JITCoS : Journal of Information Technology and Computer System
Vol. 1, No. 1; June 2025
e-ISSN: XXXX-XXXX
Published by CV. Multimedia Teknologi Kreatif

# Application Of Naive Bayes Algorithm For Sentiment Analysis On Economic Recession Threat

**Fajar Gilang Ramadhan Panggabean**

Politeknik Negeri Medan; fajargilangr637@gmail.com

**ABSTRACT**

Recession is a condition in which real economic growth becomes negative, or in other words, there is a decline in Gross Domestic Product (GDP) for two consecutive quarters in one year. A recession is characterized by a weakening of the global economy that has an impact on the domestic economy in various countries. The greater the dependence of a country on the global economy, the more likely the country is to experience a recession. An economic recession can cause a simultaneous decline in all economic activities, including corporate profits, employment, and investment. In this study, data was collected from YouTube using a crawling technique, with a total of 200 comments analyzed. These comments were then labeled with a lexicon-based method using an Indonesian dictionary. The preprocessing stage was carried out to prepare the data before sentiment analysis. In addition, the TF-IDF word weighting method was applied with the bigram feature (n = 1) in the analysis. The system was evaluated using a confusion matrix, and the results showed that the prediction model, which was based on 200 opinion data with a 9:1 split ratio between training data and test data, achieved an accuracy of 75.00%. However, the precision, recall, and F1-score values each show 0.00%. The performance of the system model built in this study shows less than satisfactory results and may require improvements to increase its effectiveness.

**Keywords :** *Economic Recession; Sentiment Analysis; Naïve Bayes Classifier*

***Corresponding Author:***
Fajar Gilang Ramadhan Panggabean
Politeknik Negeri Medan
Email : fajargilangr637@gmail.com



## 1. INTRODUCTION

A recession is a condition where real economic growth is negative or in other words there is a decline in gross domestic product for two consecutive quarters in a year. Recessions are characterized by a weakening global economy and will affect the domestic economies of countries around the world. The likelihood of a country experiencing a recession is stronger if the country's economy is dependent on the global economy. An economic recession can cause a simultaneous decline in all economic activities such as corporate profits, employment and investment. Economic recessions are usually associated with falling prices (deflation), or conversely, a sharp rise in prices (inflation) in a process called stagflation. Other factors for a recession can be seen from several things such as an imbalance between production and consumption, slow or declining economic growth for two consecutive quarters, the value of imports is much greater than the value of exports, and the unemployment rate is getting higher (Blandina et al., 2020).

An economic recession in Indonesia is caused by a condition where the economy of a country is deteriorating as seen from a negative Gross Domestic Product (GDP), increased unemployment, or negative real economic growth for two consecutive quarters. A recession is now considered a basically avoidable phenomenon, but problems for the Indonesian economy include declining economic growth, high unemployment, declining income, declining production levels, and reduced investment and high inflation. A number of efforts have been made by the Indonesian government to overcome the economic recession, such as providing financial stimulus for certain sectors, increasing domestic production, and encouraging investment (Inesta et al., 2023).

Sentiment analysis is a method used to extract opinion data, understand and process textual data automatically to see the sentiment contained in an opinion (Sari et al., 2019). The goal is to evaluate comments, actions, calculations, and sentiments related to various entities such as products,

topics, organizations, individuals, services, or activities(Alfandi et al., 2023). The Naïve Bayes Classifier method, which is a simple probabilistic classification method. It calculates probabilities based on the frequency and combination of values in the dataset (Ratnawati, 2018). The advantage of this method is its ability to perform classification with relatively small training data, which helps ensure the effectiveness of the required classification process (Halim Lubis et al., 2023).

The relevant previous research (Merinda Lestandy et al., 2021). This research was successfully conducted by comparing the performance of several RNN and Naïve Bayes methods using the TF-IDF weighting technique. The dataset in this study was obtained from 5000 COVID-19 vaccine tweets with a division of 3800 positive sentiment tweets, 800 negative sentiment tweets and 400 neutral sentiment tweets. The RNN (TF-IDF) method shows the best accuracy results of 97.77% compared to Naïve Bayes (TFIDF) with an accuracy value of 80%.

In other relevant research (Sutresno, 2023). Based on the results of research on the sentiment of the Indonesian people towards the impact of the global downturn as a result of the recession from Twitter social media totaling 780 tweet data, the classification test results show that the SVM method has a higher accuracy rate than the Naive Bayes method(Darwis et al., 2021), which is 79.5%. The prediction results using the SVM method show a total of 144 positive and 636 negative sentiments, it can be concluded that the Indonesian people on the impact of the global downturn as a result of the recession are dominantly negative in opinion.

In other relevant research (Prasetiyo Wibowo et al., 2023). From the results of testing and evaluating the application built using the dataset and the proposed algorithm, conclusions can be drawn, based on 326 tweets, the direction of views (sentiment)(Sari et al., 2019) of the Indonesian people on the issue of recession in 2023 5 times testing the highest value is at a value of 83.333% and the lowest value is at 72.727%. Some of the main steps involved in this research include crawling, labeling, preprocessing, modeling, data sharing, and classification using the Naive Bayes method. The importance of the preprocessing stage in producing optimal results at a later stage cannot be ignored. Therefore, this stage plays a very vital role in the success of the research.

Based on the previous explanation, a study will be conducted to analyze sentiment regarding the threat of economic recession using the Naïve Bayes algorithm classification method. This research will utilize the Naïve Bayes Classifier algorithm to classify opinions in comments, with the aim of separating opinions into positive or negative categories. Hopefully, the results of this research will produce a classification model that is able to analyze sentiment and provide information about the sentiment contained in the comments.

## 2. LITERATURE REVIEW

### *2.1. Economic recession*

A recession is a condition in which the economy experiences a significant decline. Typically, a recession is characterized by a country's Gross Domestic Product (GDP) falling into the negative and unemployment rising. In other words, a recession occurs if GDP declines for two consecutive quarters in one year. The risk of a recession is higher if a country is highly dependent on the global economy. During a recession, there is a simultaneous decline in economic activity, including corporate profits, employment and investment. Recessions are often associated with falling prices (deflation) or, conversely, a sharp rise in prices (inflation) in a phenomenon known as stagflation (Hutagaol et al., 2022).

### *2.2. Analisis sentimen*

Sentiment analysis is a method to collect people's opinions through social networks covering public services and current issues. Sentiment analysis is an automated process for understanding and processing textual data to obtain information about the sentiment contained in opinion sentences or comments (Khalil Gibran et al., 2024).

### *2.3. Algoritma naive bayes classifier*

Naive Bayes is one of the methods used to classify data (Fadhillah Azmi et al., 2023). Bayesian classification is a statistical approach that predicts the probability of class membership. Naïve Bayes is a decision-making method that uses mathematical probability calculations, assuming that the

decision value is correct based on existing object information. The Naïve Bayes Classifier method has several advantages, such as simplicity, speed, and high accuracy. Naïve Bayes classification can be more efficient if applied in supervised learning. The following is the flow of the Naïve Bayes method (Damuri et al., 2021):

1. Access Training Data: Start by accessing and preparing the training data that will be used to build the classification model.
2. Calculate the Sum and Probability:
   - If Numeric Data
     Calculate Mean and Standard Deviation: For each numerical parameter in the dataset, calculate the mean and standard deviation. This will give an idea of the distribution of data for each parameter in different categories.
   - Calculate Category Probability:
     Category Probability: Calculate the probability of each category by dividing the number of data belonging to that category by the total number of data in that category. This gives the base probability of each category.
3. Create a Table:
   - Mean and Standard Deviation Table: Arrange the mean and standard deviation for each numerical parameter in a table, which will be used to calculate the probability of a normal distribution in the classification process.
   - Probability Table: Create a table that shows the probability of each category based on the available data.

These steps help in building the Naïve Bayes model by calculating the parameters required for classification, such as the probability distribution and descriptive statistics for each category in the numerical data.

## 3. METHOD

The data used in this study comes from YouTube user comments on content with the title “Indonesia's Economy is Resilient from the Threat of Recession?” “from the CNBC Indonesia Channel (Aini et al., 2023). Data is collected using web crawling techniques by utilizing the YouTube API (Ningtyas et al., 2023). The crawling process was carried out using Google Collaboratory and the Python library, pandas. The data retrieved includes user comments, date the comment was uploaded, and YouTube username, and is stored in .csv format. However, only user comment data will be processed. Of the more than +300 comments obtained, this research will use 200 comments for analysis (Halim Lubis et al., 2023).

This research is conducted in several stages. First, data will be obtained from YouTube comments using the YouTube API and pandas library. The data collected through the crawling process will be processed at the next stage, namely the preprocessing stage. In this stage, the steps include cleaning, case folding to equalize the font format, tokenizing to break the text into smaller units, stopword removal to remove common words that are not important, and stemming to simplify the words to their basic form. After that, duplicate data will be removed to ensure the uniqueness of the data used in the analysis (Ningsih et al., 2023).

After preprocessing (Ressan et al., 2022), the comment data will be labeled by categorizing them into two classes, namely positive and negative. Then, the comments will be converted into numeric format using TF-IDF feature extraction technique (Biswas, 2020). The processed data will be divided into two parts: training data and test data. With this division, classification is performed using the Naïve Bayes Classifier algorithm, and the results will be evaluated using the confusion matrix (Setiawati et al., 2024).

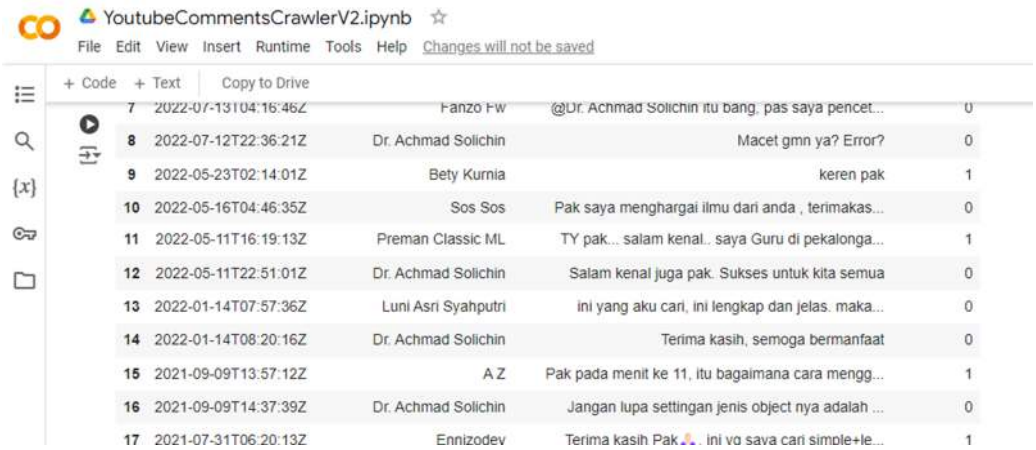
System testing is conducted to assess whether the developed system is able to analyze sentiment from data collected by crawlers, which is then processed through the pre-processing stage and word weighting using the TF-IDF method, and categorized into classes using the Naïve Bayes method (Putri Ratna et al., 2019). This test is conducted using confusion matrix. Confusion Matrix is a commonly used method to calculate the level of accuracy in data mining (Eka Putra et al., 2023). This matrix presents information about the classifications that are actually predicted by the system. Usually, the three main parameters calculated are accuracy, recall, and precision.

# 4. RESULTS AND DISCUSSION

## *4.1 Data collection*

The dataset collection includes comments, opinions, or sentiments regarding the threat of economic recession. The dataset to be classified consists of 500 sentiments derived from YouTube user comments on the content "Indonesian Economy Resilient From Recession Threat?" from CNBC Indonesia Channel. This data is obtained from the YouTube social media platform using a crawling technique, with the help of a Python library, namely pandas, through the Google API Client.

The data crawling process is done using the Python programming language and Google Collaboratory tools. The first step is to activate the Google Data API at https://console.developers.google.com/, then activate the YouTube Data API v3 and create credentials to get the API Key that will be applied in programming. After the crawling process is complete, the data obtained is converted into a dataframe and saved in a .csv file format with the name "youtube.csv". The resulting data includes +300 comments with information such as publishedAt, auhourDisplayName, textDisplay, and likecount.




| | | | | |
|---|---|---|---|---|
| 7 | 2022-07-13T04:16:46Z | Fanzo FW | @Dr. Achmad Solichin itu bang, pas saya pencet... | 0 |
| 8 | 2022-07-12T22:36:21Z | Dr. Achmad Solichin | Macet gmn ya? Error? | 0 |
| 9 | 2022-05-23T02:14:01Z | Bety Kurnia | keren pak | 1 |
| 10 | 2022-05-16T04:46:35Z | Sos Sos | Pak saya menghargai ilmu dari anda , terimakas... | 0 |
| 11 | 2022-05-11T16:19:13Z | Preman Classic ML | TY pak... salam kenal.. saya Guru di pekalonga... | 1 |
| 12 | 2022-05-11T22:51:01Z | Dr. Achmad Solichin | Salam kenal juga pak. Sukses untuk kita semua | 0 |
| 13 | 2022-01-14T07:57:36Z | Luni Asri Syahputri | ini yang aku cari, ini lengkap dan jelas. maka... | 0 |
| 14 | 2022-01-14T08:20:16Z | Dr. Achmad Solichin | Terima kasih, semoga bermanfaat | 0 |
| 15 | 2021-09-09T13:57:12Z | A Z | Pak pada menit ke 11, itu bagaimana cara mengg... | 1 |
| 16 | 2021-09-09T14:37:39Z | Dr. Achmad Solichin | Jangan lupa settingan jenis object nya adalah ... | 0 |
| 17 | 2021-07-31T06:20:13Z | Ennizodev | Terima kasih Pak . ini yg saya cari simple+le... | 1 |

**Figure 1.** Youtube Crawling Results

## *4.2 Preprocessing data*

Data pre-processing is a stage that aims to address various issues that may interfere with data processing. Many data may have inconsistent formats, so they need to be corrected. Data preprocessing is a crucial first step before proceeding to the data mining stage, here are the steps in data pre-processing:

1. Cleaning
   At this stage, all comments will be cleaned by removing elements that do not provide information value, such as usernames, numbers, hashtags, punctuation marks, and URLs or links. The purpose of this process is to reduce noise in the data.
2. Case Folding
   In this stage, all the letters in the dataset will be converted to lowercase to equalize the format and avoid differences caused by capitalization.
3. Tokenizing This step involves breaking the text from the first character to the last. If the first character is not a word separator character, such as a period (.), comma (,), space, or other separator mark, it will be merged with the next character.
4. Normalization
   Normalization is the process of correcting the writing of words that are not standard, removing abbreviations, and improving the form of writing words to match the correct Indonesian language rules.
5. Stopword Removal
   At this stage, every word in the comment is examined and words that are considered less relevant, such as conjunctions, prepositions, and pronouns, are removed as they are not directly related to sentiment analysis.
6. Stemming

This step involves modifying the data by removing affixes from words, so that each word is represented in its base form or basic form.

| | |
|---|---|
| Cleaning | Semoga indonesia tetap kuat menghadapi krisis global |
| *Case folding* | semoga indonesia tetap kuat menghadapi krisis global |
| *Tokenizing* | 'semoga', 'indonesia', 'tetap', 'kuat', 'menghadapi', 'krisis', 'global' |
| *Normalization* | semoga indonesia tetap kuat menghadapi krisis global |
| *Stopword Removal* | 'semoga', 'indonesia', 'kuat', 'menghadapi', 'krisis', 'global' |
| *Stemming* | moga indonesia kuat hadap krisis global |

**Figure 2**. Results of Data Preprocessing

### *4.3 Dataset labeling*

This stage involves labeling the dataset by dividing it into two classes. Comments containing positive sentiment will be labeled as "positive," while comments containing negative sentiment will be labeled as "negative." The labeling process is done automatically using a lexicon-based method, which allows the determination of labels based on the sentiment value contained in each comment.

Once each word in the text is labeled, the overall sentiment score of the text can be calculated by adding up the number of positive and negative words, and mathematically combining these values. A commonly used formula for calculating sentiment score (StSc) is:

$$StSc = \frac{number\ of\ positive\ words - number\ of\ negative\ words}{total\ word\ count}$$

In this formula, the overall sentiment score of the text (StSc) is calculated by subtracting the number of negative words from the number of positive words. This score gives an indication of whether the text has a positive, negative or neutral sentiment.

### *4.4 TF – IDF*

In this step, the weight for each word (term) contained in the YouTube user comment dataset is calculated. The TF-IDF process starts by calculating the term frequency (TF) and document frequency (DF) values. Next, the inverse document frequency (IDF) value is calculated, and the final weight is obtained by multiplying the TF and IDF values. The following is the formula used:

$$IDF = ln\frac{d+1}{df+1} + 1$$

$$W_{dt} = TF_{dt} \times IDF$$

$$Norm\ W_{dt} = \frac{W_{dt}}{\sqrt{\sum_{i=1}^{n} x_i^2}}$$

### *4.5 Split dataset*

After the pre-processing and feature extraction stages with TF-IDF are completed, the next step is to split the dataset. This process involves dividing the dataset into two parts: training data and test data. In this scenario, the data is split by a proportion where the amount of training data is greater than the test data. In this study, the data is split with a ratio of 9:1, where 90% of the dataset is used as training data, and the remaining 10% is used as test data. The same principle applies to other data splitting scenarios. The purpose of this split is to evaluate the performance of the model using test data that is not involved in the training process.

### *4.6 Naive Bayes Classifier*

Naive Bayes uses probability calculations and applies Bayes' Theorem, which is formulated with the following formula:

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

The steps in calculating class classification on the first document test data start by calculating the prior probability value, conditional probability, and then posterior probability:

- Calculating the prior probability value
  P(X) = $\frac{dx}{d}$

- Calculating the conditional probability value with Laplacian smoothing
  P(Term Hn|X ) = $\frac{Hn|X + 1}{(c)+|V|}$

- Calculating the posterior probability value
  P(Term H|X) = P(X) * P(Term H1|X )* P(Term H2|X )

### *4.7 System evaluation*

At this stage, the confusion matrix is used to calculate the accuracy level of the classification system by presenting the classification results in tabular form. The confusion matrix shows the amount of test data that is successfully predicted, and the results are presented in a 2x2 matrix that corresponds to the number of sentiment classes, namely positive and negative. From the confusion matrix, the accuracy, recall, precision, and F1-score values of the system that has been built using the classification method are calculated. The following is a table display of the confusion matrix results in this study:

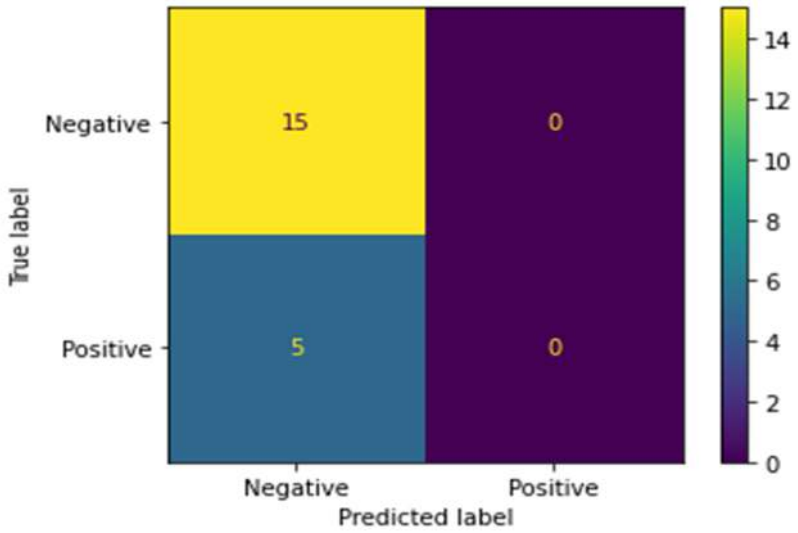


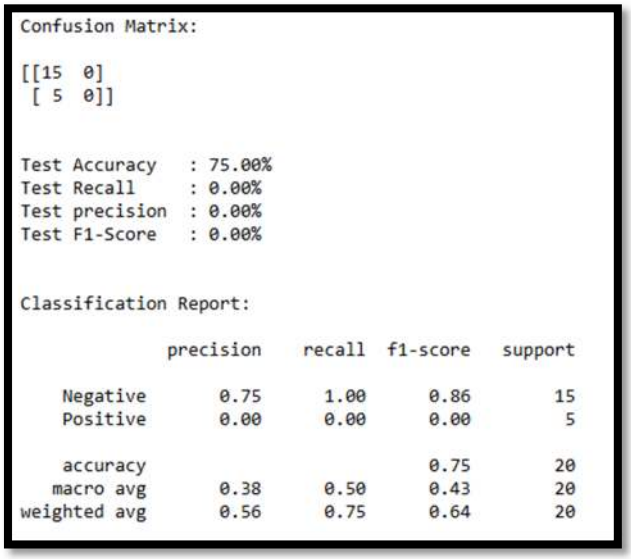

**Figure 3.** Results of Confusion Matrix

$$Accuracy = \frac{0 + 15}{0 + 5 + 0 + 15} * 100\% = 75.00\ \%$$

$$Precision = \frac{0}{0 + 0} * 100\% = 0.00\ \%$$

$$Recall = \frac{0}{0 + 0} * 100\% = 0.00\ \%$$

Classification report shows the results of all the values that have been presented previously. Furthermore, the classification report results from confusion mastrix:



```
Confusion Matrix:

[[15  0]
 [ 5  0]]


Test Accuracy   : 75.00%
Test Recall     : 0.00%
Test precision  : 0.00%
Test F1-Score   : 0.00%


Classification Report:

              precision    recall  f1-score   support

    Negative       0.75      1.00      0.86        15
    Positive       0.00      0.00      0.00         5

    accuracy                           0.75        20
   macro avg       0.38      0.50      0.43        20
weighted avg       0.56      0.75      0.64        20
```

**Figure 4.** Results of the classification report

## 5. CONCLUSION

The dataset obtained through the crawling technique consists of approximately 300 comments (opinions) about the economic recession. Of these, 200 comments (opinions) were selected for analysis after applying preprocessing and labeling stages. The data was labeled using a lexicon-based technique with an Indonesian dictionary. This approach involves matching words with the dictionary to calculate sentiment scores. The Naïve Bayes Classifier method performed well in the sentiment classification system, as shown by the accuracy results on the dataset. The dataset is divided by a ratio of 9:1, consisting of 180 training data and 20 test data. By using the TF-IDF word weighting scheme, the following evaluation values are obtained:

- Accuracy: 75,00%
- Precision: 0,00%
- Recall: 0.00%
- F1-Score: 0.00%

## REFRENCES


Aini, Q., Fauzi, R. R., & Khudzaeva, E. (2023). Economic Impact Due Covid-19 Pandemic: Sentiment Analysis on Twitter Using Naive Bayes Classifier and Support Vector Machine. International Journal on Informatics Visualization, 7(3), 733–741. https://doi.org/10.30630/joiv.7.3.1474

Alfandi Safira, & Hasan, F. N. (2023). Analisis Sentimen Masyarakat Terhadap Paylater Menggunakan Metode Naive Bayes Classifier. ZONAsi: Jurnal Sistem Informasi, 5(1), 59–70. https://doi.org/10.31849/zn.v5i1.12856

Biswas, S. (2020). Scope of Sentiment Analysis on News Articles Regarding Stock Market and GDP in Struggling Economic Condition. International Journal of Emerging Trends in Engineering Research, 8(7), 3594–3609. https://doi.org/10.30534/ijeter/2020/117872020

Blandina, S. R., Fitrian, A. N., & Septiyani, W. (2020). Strategi Menghindarkan Indonesia dari Ancaman Resesi Ekonomi di Masa Pandemi. *Efektor*, *7*(2), 181–190. https://doi.org/10.29407/e.v7i2.15043

Damuri, A., Riyanto, U., Rusdianto, H., & Aminudin, M. (2021). Implementasi Data Mining dengan Algoritma Naïve Bayes Untuk Klasifikasi Kelayakan Penerima Bantuan Sembako. *Jurnal Riset Komputer*, *8*(6), 219–225. https://doi.org/10.30865/jurikom.v8i6.3655

Darwis, D., Siskawati, N., & Abidin, Z. (2021). Penerapan Algoritma Naive Bayes Untuk Analisis Sentimen Review Data Twitter Bmkg Nasional. Jurnal Tekno Kompak, 15(1), 131. https://doi.org/10.33365/jtk.v15i1.744

Eka Putra, F. P., Maulana, F. I., Akbar, N. M., & Febriantoro, W. (2023). Twitter sentiment analysis about economic recession in indonesia. Bulletin of Social Informatics Theory and Application, 7(1), 1–7. https://doi.org/10.31763/businta.v7i1.592

Halim Lubis, A., Fadillah Harahap, Y., & Studi Ilmu Komputer, P. (2023). Analisis Sentimen Masyarakat Terhadap Resesi Ekonomi Global 2023 Menggunakan Algoritma Naïve Bayes Classifier. *Jurnal Ilmiah Elektronika Dan Komputer*, *16*(2), 442–450. http://journal.stekom.ac.id/index.php/elkom

Hutagaol, Y. R. T., Sinurat, R. P. P., & Shalahuddin, S. M. (2022). Strategi Penguatan Keuangan Negara Dalam Menghadapi Ancaman Resesi Global 2023 Melalui Green Economy. *Jurnal Pajak Dan Keuangan Negara (PKN)*, *4*(1S), 378–385.

Inesta, R., & Hukom, A. (2023). Analisis Fenomena Resesi Ekonomi Indonesia Dimasa Pandemi Virus Covid-19.*Jurnal Manajemen Riset Inovasi*, *1*(2), 121–127. http://prin.or.id/index.php/mri/article/view/1054%0Ahttps://prin.or.id/index.php/mri/article/download/1054/1135

Merinda Lestandy, Abdurrahim Abdurrahim, & Lailis Syafa'ah. (2021). Analisis Sentimen Tweet Vaksin COVID-19 Menggunakan Recurrent Neural Network dan Naïve Bayes. *Jurnal RESTI (Rekayasa Sistem Dan Teknologi Informasi)*, *5*(4), 802–808.

Ningsih, M. R., Wibowo, K. A. H., Dullah, A. U., & Jumanto, J. (2023). Global recession sentiment analysis utilizing VADER and ensemble learning method with word embedding. Journal of Soft Computing Exploration, 4(3), 142–151. https://doi.org/10.52465/joscex.v4i3.193

Ningtyas, A. A., Solichin, A., & Pradana, R. (2023). Analisis Sentimen Komentar Youtube Tentang Prediksi Resesi Ekonomi Tahun 2023 Menggunakan Algoritme Naïve Bayes. Bit (Fakultas Teknologi Informasi Universitas Budi Luhur), 20(1), 9. https://doi.org/10.36080/bit.v20i1.2317

Prasetiyo Wibowo, M., Amini, S., & Kusumaningsih, D. (2023). Analisis Sentimen Masyarakat Indonesia Pada Twitter Terhadap Isu Resesi 2023 Menggunakan Metode Naive Bayes. *2 Nd Seminar Nasional Mahasiswa Fakultas Teknologi Informasi (SENAFTI)*, *2*(1), 201–210.

Putri Ratna, A. A., Kaltsum, A., Santiar, L., Khairunissa, H., Ibrahim, I., & Purnamasari, P. D. (2019). Term Frequency-Inverse Document Frequency Answer Categorization with Support Vector Machine on Automatic Short Essay Grading System with Latent Semantic Analysis for Japanese Language. ICECOS 2019 - 3rd International Conference on Electrical Engineering and Computer Science, Proceeding, 2, 293–298. https://doi.org/10.1109/ICECOS47637.2019.8984530

Ratnawati, F. (2018). Implementasi Algoritma Naive Bayes Terhadap Analisis Sentimen Opini Film Pada Twitter. INOVTEK Polbeng - Seri Informatika, 3(1), 50. https://doi.org/10.35314/isi.v3i1.335

Ressan, M. B., & Hassan, R. F. (2022). Naïve-Bayes family for sentiment analysis during COVID-19 pandemic and classification tweets. Indonesian Journal of Electrical Engineering and Computer Science, 28(1), 375–383. https://doi.org/10.11591/ijeecs.v28.i1.pp375-383

Sari, F. V., & Wibowo, A. (2019). Analisis Sentimen Pelanggan Toko Online Jd.Id Menggunakan Metode Naïve Bayes Classifier Berbasis Konversi Ikon Emosi. *Jurnal SIMETRIS*, *10*(2), 681–686.

Sari, R., & Hayuningtyas, R. Y. (2019). Penerapan Algoritma Naive Bayes Untuk Analisis Sentimen Pada Wisata TMII Berbasis Website. Indonesian Journal on Software Engineering (IJSE), 5(2), 51–60. https://doi.org/10.31294/ijse.v5i2.6957

Setiawati, P. A., Suarjaya, I. M. A. D., & Trisna, I. N. P. (2024). Sentiment Analysis of Unemployment in Indonesia During and Post COVID-19 on X (Twitter) Using Naïve Bayes and Support Vector Machine. Journal of Information Systems and Informatics, 6(2), 662–675. https://doi.org/10.51519/journalisi.v6i2.713

Sutresno, S. A. (2023). Analisis Sentimen Masyarakat Indonesia Terhadap Dampak Penurunan Global Sebagai Akibat Resesi di Twitter. *Building of Informatics, Technology and Science (BITS)*, *4*(4), 1959–1966. https://doi.org/10.47065/bits.v4i4.3149