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Sentiment Analysis of Public Comments on Coldplay Concerts on Twitter Using the Naïve Bayes Method

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ABSTRACT

Twitter had become a major platform for communication and information sharing, especially for entertainment events like music concerts. Fans actively shared their experiences about Coldplay concerts on Twitter, leading to a variety of comments and opinions. These comments required thorough understanding to interpret the overall public sentiment, which was crucial for event organizers and Coldplay's management to evaluate and improve future concerts. Due to the brevity and diversity of Twitter comments, manual data processing was inefficient, necessitating automated tools for sentiment analysis. Sentiment analysis, or opinion mining, is used to automatically process text data to gather sentiment information from opinion sentences. Using the Naive Bayes (NB) approach, this study frequently focuses on sentiments that are labeled as positive or negative. The purpose of the study was to use the Naive Bayes approach to assess the sentiment of public comments on Coldplay performances on Twitter. It sought to provide insights into public sentiment towards Coldplay concerts, aiding event organizers and the band's management in evaluating and enhancing future events. Test data consisting of 120 samples showed an accuracy rate of 72.5%, indicating the model's effectiveness in predicting or classifying the test data accurately. Analysis of the collected comments revealed that the majority were positive regarding Coldplay's arrival in Indonesia. Out of 491 data points, 314 comments were positive (63.95%) and 177 were negative (36.05%). The public predominantly commented positively about Coldplay's arrival.

Keywords: Coldplay, Comments, Naive Bayes, Sentiment Analysis, Twitter

INTRODUCTION

One of the most widely utilized social media sites for public communication and information sharing is now Twitter (Putri & Romli, 2021). In entertainment events such as music concerts, Twitter became a bustling space filled with various comments and opinions from the public about their experiences attending these concerts (Ariawijaya & Nugrahani, 2020). Coldplay, one of the most famous bands in the world, frequently attracted significant attention from their fans, who actively shared stories, photos, and videos from the concerts on Twitter (Harisnanda et al., 2023).

Initially, Twitter limited message length to 140 characters. However, in 2017, this limit was expanded to 280 characters, which is now referred to as a "tweet." These tweets contained users' opinions and views on various events. Twitter was then used to voice opinions on social activities, provide information about traffic, weather, natural disasters, and alert about ongoing phenomena (Rizkina & Hasan, 2023).

Comments on Twitter about Coldplay concerts were highly diverse, and processing this data manually to understand public sentiment was an inefficient task (Sinaga, 2023). Event organizers and Coldplay's band managers required a method to understand public feelings about their concerts to conduct evaluations and improvements for future events.

Sentiment analysis became a crucial tool to comprehend the emotions and reactions of the public towards an event or a particular topic (Puad et al., 2023). Sentiment analysis demonstrated the effectiveness of the Naive Bayes approach, one of the classification techniques based on the Bayes theorem and the assumption of variable independence. This study employed the Naive Bayes approach to analyze the sentiment of user comments on Coldplay performances on Twitter.

The technique of mechanically deciphering and analyzing textual material to derive information about sentiment within opinions was known as sentiment analysis. Twitter sentiment analysis of comments made during the Coldplay concert might offer insightful information on how the public felt about the performance overall, whether it was viewed positively, negatively, or neutrally. The urgency of this research arose from the need to evaluate event performance, offering practical feedback for the organizers and Coldplay's management regarding the audience's response and impressions of the event. Sentiment analysis also assisted in decision-making for future event planning by evaluating

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public perception and identifying trends or changes in public preferences to enhance future concert experiences.

This research considered two time periods for sentiment analysis: before and after the event. Before the event, sentiment analysis aimed to identify the audience's expectations and anticipation for the concert, which could be used to adjust promotional strategies and event preparations. After the event, sentiment analysis assessed the actual responses and experiences of the audience, providing an accurate picture of satisfaction and areas needing improvement. The method employed for sentiment analysis in this study was Naive Bayes, which was effective in predicting sentiment from text based on Bayes' theorem with the assumption of variable independence.

This study sought to shed light on how the public felt about the Coldplay concert and give essential details for both event planners and the band's supporters by employing the Naive Bayes approach to analyze the sentiment of Twitter comments on the performance. The results of this sentiment analysis would provide benefits for event organizers and the band's management in evaluating and improving the quality of future events, as well as for fans to understand the extent to which the Coldplay concert succeeded in delivering its message and creating a satisfying experience. Therefore, this research emphasized the importance of sentiment analysis both before and after the event to obtain a comprehensive understanding of public responses.

LITERATURE REVIEW

Previous studies conducted on Sentiment Analysis of Netizen Comments on the Disbandment of NCT 127 Concert Using Naive Bayes Method yielded processed Twitter data amounting to 2451 entries, focusing on the disbandment topic of NCT 127 with data collected between November 4-6, 2022. The data processing aimed to understand how Twitter users commented on the issue (Rizkina & Hasan, 2023).

Subsequently, in the study of Sentiment Analysis with Naïve Bayes on Tokopedia Application Comments, it was found that the Naive Bayes method effectively automated sentiment analysis. Testing was conducted in real-time using a built application and rapidminer, where each word was classified into positive or negative sentiment categories (Apriani & Gustian, 2019).

In comparison with Previous Research, this study offers several distinctions and innovations regarding Sentiment Analysis of Public Comments on Coldplay Concerts on Twitter using Naive Bayes Method. Firstly, it focuses on sentiment analysis of Coldplay concerts, a topic distinct from previous studies on NCT 127 concerts and Tokopedia applications. This demonstrates diversification in applying Naive Bayes method across various relevant contexts and topics. Secondly, this study utilized public comments data from Twitter related to Coldplay concerts, whereas previous research may have used different platforms or data contexts, showcasing method adaptation to different platforms and expanding the relevance of sentiment analysis applications across diverse digital environments. Thirdly, the study illustrates that manual sentiment data processing is inefficient, thus applying Naive Bayes to classify sentiments from these comments emphasizes automation and efficiency in sentiment data analysis. Lastly, the research aims to provide in-depth insights into public perceptions of Coldplay concerts, with the goal of offering valuable information for event organizers and band managers for future evaluation and improvement. The focus on practical application of research findings in entertainment industry and event management underscores the direct relevance of the study's outcomes in broader contexts. Thus, the innovation of this research lies in applying Naive Bayes method to specific music concert topics (Coldplay), implementing it on Twitter platform, automating sentiment analysis, and developing methodologies for sentiment analysis application in varied digital contexts.

METHOD

In this research method, the research steps used are the design or outline stages employed in the study. The research framework is as follows:

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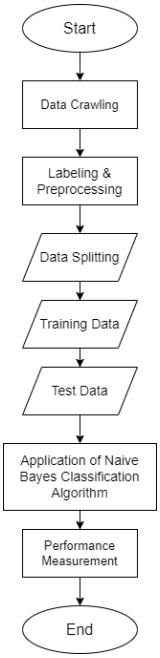

Fig 1 Research Framework

Based on the framework above, several stages can be outlined. In the initial step of the research process, literature was gathered to identify the problem, and comments from Twitter social media accounts were collected using data crawling techniques. Subsequently, all collected data were labeled to determine the sentiment of the comments obtained. Next, a preprocessing stage was conducted to select and transform the data into structured data. This preprocessing stage consisted of four steps: cleaning, stopword removal, tokenization, and stemming. The next step involved feature extraction to facilitate the process of training the Naïve Bayes Classifier. The subsequent crucial step was to perform the Naïve Bayes classifier process. This stage commenced with the classification process based on the sentiments present in the documents. After completing all preceding steps, a model was generated which would subsequently be utilized to demonstrate the accuracy of the classification results. Following this, the next stage involved model testing, aimed at measuring the classification performance. Once the model testing was completed, an evaluation of the model was conducted by assessing the accuracy level of the method using confusion matrices and accuracy tables for each model.

Naïve Bayes

Naïve Bayes, rooted in the probability theory by British scientist Thomas Bayes, is a classification method/tool used in data mining to predict future events. It assumes strong independence conditions for each condition/event. Despite not fully assuming independence among words in documents, Naïve Bayes Classifier performs relatively well in classification tasks (Huda et al., 2020).

Naïve Bayes Classifier, a probabilistic and simple statistical classification method, computes a set of probabilities by summing the frequencies and combinations of values from a given dataset (Simanjuntak et al., 2022). It relates to simple probability theory, a branch of probabilistic mathematics used to define models with uncertain data, aiming for interesting outcomes by combining knowledge from experimental results and observational evidence (Faizah et al., 2023). The general formula of Bayes' Theorem can be seen in Formula 1 below:

$$P\ (C|X) = \frac{P(x|c).P(c)}{P(X)} \qquad (1)$$

Formula 1 can be understood as follows: x stands for data that is unknown in class, and c for the data's specific class hypothesis. In the meantime, p(h) represents the likelihood of hypothesis h based on condition p(posterior probability), and p(h) represents the probability of hypothesis h (prior probability). In the case of $P(x|c)$, it denotes the likelihood of x with respect to the hypothesis c, while $P(x)$ denotes the likelihood of x (Pratiwi et al., 2020).

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RESULT

Data Collecting

The initial step involves data retrieval regarding public responses to Coldplay's planned visit to Indonesia using the Twitter/X application. Data retrieval employs crawling techniques, an automated method for collecting data from specific websites or applications using specific keywords. In this study, data crawling will be conducted using Python and Node.js programming languages, assisted by the tweet-harvest package. This package functions to gather Twitter data based on specified search keywords and desired time ranges.

The sentiment data retrieval process uses keywords "Coldplay Indonesia" and "Konser Coldplay" for crawling data. Tweets were collected between May 2023 and January 2024, resulting in 491 filtered tweets that will be analyzed to understand public sentiment regarding Coldplay's visit to Indonesia.

The crawled data results will be stored in an Excel file with columns such as created_at (tweet upload time), full_text (tweet content), lang (language used), user_id_str (user's Twitter ID), username (Twitter username), tweet_url (tweet link), and others. In the sentiment analysis process, only the full_text attribute will be utilized. Below are some of the data obtained from the data crawling process:

Table 1
Crawling Data Results

No	Full Text	username
1	Sebagian petinggi Majelis Ulama Indonesia (MUI) meminta Pemerintah melarang band coldplay manggung di Indonesia. Alasannya mereka mendukung hak-hak kaum LGBT. Menjijikkan sekali https://t.co/VxgZjNC9pw	saifulmujani
2	Erick Thohir Ketua Umum PSSI mengumumkan harga tiket pertandingan sepakbola Indonesia vs Argentina. Nominalnya membuat netizen kaget karena tergolong murah dibandingkan tiket Coldplay. Tiket coldplay mahal banget	detikinet
3	Wasekjen PA 212 Novel Bamukmin menolak konser Coldplay bukan tanpa alasan. https://t.co/eH47ARJ5Jj	himahiudayana
…	…	…
18	Nunggu kabar coldplay batal tampil di Indonesia. Gabisa bayangin mas Chris bawa bendera pelangi di GBK	plsleavemyx
19	Kadang-kadang syyuka syedihh kalau ngelihat musisi dunia pada nge-skip konser di Indonesia. Tapi mas chris malah mau konser di indonesia. Terima kasih mas chris pengen banget liat coldplay konser di indonesia #taylorswift #coldplay #musisi #konser #event #indonesia #singapura #pinterpolitik #beritapolitik #infografis #politik #politikIndonesia https://t.co/wJeVovxucp	pinterpolitik

Preprocessing Data

In sentiment analysis, data preprocessing is crucial to clean and prepare crawled data for analysis (Prasetyo et al., 2023). This stage reduces noise and ensures that the data used is representative and relevant, achieved through several common steps.

Text Cleaning

The cleaning process was carried out to purify the text comments within the dataset, making the data more structured and suitable for sentiment analysis. This included removing punctuation marks, symbols, numbers, special characters, hashtags, URLs, and other irrelevant elements (Batubara & Nasution, 2023).

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Ro...	full_text
1	Sebagian petinggi Majelis Ulama Indonesia (MUI) meminta Pemerintah melarang band coldplay manggung di Indonesia. Alasannya mereka mendukung hak-hak kaum LGBT. Menjijikkan sekali https://t.co/VxgZjNC9p
2	Erick Thohir Ketua Umum PSSI mengumumkan harga tiket pertandingan sepakbola Indonesia vs Argentina. Nominalnya membuat netizen kaget karena tergolong murah dibandingkan tiket Coldplay. Tiket coldplay
3	Wasekjen PA 212 Novel Bamukmin menolak konser Coldplay bukan tanpa alasan. https://t.co/eH47ARJ5Jj
4	PT Garuda Indonesia menyambut baik event besar di Indonesia mulai dari KTT ASEAN kehadiran Timnas Argentina hingga konser Coldplay. Acara tersebut dinilai dapat meningkatkan jumlah penerbangan ke Indo
5	....ayo retweet netizen 62 dampak konser Coldplay akan mempromosikan LGBT di Indonesia â€¼ï¸ini akan berdampak buruk bagi Indonesia
6	Mayoritas publik Indonesia menerima rencana kedatangan Coldplay. Banyak yang menantikan kehadiran band tersebut. https://t.co/rXwgtNhDFV
7	Astagfirullah jijik orang begini mau concert'di Indonesia Coldplay. Tolak coldplay pro LGBT
8	BIARKAN SAJA NANTI PAK JOKOWI DAN SANDIAGA UNO DAN YANG MENYETUJUI KONSER COLDPLAY DI INDONESIA YG AKAN DIMINTAI PERTANGGUNG JAWABAN NYA DI AKHIRAT. MEREKA PRO LG..
9	SMRC: Mayoritas Publik Indonesia Menerima Kedatangan Coldplay https://t.co/ekYX3VY1CO
10	Ketika Coldplay mengumumkan akan datang ke Indonesia banyak nih teman-teman saya yang langsung berburu tiket sepertinya sangat antusias menyambut kedatangan mas chris
11	Males nonton nanti Coldplay bawa bendera LGBT di Indonesia
12	APAKAH KONSER COLDPLAY ITU LEBIH BERGENGSI BUAT NEGARA DAN BANGSA INDONESIA? TIDAK BUKAN? HATI2 KARENA POLEMIK YG MENGGAMBARKAN adaNYA PERTIKAIAN PETINGGI2 NEGA..
13	ga tau mau blng apa yg didalam komunitas emang ga pada tau apa gmna bingung pertemuan di Indonesia jelas atuh anyinggg coldplay aja mau dilarang karena pro LGBT
14	banyak yang nolak konser coldplay karena pernah mempromosikan bendera lgbt lo. Kata aku bagusan ditolak saja si
15	banyak yang nolak kedatangan coldplay karena pro kaum pelangi
16	Pemerintah fokus nge banned coldplay, padahal mah gapapa sih konser doang yang penting dibatasin
17	Pildun maupun konser Coldplay akan mempunyai dampak positif bagi perekonomian Indonesia. Terima saja kedatangan coldplay. #Sindonews #news .https://t.co/eLvC4ElzbR

Fig 2 Sentiment Data

Image above depicted raw sentiment data obtained from crawling. This data appeared unprocessed and unsuitable for sentiment analysis modeling. Therefore, a dataset cleaning process was necessary to ensure optimal results for sentiment analysis modeling. Below outlines the steps for text cleaning using the RapidMiner application.

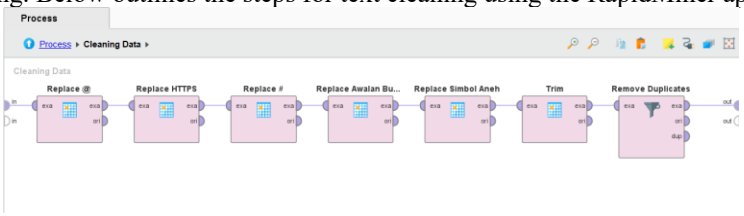

Fig 3 Dataset Cleaning Process

Figure 3 displayed the operators utilized in the RapidMiner application to conduct dataset cleaning. The operators employed included the replace operator used for removing unnecessary characters, the trim operator utilized for eliminating whitespace, and the remove duplicate operator for eliminating duplicate comments.

Row No.	full_text
1	Sebagian petinggi Majelis Ulama Indonesia MUI meminta Pemerintah melarang band coldplay manggung di Indonesia Alasannya mereka mendukung hakhak kaum LGBT Menjijikkan sekali
2	Erick Thohir Ketua Umum PSSI mengumumkan harga tiket pertandingan sepakbola Indonesia vs Argentina Nominalnya membuat netizen kaget karena tergolong murah dibandingkan tiket Coldplay Tiket co
3	Wasekjen PA 212 Novel Bamukmin menolak konser Coldplay bukan tanpa alasan
4	PT Garuda Indonesia menyambut baik event besar di Indonesia mulai dari KTT ASEAN kehadiran Timnas Argentina hingga konser Coldplay Acara tersebut dinilai dapat meningkatkan jumlah penerbangan k
5	ayo retweet netizen 62 dampak konser Coldplay akan mempromosikan LGBT di Indonesia ini akan berdampak buruk bagi Indonesia
6	Mayoritas publik Indonesia menerima rencana kedatangan Coldplay Banyak yang menantikan kehadiran band tersebut
7	Astagfirullah jijik orang begini mau concertdi Indonesia Coldplay Tolak coldplay pro LGBT
8	BIARKAN SAJA NANTI PAK JOKOWI DAN SANDIAGA UNO DAN YANG MENYETUJUI KONSER COLDPLAY DI INDONESIA YG AKAN DIMINTAI PERTANGGUNG JAWABAN NYA DI AKHIRAT MEREKA P
9	SMRC Mayoritas Publik Indonesia Menerima Kedatangan Coldplay
10	Ketika Coldplay mengumumkan akan datang ke Indonesia banyak nih temanteman saya yang langsung berburu tiket sepertinya sangat antusias menyambut kedatangan mas chris
11	Males nonton nanti Coldplay bawa bendera LGBT di Indonesia
12	APAKAH KONSER COLDPLAY ITU LEBIH BERGENGSI BUAT NEGARA DAN BANGSA INDONESIA TIDAK BUKAN HATI2 KARENA POLEMIK YG MENGGAMBARKAN adaNYA PERTIKAIAN PETINGGI2 N
13	ga tau mau blng apa yg didalam komunitas emang ga pada tau apa gmna bingung pertemuan di Indonesia jelas atuh anyinggg coldplay aja mau dilarang karena pro LGBT
14	banyak yang nolak konser coldplay karena pernah mempromosikan bendera lgbt lo Kata aku bagusan ditolak saja si
15	banyak yang nolak kedatangan coldplay karena pro kaum pelangi
16	Pemerintah fokus nge banned coldplay padahal mah gapapa sih konser doang yang penting dibatasin
17	Pildun maupun konser Coldplay akan mempunyai dampak positif bagi perekonomian Indonesia Terima saja kedatangan coldplay

Fig 4 shows the Results of Dataset Cleaning

The outcomes of the dataset cleansing procedure are shown in the image above. After additional processing, this set of comment data will be used to feed a sentiment analysis model.

Table 2 Cleaning Results

Tweet Data	Cleaned Results
Sebagian petinggi Majelis Ulama Indonesia (MUI) meminta Pemerintah melarang band coldplay manggung di Indonesia. Alasannya mereka mendukung hak-hak kaum LGBT. Menjijikkan	Sebagian petinggi Majelis Ulama Indonesia MUI meminta Pemerintah melarang band coldplya manggung di Indonesia Alasannya mereka mendukung hak kaum

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sekali https://t.co/VxgZjNC9pw Wasekjen PA 212 Novel Bamukmin menolak konser Coldplay bukan tanpa alasan. https://t.co/eH47ARJ5Jj	LGBT Menjijikkan sekali Wasekjen PA Novel Bamukmin menolak konser Coldplay bukan tanpa alasan
PT Garuda Indonesia menyambut baik event besar di Indonesia mulai dari KTT ASEAN kehadiran Timnas Argentina hingga konser Coldplay. Acara tersebut dinilai dapat meningkatkan jumlah penerbangan ke Indonesia. #bisnisupdate #update #bisnis #storyshot https://t.co/YoC5vtw9XV https://t.co/lv2T3UmdtJ	PT Garuda Indonesia menyambut baik event besar di Indonesia mulai dari KTT ASEAN kehadiran Timnas Argentina hingga konser coldplay Acara tersebut dinilai dapat meningkatkan jumlah penerbangan ke Indonesia
Pildun maupun konser Coldplay akan mempunyai dampak positif bagi perekonomian Indonesia. Terima saja kedatangan coldplay. #Sindonews #news .https://t.co/eLvC4ElzbR	Pildun maupun konser Coldplay akan mempunyai dampak positif bagi perekonomian Indonesia Terima saja kedatangan coldplay

Word Tokenization

The next step was to perform tokenization process. This step involved breaking down the cleaned text data or comments into smaller units such as words or phrases, known as tokens (Kurniawan et al., 2022). The tokenization process was carried out using the tokenize operator available in the RapidMiner application. Below is an example of the tokenization process results on the existing comment data.

Table 3 Tokenization Results

Before Tokenization	Tokenization Result
Sebagian petinggi Majelis Ulama Indonesia MUI meminta Pemerintah melarang band coldplay manggung di Indonesia Alasannya mereka mendukung hak kaum LGBT Menjijikkan sekali	[‘Sebagian’, ‘petinggi’, ‘Majelis’, ‘Ulama’, ‘Indonesia’, ‘MUI’, ‘meminta’, ‘Pemerintah’, ‘melarang’, ‘band’, ‘coldplay’, ‘manggung’, ‘di’, ‘Indonesia’, ‘Alasannya’, ‘mereka’, ‘mendukung’, ‘hak’, ‘kaum’, ‘LGBT’, ‘Menjijikkan’, ‘sekali’]
Wasekjen PA 212 Novel Bamukmin menolak konser Coldplay bukan tanpa alasan	[‘Wasekjen’, ‘PA’, ‘Novel’, ‘Bamukmin’, ‘menolak’, ‘konser’, ‘Coldplay’, ‘bukan’, ‘tanpa’, ‘alasan’]
PT Garuda Indonesia menyambut baik event besar di Indonesia mulai dari KTT ASEAN kehadiran Timnas Argentina hingga konser coldplay Acara tersebut dinilai dapat meningkatkan jumlah penerbangan ke Indonesia	[‘PT’, ‘Garuda’, ‘Indonesia’, ‘menyambut’, ‘baik’, ‘event’, ‘besar’, ‘di’, ‘Indonesia’, ‘mulai’, ‘dari’, ‘KTT’, ‘ASEAN’, ‘kehadiran’, ‘Timnas’, ‘Argentina’, ‘hingga’, ‘konser’, ‘coldplay’, ‘Acara’, ‘tersebut’, ‘dinilai’, ‘dapat’, ‘meningkatkan’, ‘jumlah’, ‘penerbangan’, ‘ke’, ‘Indonesia’]
Pildun maupun konser Coldplay akan mempunyai dampak positif bagi perekonomian Indonesia Terima saja kedatangan coldplay	[‘Pildun’, ‘maupun’, ‘konser’, ‘Coldplay’, ‘akan’, ‘mempunyai’, ‘dampak’, ‘positif’, ‘bagi’, ‘perekonomian’, ‘Indonesia’, ‘Terima’, ‘saja’, ‘kedatangan’, ‘coldplay’]

The results of word tokenization are shown in Table 3. The separation of words from the existing sentiment sentences will facilitate the sentiment analysis process in the subsequent stage.

Case Folding

The process of case folding involves giving each letter in the text a uniform shape (Gifari et al., 2022). Typically, all words resulting from tokenization are converted to lowercase. This is one of the stages conducted in Natural Language Processing (NLP), including for sentiment analysis. By performing this process, words that appear will be treated as the same entity and not affected by the case of the word. In the RapidMiner application, there is a transform case operator that facilitates the case folding process in this study. An illustration of the case folding process's result is shown below.

Table 4 Results of Case Folding

Tokenization Result	Case Folding Result
[‘Sebagian’, ‘petinggi’, ‘Majelis’, ‘Ulama’, ‘Indonesia’, ‘MUI’, ‘meminta’, ‘Pemerintah’, ‘melarang’, ‘band’, ‘coldplay’, ‘manggung’, ‘di’, ‘Indonesia’, ‘Alasannya’, ‘mereka’, ‘mendukung’, ‘hak’, ‘kaum’, ‘LGBT’, ‘Menjijikkan’, ‘sekali’]	[‘sebagian’, ‘petinggi’, ‘majelis’, ‘ulama’, ‘indonesia’, ‘mui’, ‘meminta’, ‘pemerintah’, ‘melarang’, ‘band’, ‘coldplay’, ‘manggung’, ‘di’, ‘indonesia’, ‘alasannya’, ‘mereka’, ‘mendukung’, ‘hak’, ‘kaum’, ‘lgbt’, ‘menjijikkan’, ‘sekali’]
[‘Wasekjen’, ‘PA’, ‘212’, ‘Novel’, ‘Bamukmin’, ‘menolak’, ‘konser’, ‘Coldplay’, ‘bukan’, ‘tanpa’, ‘alasan’]	[‘wasekjen’, ‘pa’, ‘novel’, ‘bamukmin’, ‘menolak’, ‘konser’, ‘coldplay’, ‘bukan’, ‘tanpa’, ‘alasan’]
[‘PT’, ‘Garuda’, ‘Indonesia’, ‘menyambut’, ‘baik’, ‘event’, ‘besar’, ‘di’, ‘Indonesia’, ‘mulai’, ‘dari’, ‘KTT’, ‘ASEAN’, ‘kehadiran’, ‘Timnas’, ‘Argentina’, ‘hingga’, ‘konser’, ‘coldplay’, ‘Acara’, ‘tersebut’, ‘dinilai’, ‘dapat’, ‘meningkatkan’, ‘jumlah’,	[‘pt’, ‘garuda’, ‘indonesia’, ‘menyambut’, ‘baik’, ‘event’, ‘besar’, ‘di’, ‘indonesia’, ‘mulai’, ‘dari’, ‘ktt’, ‘asean’, ‘kehadiran’, ‘timnas’, ‘argentina’, ‘hingga’, ‘konser’, ‘coldplay’, ‘acara’, ‘tersebut’, ‘dinilai’, ‘dapat’,

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'penerbangan', 'ke', 'Indonesia']	'meningkatkan', 'jumlah', 'penerbangan', 'ke', 'Indonesia']
['Pildun', 'maupun', 'konser', 'Coldplay', 'akan', 'mempunyai', 'dampak', 'positif', 'bagi', 'perekonomian', 'Indonesia', 'Terima', 'saja', 'kedatangan', 'coldplay']	['pildun', 'maupun', 'konser', 'coldplay', 'akan', 'mempunyai', 'dampak', 'positif', 'bagi', 'perekonomian', 'Indonesia', 'terima', 'saja', 'kedatangan', 'coldplay']

Stopword Removal

Stopword removal is a stage aimed at removing common words that frequently appear and are considered meaningless or insignificant in sentiment analysis (Zalukhu, 2023). These words typically include prepositions, conjunctions, and others that do not provide important information in text analysis. The list of stopwords is extracted from a dataset available on the Kaggle website. The stopwords filter operator in RapidMiner is employed to facilitate this process.

Table 5 Stopword Removal Results

Results of Case Folding	Results of Stopword Removal
['sebagian', 'petinggi', 'majelis', 'ulama', 'indonesia', 'mui', 'meminta', 'pemerintah', 'melarang', 'band', 'coldplay', 'manggung', 'di', 'indonesia', 'alasannya', 'mereka', 'mendukung', 'hak', 'kaum', 'lgbt', 'menjijikkan', 'sekali']	petinggi majelis ulama indonesia Pemerintah melarang band coldplay manggung indonesia alasan mendukung hak kaum lgbt menjijikkan
['wasekjen', 'pa', 'novel', 'bamukmin', 'menolak', 'konser', 'coldplay', 'bukan', 'tanpa', 'alasan']	wasekjen novel bamukmin menolak konser coldplay alasan
['pt', 'garuda', 'indonesia', 'menyambut', 'baik', 'event', 'besar', 'di', 'indonesia', 'mulai', 'dari', 'ktt', 'asean', 'kehadiran', 'timnas', 'argentina', 'hingga', 'konser', 'coldplay', 'acara', 'tersebut', 'dinilai', 'dapat', 'meningkatkan', 'jumlah', 'penerbangan', 'ke', 'Indonesia']	garuda indonesia menyambut event besar Indonesia asean kehadiran timnas argentina konser coldplay acara dinilai meningkatkan penerbangan indonesia
['pildun', 'maupun', 'konser', 'coldplay', 'akan', 'mempunyai', 'dampak', 'positif', 'bagi', 'perekonomian', 'Indonesia', 'terima', 'saja', 'kedatangan', 'coldplay']	pildun konser coldplay mempunyai dampak positif perekonomian indonesia terima kedatangan coldplay

Stopword removal is the final preprocessing step conducted to enhance the performance of sentiment analysis models (Ardiansyah et al., 2023). Through this entire process, the dataset used can make the model more efficient and enhance the performance of the machine learning model constructed.

Labeling Data

The Naive Bayes machine learning algorithm falls under supervised learning, capable of conducting sentiment analysis on labeled sentiment data (positive or negative) (Syahranitazli & Samsudin, 2023). In this study, previously obtained sentiment data undergoes manual labeling. The sentiment data is categorized into positive and negative sentiment classes. After labeling, the data can then be utilized to construct a Naive Bayes learning model for classifying new sentiment data. Below is an example of data labeling for existing comments.

Table 6 Data Labeling

Dataset	Class
petinggi majelis ulama indonesia meminta pemerintah melarang band coldplay manggung Indonesia alasannya mendukung hak kaum lgbt menjijikkan sekali	Negatif
erick thohir ketua umum pssi mengumumkan harga tiket pertandingan sepakbola indonesia vs argentina nominalnya membuat netizen kaget tergolong murah dibandingkan tiket coldplay tiket coldplay mahal banget	Negatif
wasekjen novel bamukmin menolak konser coldplay alasan	Negatif
garuda indonesia menyambut event besar indonesia mulai ktt asean kehadiran timnas argentina konser coldplay acara dinilai meningkatkan penerbangan indonesia	Positif
dampak konser coldplay mempromosikan lgbt indonesia berdampak buruk indonesia	Negatif
mayoritas publik indonesia menerima rencana kedatangan coldplay menantikan kehadiran band	Positif
astagfirullah jijik konser indonesia coldplay tolak coldplay pro lgbt	Negatif
biarkan jokowi sandiaga uno menyetujui konser coldplay indonesia dimintai pertanggung jawaban akhirat mereka pro lgbt malah dibiarkan masuk	Negatif
mayoritas publik indonesia menerima kedatangan coldplay	Positif
coldplay mengumumkan datang indonesia teman teman langsung berburu tiket sepertinya sangat antusias menyambut kedatangan chris	Positif

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The table above is an example of a sample dataset that has undergone data labeling process. Out of all the data available, a total of 491 comment data were obtained, consisting of 314 comments labeled as positive and 177 comments labeled as negative. The labeling process for the comment data was conducted carefully and meticulously to ensure accurate sentiment classification results. These comment data will then be prepared for use in the Naive Bayes algorithm-based sentiment analysis model development.

Manual calculation of Naive Bayes

The application of the Naive Bayes algorithm for sentiment classification without the use of RapidMiner was covered in this part. The practice of classifying text comments or thoughts on a certain topic into positive or negative classifications is known as sentiment analysis.

The dataset was subjected to the Naive Bayes method for sentiment analysis following the preprocessing of the data. Weighting words collected from the comment data for each document was the first stage in the implementation process. The TF-IDF technique (Term Frequency – Inverse Document Frequency) is a popular word weighting method. Here is an illustration of how the Naive Bayes algorithm was manually calculated using many comment data entries.

Table 7 Comment Data

Doc 1 (negatif)	melarang coldplay manggung mendukung lgbt menjijikkan
Doc 2 (negatif)	menolak kehadiran coldplay lgbt
Doc 3 (positif)	konser coldplay dinilai meningkatkan perekonomian
Doc 4 (positif)	konser coldplay mempunyai dampak positif perekonomian terima kedatangan coldplay

For example, there were 4 comment data in Table 7. The comments in the table had undergone data preprocessing and labeling. The comments consisted of 2 negative comments and 2 positive comments. The initial step required was to calculate the prior probabilities for each class, namely positive and negative. To obtain the prior probability values for each class, Equation (1) was used.

After calculating the prior probabilities, the next step was to determine the likelihood probabilities for each word in the document. The likelihood probabilities for each word were obtained using the following equation:

$$P(w_i|c) = \frac{N_{w_ic}+1}{N_c+V} \qquad (2)$$

Explanation:
The word weight value in class C is represented by N_{wic}
The total word weight value for all words in class c is denoted by N_c
V is the overall word count.

Consequently, in order to ascertain the weight value of every word in the document, TF-IDF computation was required. A document's word frequency is indicated by its TF value. In the meanwhile, the following equation was used to determine the IDF value:

$$IDF = \log\left(\frac{N}{dft}\right) \qquad (3)$$

N represents the total number of documents, while dft is the number of documents that contain the phrase t. Subsequently, the weighted value of each document was obtained by multiplying the TF value by the IDF value obtained.

Table 8 presents the Calculation Results of TF and IDF

Term	TF				Doc Freq	IDF
	Doc 1	Doc 2	Doc 3	Doc 4		
melarang	1	0	0	0	1	0,602
coldplay	1	1	1	1	4	0
manggung	1	0	0	0	1	0,602
mendukung	1	0	0	0	1	0,602
lgbt	1	1	0	0	2	0,301
menjijikkan	1	0	0	0	1	0,602
menolak	0	1	0	0	1	0,602
kehadiran	0	1	0	0	1	0,602

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dinilai	0	0	1	0	1	0,602
meningkatkan	0	0	1	0	1	0,602
perekonomian	0	0	1	1	2	0,301
konser	0	0	0	1	1	0,602
mempunyai	0	0	0	1	1	0,602
dampak	0	0	0	1	1	0,602
positif	0	0	0	1	1	0,602
terima	0	0	0	1	1	0,602
kedatangan	0	0	1	1	2	0,301
Total Doc	4					
Total Kata	17					

The word "melarang" in the sample calculation was found only in document 1, resulting in a TF value of 1 for document 1 and 0 for other documents. To determine the IDF value, the equation below was used:

$$IDF_{melarang} = \log\left(\frac{N}{dft}\right) = \log\left(\frac{4}{1}\right) = 0{,}602$$

Table 9 presents the results of TF-IDF word weighting calculations

Term	TF X IDF				IDF
	Doc 1	Doc 2	Doc 3	Doc 4	
melarang	0,60206	0	0	0	0,60206
coldplay	0	0	0	0	0
manggung	0,60206	0	0	0	0,60206
mendukung	0,60206	0	0	0	0,60206
lgbt	0,30103	0,30103	0	0	0,30103
menjijikkan	0,60206	0	0	0	0,60206
menolak	0	0,60206	0	0	0,60206
kehadiran	0	0,60206	0	0	0,60206
dinilai	0	0	0,60206	0	0,60206
meningkatkan	0	0	0,60206	0	0,60206
perekonomian	0	0	0,30103	0,30103	0,30103
konser	0	0	0	0,60206	0,60206
mempunyai	0	0	0	0,60206	0,60206
dampak	0	0	0	0,60206	0,60206
positif	0	0	0	0,60206	0,60206
terima	0	0	0	0,60206	0,60206
kedatangan	0	0	0,30103	0,30103	0,30103
Total Bobot	2,70927	1,50515	1,80618	3,61236	

The calculations in the table above represent the weighting of each word in the document data. With these values obtained, the next step was to calculate the likelihood probability for each word in the document. Here is an example calculation to determine the likelihood probability values for each word in document 1. The words present in document 1 were “melarang”, “coldplay”, “manggung”, “mendukung”, “kaum”, “lgbt”, dan “menjijikkan”.

Probability of Each Word

Total weight of positive sentiment documents = WD3 + WD4 = 1,806 + 3,612 = 5,418

$$P(melarang|positif) = \frac{0+1}{5{,}418+17} = 0{,}0446$$

$$P(coldplay|positif) = \frac{0+1}{5{,}418+17} = 0{,}0446$$

$$P(manggung|positif) = \frac{0+1}{5{,}418+17} = 0{,}0446$$

$$P(mendukung|positif) = \frac{0+1}{5{,}418+17} = 0{,}0446$$

$$P(lgbt|positif) = \frac{0+1}{5{,}418+17} = 0{,}0446$$

$$P(menjijikkan|positif) = \frac{0+1}{5{,}418+17} = 0{,}0446$$

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Probability of Each Word Negative
Total weight of negative sentiment documents = WD1 + WD2 = 2,709 + 1,505 = 4,214

$$P(melarang|positif) = \frac{0{,}602 + 1}{4{,}214 + 17} = 0{,}0755$$
$$P(coldplay|positif) = \frac{0 + 1}{4{,}214 + 17} = 0{,}0471$$
$$P(manggung|positif) = \frac{0{,}602 + 1}{4{,}214 + 17} = 0{,}0755$$
$$P(mendukung|positif) = \frac{0{,}602 + 1}{4{,}214 + 17} = 0{,}0755$$
$$P(lgbt|positif) = \frac{0{,}301 + 1}{4{,}214 + 17} = 0{,}0613$$
$$P(menjijikkan|positif) = \frac{0{,}602 + 1}{4{,}214 + 17} = 0{,}0755$$

Class Probability in Document 1
Positive Class

$P(Dok1|positif) = P(melarang|positif)\ x$

$P(coldplay|positif)\ x\ P(manggung|positif)\ x\ P(mendukung|positif)\ x$

$P(lgbt|positif)\ x\ P(menjijikkan|positif)\ x\ P(positif)$

$P(Dok1|positif) =$ 0,0446 x 0,0446 x 0,0446 x 0,0446 x 0,0446

x 0,0446 x 0,5 = 0,000000004

Negative Class

$P(Dok1|negatif) = P(melarang|negatif)\ x$

$P(coldplay|negatif)\ x\ P(manggung|negatif)\ x\ P(mendukung|negatif)\ x$

$P(lgbt|negatif)x\ P(menjijikkan|negatif)x\ P(negatif)$

$P(Dok1|negatif) =$ 0,0755 x 0,0471 x 0,0755 x 0,0755 x 0,0613

x 0,0755 x 0,5 = 0,000000047

From the calculations above, it was found that the probability value of the negative class for document 1 was greater than the probability value for the positive class. Based on these results, document 1 was classified into the negative class category.

Implementation of the Model

The RapidMiner program was used to implement the Naive Bayes model. The model was created to examine how the general people felt about Coldplay's visit to Indonesia. Text comments are categorized into good and negative classes using the built model. Training and test data were derived from a total of 491 labeled comment data that were gathered. The model was trained using the training data, and its performance was assessed using the test data. 25% was utilized for test data and 75% was used for training data.

In implementing Naive Bayes algorithm for analyzing public sentiment regarding the presence of the Coldplay band, several stages were undertaken as follows:

Importing Dataset

The comments data collected from the crawling process were imported into the RapidMiner application to facilitate model implementation. RapidMiner provides features to import data in various file formats including .xlsx or .csv.

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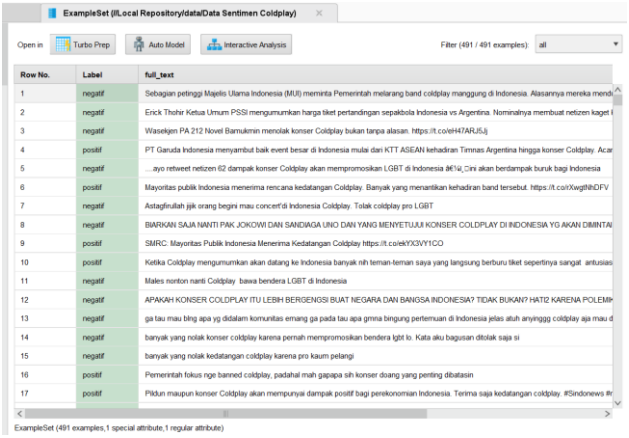

Fig 5 Dataset Import Results

Preprocessing Data

The data entered into RapidMiner was then subjected to data preprocessing. This process included text cleaning, tokenization, case folding, and stopword removal. Several operators were employed to facilitate these processes, such as the nominal-to-text operator, which converted the data format into text form for the application of sentiment analysis models.

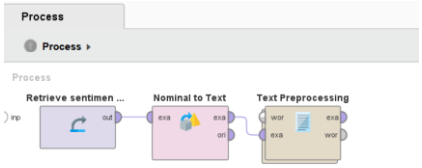

Fig 6 Text Preprocessing

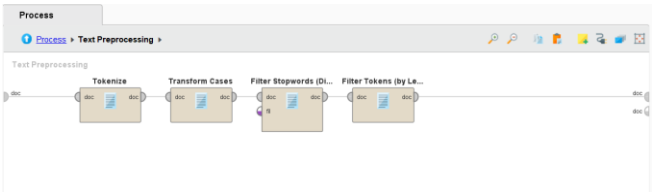

Fig 7 illustrates the Sub Process of Text Processing Operators

Implementation of Naive Bayes Model

The next stage was to separate the dataset into training and test data in order to put the model into practice. The data was divided at a ratio of 75:25% using the split data operator. The test data partition was then connected to the apply model operator in order to evaluate the performance of the created model, and the training data partition was connected to the Naive Bayes operator in order to train the model.

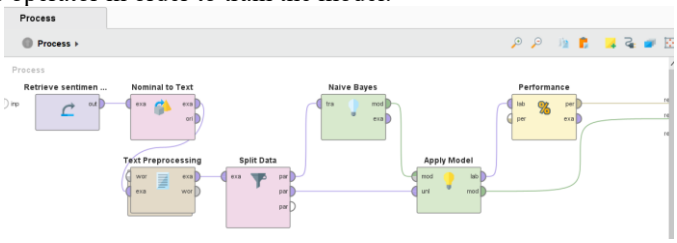

Fig 8 Model Application Process

Model Performance

After configuring the model architecture in the RapidMiner application, the next step was to execute the process on the constructed model to assess its performance. Performance evaluation of the model was conducted using a confusion matrix calculation. The RapidMiner application's shown test results for the constructed model are shown below.

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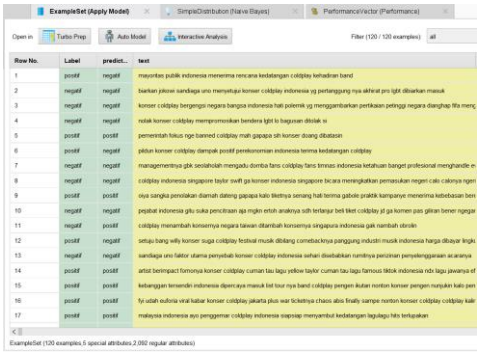

Fig 9 Displays the Prediction Results of Test Data

accuracy: 72.50%

	true negatif	true positif	class precision
pred. negatif	36	26	58.06%
pred. positif	7	51	87.93%
class recall	83.72%	66.23%	

Fig 10 Displayed the accuracy results of the model

Figure capable of classifying sentiment data quite effectively.
The confusion matrix's computation process produced the accuracy value. Several terms in the confusion matrix are important to comprehend: Correctly predicted positive classes are referred to as True Positive (TP), wrongly projected positive classes are referred to as False Positive (FP), correctly predicted negative classes are referred to as True Negative (TN), and incorrectly predicted negative classes are referred to as False Negative (FN).

Calculations were done for accuracy, precision, and recall based on Figure 9. The findings of the calculations made for the confusion matrix are shown below:

$$Accuracy = \frac{TP+TN}{TP+FP+TN+FN}\ X\ 100\% = \frac{51+36}{51+7+36+26}\ X\ 100\% = 72{,}5\%$$

$$Precision = \frac{TP}{TP+FP}\ X\ 100\% = \frac{51}{51+7}\ X\ 100\% = = \frac{51}{58}\ X\ 100\% = 87{,}9\%$$

$$Recall = \frac{TP}{TP+FN}\ X\ 100\% = \frac{51}{51+26}\ X\ 100\% = = \frac{51}{77}\ X\ 100\% = 66{,}3\%$$

The test data, consisting of 120 samples, exhibited an accuracy rate of 72.5%. This accuracy result was considered quite satisfactory and demonstrated that the constructed model could predict or classify the test data effectively and accurately.

Results

The obtained comment data showed that the majority of the public provided positive comments compared to negative ones regarding the issue of Coldplay's arrival in Indonesia. Out of the total 491 data points, 314 comments were positive (63.95%) and 177 comments were negative (36.05%). The public predominantly commented positively regarding Coldplay's arrival issue. A word cloud can be used to visualize the words that are used frequently in both positive and negative remarks. These are the word cloud visualization results for the positive class:

Fig 11 Displayed the Wordcloud of Positive Sentiments

Fig 12 displayed the Wordcloud of Negative Sentiments

From the above figure, it can be observed the frequent use of words that lead to both positive and negative sentiments. The figure reveals that words such as "tolak," "lgbt," and "tiket" are often used in negative comments, whereas words like "keren," "nonton," "musik," and "terima" are frequently used in positive comments.

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DISCUSSIONS

During the sentiment data collection process, data crawling techniques using the keywords "Coldplay Indonesia" and "Coldplay Concert" were applied to tweets from users between May 2023 and January 2024. This activity gathered 491 tweets to be analyzed for public sentiment regarding Coldplay's presence in Indonesia. The results of the data crawling were stored in Excel format, including columns such as created_at (tweet timestamp), full_text (tweet content), lang (language used), user_id_str (user ID), username (Twitter handle), tweet_url (tweet link), and others, although only the full_text attribute was used in sentiment analysis. Data preprocessing was a crucial step to clean and prepare the data, making it more representative and relevant for analysis. In this analysis, the Naive Bayes algorithm, a supervised learning method, was employed to classify sentiments into positive and negative. The labeling process was conducted manually, grouping data into positive and negative sentiment classes, which were then used to develop the Naive Bayes model for classifying new sentiment data. From the entire dataset, 314 comments were positive (63.95%) and 177 comments were negative (36.05%). To assess the model, the labeled data were divided into training data (75%) and test data (25%). The test data, which included 120 samples, demonstrated a 72.5% accuracy rate, which was deemed satisfactory and showed that the model successfully and precisely predicted or classified the data. The analysis revealed that the majority of the public provided positive comments regarding Coldplay's presence, and frequently used words in both positive and negative comments were visualized in a word cloud.

CONCLUSION

According to the study's findings, 314 (63.95%) of the 491 comments that were made accessible were classified as favorable, and 177 remarks (36.05%) were classified as negative. After splitting the dataset into two parts, 271 and 120 data, the model was trained on the former and tested on the latter. The model evaluation showed an accuracy of 72.5%, indicating that the Naive Bayes algorithm effectively predicted and classified data accurately. The study used Twitter to show how well the Naive Bayes algorithm works for creating sentiment analysis models related to Coldplay's presence in Indonesia. It is also advised to evaluate the accuracy of the current algorithm with alternative classification techniques, such as Support Vector Machine (SVM), K-Nearest Neighbors (K-NN), Decision Tree, or other techniques.

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