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# Comparison of Naive Bayes and Support Vector Machine (SVM) Algorithms Regarding The Popularity of Presidential Candidates In The Upcoming 2024 Presidential Election

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## ABSTRACT

This study aims to compare the effectiveness of two classification algorithms, Naive Bayes and Support Vector Machine (SVM), in analyzing the popularity of presidential candidates for the 2024 Presidential Election (Pilpres). The popularity of presidential candidates plays a crucial role in campaign strategies and political decision-making in the modern political era. This research utilizes data from social media, encompassing public sentiment towards presidential candidates and related political issues. The research results indicate that SVM achieves an accuracy rate of 97%, while Naive Bayes achieves 95%, demonstrating the superiority of SVM in predicting the popularity of presidential candidates. In conclusion, the selection of the appropriate algorithm for analyzing complex political data has a significant impact, and the high accuracy rates of both algorithms provide valuable guidance for political decision-makers and campaign teams in preparation for the upcoming 2024 Pilpres.

**Keywords**: Naive Bayes, Support Vector Machine, presidential candidate popularity, 2024 Pilpres, accuracy rate, sentiment analysis.

## 1. INTRODUCTION

In this era of computerization and internet connectivity, information technology has become an essential component of daily life. Its far-reaching influence extends across various aspects of society, including a significant role in the electoral process. Information technology can significantly enhance transparency and accountability in elections while facilitating better decision-making by voters.

The presidency is a leadership position in a nation, encompassing two roles: head of state and head of government. Over the course of Indonesia's 76-year history, various different figures have led the nation. In Indonesia, presidential elections are conducted through a democratic process every five years. However, certain circumstances governing the presidency limit the current president from running for re-election in 2024.

One of the data methods used in general elections is the prediction of presidential candidate popularity. This is attempted by using the Naive Bayes and SVM algorithms based on reliable survey information regarding the popularity of these candidates in the community.

In the political context of Indonesia, the Presidential Election (Pilpres) is one of the most prominent and widely covered political events. Preparations and planning

for the Pilpres, a major event in the political calendar, require careful consideration by political parties or political coalitions proposing presidential candidate pairs. In this regard, algorithms like Naïve Bayes and Support Vector Machine (SVM) can assist these entities in assessing the popularity of their respective candidate pairs for the upcoming 2024 Presidential Election.

Naive Bayes and SVM algorithms are well-established methods in data processing and predictive modeling. Naive Bayes, rooted in Bayes' theorem, is a probabilistic classification algorithm, while SVM is a machine learning technique used for classification and regression tasks by creating an effective model to separate data into two classes.

Several previous studies have employed Naive Bayes and SVM algorithms to assess the popularity levels of presidential candidates in the context of general elections. For instance, Panjaitan and Lhaksmana's study (2019) [7] utilized the Naive Bayes method to analyze candidate popularity in the 2019 elections. Additionally, Ananda and Pristyanto's research (2021) [8] employed the SVM algorithm to predict the presidential election outcome based on sentiment analysis on Twitter. Similarly, Luthfanida's study (2020) [4] applied both the Naive Bayes and SVM methods to analyze sentiment regarding three different periods.

The aim of this study is to provide accurate information regarding the popularity of presidential candidates in the 2024 presidential election, assist the public in making wiser decisions based on reliable data, and drive the advancement of information technology in politics to enhance transparency and accountability in general elections

## 2. RELATED WORKS

The materials used in analyzing public sentiment towards presidential candidates in the 2024 Presidential Election in Indonesia will depend on the project scope and data sources used. Here is a general guideline regarding the materials to consider:

Sentiment Data: Data encompassing text, comments, or messages from various sources such as social media (Twitter, Facebook, Instagram), online forums (Reddit, Kaskus), news, and public surveys. You can collect this data using web scraping or APIs.

Presidential Candidate Data: Detailed information about candidates whose sentiments will be examined, including backgrounds, platforms, and statements. This information can be sourced from news outlets and official websites. Sentiment Analysis Tools: You will require tools or software capable of analyzing sentiment in text. This could be Python libraries like NLTK.

### 2.1 CONTRIBUTION

In the mentioned articles, various research contributions related to sentiment analysis and the use of methods like Naive Bayes and SVM in the context of presidential elections or the selection of presidential candidates in Indonesia are present. The differences in focus, methods, and research scope indicate the various approaches used in studying public sentiment regarding presidential candidates and their elections.

The research contributions in these articles aim to provide insights into sentiment analysis and the use of specific methods in the context of presidential elections in


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Indonesia. Sentiment analysis from Twitter data can be a valuable source of information in predicting the outcomes of presidential elections.

## 3. METHODOLOGY

### 3. 1 ALGORITHM METHOD

This research focuses on sentiment analysis related to the popularity of presidential candidates in the 2024 Presidential Election in Indonesia. The research methodology is based on the analysis of data from the Twitter social media platform using the Naive Bayes and Support Vector Machine (SVM) algorithms [4]. The goal is to classify public sentiment towards the presidential candidates.

### 3.1.1 NAÏVE BAYES ALGORITHM

The Naïve Bayes algorithm is one of the classification techniques. Naïve Bayes is a probabilistic and statistical model-based classification with simplification based on Bayes' theorem, assuming that each attribute is independent. In other words, the algorithm assumes that the presence or absence of specific features in one class is unrelated to the features of other classes [3].

$$P\ (H|X) = \frac{\mathrm{P(H)P(H)}}{\mathrm{P(X)}} \quad (1)$$

Where:

| | |
|---|---|
| X | = Data with an unknown class |
| H | = The hypothesis of data X, representing a specific class |
| P(H\|X) | = The probability of hypothesis H based on condition X (posterior probability) |
| P(H) | = The probability of hypothesis H (prior probability) |

### 3.1.2 SUPPORT VECTOR MACHINE (SVM) ALGORITHM

SVM is a Machine Learning algorithm that applies a hyperplane function to data, creating regions for each class. A hyperplane is a function used to separate classes. When predicting a class from data, SVM labels it based on the class region to which the data belongs. SVM is typically used with large datasets gathered from online sources and has become popular for its applications in text classification. The principle of SVM is to construct a hyperplane with an equal margin and without favoring one class region. This is achieved by measuring the margin and finding its maximum point. The effort to find the best hyperplane as a separator between classes is the core of the SVM method [3].

SVM methodology has three primary kernel models: radial, linear, and sigmoid. In this research, the linear kernel model is used [3].

In the research methodology, the steps that may be taken are as follows:

- Data Collection: Data will be collected from Twitter, including tweets and comments related to presidential candidates and the 2024 Presidential

Election. You mentioned that this data will be obtained through crawling on Twitter.

- Data Processing: Data obtained from Twitter will likely require processing. This includes removing incomplete or irrelevant data, data normalization, and encoding categorical features into numeric forms if necessary.
- Sentiment Analysis: In this step, you will apply the Naive Bayes and SVM algorithms to analyze sentiment in Twitter data[4]. These algorithms will be used to classify sentiments into categories like positive, negative, or neutral.
- Model Training: The processed data will be used to train Naive Bayes and SVM models. This involves using training data to create models that can classify sentiments with high accuracy.
- Model Evaluation: After model training, you will evaluate its performance. This may include using metrics like accuracy, precision, recall, and F1-score to measure how well the model predicts sentiment correctly.

## 3.2 RESEARCH FLOW

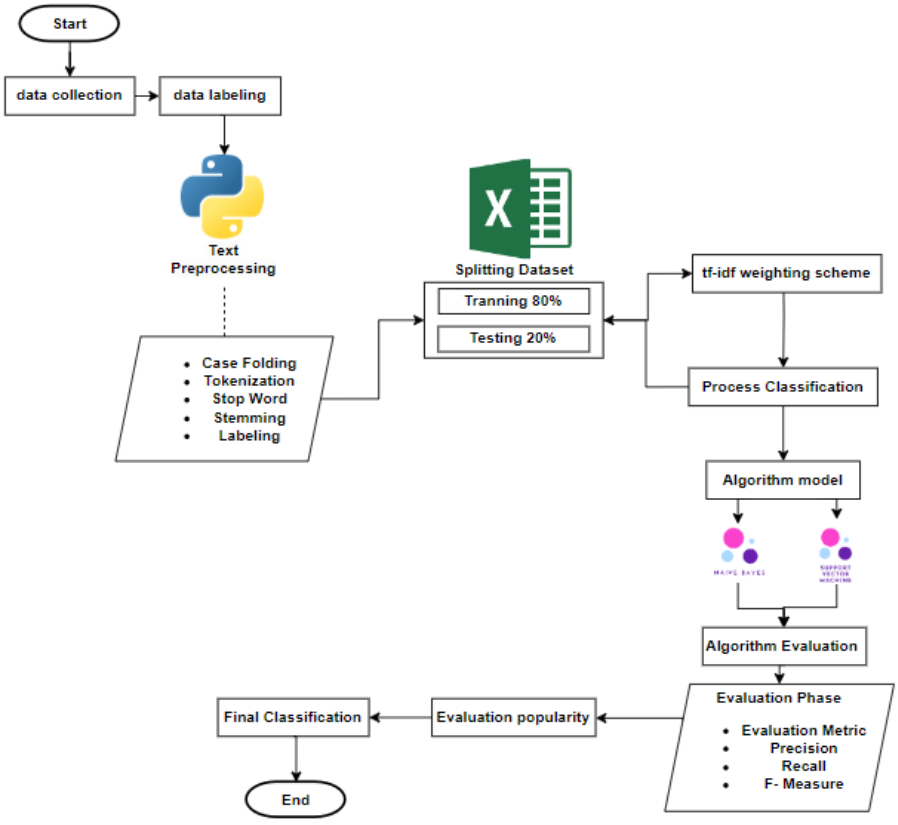


FIGURE 1. Research Flow


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### 3.2.1 DATASET

In this study, we used user opinions from Twitter as the primary dataset. The mining process resulted in a total of 3142 data sets. After cleaning and removing unclassifiable data, we obtained a total of 3,141 data related to Twitter user opinions. The Indonesian community on Twitter expressed their opinions on the topic of the 2024 presidential election.

### 3.2.2 PRE-PROCESSING

Pre-processing of information is a step in preparing information to suit the needs effectively so that it can be processed using the procedures in the main part of the system. The stages in performing information pre-processing are as follows: text cleaning, tokenization, stopwords removal, stemming, and labeling.

### 3.2.3 DATA SPLITTING

In machine learning and data analysis, data splitting refers to the process of dividing a dataset into two or more distinct subsets for use in various stages of analysis, such as model training, testing, and validation. Typically, the dataset is divided into two main groups: the training dataset and the testing dataset. The training dataset is used to train the machine learning model, while the testing dataset is used to evaluate the performance of the trained model.

### 3.2.4 MODEL ALGORITHMS

a) Naive Bayes:

- Model Selection: Choose a Naive Bayes variant suitable for sentiment analysis, such as Multinomial Naive Bayes or Gaussian Naive Bayes, depending on your data type.
- Model Training: Train the Naive Bayes model using the training data.
- Hyperparameter Tuning: Adjust parameters such as smoothing (alpha) if necessary.
- Model Evaluation: Evaluate the model's performance using validation data and metrics such as accuracy, precision, recall, and F1 score.
- Model Testing: Test the selected model on unseen test data.

b) Support Vector Machine:

- Model Selection: Choose an SVM variant suitable for text classification, such as SVM with a linear kernel or a non-linear kernel (e.g., Linear kernel).
- Model Training: Train the SVM model using the training data.
- Hyperparameter Tuning: Adjust SVM parameters, such as the kernel parameter and regularization parameter (C).
- Model Evaluation: Evaluate the model's performance using validation data and evaluation metrics.
- Model Testing: Test the selected model on test data.

### 3.4.5 EVALUATION PHASE

The Evaluation Phase in machine learning is the stage in the machine learning model development process where the built model is evaluated to measure its performance. The purpose of this stage is to assess how well the machine learning model can predict or classify data accurately and effectively.

### 3.4.6 FINAL CLASSIFICATION

In the context of machine learning or data analysis, it refers to the final outcome of the data classification process, where each data point has been categorized into the appropriate group or category based on the applied classification model. The final classification results indicate the label or class assigned to each data point in the dataset.

## 4. RESULTS AND CONCLUSIONS

In this study, we utilized data from Twitter user opinions as the primary dataset. Through data mining, we obtained a total of 3,142 datasets. After cleaning and eliminating data that couldn't be classified, we ended up with a total of 3,141 data related to Twitter user opinions. These opinions represent the views of Indonesian citizens on the topic of the 2024 presidential election.

```
print ( "accuracy_score:" , score*100, '%')
print ('=====================================================\n')
print(f'confusion_matrix:\n {confusion_matrix(y_test, predicted)}')
print('=====================================================\n')
print(classification_report(y_test, predicted))
```

```
accuracy_score: 95.07154213036566 %
=====================================================

confusion_matrix:
 [[  0   6   0]
 [  0 598   0]
 [  0  25   0]]
=====================================================

              precision    recall  f1-score   support

     negatif       0.00      0.00      0.00         6
      netral       0.95      1.00      0.97       598
     positif       0.00      0.00      0.00        25

    accuracy                           0.95       629
   macro avg       0.32      0.33      0.32       629
weighted avg       0.90      0.95      0.93       629
```

FIGURE 2. Accuracy Results of Naive Bayes


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```
print ( "accuracy_score:" , score*100, '%')
print ('=====================================================\n')
print(f'confusion_matrix:\n {confusion_matrix(y_test, prediction)}')
print('=====================================================\n')
print(classification_report(y_test, prediction))
```

```
accuracy_score: 97.2972972972973 %
=====================================================

confusion_matrix:
 [[  3   5   0]
 [  0 598   0]
 [  0  12  11]]
=====================================================

              precision    recall  f1-score   support

     negatif       1.00      0.38      0.55         8
      netral       0.97      1.00      0.99       598
     positif       1.00      0.48      0.65        23

    accuracy                           0.97       629
   macro avg       0.99      0.62      0.73       629
weighted avg       0.97      0.97      0.97       629
```

FIGURE 3. Accuracy Results of Support Vector Machine

Figure 2 displays a graph showing the accuracy results with a value of 95.07%, while Figure 3 shows a graph of accuracy results with a value of 97.30.

## 4.1 DISCUSSION

```
data.head()
```

| | Unnamed: 0 | id | text |
|---|---|---|---|
| 0 | 0 | di_dimu54412940 | Calon Presiden Indonesia Ganjar Pranowo bersil... |
| 1 | 1 | Monkdz25 | *KODE ALAM DAN TANDA ZAMAN SIAPA PRESIDEN RI K... |
| 2 | 2 | Presiden_Swasta | @ch_chotimah2 Dulu waktu AHY calon gubernur di... |
| 3 | 3 | di_dimu54412940 | Sang calon presiden Indonesia, Ganjar Pranowo ... |
| 4 | 4 | okezonenews | Banyak tokoh yang digadang-gadang jadi calon w... |

```
df.tail()
```

| | Unnamed: 0 | id | text |
|---|---|---|---|
| 3137 | 3137 | devan_r7 | Ganjar Capres 2024 pilihan rakyat Indonesia\n#... |
| 3138 | 3138 | ShenoWirang | Dua hal yang bisa menjegal si "pembual" Anies ... |
| 3139 | 3139 | cnbcindonesia | Video: Naik Turun Elektabilitas Capres 2024 ht... |
| 3140 | 3140 | cerevisiatee | capres 2024 https://t.co/0uFSg1xtAQ |
| 3141 | 3141 | alessyeni_ | @likechizu KIM NAMJOON CAPRES 2024!!! |

FIGURE 4. Dataset

In Figure 4, the dataset obtained from Twitter is displayed, showing the data collected.

```
data.head()
```

| | text | text_clean | token | stop | stemmed |
|---|---|---|---|---|---|
| 0 | Calon Presiden Indonesia Ganjar Pranowo bersil... | calon presiden indonesia ganjar pranowo bersil... | ['calon', 'presiden', 'indonesia', 'ganjar', '... | ['calon', 'presiden', 'indonesia', 'ganjar', '... | ['calon', 'presiden', 'indonesia', 'ganjar', '... |
| 1 | *KODE ALAM DAN TANDA ZAMAN SIAPA PRESIDEN RI K... | kode alam dan tanda zaman siapa presiden ri ke... | ['kode', 'alam', 'dan', 'tanda', 'zaman', 'sia... | ['kode', 'alam', 'tanda', 'zaman', 'siapa', 'p... | ['kode', 'alam', 'tanda', 'zaman', 'siapa', 'p... |
| 2 | @ch_chotimah2 Dulu waktu AHY calon gubernur di... | chchotimah dulu waktu ahy calon gubernur di dk... | ['chchotimah', 'dulu', 'waktu', 'ahy', 'calon'... | ['chchotimah', 'dulu', 'waktu', 'ahy', 'calon'... | ['chchotimah', 'dulu', 'waktu', 'ahy', 'calon'... |
| 3 | Sang calon presiden Indonesia, Ganjar Pranowo ... | sang calon presiden indonesia ganjar pranowo t... | ['sang', 'calon', 'presiden', 'indonesia', 'ga... | ['sang', 'calon', 'presiden', 'indonesia', 'ga... | ['sang', 'calon', 'presiden', 'indonesia', 'ga... |
| 4 | Banyak tokoh yang digadang-gadang jadi calon w... | banyak tokoh yang digadanggadang jadi calon wa... | ['banyak', 'tokoh', 'yang', 'digadanggadang', ... | ['banyak', 'tokoh', 'digadanggadang', 'jadi', ... | ['banyak', 'tokoh', 'digadanggadang', 'jadi', ... |

FIGURE 5. Data Preprocessing

After importing the necessary libraries, Figure 5 demonstrates the step of loading cleaned data, which has been converted into a CSV, and displays the results.

```
sentiments = SentimentIntensityAnalyzer()
data["Positif"] = [sentiments.polarity_scores(i)["pos"] for i in data["text"]]
data["Negative"] = [sentiments.polarity_scores(i)["neg"] for i in data["text"]]
data["Neutral"] = [sentiments.polarity_scores(i)["neu"] for i in data["text"]]
data["Compound"] = [sentiments.polarity_scores(i)["compound"] for i in data["text"]]
data.head()
```

| | text | text_clean | token | stop | stemmed | Positif | Negative | Neutral | Compound |
|---|---|---|---|---|---|---|---|---|---|
| 0 | Calon Presiden Indonesia Ganjar Pranowo bersil... | calon presiden indonesia ganjar pranowo bersil... | ['calon', 'presiden', 'indonesia', 'ganjar', '... | ['calon', 'presiden', 'indonesia', 'ganjar', '... | ['calon', 'presiden', 'indonesia', 'ganjar', '... | 0.0 | 0.0 | 1.0 | 0.0 |
| 1 | *KODE ALAM DAN TANDA ZAMAN SIAPA PRESIDEN RI K... | kode alam dan tanda zaman siapa presiden ri ke... | ['kode', 'alam', 'dan', 'tanda', 'zaman', 'sia... | ['kode', 'alam', 'tanda', 'zaman', 'siapa', 'p... | ['kode', 'alam', 'tanda', 'zaman', 'siapa', 'p... | 0.0 | 0.0 | 1.0 | 0.0 |
| 2 | @ch_chotimah2 Dulu waktu AHY calon gubernur di... | chchotimah dulu waktu ahy calon gubernur di dk... | ['chchotimah', 'dulu', 'waktu', 'ahy', 'calon'... | ['chchotimah', 'dulu', 'waktu', 'ahy', 'calon'... | ['chchotimah', 'dulu', 'waktu', 'ahy', 'calon'... | 0.0 | 0.0 | 1.0 | 0.0 |
| 3 | Sang calon presiden Indonesia, Ganjar Pranowo ... | sang calon presiden indonesia ganjar pranowo t... | ['sang', 'calon', 'presiden', 'indonesia', 'ga... | ['sang', 'calon', 'presiden', 'indonesia', 'ga... | ['sang', 'calon', 'presiden', 'indonesia', 'ga... | 0.0 | 0.0 | 1.0 | 0.0 |
| 4 | Banyak tokoh yang digadang-gadang jadi calon w... | banyak tokoh yang digadanggadang jadi calon wa... | ['banyak', 'tokoh', 'yang', 'digadanggadang', ... | ['banyak', 'tokoh', 'digadanggadang', 'jadi', ... | ['banyak', 'tokoh', 'digadanggadang', 'jadi', ... | 0.0 | 0.0 | 1.0 | 0.0 |

FIGURE 6. Data Lebeling

In Figure 6, data labeling is explained to determine positive, negative, and neutral outcomes.


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```
from sklearn.naive_bayes import MultinomialNB
nb = MultinomialNB()
nb.fit(tfidf_train, y_train)
```

```
MultinomialNB()
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3142 entries, 0 to 3141
Data columns (total 6 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   text        3142 non-null   object
 1   text_clean  3142 non-null   object
 2   token       3142 non-null   object
 3   stop        3142 non-null   object
 4   stemmed     3142 non-null   object
 5   sentiment   3142 non-null   object
dtypes: object(6)
memory usage: 147.4+ KB
```

FIGURE 7. Multinomial Naïve Bayes

```
model = SVC(kernel = 'linear', random_state = 10)
model.fit(data_train, y_train)
```

```
SVC(kernel='linear', random_state=10)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3142 entries, 0 to 3141
Data columns (total 6 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   text        3142 non-null   object
 1   text_clean  3142 non-null   object
 2   token       3142 non-null   object
 3   stop        3142 non-null   object
 4   stemmed     3142 non-null   object
 5   sentiment   3142 non-null   object
dtypes: object(6)
memory usage: 147.4+ KB
```

FIGURE 8. Support Vector Classification

Figures 7 and 8 represent one of the text mining methods for classifying text by utilizing the probability values of a class within a document.

```
text_clean = data["text_clean"].tolist()

kata_kunci = ["Prabowo Subianto", "ganjar pranowo", "Anies Baswedan"]

analyzer = SentimentIntensityAnalyzer()
sentimen_scores = [analyzer.polarity_scores(teks)["compound"] for teks in text_clean]

popularitas = {}
for kata in kata_kunci:
    kemunculan = sum(teks.lower().count(kata.lower()) for teks in text_clean)
    popularitas[kata] = (kemunculan / len(text_clean)) * 100

total_persentase = sum(popularitas.values())

persentase_lainnya = 100 - total_persentase

popularitas["lainnya"] = persentase_lainnya

for kata, persentase in popularitas.items():
    print(f"Popularitas {kata}: {persentase:.2f}%")
```

```
Popularitas Prabowo Subianto: 24.76%
Popularitas ganjar pranowo: 26.77%
Popularitas Anies Baswedan: 5.35%
Popularitas lainnya: 43.13%
```

FIGURE 9. Popularity Results

Figure 9 explains data labeling to determine the popularity results of the electability of three presidential candidates.

## 5. CONCLUSION

In this study, we utilized data from Twitter user opinions as the primary dataset, obtaining a total of 3,142 datasets through web crawling. After cleaning and eliminating data that could not be classified, we ended up with a total of 3,141 data representing the opinions of Indonesian Twitter users regarding the topic of the 2024 presidential election.

This information was divided into two parts, namely, training data consisting of 2,513 tweets, and test data consisting of 629 tweets. In the test data, 25 tweets were categorized as positive, 6 tweets as negative, and the majority, which is 598 tweets, as neutral.

The procedures used in this study were Naive Bayes and Support Vector Machine (SVM). The research results showed that the accuracy rate of SVM reached 97%, while Naive Bayes achieved 95%. Therefore, SVM demonstrated slightly superior performance in predicting the popularity of presidential candidates based on Twitter data. In the analysis of the popularity of presidential candidates, the following breakdown was identified:

- Popularity of Prabowo Subianto: 24.76%


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- Popularity of Ganjar Pranowo: 26.77%
- Popularity of Anies Baswedan: 5.35%
- Popularity of other presidential candidates: 43.13%

These results reflect the percentage of popularity for each presidential candidate based on the analyzed data. Ganjar Pranowo had the highest popularity, followed by Prabowo Subianto, while Anies Baswedan had lower popularity, and the majority of the popularity was attributed to other presidential candidates.

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