

## SENTIMENT ANALYSIS FOR USER REVIEW POLRI HOSPITAL REGISTRATION APP

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**Abstract** – *The POLRI Hospital registration application is an application used to register and get health services at the POLRI Hospital. Sentiment analysis research can identify the most common complaints about the app. Additionally, it helps app developers improve user experience and fix issues. as part of the application assessment that has been used. This study uses the Naive Bayes method to collect complaint data from users of the POLRI Hospital registration application. This is done using the Google Play store platform. The results of using a model with 100 test data show that the model can categorize all evaluation data for POLRI Hospital registration applications into classes 29, 68 negative, and 3 neutral. The comparison value between positive, negative and neutral evaluations is 3:6:1. In conclusion, 68% of registration application users feel that the application does not make it easy for them to register patients.*

**Keywords:** *Sentiment Analysis, Naïve bayes, Opinion mining, NLP, Text Mining*

### I. INTRODUCTION

Technological developments and application adoption make it possible to use data analytics to collect unstructured data. In the era of big data, opinion mining and sentiment analysis (OMSA) has been used to assess public mood and divide opinion into different types of sentiment. (Apriani et al., 2019)(Zhang et al., 2016) One of the studies conducted on the My Pertamina Application used sentiment analysis to find out the tendency of users' Twitter comments about Peralite's purchasing policy. The results of the study using the Naive Bayes Classifier Method showed that the value of complaint comments increased on the MyPertaminaID Twitter account. The Naive Bayes method is a fairly good text mining classification method. This is due to the fact that this technique can achieve a very high degree of accuracy.(Arsi et al., 2021) The POLRI Hospital Registration Application allows members and the general public to register and obtain health services at POLRI hospitals. Polri hospitals (Polri Health) are a network of hospitals managed by the Indonesian National Police (POLRI) and located in various regions in Indonesia. Thus,

the National Police Hospital is included in the category of health services owned by the government. In the context of network strategy, sentiment analysis can help social management practices. It is used to express citizen opinion, which is expressed on Twitter and relates to important social programs during the Brazilian government of Rousseff.(Daffa Rhajendra<sup>1</sup> & Trianasari, 2021). It is difficult to track all activity in sentiment analysis, as it is one of the fastest growing areas of computer science research.(Diekson et al., 2023) Several researchers have used the Naive Bayes Algorithm to perform sentiment analysis. (Filemon et al., 2021), (Hirata & Matsuda, 2023), (J & U, 2023), (Maria et al., 2023), (Nugraha et al., 2020), (Ratnawati, 2018), (Tinaliah & Elizabeth, 2022) . The results show that the naive Bayes algorithm has a fairly high level of accuracy.

**Table 1.** Sentiment Analysis Research

Source	Result	Method	Data Set
(Maria et al., 2023)	Evaluation of public perceptions about using the My PERTAMIN A App. This study found an accuracy of 82.96%, an accuracy of 81.17%, a recall of 86.07%, and an AUC of 0.906.	<i>Naïve Bayes Classifier</i>	<i>Twitter</i>
(Apriani et al., 2019)	Evaluation of Tokopedia Application Comments. good accuracy performance of 97.13% with a precision value of 1, while Class Recall produces a value of 95.49% (positive class,	<i>Naïve Bayes</i>	<i>Google Play store</i>

Source	Result	Method	Data Set
	negative value). In addition, the AUC value is 0.980		
(Tinaliah & Elizabeth, 2022)	According to sentiment analysis reviews on the Jamsostek Mobile Application, it has an accuracy of 96 percent, accuracy of 92 percent, recall of 96 percent, and an f1 score of 94 percent.	<i>Support Vector Machine</i>	<i>Google Play store</i>
(Ratnawati, 2018)	Algorithm Implementation for Film Opinion Sentiment Analysis: The system can perform sentiment analysis with 90% accuracy with details of 92% accuracy, 90% recall, and 90% f-measure.	<i>Naive Bayes</i>	<i>Twitter</i>
(Daffa Rhajendra <sup>1</sup> & Trianasari, 2021)	Evaluate customer reviews to improve Bukalapak is services. The results of sentiment analysis using the Naïve Bayes Classifier (NBC) show an accuracy value of 83%, a precision value of 82%, a recall value of 80.33%, and an f1-score value of 80.66%.	<i>Naive Bayes</i>	<i>Twitter</i>
(Arsi et al., 2021)	Results of Sentiment	<i>Naive Bayes</i>	<i>Twitter</i>

Source	Result	Method	Data Set	Source	Result	Method	Data Set
	Analysis for Moving the Capital: The results of this study indicate that this sentiment analysis has an accuracy value of 94.33%. By conducting this analysis, it is expected to identify issues related to the debate on moving the capital city. Therefore, this analysis can be used as a reference for further evaluation.	<i>Classifier</i>			89%, a precision of 83%, and a recall of 87%.		
(Nugraha et al., 2020)	Method (Case Study: Public Opinion on New Normal Policy) for Twitter Sentiment Analysis The results of five classification accuracy tests using the Naive Bayes classification averaged 62.6%, while the classification accuracy test with the addition of RFFS averaged 65.3%.	<i>Naive Bayes with Relevance Frequency Feature Selection</i>	<i>Twitter</i>	(Diekson et al., 2023)	Analysis of customer perception of reviews: Traveloka case study Our classification method found, based on 1,200 collected tweets, 610 positive tweets and 590 negative tweets each had a relatively high score; however, positive tweets have a higher score than negative tweets.	<i>Support Vector Machine Naive Bayes Logistic Regression</i>	<i>Twitter</i>
(Filemon et al., 2021)	E-Government Application Sentiment Analysis: The test results using the Naive Bayes algorithm with TF-IDF weighting show an accuracy of	<i>Algorithm Naive Bayes</i>	<i>Google Play</i>	(Hirata & Matsuda, 2023)	The results of Twitter's data sentiment analysis were used to investigate logistics developments in Japan after the pandemic. The results show that sentiment towards the word "logistics" is usually positive. The main positive sentiment is caused by the efforts made by relevant government agencies to support and encourage white logistics	<i>Bert Model</i>	<i>Twitter</i>
				(J & U, 2023)	A hybrid method is used to analyse	<i>Pearson correlation coefficient-based</i>	<i>Amazon User Reviews</i>

Source	Result	Method	Data Set	Source	Result	Method	Data Set
	Amazon user reviews. Experimental results show that the proposed PCCHH-RNNLSTM shows significant improvement with 95.2% F-measurement, 95.8% accuracy, 95.4% precision and 95.6% recall.	<i>Harris Hawks Optimization – based Recurrent Neural Network-Long Short-Term Memory (PCCHHO-RNN-LSTM) algorithm</i>			influence of three variables on sentiment analysis, including the distribution of sentiment polarity, the language model employed, and the model setting utilized.	(neural net), and PV (neural net).	<i>platform for health-related forums. Typically, each forums exhibit a distinct thematic concentration, such as diabetes, heart disease, and arthritis health forum</i>
(Windarto, 2017)	Implementation of Rice Import Data Mining by the majority Country of origin. The experimental results show that Centroid data for high import level clusters are 7429179.9 and 2735452.25, medium import level clusters are 1046359.5 and 337703.05, and low import level clusters are 185559.425 and 53089.225	K-Means Clustering Method	<i>Directorate General of Customs and Excise</i>	(Yang et al., 2016)	The performance of conLDA surpasses that of the classic LDA, since it effectively clusters pertinent medical phrases and related queries together.	Latent Dirichlet Allocation (LDA), conLDA, (C-topic).	
(Zheng et al., 2018)	This study aims to employ sentiment analysis as a method to investigate the dynamics and assess the influence of online health support groups.	SVM, logistic regression, AdaBoost and Neural Networks	<i>Facebook</i>	(Dales et al., 2021)	This study aims to conduct an analysis of the observed changes, discern patterns, and ascertain the causal factors behind these trends, specifically examining if they can be attributed to the COVID-19 pandemic or external influences.	the vader model	<i>Social media tools - Twitter</i>
(Zhang et al., 2016)	The present study aims to examine the	NBSVM (n-gram), RNNLM	<i>A web crawler-based</i>	(Shi et al., 2020)	This study used sentiment analysis and topic modelling to capture social bots' sentiment engagement in distinct topics in online discussions	Linguistic Inquiry and Word Count (or LIWC)	<i>Twitter platform</i>

Source	Result	Method	Data Set
(Gohil et al., 2018)	of COVID-19. Moreover, 4 out of the 12 tools were trained using a smaller sample of the study's final data. The sentiment method was trained against, on an average, 0.45% (2816/627,024) of the total sample data. One of the 12 papers commented on the analysis of accuracy of the tool used	Multiple methods are used for sentiment analysis of tweets in the health care setting	Twitter health care research

Sentiment analysis is the government's way of knowing what people think. Public opinion can be positive, negative, or neutral.(Maria et al., 2023) In addition, research shows that the use of social media can increase the engagement index of local governments in Indonesia. (Kusumawati et al., 2022) Companies, governments and other groups benefit from sentiment analysis. (Apriani et al., 2019)

This study aims to identify patient complaints regarding upcoming medical examinations at the National Police Hospital through the application of the Naive Bayes Algorithm. This study will additionally aid application developers in assessing the level of acceptance of patient registration applications at the National Police Hospital.

## II. METHODS

This research must complete six steps. This includes collection, manual labeling, preprocessing, TF-IDF weighting, data separation for training and test data, classification using the Naive Bayes algorithm,

and data evaluation. System output can be classified into one of three emotional categories: Positive, Neutral, or Negative.



Figure 1. Research Methodology

### Data Collection Preparation

The process of collecting and inputting data in this system begins with scraping web data. This data comes from the Google Play Store and consists of 100 comments. For this study, 20 percent of the exercise data was derived from the 20 prior datasets, and 100 percent of the test data were derived from the 100 prior datasets. Once collected, data is manually labelled as positive, neutral, or negative.

### Preprocessing

One of the preprocessing stages, which consists of several stages, is eliminating problems that can interfere with the results of data processing, namely:

- Case Folding: Change text to lowercase, remove extra characters, username or mention of user (@), hashtag (#), and comment URL or link.
- Filtering: There's no point wasting words from the token results. Punctuation marks and stop words are also removed. Stop words are also omitted if there are words that often come out and are considered unimportant in a sentence, such as time, connectors, etc
- Stemming: At this point, the affixes are replaced with root words.
- Tokenizing: At this point, each word is separated according to the spaces found.

### Transformation

In the word extraction process, TF-IDF (Term Frequency-Inverse Document Frequency) uses common word calculations on data retrieval to produce word weights. This weighting method combines the frequency term and the inverse frequency document. Terms that frequently appear in documents are called frequency.

$$W_{tf_{i,d}} = \begin{cases} 1 + \log_{10} tf_{t,d}, & \text{if } tf_{t,d} > 0 \\ 0, & \text{if } tf_{t,d} = 0 \end{cases} \quad (1)$$

$$idf_i = \log_{10} \frac{n}{Df_i} \quad (2)$$

$$W_{t,c} = W_{tf_{i,d}} \cdot idf_i \quad (3)$$

*Information:*

$W_{tf_{i,d}}$  = Word weight in each document

$tf_{i,d}$  = The number of occurrences of the term in the document

N = The total number of documents

Df = The number of documents containing the term

$idf$  = Inverse weights in df values

$W_{t,d}$  = TF-IDF weighting

### Data Sparation

The labeled data is divided into two: training data and test data. The author divides the training and test data into two for two reasons: the first is that the amount of training data is smaller than the amount of test data; the second is that the amount of training data is greater than the amount of test data.

### Analisa dan Evaluasi

At this evaluation stage, we will use the confusion matrix to find out the results of the Naive Bayes algorithm accuracy performance, which includes accuracy, precision, and recall. Confusion Matrix is a method for measuring the performance of a classification model. The formulas used are accuracy (1), precision (2), recall (3) and F-measure (4) as follows:

$$\text{Accuracy} = \frac{TP+TN}{(TP+FP+FN+TN)} \quad (1)$$

$$\text{Precision} = \frac{TP}{TP+FP} \quad (2)$$

$$\text{Recall} = \frac{TP}{TP+FN} \quad (3)$$

$$\text{F-measure} = \frac{2 \times \text{precision} \times \text{recall}}{\text{Precision} + \text{recall}} \quad (4)$$

*Information:*

*True Positive (TP)* is the amount of data with a positive value that is correctly predicted as positive,

*True Negative (TN)* is the amount of data that has a negative value and is correctly predicted to be negative, *False Positive (FP)* is the amount of negative data but is predicted to be positive,

*False Negative (FN)* is a data set that has a positive value but is predicted to be negative

The Naive Bayes algorithm is used to classify this research. This algorithm is based on Bayes' Theorem, which is derived from Bayesian statistics with strong independent assumptions.

### Visualisasi

We use a word cloud to visually display the most common words.

## III. RESULTS AND DISCUSSION

This section describes the results and discussion of sentiment analysis using the Naive Bayes Classifier algorithm. In this study the data used was obtained directly from the Police Hospital Registration Application on Google Play. After the data collection process, 100 reviews were obtained and the labeling process was carried out manually using positive, neutral and negative labels. As shown in table.2. The Police Hospital Registration Application gets negative reviews from users, shown in Fig. 2

**Tabel 2.** Dataset

Sentimen	Amount
Positif	27
Netral	8
Negatif	65

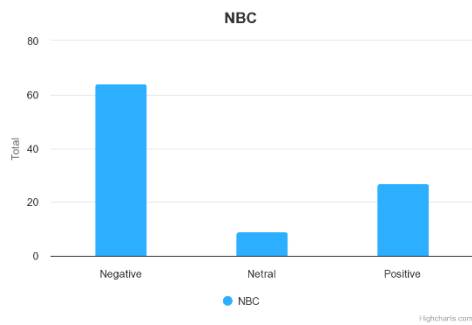


Fig. 2. Results of User Reviews with the Naive Bayes Classifier Method

### Data collection

This study uses 100 data, some as training data and some as test data. For the data collection stage for user reviews of the Polri Hospital registration application, the web scraping technique is used. To retrieve the data using Google Collab with the program code as below:

```
!pip install google-play-scraper

from google_play_scraper import app
import pandas as pd
import numpy as np

from google_play_scraper import Sort,
reviews
result, continuation_token = reviews(
'etransmedic.reservasi.polri.kramatjat
i',
    lang='id', # defaults to 'en'
    country='id', # defaults to 'us'
    sort=Sort.NEWEST, # defaults to
Sort.MOST_RELEVANT you can use
Sort.NEWEST to get newst reviews
    count=100, # defaults to 100
    filter_score_with=None # defaults
to None(means all score) Use 1 or 2 or
3 or 4 or 5 to select certain score
)
```

Fig. 3. Program Code for Scraping Data

Furthermore, data labelling is made positive, neutral, and negative, and the process is done

manually. This labelling is called data training and is tested by data assessment.

Tabel 3. Review Data Labeling

Label	Teks
Positif	Bagus
Netral	Kok bukan erikke SIM ya
Negatif	Sangat lambat loading terus. Tolong perbaiki sistemnya ya!!!

### Preprocessing

The initial stage of text processing is preprocessing, which is carried out to extract interesting information from unstructured data and remove useless words from documents. There are four stages in the data preprocessing process: case folding, filtering, tokenizing, and stemming.

- a. Case folding is the data processing stage to make all letters lowercase. Table 4 shows the results of the case folding stage.

Tabel 4. Case Folding

Teks	Teks
Minta tolong dong di perbaiki..stiap kali mau daftar kok di bilang koneksi buruk padahal sinyal lancar.butuh banget daftar online kek gini apalagi saya punya baby,butuh banget nomor antrian yg cepat,harus ningalin baby jam 6 pagi di rmh hanya ambil nomor antrian..	minta tolong dong di perbaikistiap kali mau daftar kok di bilang koneksi buruk padahal sinyal lancarbutuh banget daftar online kek gini apalagi saya punya babybutuh banget nomor antrian yg cepatharus ningalin baby jam pagi di rmh hanya ambil nomor antrian

- b. Filtering: get the word out of the insignificant token yield. Punctuation and stop words are removed as well. If a sentence contains words that often come out and are considered unimportant, such as time, liaisons, etc., stop words are also omitted.

Tabel 5. Filtering

Teks	Teks
Minta tolong dong di perbaiki..stiap kali mau daftar kok di bilang koneksi buruk padahal	minta tolong dong perbaikistiap kali mau daftar kok bilang koneksi buruk padahal sinyal

<p>signal lancar..butuh banget daftar online kek gini apalagi saya punya baby,butuh banget nomor antrian yg cepat,harus ningalin baby jam 6 pagi di rmh hanya ambil nomor antrian..</p>	<p>lancarbutuh banget daftar online kek gini apalagi punya babybutuh banget nomor antrian cepatharus ningalin baby jam pagi rmh hanya ambil nomor antrian</p>
---	---

- c. Stemming: At this point, the affixes are replaced with root words;

Tabel 6. Stemming

Teks	Teks
<p>Minta tolong dong di perbaiki..stiap kali mau daftar kok di bilang koneksi buruk padahl signal lancar..butuh banget daftar online kek gini apalagi saya punya baby,butuh banget nomor antrian yg cepat,harus ningalin baby jam 6 pagi di rmh hanya ambil nomor antrian..</p>	<p>minta tolong dong perbaikistiap kali mau daftar kok bilang koneksi buruk padahl signal lancarbutuh banget daftar online kek gin apalagi punya babybutuh banget nomor antri cepatharus ningalin baby jam pagi rmh hanya ambil nomor antri</p>

- d. Tokenizing: At this stage, each word is separated according to the spaces found.

Tabel 7. Tokenizing

Teks	Teks
<p>Minta tolong dong di perbaiki..stiap kali mau daftar kok di bilang koneksi buruk padahl signal lancar..butuh banget daftar online kek gini apalagi saya punya baby,butuh banget nomor antrian yg cepat,harus ningalin baby jam 6 pagi di rmh hanya ambil nomor antrian..</p>	<p>Minta tolong dong di perbaikistiap kali mau daftar kok di bilang koneksi buruk padahl signal lancarbutuh banget daftar online kek gini apalagi saya punya babybutuh banget nomor antrian yg cepatharus ningalin baby jam pagi di rmh hanya ambil nomor antrian</p>

### Transformation

In the transformation stage, data is converted into a form that can be processed.(Moh Khoirul Insan et al., 2023).

### Data Separation

The data is divided into two parts: training data and test data. In this study, the amount of data separation was 8:2, which consisted of 20%

test data and 80% training data from 100 data that were successfully scrapped from Google Play.

Tabel 8. Data Separation

Review Data	Amount
Train Data	80
Test Data	20

### Analysis and Evaluation

Evaluation and classification analysis using the Naive Bayes algorithm. In the process of sentiment analysis for the Police Hospital Patient Registration application, the Confusion matrix generated from the test data of 20 data is shown in Table 9.

Tabel 9. Confusion Matrix Result

		Predictive		
		Positive	Negative	Neutral
Actual	Positive	25	2	0
	Negative	63	1	0
	Neutral	9	0	0

As shown in the information in Table 9, out of 100 data predicted using the Naive Bayes Classifier algorithm, there were 25 predicted positive review data, 2 positive review data predicted as negative reviews, 1 negative review data predicted as positive reviews, and 63 correctly predicted negative review data. The results of calculating the classification evaluation based on the confusion matrix are shown below:

### Negative:

$$\text{Accuracy} = \frac{63+2}{(63+34+1+2)} = \frac{65}{100} = 0.65 \times 100\% = 65\%$$

$$\text{Precision} = \frac{63}{63+34} = \frac{63}{97} = 0.649 \times 100\% = 64.9\%$$

$$\text{Recall} = \frac{63}{63+1} = \frac{63}{64} = 0.984 \times 100\% = 98.4\%$$

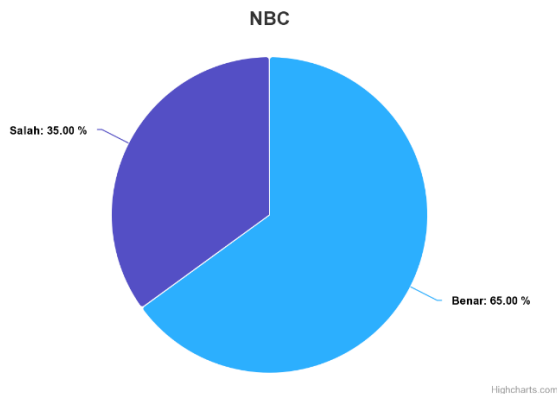


**Positive:**

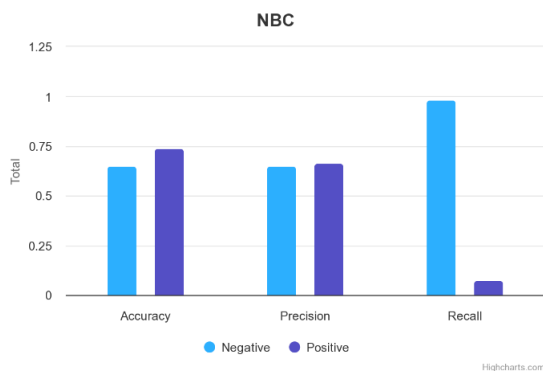
$$\text{Accuracy} = \frac{2+72}{(2+1+72+25)} = \frac{74}{100} = 0.74 \times 100\% = 74\%$$

$$\text{Precision} = \frac{2}{2+1} = \frac{2}{3} = 0.667 \times 100\% = 66.7\%$$

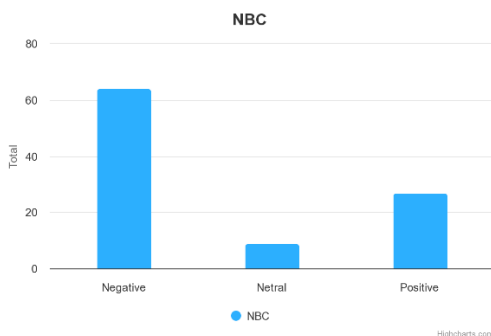
$$\text{Recall} = \frac{TP}{TP+FN} = \frac{2}{2+25} = 0.074 \times 100\% = 7.4\%$$



**Fig. 4.** Accuracy results using the Naïve Bayes Classifier Algorithm



**Fig. 5.** Positive Accuracy Comparison Diagram and Negative Accuracy



**Fig. 6.** Diagram of User Reviews of the Police Hospital Registration Application

**Visualizes**

The results of preprocessing data are used to describe words that are often used by users of the Polri Hospital Registration Application. This data visualization is carried out on all data both positive and negative and neutral. Data visualization is presented in wordcloud form.



**Fig. 7.** Word Cloud Sentiment Analysis User Reviews of the Police Hospital Registration Application

**IV. CONCLUSION**

This study found the Naive Bayes classification technique to analyze sentiment reviews of users of the Polri Hospital application, using data from Google Play scrapping which includes one hundred reviews. And divided by 80% for training data and 20% for testing data, it produces an accuracy value of 65% for negative sentiment reviews and 25% for positive sentiment reviews. With an execution time of 0.22803783416748 s, the Bayes classification algorithm can be used to get a better accuracy value.

The results of the sentiment analysis of the Polri Hospital Patient Registration Application can help application developers to improve the infrastructure and appearance of the application so that users are more comfortable using it. This is because this application is needed by patients at the Police Hospital

## V. ACKNOWLEDGEMENT

Thanks to for Universitas Kristen Satya Wacana for supporting the research.

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