengalaman yang terbaik jelas ada di shopee dengan berbagai promo

3) Tokenizing

The tokenizing stage involves chunking the dataset based on each word that makes it up, resulting in tokens. The tokenization results for the Shopee review dataset are 3,409 attributes or terms. Table 4 below is an example of the tokenization results.

Table. 4 Tokenizing

Data Input	Tokenizing Result
pengalaman yang terbaik jelas ada di shopee dengan berbagai promo	‘pengalaman’ ‘yang’ ‘terbaik’ ‘jelas’ ‘ada’ ‘di’ ‘shopee’ ‘dengan’ ‘berbagai’ ‘promo’

4) Filtering (Stopword Removal)

Filtering stopword removal removes words from a stopword dictionary. The stopword dictionary used is from www.kaggle.com. Here are some words that fall into the stopword category:

Table. 5 Stopword Dictionary

a	**b**	**c**	**d**	**e**
ada	bagi	caranya	dahulu	emang
adalah	bagai	cukup	dalam	enggak
adanya	bagaimana	cukuplah	dan	entah

After stopword removal, filtering was carried out, and the data, which previously had 3,409 attributes, was reduced to 2,204 attributes. Table 6 below shows an example of the results of the stopword removal filtering process.

Table. 6 Filtering Stopword Removal

Data Input	Hasil *filtering*
‘pengalaman’ ‘yang’ ‘terbaik’ ‘jelas’ ‘shopee’ ‘dengan’ ‘berbagai’ ‘promo’	‘pengalaman’ ‘terbaik’ ‘jelas’ ‘shopee’ ‘promo’

5) Filtering (By Length)

Filtering by length removes several words with a specific character length. In this case, the words

removed are those with fewer than (<) 4 characters and more than (>) 25 characters. After filtering by length, the number of attributes in the data is reduced to 1,886. Table 7 shows an example of the results of filtering by length.

Table. 7 Filtering by Length

Data Input	Hasil *Filtering*
'pengalaman' 'yang' 'terbaik' 'jelas' 'ada' 'di' 'shopee' 'dengan' 'berbagai' 'promo'	'pengalaman' 'yang' 'terbaik' 'jelas' 'shopee' 'dengan' 'berbagai' 'promo'

6) Stemming

In the stemming process, the stemming operator (dictionary) is used with dictionary input that is created manually by looking at the suffixed words in the dataset and the base words in the Big Indonesian Dictionary, as shown in the following image,

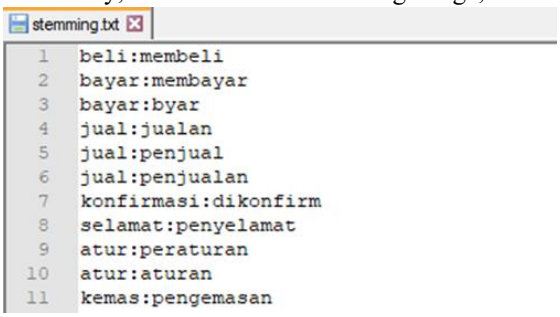

Fig. 6 Stemming Dictionary

After stemming the dataset, the number of attributes in the data was reduced to 1,178 attributes. Table 8 below is an example of the tokenizing results.

Table. 8 Stemming

Data Input	Stemming Result
'pengalaman' 'terbaik' 'jelas' 'shopee' 'promo'	'pengalaman' 'baik' 'jelas' 'shopee' 'promo'

7) SMOTE Upsampling

Synthetic Minority Oversampling Technique (SMOTE) is an oversampling method where data in the minority class is augmented using synthetic data derived from replicated minority class data. Using SMOTE, the sentiment-labeled data from 1,629 data sets became 2,418, as the initial 420 positive class data sets were replicated to 1,209.

D. Modelling

The modeling stage involves creating a data mining model in RapidMiner, which is shown in Figure 7.

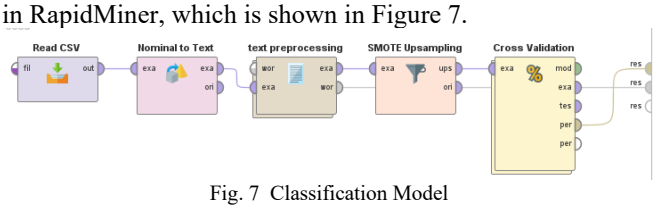

Fig. 7 Classification Model

Cross-validation will randomly divide the dataset into training data and testing data, and then group the data by K values. In the Cross Validation operator parameters section, set the number of folds to 10. In the cross-validation process, the training section is populated with the Naive Bayes operator, which applies the Naive Bayes Classifier algorithm to learn data patterns in the training data subset. Next, in the testing section, it is filled with the Apply Model and Performance operators. The Apply Model operator is used to apply a previously trained model using training data to the testing data, while the Performance operator is used to calculate and display the Confusion Matrix results from the model that has been created (accuracy level). Figure 8 below is a display of the process in cross-validation.

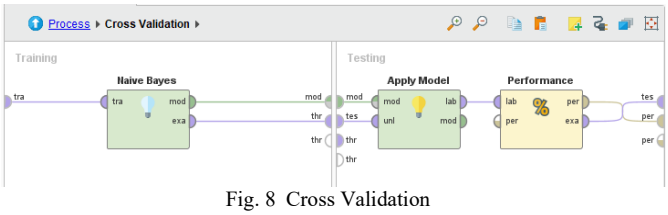

Fig. 8 Cross Validation

The classification model has been created, and all necessary data has been input, so the process is ready to run. Once the process is complete, the classification results will appear, as shown in Figure 9 below.

Row No.	Sentimen	prediction(Sentimen)	confidence(positif)	confidence(negatif)	text
1	negatif	negatif	0	1	lama fitur layan shopee kecewa
2	negatif	negatif	0	1	shopeepay mbanking lama mb...
3	negatif	negatif	0	1	potong ongkir shopeefood kura...
4	negatif	negatif	0	1	biaya admin shopee
5	positif	negatif	0	1	customer service tokopedia la...
6	positif	positif	1	0	bagus bayar pakai shopeepay ...
7	negatif	positif	1	0	shopeefood tidak ramah kanto...
8	negatif	negatif	0	1	gila shopee biaya admin freeo...
9	positif	positif	1	0	beli laptop shopee alhamdulill...
10	negatif	negatif	0	1	pesan shopeefood jam kaga a...
11	negatif	negatif	0	1	potong ongkir shopeefood kura...
12	negatif	negatif	0	1	shopee ribet checkout pakai vo...

Fig. 9 Classification Results Display in RapidMiner

E. Evaluation

In the evaluation phase, testing is conducted to measure the performance of the model. Testing was conducted using the cross-validation and Confusion Matrix methods. The values taken in this test are based on precision, recall, and accuracy. The Confusion Matrix from this test is shown in Table 9.

Table. 9 Classification Result Confusion Matrix

Class	Positive Prediction	Negative Prediction
Positive Actual	1.190 (TP)	19 (FN)
Negative Actual	363 (FP)	846 (TN)

From the Confusion Matrix in Table 9, the accuracy, recall, and precision values can be calculated as follows:

$$accuracy = \frac{(TP + TN)}{(TP + TN + FP + FN)} x100\%$$
$$= \frac{(1.190 + 846)}{(1.190 + 846 + 363 + 19)} x100\%$$
$$= \frac{2.036}{2.418} x100\% = 84{,}20\%$$

$$precision\ positif = \frac{TP}{(TP + FP)} x100\%$$
$$= \frac{1.190}{(1.190 + 363)} x100\%$$
$$= \frac{1.190}{1.553} x100\% = 76{,}63\%$$

$$precision\ negatif = \frac{TN}{(TN + FN)} x100\%$$
$$= \frac{846}{(846 + 19)} x100\% = \frac{846}{865} x100\%$$
$$= 97{,}80\%$$

$$recall\ positif = \frac{TP}{(TP + FN)} x100\%$$
$$= \frac{1.190}{(1.190 + 19)} x100\% = \frac{1.190}{1.209} x100\%$$
$$= 98{,}42\%$$

$$recall\ negatif = \frac{TN}{(TN + FP)} x100\%$$
$$= \frac{846}{(846 + 363)} x100\% = \frac{846}{1.209} x100\%$$
$$= 69{,}98\%$$

The sentiment classification accuracy was 84.20%, the precision was 87.21%, and the recall was 84.20%. RapidMiner displays the results in Figure 10 below.

accuracy: 84.20% +/- 2.70% (micro average: 84.20%)

	true negatif	true positif	class precision
pred. negatif	846	19	97.80%
pred. positif	363	1190	76.63%
class recall	69.98%	98.43%	

Fig. 10 Sentiment classification performance evaluation output

Next, evaluate the model for subject and object classification. Subject classification yielded an accuracy of 80.25%, and object classification yielded an accuracy of 58.64%. The performance evaluation output for subject classification is shown in Figure 11, and for object classification in Figure 12 below.

accuracy: 80.25% +/- 1.79% (micro average: 80.25%)

	true pembeli	true penjual	class precisio
pred. pembeli	854	4	99.53%
pred. penjual	551	1401	71.77%
class recall	60.78%	99.72%	

Fig. 11 Subject classification performance evaluation output

accuracy: 58.64% +/- 2.05% (micro average: 58.64%)

	true fitur	true promo	true pengi...	true pemb...	true kualit...	true kebija...	true aplik...	true pelay...	class pre...
pred. fitur	57	151	28	8	0	39	23	12	17.92%
pred. pro...	18	122	4	4	0	27	8	6	64.55%
pred. pen...	4	14	255	3	0	9	11	18	81.21%
pred. pem...	15	16	14	47	1	18	35	6	30.92%
pred. kuali...	5	1	7	0	412	1	16	2	92.79%
pred. kebij...	11	70	12	8	0	140	11	1	55.34%
pred. aplik...	12	13	19	6	0	7	94	6	59.87%
pred. pela...	12	26	28	0	0	35	22	40	24.54%
class recall	42.54%	29.54%	69.48%	61.84%	99.76%	50.72%	42.73%	43.96%	

Fig. 12 Object classification performance evaluation output

Furthermore, the model evaluation results are visualized in the form of word clouds and bar charts, along with data interpretation to facilitate understanding of the research. The word cloud visualization shown is the output of RapidMiner, and only the 100 most frequently occurring words are used. A word cloud visualization of all review data can be seen in Figure 13.

Fig. 13 Word cloud of all review data

In addition to describing the overall reviews, the interpretation of the information in this study will be discussed based on each sentiment. This is intended to be useful for Shopee marketplace stakeholders in maintaining the quality and improving its services.

1) Positive

A word cloud visualization of data classified by positive sentiment is shown in Figure 14.

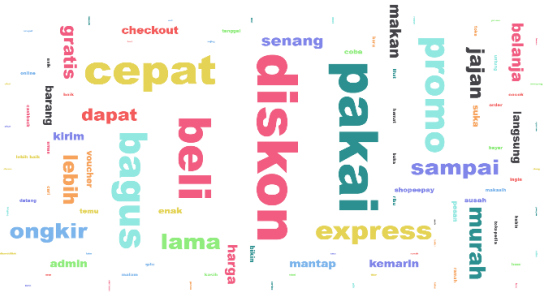

Fig. 14 Positive sentiment word cloud

Apart from word clouds, visualization is also carried out using a bar chart of term frequencies, which often appear in positive sentiments, as in Figure 15.

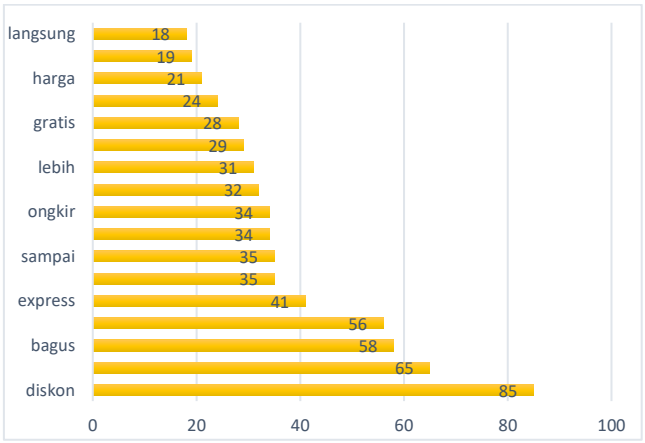

Fig. 15 bar chart of term frequency in positive sentiment

As seen in Figures 14 and 15, information obtained from 420 data points in the positive category reveals that the most frequently mentioned word is "discount," which was mentioned 85 times. The words "good," "happy," and "good" also express user satisfaction with the service provided by the Shopee marketplace.

Figure 16 below illustrates the number of positive sentiment data items grouped by subject and object labels. Figure 16 shows data with the most positive sentiments made by buyers with comments regarding promos provided by Shopee.

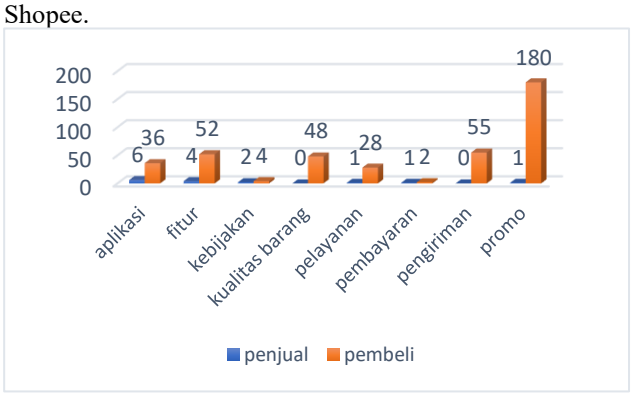

Fig. 16 object frequency bar chart by subject in positive sentiment

2) Negative

A word cloud visualization of data classified as negative sentiment can be seen in Figure 17.

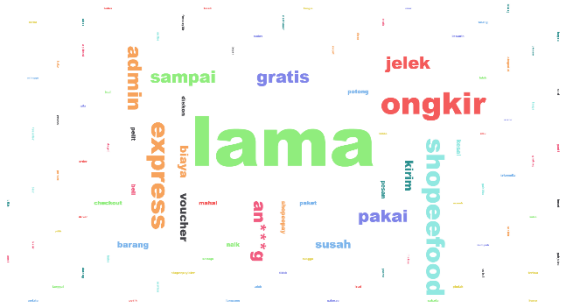

Fig. 17 Negative sentiment word cloud

Figure 18 will show a bar chart of term frequencies that frequently appear in negative sentiment.

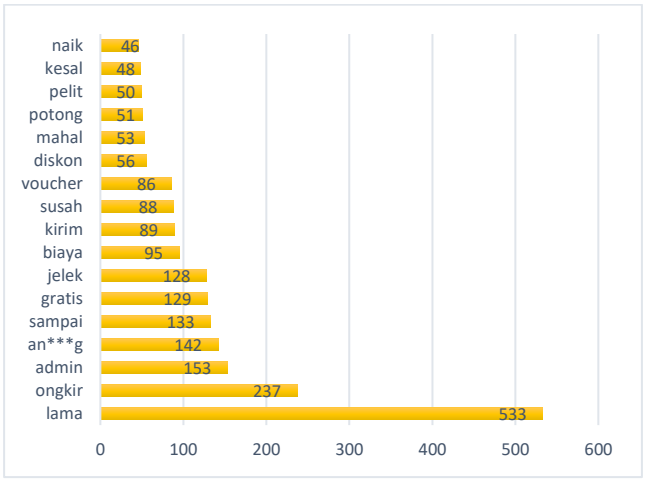

Fig. 18 bar chart of term frequency in negative sentiment

As seen in Figures 17 and 18, information obtained from 1,209 reviews in the positive category revealed several of the most frequently mentioned words: "lama" (old), mentioned 533 times. "jelek," "an***g," and "kesal" expressed user disappointment with the service provided by the Shopee marketplace. "mahal" and "ongkir" were used to comment on the policy of determining shipping costs, which were considered expensive. "pelit", "potong", "gratis", "ongkir", "susah", "diskon" and "voucher" were used to express user dissatisfaction with Shopee's promotions, which were perceived as decreasing daily.

Figure 19 below is a visualization of the total data on negative sentiment grouped by subject and object labels.

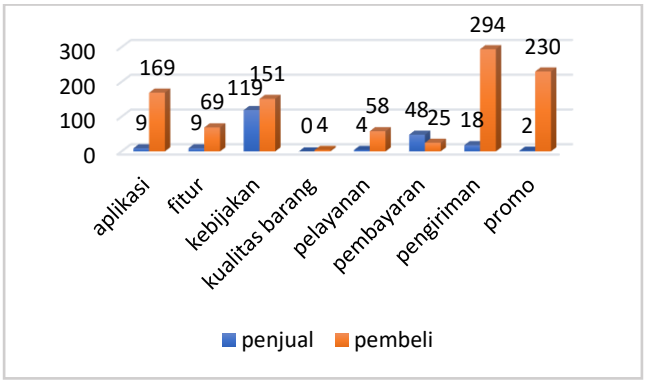

Fig. 19 object frequency bar chart by subject in negative sentiment

Figure 19 shows the review data with the most negative sentiment, written by buyers complaining about shipping by Shopee Express. Based on these negative reviews, the recommendations provided in this study are outlined in Table 10.

Table. 9 Troubleshooting suggestions for dealing with negative comments

No	Object	Problem	Suggestion Solution
1	Application	The application is slow or takes a long time to load, even though the internet connection is good, and the application size is too large.	Maximize and optimize application resources to avoid overloading the process.
		Frequent errors occur	Conduct more testing to minimize bugs and errors.
		The user interface is poor, and the bright colors are an eye-sore	Redesign the user interface and layout to be more attractive and choose colors that are easier on the eyes. You can also try adding a dark mode feature to the Shopee app.
2	Feature	Shopeefood takes a long time to find a driver.	Shorten the wait time. If the wait time exceeds, issue a warning that no driver was found, allowing the buyer to continue the order or cancel it. Another option is to add more Shopeefood drivers.
3	Policy	High admin fees for sellers and high service fees for buyers	Providing app users with an understanding that the service fees charged are reasonable to promote innovation and maintain the quality of Shopee's services.
		High shipping costs	Reducing the difference in shipping costs on the Shopee app compared to other marketplace apps.
		Can't select shipping method at checkout	Adding a shipping option for users to choose before making a payment.
4	Service	Customer service is slow to respond to messages and doesn't provide solutions to user complaints.	Provide affirmation or performance evaluation of customer service to effectively handle consumer questions and complaints.
		Refunds are difficult and take a long time to process.	Customer service should provide transparency regarding the refund process.
5	Payment	Sales funds are disbursed slowly.	Shorten the processing time for sales disbursements so sellers can quickly resume production.
6	Shipment	Shopee Express is slow to deliver packages.	Provide additional contact information for the warehouse or courier delivering the package to make it easier for buyers to inquire about the package's whereabouts.
7	Promo	Shipping discounts are reduced and limited by minimum purchases.	Shopee should be consistent in providing shipping subsidies by returning the initial subsidy in the free shipping promotion throughout Indonesia and not imposing spending restrictions to obtain the shipping subsidy.

F. Deployment

The research results can be used as evaluation material to improve the Shopee app based on the object category or target of the comments, thereby further improving user satisfaction. The user review classification model can also be developed into a machine learning application to automate the user review classification process. Furthermore, future research could also develop an application for the preprocessing stage to enable real-time classification.

V. CONCLUSION

Review data collected from January to March 2022 predominantly contained negative sentiment, accounting for 74% of the total data, and was primarily written by buyers, accounting for 86% of the total data, with the highest frequency of discussion regarding Shopee's promotions, accounting for 25% of the total data. Positive reviews expressed satisfaction with Shopee's services, with the words "bagus" 58 times, "senang" 24 times, and "mantap" 19 times. Furthermore, reviews discussed the low prices of goods or food on Shopee, as well as user satisfaction with Shopee's promotions, with the words "murah" 34 times, "diskon" 85 times, and "promo" 56 times. Negative reviews included complaints about package delivery issues, with the words "lama" 533 times, and complaints about high shipping costs, with the words "mahal" 53 times, and "ongkir" 237 times. Sentiment classification using TF-IDF and a Naive Bayes classifier, along with 10-fold cross-validation, yielded an accuracy of 84.20%, a precision of 87.21%, and a recall of 84.20%. Subject classification yielded an accuracy of 80.25%, a precision of 85.65%, and a recall of 80.25%. Object classification yielded an accuracy of 58.64%, a precision of 53.39%, and a recall of 55.07%.

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