

## SENTIMENT ANALYSIS OF THE NATIONAL MANDATE PARTY (PAN) IN YOUTUBE COMMENTS USING THE TF-IDF AND COSINE SIMILARITY APPROACHES

By

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### ABSTRACT

*This study analyzed public sentiment towards the National Mandate Party (PAN) on YouTube comments using the Term Frequency Inverse Document Frequency (TF-IDF) approach and cosine similarity. The aim of the study was to map the tendency of public opinion into three categories: positive, negative, and neutral, and to evaluate the performance of this method compared to a simple lexicon-based approach. Comment data is obtained through the YouTube Data API, then processed through the stages of text cleanup, normalization, stopword removal, and stemming using Sastrawi. Word representation is formed with TF-IDF, while sentiment classification is done by calculating vector similarity using cosine similarity. The results of the analysis showed that neutral sentiment dominated at 63.2%, followed by negative sentiment at 20.7%, and positive sentiment at 16.1%. The TF-IDF model is able to classify neutral and negative comments quite well, although some positive comments are difficult to distinguish from neutral comments. These findings suggest that discussions about PAN on YouTube tend to be informative rather than emotional, with a higher tendency to criticize than support. In conclusion, the TF-IDF and cosine similarity methods are effective in providing an overview of public opinion with low computational complexity, while being a lightweight alternative to deep learning-based methods.*

**Keywords:** Sentiment analysis, YouTube, TF-IDF, cosine similarity, National Mandate Party

## ANALISIS SENTIMEN TERHADAP PARTAI AMANAT NASIONAL (PAN) PADA KOMENTAR YOUTUBE MENGGUNAKAN PENDEKATAN TF-IDF DAN COSINE SIMILARITY

### ABSTRAK

*Penelitian ini menganalisis sentimen publik terhadap Partai Amanat Nasional (PAN) pada komentar YouTube dengan pendekatan Term Frequency–Inverse Document Frequency (TF-IDF) dan cosine similarity. Tujuan penelitian adalah memetakan kecenderungan opini publik menjadi tiga kategori: positif, negatif, dan netral, serta mengevaluasi kinerja metode ini dibandingkan pendekatan berbasis lexicon sederhana. Data komentar diperoleh melalui*

*YouTube Data API, kemudian diproses melalui tahapan pembersihan teks, normalisasi, penghapusan stopword, dan stemming menggunakan Sastrawi. Representasi kata dibentuk dengan TF-IDF, sementara klasifikasi sentimen dilakukan dengan menghitung kesamaan vektor menggunakan cosine similarity. Hasil analisis menunjukkan sentimen netral mendominasi sebesar 63,2%, diikuti sentimen negatif 20,7%, dan sentimen positif 16,1%. Model TF-IDF mampu mengklasifikasikan komentar netral dan negatif dengan cukup baik, meskipun sebagian komentar positif sulit dibedakan dari komentar netral. Temuan ini menunjukkan bahwa diskusi mengenai PAN di YouTube cenderung bersifat informatif daripada emosional, dengan kecenderungan kritik yang lebih tinggi dibandingkan dukungan. Kesimpulannya, metode TF-IDF dan cosine similarity efektif untuk memberikan gambaran umum opini publik dengan kompleksitas komputasi yang rendah, sekaligus menjadi alternatif ringan dibandingkan metode berbasis deep learning.*

**Keywords:** Analisis sentimen, YouTube, TF-IDF, cosine similarity, Partai Amanat Nasional

## INTRODUCTION

Rapid advances in information and communication technology, especially through video-sharing platforms such as YouTube, have changed the way people express their political opinions. This is in line with the view of Nasrullah (2017) who states that social media has created a new public space for digital political participation. The responses written by netizens on political video channels or content are now an important source for understanding public opinion about political parties in Indonesia. The National Mandate Party (PAN), as one of the significant parties that has a large contribution to the national political scene, is interesting to study to see how the public supports, criticizes, or is neutral on various matters related to the party.

Sentiment analysis from comments on YouTube provides an opportunity for researchers to capture people's perceptions directly and data-driven. Several previous researches have explored various methods in grouping sentiment through different approaches, for example the study by Mahfudza and Ihksan (2024) which used Naive Bayes with an accuracy rate of around 66.90%, research (Prayudani et al. 2024) which combined BERT marking and Naive Bayes classification with an accuracy above 85%, and research (Pookduang et al. 2025) which showed the advantages of the RoBERTa model with an accuracy of 96.30% and an F1-score of 98.11%. In addition, (Sudar, et al. 2024) highlight the

crucial importance of structured methodologies such as CRISP-DM to improve the quality of sentiment analysis on social media platforms.

Although modern algorithms such as BERT and RoBERTa have shown satisfactory results, conventional approaches based on *Term Frequency–Inverse Document Frequency (TF-IDF)* and *cosine similarity* remain relevant. As explained by (Adek et al. 2024), the use of *TF-IDF* is very effective in selecting important keywords from thousands of unstructured comments. In addition, (Nilawati, et al. 2022) emphasized that this method can provide recommendations for ease and speed in interpreting word features. This approach is also strengthened by (Liawati, et al., 2023) which prove that text classification based on word weighting is still very capable for informal Indonesian-language data. This research with the title *Sentiment Analysis Towards the National Mandate Party (PAN) on Youtube Comments Using the Tf-IDF Approach and Cosine Similarity* was carried out with the intention of systematically mapping public tendencies towards PAN to make a real contribution to political communication strategies in the digital era.

## LITERATURE REVIEW

### 1. Sentiment Analysis

Sentiment analysis is an effort to explore the views or attitudes (positive–negative–neutral) of a text. In the context of *YouTube's* commentary on PAN, the goal is to understand the overall public sentiment. This is in line with the view that social media has become a significant space for communication and digital culture in shaping opinions (Nasrullah, 2017). Usually, there are two ways: using rules/lexicons (relying on emotion-laden word lists) and machine learning (relying on labeled data) (Liu, 2020). This study focuses on the representation of *TF-IDF features* and the measurement of similarity with *cosine similarity*.

### 2. Data Collection

Comments were taken from videos related to PAN using *the YouTube Data API*. Each data at least includes comment text, upload time, and channel/video info. This data extraction process is commonly carried out to capture the phenomenon of public opinion on video platforms (Adek et al., 2024). For the data to be accurate, it is necessary to filter out

spam/duplicates, limit only Indonesian, and label sentiment (manual or semi-automatic) for evaluation purposes (Al-Ghuribi., 2021).

### 3. Text Preprocessing

The pre-process aims to reduce distractions: changing characters, changing to lowercase, cleaning *URLs/emojis/hashtags/mentions*, normalizing slang, removing punctuation and unimportant numbers, tokenization, *removing stopwords*, and *stemming*. For Indonesian, Sastrawi (*stemmer/stopword*) is often used (Adriani et al., 2007); in Python it can be combined with *re (regex)* and *nlTK* for basic tokenization. This stage is crucial in analyzing political sentiment to maintain the quality of data before entering the classification stage (Mauliana et al., 2024).

### 4. TF-IDF Feature Representation

*TF-IDF (Term Frequency–Inverse Document Frequency)* describes the document as a word weight vector: TF records the local frequency in the document, IDF reduces the weight of words that are too common in all documents. This weighting method has proven to be effective in distinguishing text characteristics in content-based classification (Nilawati et al., 2024). In Python, *scikit-learn (TfidfVectorizer)* provides weighting, *n-gram* filters, and minimum frequency settings (Pedregosa et al., 2011).

### 5. Vector Space Model and Cosine Similarity

In a vector space model, the similarity of a document is measured from the angle between two vectors. *Cosine similarity normalizes* the length of the vector so that it focuses on the direction (word pattern), not the size of the document. The implementation of *the combination of TF-IDF and cosine similarity* has been widely used in document classification due to its efficiency (Nilawati et al., 2024). For simple classification, the document can be labeled according to the nearest prototype/centroid class (e.g. average *TF-IDF vector* per positive/negative/neutral class). Alternatively, *cosine* can be used as a metric in *K-NN* in the *TF-IDF space*.

### 6. Classification Scheme

Two general schemes: (a) *Nearest-centroid/K-NN based on cosine*: fast, clear, easy to interpret; (b) Linear classifiers (SVM/LogReg) feature TF-IDF: remain lightweight but usually more accurate. Although *deep learning approaches* are becoming popular for

political issues on social media (Liawati et al., 2023), this study focuses on interpretability—words with *high TF-IDF* per class can be traced back as a feature marker to map political promises or candidate backgrounds (Prayudani et al., 2024).

#### 7. Evaluation

The data set is divided into training/test (e.g. 80/20) or using *k-fold cross-validation*. Key metrics: accuracy, *precision*, *recall*, and *F1-score* per class to address label imbalances. This structured evaluation is important to ensure that the model can distinguish traditional sentiments from modern sentiments based on language models (Pookduang et al., 2025). Error analysis (*confusion matrix*) helps recognize ambiguous words, irony, or political context that trigger misclassification in a systematic data analysis framework (Sudar et al., 2024).

#### 8. Python Tools

Important libraries: *pandas* (manage data), *numpy* (vector algebra), *scikit-learn* (*TF-IDF*, data divider, classification, metrics, *cosine similarity*), *Sastrawi* (*stemming/stopword ID*), *nltk* (basic tokenization), and *google-api-python-client* (*YouTube API*). *Automated pipelines* make it easy to replicate and track experiments to support the transparency of research methodologies.

## RESEARCH METHODS

This study applied a descriptive quantitative method using *text mining* techniques to evaluate public views of the National Mandate Party (PAN) through comments on *YouTube* (Adek et al., 2024). The research process was carried out through several systematic steps following a structured data analysis framework (Sudar et al., 2024), starting from data collection, text preprocessing, to creating feature representations using *Term Frequency–Inverse Document Frequency (TF-IDF)*. Furthermore, sentiment classification was carried out based on *cosine similarity* (Nilawati et al., 2024), as well as evaluation of model results using accuracy, *precision*, *recall*, and *F1-score* metrics to ensure the validity of the findings (Mauliana et al., 2024). The following are the steps contained in this research process:

#### 1. Data Information Collection

The study used comment data from YouTube, which was stored in a file called *commentar\_youtube\_mentah.csv*. This raw data is then organized into two important columns: the video ID and the comment text, for easier analysis.

## 2. Initial Steps of Text Processing (Preprocessing)

In order for the data to be ready for processing, there are several stages of preparation that need to be done:

- a. Change to Lowercase: All letters are changed to lowercase.
- b. Text Cleanup: Characters other than the letters of the alphabet are omitted using regular expressions.
- c. Remove *Stopwords*: Common words that have less effect on the meaning of sentiment are removed with Sastrawi *Stop Word Remover*.
- d. Word Stemming: Words are returned to their basic form with Stemmer Literature.

The results of all this are stored in the *komentar\_bersih* column.

## 3. Compilation of Sentiment Word List

There are two lists of keywords that have been created:

- a. A list of positive words (e.g.: good, great, awesome).
- b. A list of negative words (e.g.: ugly, failing, disappointing).

These lists are used as a guide to assess sentiment.

## 4. Determination of *TF-IDF* Weights and *Cosine Similarity*

To assess whether a comment has positive, negative, or neutral sentiment, word assessment is carried out using the *TF-IDF* (*Term Frequency – Inverse Document Frequency*) method and similarity calculation using *Cosine Similarity*.

*TF-IDF Formula:*

$$TF(t, d) = \frac{\text{Jumlah kemunculan kata } t \text{ dalam dokumen } d}{\text{Total kata dalam dokumen } d}$$

$$IDF(t) = \log \frac{N}{df(t)}$$

$$TF - IDF(t, d) = TF(t, d) \times IDF(t)$$

*Cosine Similarity Formula:*

$$\cos(\theta) = \frac{\sum_{i=1}^n A_i \times B_i}{\sqrt{\sum_{i=1}^n A_i^2} \times \sqrt{\sum_{i=1}^n B_i^2}}$$

Where:

- a.  $A$  = TF-IDF vector comment
- b.  $B$  = TF-IDF vector lexicon positive or negative

If:

- a. Positive score > negative score → positive sentiment
- b. Negative score > positive score → negative sentiment
- c. Both scores are the same → neutral sentiment

### 5. Visual Presentation of Data

The results of the analysis are displayed through the Sentiment distribution and presented in the form of bar charts and pie charts.

### 6. Evaluation Using *the Confusion Matrix*

To see the performance of the *TF-IDF + Cosine Similarity* method, the results were compared to the *simple dummy lexicon* method .

- a. *The Dummy label* → determined by adding up the positive and negative words directly.
- b. *The Confusion Matrix* → measure the suitability of the results of the two methods.

The following are the stages described in *the FlowChart* :

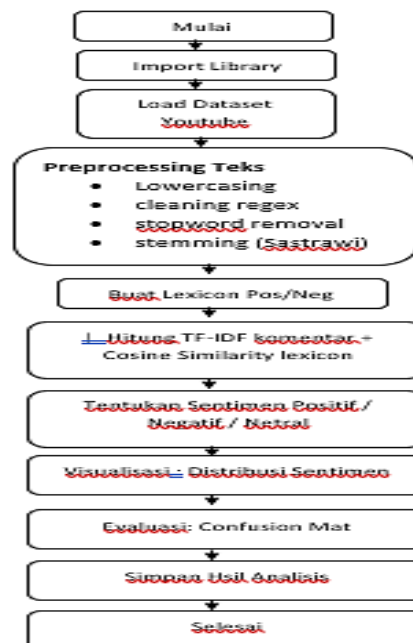


Figure 1. Stages of the sentiment analysis process of the *TF-IDF* approach and *cosine similarity*

## RESULTS AND DISCUSSION

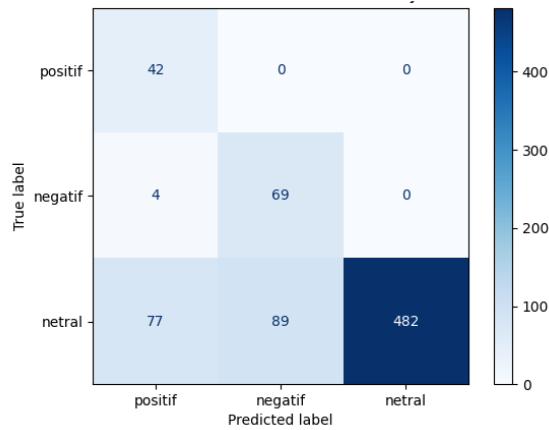


Figure 2. *Confusion Matrix* between Dummy vs *TF-IDF* Sentiment.

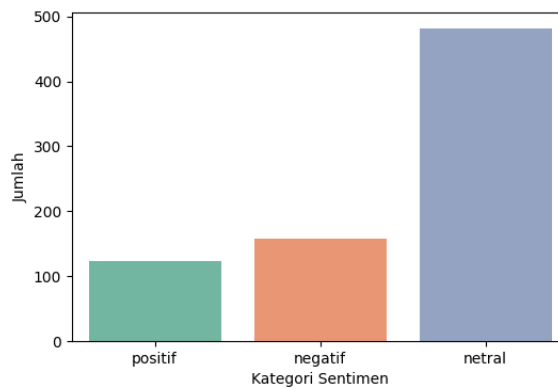


Figure 3. Comment Sentiment Distribution

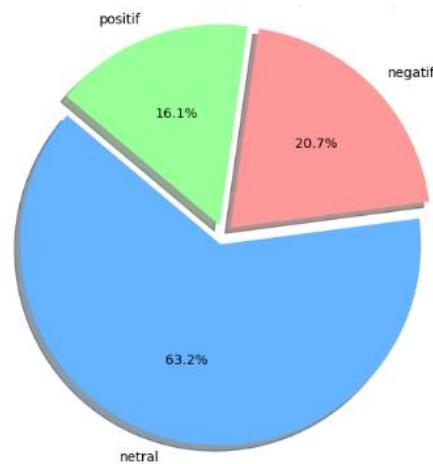


Figure 4. Comment Sentiment Distribution (*Percentage*)

Sentiment analysis on various *YouTube* comments about the National Mandate Party (PAN) using the *TF-IDF method* showed a difference in the distribution of sentiment.

The sentiment distribution graph in (Figure 2, Figure 3 and Figure 4) shows that neutral comments are the most found, at around 63.2%. After that, there were negative comments of 20.7%, and the rest were positive comments with a figure of 16.1%. From this data, it can be seen that the majority of *YouTube* users tend to leave comments that contain information or do not really show their opinions. However, the number of negative comments is slightly more than the positive ones.

The performance assessment of sentiment classification was carried out using a *confusion matrix* (Figure 1). The results of the research show that the *TF-IDF model* is quite accurate in grouping negative and neutral sentiments. This is evidenced by the number of correct predictions in the neutral category (482 comments) and the negative category (69 comments).

However, there are some misclassifications, especially in positive sentiment. Many positive comments are actually considered neutral comments. Possibly, this is due to the similarity of words between positive and neutral comments, so that the *TF-IDF* value becomes less effective in distinguishing the two. Broadly speaking, the *TF-IDF* model manages to provide a general view of public opinion of PAN on *YouTube*. The high number of neutral sentiments indicates that chatting about PAN on social media contains more descriptions or information, rather than opinions full of emotions. However, the higher number of negative sentiments than positive sentiment indicates a tendency to criticize PAN, and this is worth noting. These findings are in line with previous research (as reported by Santoso et al., 2021; Pradana and Wibowo, 2022) who stated that political comments on social media are generally neutral, but negative sentiments can increase if there are sensitive or controversial issues that arise.

## CONCLUSION

### 1. Public Opinion

The analysis shows that how the public views PAN is divided into three main groups: there are pro, con, and mediocre. The majority tend to be neutral, which means that many netizens simply share info or news without showing strong emotions.

## 2. Positive Opinion

Positive views usually arise when there are issues or news about successful work programs, social actions, or achievements of PAN cadres both at the central and regional levels.

## 3. Negative Opinions

Meanwhile, negative views appear on sensitive political issues, such as policy debates or internal party conflicts, which shows the need for improvement in the management of political communication.

## 4. Changing Opinions – Trends

This opinion can change depending on political moments, for example during elections or when PAN issues important statements. This proves that public opinion is very easily influenced by the context and way of presenting issues on social media.

### Suggestions:

1. Highlight the Positive - PAN needs to constantly show the success of cadres and clear programs to expand a positive outlook.
2. Address negative content quickly - A swift and communicative response to suppress negative opinions, such as with formal clarifications or targeted digital campaigns.
3. Know the Pros and Cons - Group supporters and opponents so that the message is more targeted, not just general and broad.
4. Optimize social media - Utilize engaging formats (such as infographics, short videos, and testimonials) to make PAN messages more engaging and easy to disseminate.
5. Monitor Constantly - Conduct opinion analysis regularly to respond to changes in public views and adjust existing communication strategies.

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