

Sentiment Analysis on TikTok Shop Reviews Using Long Short-Term Memory Method to Find Business Opportunity

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Abstract— During the world-changing year of covid 19, social media commerce grew fast. The prolonged use of social media encourages users to make online purchases via social media. TikTok, the most downloaded social media app, offers its users a social media commerce experience, TikTok Shop. The TikTok shop provided a new option for business expansion. Business owners may optimize the potential use of TikTok shops by learning more about TikTok Shop. The purpose of this study is to use sentiment analysis to evaluate the business potential of TikTok Shop. The data from Google Play reviews is analysed using the LSTM algorithm. Based on the results of research conducted using a confusion matrix, the LSTM algorithm method using word2vec has an accuracy of 74%. This study found that the business prospects of TikTok shops may be challenging.

Keywords— TikTok shop; Business; Sentiment analysis; Social media commerce; LSTM algorithm.

I. INTRODUCTION

Modern technology and digital innovations have made significant revolutions. Many modifications have been made in many different business-related areas. Digital has become crucial for company continuity and growth during the long pandemic (COVID-19). Entrepreneurs and aspiring entrepreneurs need to comprehend various concepts, particularly when using digital data. A wealth of information is available in the digital world that may be used to grow a firm and discover business prospects. Opinions from the general public or future customers are crucial when a brand wants to develop or launch a new product. Learning behavioural trends and market perspectives on products is simple, thanks to the current growth of social media platforms. Using social media, we can gather consumer opinions about a brand, product, or event. In the digital age, social media is where people may share their feelings about numerous issues. They covered a wide range of topics, from universal to personal. Businesses and entrepreneurs can learn about trends, hear from customers, and understand what they want from a product. Social media analytics can extract the public's or consumers' opinions. With the array of tools, methods, and technologies available online, social media data analysis promotes open digital communication. Social media data analysis involves gathering and extracting existing data, structuring it according to specific patterns, and then making a prediction [1].

The new presence of TikTok shops is one of the business phenomena that this research wishes to investigate. The most popular social media platform in terms of downloads is TikTok. The platforms' popularity has skyrocketed as the COVID-19 pandemic broke out in 2020. People were required to isolate by staying at home. Seeking new hobbies to maintain mental health during this period, many turned to TikTok. This social media platform, known for its simplicity and organic

engagement, surged in popularity. TikTok introduced an e-commerce component called the TikTok Shop in line with its growing traction.

TikTok shop's uniqueness comes from the platform's unique features. TikTok shop is a social media shopping platform that mixes e-commerce with social media experiences. They offer new lifestyle buying options. TikTok shop is a game-changing new shopping solution that allows creators, brands, and merchants to promote and sell items directly through TikTok apps. In-feed videos, live streaming, and a page for product showcase are all available for sale activities. Their user experience and interactivity are innovative. TikTok's innovation and differences with its users have resulted in a new model favourable to small business users. This paper aims to examine the TikTok shop from the perspective of the user to determine the user's feelings about the existence of the TikTok shop. The primary goal of this study is to provide sentiment analysis that could potentially be used to find business opportunities.

II. RELATED WORK

A. Social Media Commerce

The tremendous expansion of e-commerce demonstrates today's customers' demand and opportunity. E-commerce has experienced the greatest growth, particularly between 2020 and now. This trend is backed by COVID-19, which alters people's purchasing habits and preferences. Based on Statista data (updated by June 2022), the graphs show the rise of e-commerce revenue. The data indicates the tremendous growth that occurred from 2020 to 2022. Customers' choices, online buying habits, and reasons for doing so are influenced by the COVID-19 pandemic [2]. During the COVID-19 pandemic, the growth of e-commerce was extremely rapid. Small businesses must exert considerable effort for rapid growth, especially in

managing their online store and other supporting resources. Lots of them weren't familiar with an online platform. Social media is becoming an option for numerous small business owners inexperienced with online selling. Social media has several advantages, including enhanced communication with others, effective marketing tools, and the ideal platform for knowledge sharing and collaboration [3].

Social media commerce became widespread a few years ago. Yahoo first popularized social media commerce in 2005, and flower.com officially adopted it in 2009 when it opened its first online store on Facebook [4]. In social commerce, social media platforms serve critical roles in business activities such as buying and selling, obtaining reviews and purchasing suggestions from trustworthy individuals, and online collaborations among several companies, sellers, and potential customers. Users of social media e-commerce generate and share as much information as possible, involving costs, product quality, seller credibility, and customer service [5].

The originality and characteristics of social media commerce are in communication and interaction, which creates a high-engagement environment [6]. Social media commerce enables consumers to share their opinions and experiences with products widely. The user could share their experience with the buying community and others who do not intend to buy. Social media commerce allows potential customers to access recommendations, feedback, and other product reviews quickly. Users may quickly compare prices and find the best deals using search navigation. Social media commerce enabled open interaction to be created. Customers, businesses, brands, sellers, and the general public all interact with one another. As a result, some information, such as positive or negative reviews, spreads quickly and is difficult to contain. Social media allows small businesses to increase their popularity, brand recognition, sales, advertising, and social connections [5]. Social media can increase customer trust and impact their purchase intent.

B. TikTok and TikTok Shop

Zhang Yiming founded the TikTok platform in 2016, which is named musical.ly. In 2017, Beijing Byte Dance Technology purchased the platform and rebranded it as TikTok. TikTok's rapid rise occurred globally in 2019 when people were dealing with the COVID-19 pandemic. TikTok provides a platform for users to share and live-stream videos they've created, along with several tools to make content creation easier. With its infinite scrolling structure, likes, and "For Your Page" features, the site provides an unlimited user experience [7]. TikTok provides its users numerous experiences and perks as a social media platform. TikTok identified with dances during the initial phase of platform development. Dancing is the most common activity on the platform [8]. Virtually the majority of the activities and video sharing are around dance. Recently, the platform's content and image have changed dramatically without losing its excitement.

TikTok's large user communities drive brand attention to the platform. TikTok has distinct values that incorporate several of the most important features of other social media apps. Its user-

friendly features are TikTok's biggest competitive advantage. Several factors contribute to TikTok's popularity, including algorithm technology, marketing plan effectiveness, and user needs match [9] [10]. Numerous brands, from small to large and well-known, have recently launched official TikTok accounts. With new features such as TikTok shop, the apps facilitate using TikTok for business purposes. TikTok has serious goals and completely supports its new product line. They fully support the TikTok shop by providing customers with numerous discounts offers. Not just for consumers. TikTok also provides merchants with various advantages, such as video promotion and live selling, among others. Previous research has found that social media sites such as TikTok significantly influence social media behaviour patterns [10]. TikTok is the most addicting social media platform, with a smart algorithm to back it up [11]. TikTok apps and their algorithms encourage new social media-addicted behaviour. Users tend to be warped and influence individual behaviour. Regarding purchasing habits, studies show that TikTok users are influenced to purchase more [12].

In alignment with the previous explanation, this study looked at the TikTok shop from customers' point of view. This research aims to discover how Indonesian users feel about the TikTok platform, particularly the TikTok shop.

C. Sentiment Analysis

Sentiment analysis is a field that examines the way reviewers express their ideas, sentiments, evaluations, attitudes, and emotions in writing. Generally, sentiments can be classified as positive or negative [13]. While sentiment analysis has various methods applicable to different domains, some notable applications include its use in movie reviews via the Support Vector Machine (SVM) method [14], gauging public reactions to the Indonesian National Team's participation in the 2020 AFF Cup using Naïve Bayes and K-Nearest Neighbour algorithms [15], and in e-commerce platforms like Shopee where the Recurrent Neural Network method was previously employed [16]. Out of the many sentiment analysis methods available, this study chose the LSTM method. This choice stems from LSTM's notable accuracy with text-based data. It is an RNN deep learning method advancement, with the added advantage of effectively processing extensive datasets and accommodating long-term dependencies [17].

Many previous studies have employed the LSTM approach for sentiment analysis. For instance, in a study [18], the LSTM (Long Short-Term Memory) method was utilized to classify sentiments related to Covid-19 vaccination on Twitter, distinguishing between positive, neutral, and negative sentiments. This study also incorporated the Word2Vec word embedding method as input, exploring the use of pre-trained Indonesian models derived from the Wikipedia corpus and trained on a specific dataset [18]. Another research [19] leveraged the LSTM method to analyse sentiment in TripAdvisor reviews, aiming to classify visitor feedback concerning the impact of COVID-19 on tourist destinations in Bali. Additionally, researchers in a study [20] conducted an

LSTM-based analysis of reviews on Arab hotels. These reviews, written in Modern Standard Arabic (MSA), were subjected to Latent Semantic Analysis (LSA) and Chi-Square calculations.

III. RESEARCH METHODOLOGY

This descriptive research describes an object to be studied and the results of sentiment analysis and tests to be performed. This study applies a quantitative technique approach, with the LSTM algorithm producing numbers and graphics.

A. Research Flow

Based on the flow from Figure 1, the research begins with data collection using web scraping techniques with Google-Play-Scraper. The data collected is then filtered using the keywords TikTok shop to get the data that fits the needs of this research. Data will be given labels to differentiate between categories.

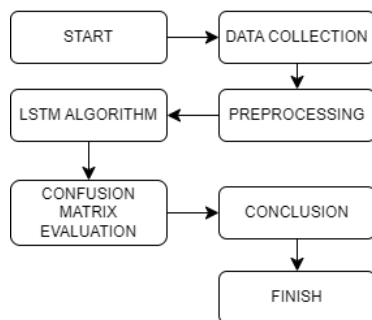


Figure 1. Research Flow

After labelling, the data will proceed to the pre-processing stage. This step is crucial as it transforms raw data into a format suitable for analysis. The word2vec method will be employed to extract features from the pre-processed datasets. Word2vec operates on the deep learning principle of representing words as vectors; moreover, using word2vec for feature extraction often leads to higher classification accuracy. Following that, the LSTM technique will be employed for sentiment evaluation. The LSTM method is favoured because it preserves information across longer sequences and addresses the vanishing gradient problem. Each word, represented as a vector (word vector), is fed into the LSTM unit sequentially, following the order of the review file. Upon obtaining the LSTM results, they will be evaluated using the Confusion Matrix to ascertain accuracy, precision, recall, and F1-score. Once the data is accurately gathered, it will be analyzed to conclude.

B. Method of Collecting Data

In this research, we employed the scraping technique to gather data. The data was collected using Python, aided by the Google-Play-Scraper library. Table I provides a sample of the collected data, which has not been filtered using the keyword "TikTok shop".

TABLE I
SAMPLE DATA

No	Content
1.	<i>Beberapa aplikasi pemutar video telah kucoba sebelumnya, tetapi tidak berfungsi - tidak memuaskan, tidak seperti yang ini! Saya benar-benar bisa menikmati video sekarang dan yang saya sukai. Walaupun ada iklan tapi tidak mengganggu karna tidak banyak dan masih bisa di loncati / skip. Sangat mudah di gunakan dan saya memakainya juga untuk mencari tambahan duitsaku dgn mengerjakan misi misi yang di sediaka aplikasi, jadi dgn apl ini hiburan sy bisa peroleh dan cuan pun demikian bisa sy dpat</i>
2.	<i>Sumpah demi apapun sekarang tiktok ini menjadi aplikasi terfavorit gue. Karena tiktok ini tuh dari tiktok shop nya banyak banget gratis ongkir voucher-voucher dan harga yang nggak masuk akal dan juga sekarang di tiktok banyak banget fitur-fitur yang biar filter-filter nya tuh yang bagus dan sekarang aku lebih happy aja sama tiktoknya sekarang daripada yang dulu enjoy bye</i>
3.	<i>Sangat bagus, aplikasi tiktok ini memberikan banyak inspirasi. Saya menemukan berbagi macam inspirasi editing saya dari aplikasi ini. Selain itu aplikasi ini juga sangat amat berguna bagi kita yang ingin memulai hal hal baru, di karenakan di tiktok ini banyak sekali orang orang yang selalu memberikan ilmu pengetahuan baru untuk kita semua. Saya sangat merekomendasikan aplikasi ini</i>

IV. RESULT AND DISCUSSION

This section will describe the data collection, pre-processing, and other phases of this research. These are the outcomes of each completed stage:

A. Data Collection

We use web scraping techniques and the Python programming language to collect data at this stage. Table II displays the results of the web scraping process. A total of 156,215 data points were collected through web scraping. This dataset includes columns such as "reviewId," "userName," "userImage," "content," "score," "thumbsUpCount," "reviewCreatedVersion," "at," "replyContent," "repliedAt," and "appVersion," providing us with a comprehensive and diverse set of information for analysis and research attempts. Once collected, the data is refined by removing unnecessary columns. Several columns, including "reviewId," "userName," "userImage," "thumbsUpCount," "reviewCreatedVersion," "at," "replyContent," "repliedAt," and "appVersion," have been removed to streamline and focus the dataset for our research purposes, leaving only the "content" and "score" columns for display. These chosen columns, "content" and "score," contain the critical information needed for our research analysis, allowing us to work with a more relevant dataset while removing unnecessary data that does not directly contribute to our research aims. Table III displays the outcome after removing non-essential columns. Afterward, the data is narrowed down using the "TikTok shop" keyword. Once the "TkTok shop" keyword filter is applied, the number of entries drops to 1,229 from the initial 156,215. The refined data's results can be seen in Table IV.

TABLE II
WEB SCRAPING OUTCOME

	reviewId	userName	userImage	content	score	thumbsUpCount	reviewCreatedVersion	at	replyContent	repliedAt	appVersion
0	f75b1b19-e73e-4224-9a3c-bd9dd9072a20	Firman kojotz	lh.googleusercontent.com/a/AACHTL...	Beberapa aplikasi pemutar video telah kucoba s...	5	278	29.7.2	2023-05-25 00:26:44	NaN	NaN	29.7.2
1	3b028d59-77d3-4995-8435-5cb02d6b89bf	pareCode	lh.googleusercontent.com/a-/AD_cM...	Semua sdh bagus tapi saran sedikit ketika upda...	5	914	29.6.4	2023-05-23 17:25:28	NaN	NaN	29.6.4
2	e8f85a8b-6702-4070-a576-ef0db41f3058	Saskia Puspita Sari	lh.googleusercontent.com/a/AACHTL...	Setelah di update kenapa ya Tik tok nya jadi s...	4	1848	29.6.4	2023-05-23 06:35:24	NaN	NaN	29.6.4
3	027278d7-3078-481f-85da-44fa97161c69	渡辺Kayfa	lh.googleusercontent.com/a-/AD_cM...	Gilaa makin parah bug ny, padahal kalo masalah...	2	1357	29.6.4	2023-05-23 12:12:55	NaN	NaN	29.6.4
4	35f3f8e7-c32e-417d-994b-47ac82345098	IsiKode	lh.googleusercontent.com/a-/AD_cM...	Termasuk salah satu apk yg bisa nyenengin ada ...	5	8853	29.3.4	2023-05-12 00:19:29	NaN	NaN	29.3.4
...
156210	91843880-6b13-462d-bf15-a0e7a5610406	Pengguna Google	lh.googleusercontent.com/EGemoI2N...	Tolong lah sesuaikan yg ngflow sma di pp nya ...	2	0	9.3.5	2020-01-17 05:05:05	Hai, maaf untuk ketidaknyamanannya. Silakan k...	2020-01-18 02:58:29	9.3.5
156211	418cbab7-d610-4277-99c1-6e73f0abd05c	Joko Suroso	lh.googleusercontent.com/a/AACHTL...	bagus kali cuk apalagi pas ada animasi vernalta	5	0	NaN	2021-04-02 11:29:17	NaN	NaN	NaN
156212	099fb731-86a4-48fa-b8e4-3c5bad410da2	Dio Pbs73	lh.googleusercontent.com/a/AACHTL...	Dear developer apk nya bagus. Tapi Tolong oran...	5	0	NaN	2020-11-02 02:21:39	NaN	NaN	NaN

TABLE III
DATA AFTER DELETING UNNECESSARY COLUMNS

	content	score
0	Beberapa aplikasi pemutar video telah kucoba s...	5
1	Semua sdh bagus tapi saran sedikit ketika upda...	5
2	Setelah di update kenapa ya Tik tok nya jadi s...	4
3	Gilaa makin parah bug ny, padahal kalo masalah...	2
4	Termasuk salah satu apk yg bisa nyenengin ada ...	5
...
156210	Tolong lah sesuaikan yg ngflow sma di pp nya ...	2
156211	bagus kali cuk apalagi pas ada animasi vernalta	5
156212	Dear developer apk nya bagus. Tapi Tolong oran...	5
156213	Saya sering post vidio di tik tik tapi kenapa ...	5
156214	Emang kece abis sih ni tik tok gak download rugi	5

156215 rows × 2 columns

TABLE IV
DATA WITH KEYWORD TIKTOK SHOP

	content	score
64	Akhir akhir ini lemot parah padahal sinyal mau...	4
104	Tolong di perbaiki bugnya dong, saya pengguna ...	1
144	tiba' keluar sendiri dari tiktok trs pas masuk...	2
149	Males amat kadang, udah di klik tidak tertarik...	1
266	Tiktok tolong ditambihin penjualan hewan hidup...	5
...
153388	Kecewa karena di akun ku gabisa akses ke tikto...	2
153938	Ini sangat berguna apalagi sekarang udah ada ti...	5
155610	Kok tiktok sy gak ada tiktok shop yah...?? Gmn...	4
155972	Di tik tok lite gk ada tik tok shop tpi di tik...	5
156067	Saya mau beli barang di tiktok shop tapi ga bi...	1

1229 rows × 2 columns

B. Pre-processing

The initial step involves classifying the data based on score values and segmenting them into negative and positive labels. Data with a score ranging from 4 to 5 is labelled as positive, while data between 1 and 3 is designated as negative. Table V showcases the labelled data. Subsequent data cleaning is performed to remove extraneous text, which improves the data's quality and results in more precise details. During the next step of pre-processing, several procedures are carried out, including:

a) Case Folding:

- Lowercase: Convert text with capital letters to an all-lowercase format.
 - Remove Numbers: Eliminate numeric characters from the text.
 - Remove Punctuation: Discard punctuation characters from the text.
 - Remove Whitespace: Delete empty characters or spaces from the text.
- b) Sentence Separation: The Split () method divides the string into a list. By default, it uses a space as a separator if none is provided.

- c) Filtering: This step involves selecting words deemed significant. The process uses the Sastrawi tool.

TABLE V
LABELLED DATA

	content	value
0	Akhir akhir ini lemot parah padahal sinyal mau...	positif
1	Tolong di perbaiki bugnya dong, saya pengguna ...	negatif
2	tiba' keluar sendiri dari tiktok trs pas masuk...	negatif
3	Males amat kadang, udah di klik tidak tertarik...	negatif
4	Tiktok tolong ditambahin penjualan hewan hidup...	positif
...
1224	Kecewa karena di akun ku gabisa akses ke tikto...	negatif
1225	Ini sangat berguna apalagi sekaran udah ada ti...	positif
1226	Kok tiktok sy gak ada tiktok shop yah...?? Gmn...	positif
1227	Di tik tok lite gk ada tik tok shop tpi di tik...	positif
1228	Saya mau beli barang di tiktok shop tapi ga bi...	negatif

1229 rows × 2 columns

C. LSTM Algorithm

The first stage involves displaying the pre-processing data from the previous stage. Then check how much data each label has: negative has 674 and positive has 555 with type int64.

Furthermore, the data shows how much data is non-null in each row; if the number is smaller, the row contains null values on the Data Frame object from the Pandas library. There are 1229 rows in this Table. Each row contains two columns, which are labelled as follows: "content" and "value". Both columns have object data type (string). There are no missing values in any columns. The memory usage for this Table is around 19.3+ KB.

Moreover, to prevent overfitting, the data is split based on labels. The negative label is an example, with 539 instances for training and 135 for testing. For the positive label, are 444 instances designated for training and 111 for testing. After the splitting, the data sets are recombined for training and testing purposes. The consolidated training data comprises 539 negative labels and 444 positive labels. In contrast, the merged testing data consists of 135 negative and 111 positive labels.

The next step involves generating the Word2Vec model after merging the data. This model is trained on training data to produce word representation vectors using parameters such as embedding dimensions, window sizes, and learning methods. Text is vectorized using TensorFlow, combined with a tokenizer to convert into a sequence of integers. This sequence is subsequently transformed into a NumPy 2D array. The pad sequences method transforms the list into this NumPy 2D array, while text to sequences convert each text within a body of text into a sequence of integers. The resulting forms (or shapes) for X_train and X_test is (983, 90) and (246, 90), respectively.

Embedding matrices are constructed to link words in the vocabulary with their corresponding representation vectors. The size of this matrix is (10,000, 1,000). The Word2Vec model is employed to acquire word vectors that align with the vocabulary. Word2Vec reduces the dimensionality of word space by encoding each word into a dense vector with a fixed number of dimensions. This allows for vector operations like addition, subtraction, and cosine similarity. Since it's trained on vast amounts of text data, Word2Vec can generalize effectively to previously unseen words or contexts. Furthermore, it is task-agnostic, making it suitable as a feature representation for various NLP tasks, including sentiment analysis, text categorization, machine translation, and more.

The LSTM Model is the next stage. Whereas the first is to develop an LSTM architecture, the LSTM Architecture uses the Embedding layer to turn input text into a vector representation with dimensions of 1000. Following that, two LSTM layers turn input text with a length of 171 words into output with dimensions of 128. In addition, the model employs a Dropout layer to reduce overfitting, a Batch Normalization layer to normalize input, and a Dense layer to do linear transformation. Finally, the last dense layer generates predictions for the three classes. This model has 10,718,530 parameters, 718,274 of which can be changed (trainable) and 10,000,256 cannot (non-trainable).

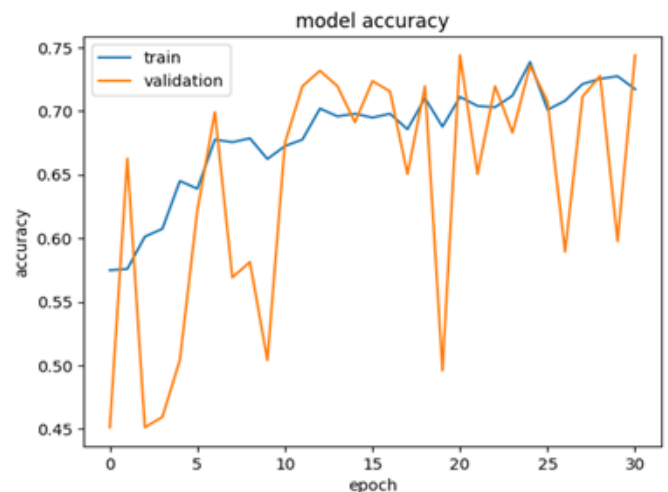


Figure 2. Train Accuracy and Validation

The model is then trained using training data and evaluated using validation data. The batch size (batch size) is 32, and the epoch is 100. The loss value after compilation is 0.5248, with an accuracy value of 0.7439. Epoch automatically terminates at epoch 31 because it applies the early stopping function to terminate the data training process when an overfit occurs. Figure 3 depicts the accuracy of the train and validation. Figure 4 depicts the loss train and validation.



Figure 3. Loss Train and Validation

D. Evaluate Confusion Matrix

The results of the confusion matrix evaluation from the LSTM model in Figure 5.

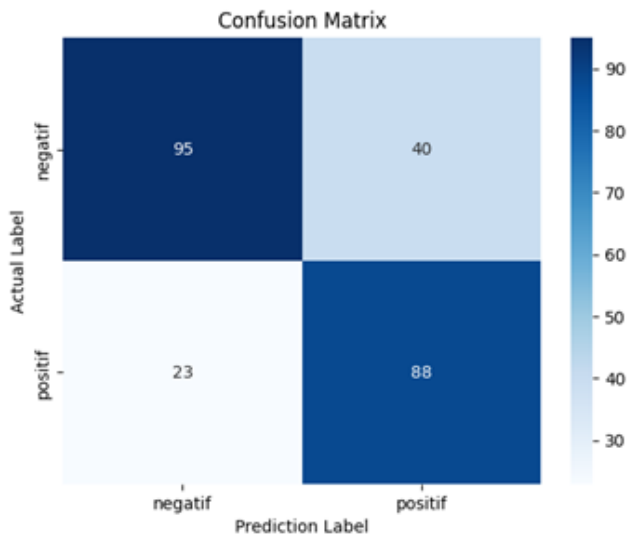


Figure 4. Confusion Matrix

The accuracy value for the training and validation data is 74% based on the process mentioned above. Figure 6 shows the outcome of this process.

	precision	recall	f1-score	support
0	0.81	0.70	0.75	135
1	0.69	0.79	0.74	111
accuracy			0.74	246
macro avg	0.75	0.75	0.74	246
weighted avg	0.75	0.74	0.74	246

Figure 5. Confusion Matrix Calculation Results

The calculations above gave negative evaluation results with an accuracy of 70.37% and positive evaluation results with an accuracy of 79.28%.

V. CONCLUSION

Bahasa pemrograman Python, metode LSTM, dan penyematan kata Word2Vec berhasil menganalisis analisis sentimen bisnis TikTok. In experiments involving 1,229 review data points, 674 users provided negative reviews, while 555 gave positive reviews. These findings suggest that users are more inclined to leave negative reviews for TikTok shops. Research results from the confusion matrix indicate that the LSTM algorithm, when paired with word2vec, achieves an accuracy of 74%.

Based on the information provided, the business prospects for the TikTok shop may be challenging. The negative sentiment shown by users and the relatively poor accuracy of the sentiment analysis model indicates potential areas for improvement for the business. However, while analyzing business prospects, examining other elements such as customer happiness, market demand, competition, product quality, pricing, customer retention, and marketing techniques is critical. It is also encouraged to do additional analysis, collect more data, and integrate these findings with relevant business insights to acquire a more profound knowledge of the TikTok shop's potential.

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