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Sentiment Analysis of the 2024 Indonesia Presidential Election on Twitter

Lisyana Damayanti [1)*], Kemas Muslim Lhaksmana [2)]
[1,2)] School of Computing, Telkom University, Bandung, Indonesia
[1)]isyanadamayanti@student.telkomuniversity.ac.id, [2)]kemasmuslim@telkomuniversity.ac.id

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Abstract: This analysis enables the identification and a deeper understanding of the positive and negative sentiments reflected in online conversations, providing a comprehensive view of the direction of public support and preferences regarding presidential candidates. Sentiment analysis through machine learning can manage extensive sentiment data, ensuring time efficiency, and enhancing accuracy in swiftly and comprehensively comprehending people's opinions and preferences. With these advantages, machine learning-based sentiment analysis has gained popularity as an effective choice for understanding people's perspectives, preferences, and responses to various issues and events. Therefore, this research focuses on sentiment analysis regarding public opinions on the 2024 presidential election. The method employed in this research is the SVM algorithm with Word2Vec feature extraction. The researcher is interested in conducting a study related to sentiment analysis of the 2024 Indonesian Presidential election using the Support Vector Machine algorithm because of its high accuracy compared to other algorithms. The use of feature extraction aims to improve the performance and effectiveness of the algorithm, and Word2Vec is chosen because it can represent contextual similarity between two words in the generated vectors, enabling concise and improved text classification based on context. The results of this research indicate the best performance at 80:20 ratio with a precision score of 88,94%, Recall 93.08%, F1-score 90,43% and accuracy of 90,75%. This study's results outperform prior research using the SVM method, which achieved an 82,3% accuracy.

Keywords: Sentiment Analysis, Indonesian Presidential Election 2024, Twitter, SVM, Word2Vec.

INTRODUCTION

In the digital era, accessing information has become effortless through the Internet, with social media being a prominent platform. Social media is one of the bridges for communication. Social media has evolved into a communication bridge, enabling active participation in various issues, including the 2024 presidential election. Through these platforms, every individual can express opinions, share ideas, and establish communities with others who share similar political views. With the advancement of time, social media has become a primary aspect in the delivery of information (Awaliyah et al., 2021). Twitter, a widely used platform, serves as a space for individuals to articulate their opinions on various matters, including the impending presidential election.

The presidential election is an election aimed at electing the President and Vice President,conducted through a democratic process, where the head of state is elected through political parties (Gultom et al., 2021).Before selecting a presidential candidate, the public assesses and chooses a candidate deemed capable of effectively leading the country. Analyzing sentiments expressed on Twitter provides valuable insights into public opinions on presidential candidates, this analysis enables the identification and a deeper understanding of the positive and negative sentiments reflected in online conversations, providing a comprehensive view of the direction of public support and preferences regarding presidential candidates.

Reportedly, the candidates running for the Indonesian presidency include Anies Baswedan,Prabowo Subianto, and Ganjar Pranowo. Each candidate has their own controversies and merits. Anies Baswedan, a former Minister of Education and Jakarta Governor, is known for his composed and professional demeanor (Alim & Rahmawati, 2021). Prabowo Subianto, an Indonesian politician and businessman, currently serves as the Minister of Defense and has previously run for president twice (Akbar, 2021). He is recognized for his firmness, strict discipline, and strong commitment to leading the country. Ganjar, the Governor of Central Java, actively employs social media to address public concerns and foster positive political relations (Eliya et al., 2017).

*name of corresponding author

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Sentiment Analysis involves computationally studying people's opinions, attitudes, and emotions towards an entity, which can be individuals, events, or topics. The goal is to identify opinions, discern expressed emotions, and classify their polarity (Medhat et al., 2014). Sentiment Analysis serves as a reference for people in decision-making regarding the selection of a presidential candidate, aiding in the evaluation of candidate's worthy of leading the nation.

Previous research on Sentiment Analysis using classification algorithms, such as the Naïve Bayes algorithm and SVM, demonstrated varying accuracies. For instance, Gerry Nugroho analyzed the 2020 American Presidential Election, revealing SVM's higher accuracy 82% compared to Naïve Bayes 69% (Nugroho et al., 2021) Another study in 2021 focused on Sentiment analysis using SVM, N-Gram, and PSO to measure global public response to WHO on Twitter. The conclusion drawn is that the combination of SVM, N-gram (bigram), and PSO yields quite good performance in classifying sentiment in tweets with an accuracy of 75.5%, precision of 71.9%, and AUC of 84% (Hafidz & Liliana, 2021)

The focus of this research discusses the results of accuracy values using the SVM algorithm with the Word2vec feature extraction model and the results of public sentiment classification in the 2024 Presidential Election. Researchers are interested in exploring sentiment analysis for the 2024 Indonesian Presidential Election using the Support Vector Machine algorithm because of its superior accuracy. The study aims to compare the Support Vector Machine algorithm using Word2Vec for feature extraction, selected for its ability to represent contextual similarity between words in resulting vectors, enhancing text classification based on context.

The research involves a comparative analysis of accuracy values using the SVM algorithm with Word2Vec feature extraction, focusing on public sentiment regarding the 2024 presidential election. The primary objective is to determine accuracy using the SVM algorithm with Word2Vec and gauge public sentiment in the upcoming Indonesian Presidential election. The research's scope is limited to a dataset of 14,318 Indonesian language tweets from Twitter, categorized into positive and negative sentiments.

LITERATURE REVIEW

Research on sentiment analysis has been extensively conducted in previous years. In a study conducted in 2021 (Nugroho et al., 2021). Sentiment analysis was performed using the Naïve Bayes and Support Vector Machine methods. This research aimed to assess the sentiment of tweets on Twitter related to the 2020 American Presidential election and evaluate the performance of the two algorithms. The findings of this experiment (Nugroho et al., 2021). Demonstrated that the SVM method outperformed Naïve Bayes, achieving the highest accuracy value of 82.3%, while Naïve Bayes yielded an accuracy of only 69%.

Research focused on Indonesian Twitter sentiment analysis using Word2Vec and SVM classification with a dataset comprising 1010 labeled positive and negative instances. The results revealed that variations in Word2Vec model architecture and dimensions influenced classification outcomes. The 100-dimensional skip-gram model exhibited superior classification results with a precision of 64.4%, a recall of 58%, and an f-score of 61%. Additionally (Kurniawan, 2020). used a dataset of 1500 manually labeled tweets as positive and negative. The sentiment classification results showed that employing the SVM method with a linear kernel function and RBF yielded a commendable accuracy value of 79.19% (Fitriyah et al., 2020).

The research focuses on Political Sentiment Analysis on Twitter, the support vector machine method with TF-IDF weighting was employed. This study achieved an accuracy value of 62.88% using 1000 tweet data with a combination of unigram, bigram, and trigram word forms through the TF-IDF and SVM process (Hulu & Lhaksmana, 2019). Furthermore, Sentiment analysis using SVM, N-Gram, and PSO to measure global public response to WHO on Twitter. The conclusion drawn is that the combination of SVM, N-gram (bigram), and PSO yields quite good performance in classifying sentiment in tweets with an accuracy of 75.5%, precision of 71.9%, and AUC of 84% (Hafidz & Liliana, 2021).

Sentiment analysis was conducted on the implementation of the E-ticket system on the social media platform Twitter using the Support Vector Machine (SVM) algorithm. A total of 2999 data points were collected, and after undergoing the Text Mining process, 2827 data points were obtained. The analysis results showed an accuracy rate of 74.20%, precision of 83.33%, and recall of 5.28% (Oktavia et al., 2023). The research discusses the sentiment classification of the Twitter community regarding the impact of the coronavirus using Naive Bayes classifier and SVM. In this research, 1104 pieces of data were utilized, extracted from tweets on Twitter with three sentiments: positive, negative, and neutral. The research results indicate that the Naïve Bayes method, without the addition of features, can classify sentiment with an accuracy of 81.07%. To validate these findings, experiments were also conducted with Support Vector Machine, yielding an accuracy of 79.96% (Hasri & Alita, 2022). Conducted research on public sentiment analysis regarding the Jakarta government's lockdown policy using the SVM algorithm with TF-IDF feature selection. The study resulted in an accuracy of 74%, precision of 75%, recall of 92%, and an F1-Score of 83% (Isnain et al., 2021).

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Table 1. Performance comparison

Publication Years	Methode	Dataset	Result
(Nugroho et al., 2021)	Naïve Bayes and SVM	Kaggle website, tweet containing "2020 American Presidential election"	The result SVM accuracy of 82.3%, whereas Naïve Bayes achieved only 69%.
(Kurniawan, 2020)	Word2vec and SVM	Tweet containing dataset comprising 1010 labeled positive and negative instances.	The result a precision of 64.4%, a recall of 58%, and an f-score of 61%
(Fitriyah et al., 2020)	SVM	Tweet containing dataset comprising 1500 labeled positive and negative instances	Highest accuracy value using SVM method with a linear kernel function and RBF achieved 79,19%
(Hulu & Lhaksmana, 2019)	SVM and TF-IDF	Tweet containing Indonesia President election 2019	Highest accuracy value using SVM and TF-IDF 62.88%.
(Hafidz & Liliana, 2021)	SVM, N-Gram, and PSO	Tweet data containing the phrases WHO and Covid is 8000 tweets	Highest accuracy value 75.5%, precision 71.9% and AUC 84%
(Oktavia et al., 2023)	SVM and TF-IDF	Keyword "E-tilang" on twitter	Highest accuracy value achieved 74,20%, precision 83,33% and recall 5,28%
(Hasri & Alita, 2022)	SVM and Naïve bayes	Keyword "COVID" on application Rapidminner	The highest accuracy value 81.07% using Naïve Bayes method, while the Support Vector Machine produces an accuracy value of 79.96%
(Hasri & Alita, 2022)	SVM and TF-IDF	Tweet about Lockdown in Jakarta	Highest accuracy values 74%, precision of 75%, recall of 92%, and an F1-Score of 83%
This research	**SVM and Word2vec**	**Tweet containing Indonesia President election 2024**	**Highest accuracy values 90,75%, precision 88,94%, recall 93.08%, and f1-score 90,43%**

Sentiment Analysis

Sentiment Analysis is the computational examination of people's opinions, attitudes, and emotions towards an entity. Entities can encompass individuals, events, or topics (Medhat et al., 2014). Sentiment classification typically involves two classes, namely positive and negative. These classes extend across various topics and document types. The objective of sentiment analysis is to unveil or represent the genuine meaning of the document's contents. One notable aspect of sentiment is that, while the concept of positive and negative opinions is widespread, the expressions and viewpoints can vary significantly (Mejova, 2009).

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Support Vector Machine

Support Vector Machine (SVM) was developed by Boser, Guyon, Vapnik, and first introduced in 1992, The fundamental concept of Support Vector Machines SVM is the result of a harmonious combination of various computational theories that have been existing for several decades (N. Vapnik, 1999). SVM has proven its use in real world problems and generally provides better solutions than other methods. The basic concept of SVM is an attempt to find the best hyperplanes that function as separators of two classes in the input space.

Classification problems can be translated by trying to find the line (hyperline) that separates the two groups. The best dividing hyperline can be found by measuring the hyperline margin and finding the maximum point. This closest pattern is called a support vector. Trying to find the hyperline position is the essence of SVM learning. The following is the SVM formula equation:

$$(w.x_i) + b = 0 \text{ , for } y_i = 0 \text{ (hyperline)} \quad (1)$$

$$(w.x_i + b) \geq 1, \text{ for } y_i = +1 \text{ (positive class)} \quad (2)$$

$$(w.x_i + b) \leq 1 \text{ , for } y_i = -1 \text{ (negative class)} \quad (3)$$

To get the largest value of a margin, you can use the following formula by maximizing the distance value by looking for the closest point.

$$\frac{1-b-(1-b)}{w} = \frac{1}{[w]} \quad (4)$$

Information:
w = weight
x = data (input)
b = bias

Word2vec

Word2vec, developed by Mikolov et al. in 2013, is a word embedding algorithm that assigns a vector to each word in each text. Word2vec represents words as vectors that can carry the semantic meaning of the word (Rong, 2014). It operates as an unsupervised learning application utilizing a neural network comprising a hidden layer and a fully connected layer. The matrix dimensions in each layer are determined by the number of words in the corpus multiplied by the number of hidden neurons in the hidden layer. This weight matrix functions as a lookup table, with each row representing a word and each column representing a word vector. The Word2vec model encompasses algorithms such as Continuous Bag-of-Word (CBOW) and Skip-gram.

1. **Continuous Bag-of-Word (CBOW)**
   CBOW is used to predict target words using context, the training time required is quite fast and has slightly better accuracy in word frequency.
2. **Skip-gram**
   In contrast to CBOW, skip-gram is used to predict target contexts using words, works well with little training data, and can represent rare words.

METHOD

In this research, a system will be created that can classify sentiments containing texts of public opinion regarding candidates for the 2024 presidential election. The dataset used is sourced from Twitter by comparing accuracy values using the SVM algorithm and the Word2vec extraction feature. The following is a flowchart of the system design which can be seen in Figure 1.

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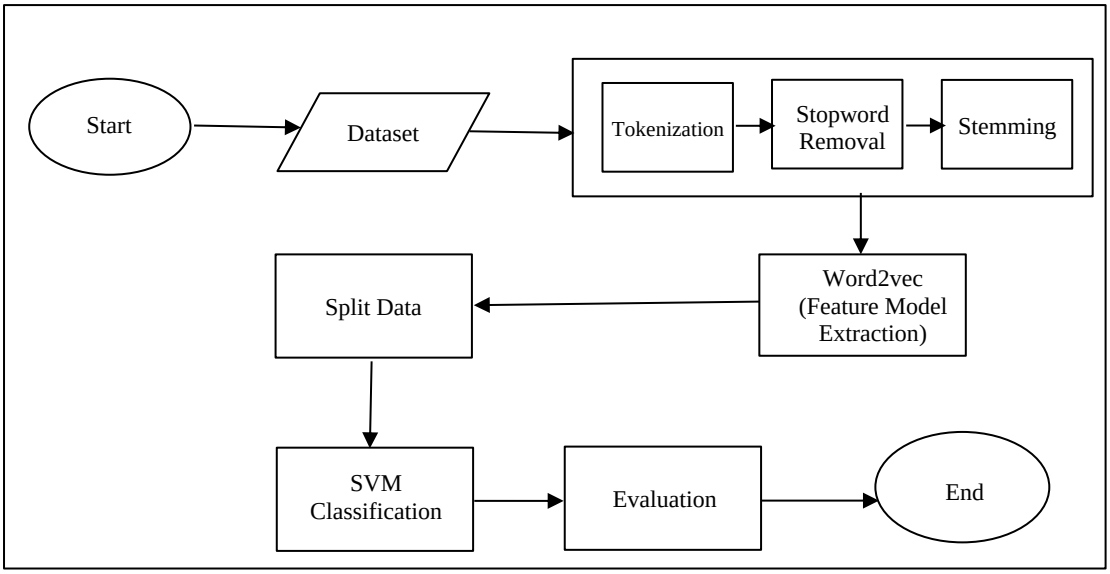

Figure 1. System overview flow chart.

Dataset

The dataset used in this research uses a dataset taken from Twitter using the crawling technique. Twitter is a social media application that is widely used. The data taken from this dataset is in the form of tweets containing opinions or public views regarding candidates for the Indonesian Presidential election using Indonesian. The dataset used is 14318 data, with data attributes including username and hashtag.

Prepocessing

Preprocessing is a step towards the processing stage. The data is processed to eliminate several problems that interfere with data processing. The following are several stages in preprocessing in this research:

Tokenization

Tokenization is the process of separating a sentence into several words separated from characters where the words have the meaning to be analyzed. The data Tokenization process can be seen in table 2.

Table 2. Example of tokenization process

Before	After
Pemilihan presiden akan berlangsung *Presidential election will take place*	[‘Pemilihan’, ‘presiden’, ‘akan’, ‘berlangsung’]
Presiden itu tidak bisa memegang janjinya *president cannot keep his promise*	[‘presiden’, ‘itu’, ‘tidak’, ‘bisa’, ‘memegang’, ‘janjinya’]

Stop Word Removal

Stopwords are words that are filtered in the preprocessing step, such as pronouns, articles, etc.(Krouska et al., 2016). It is important to remove Stop Words because it avoids words that are less important for the classification model because they can cause less accurate classification.

Stemming

Stemming is the process of removing affixes, which aims to get the basic word from the word. In other words, stemming allows us to consider in the same way nouns, verbs and adverbs that have the same root (Krouska et al., 2016). The Stemming process can be seen in table 3.

Table 3. Example of stemming

Before	After
[‘Memilih’, ‘dipilih’, ‘terpilih’]	[‘pilih’]
[‘choosing’, ‘being chosen’, ‘been chosen’]	[‘choose’]

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Feature Model Extraction (Word2Vec)

Feature Extraction that will be used in this research is Word2Vec. Word2vec was developed by Mikolov et al. In 2013, there was a word embedding algorithm that mapped each word in the text into a vector. Word2vec represents words as vectors that can carry the semantic meaning of the word (Rong, 2014).

SVM Classification

The classification carried out in this research used SVM. SVM is an algorithm for a supervised learning model. The basic concept of how SVM works is an attempt to find the best hyperplanes that function as separators of two classes in the input space (Krouska et al., 2016). In classifying the text, it can be translated by trying to find the line (hyperline) that separates the two groups. The best separating hyperline can be found by measuring the hyperline margin and finding the maximum point, the shortest distance between the hyperline and the data is called the margin.

Evaluation

This evaluation aims to determine the accuracy value with the desired method. Evaluation of a classification model is basically carried out using test data of a certain size. Classification model the classification model created is a mapping of a row of data with the output of a class or target prediction from that data. Binary classification is a classification that has two class outputs which are presented as negative and positive classes. The evaluation used in this research uses the Confusion Matrix. The possible classes that can occur can be predicted into 4 possibilities, namely (Fawcett, 2006):

1. True positive (TP), occurs if the data is positive and predicted to be positive.
2. False positive (FP), occurs if the data is positive and is predicted to be negative.
3. True negative (TN), occurs if the data is negative and is predicted to be negative.
4. False negative (FN), occurs if it is negative and is predicted to be positive.

Accuracy within each class (positive or negative) can be used to evaluate classification models. Accuracy can be calculated using the following formula:

$$Accuracy = \frac{TP+TN}{TP+FN+FP+TN} \quad (5)$$

Apart from calculating accuracy, it is also necessary to calculate precision, recall and F1-Score.

RESULT

In this research, an evaluation was carried out after going through the modeling stage with the SVM algorithm and the Word2vec extraction feature by comparing four split data propositions (60:40, 70:30, 80:20, and 90:10). Split data refers to dividing a dataset into two subsets: one subset is used to train the model (training set), while the other subset is used to test or evaluate the performance of the model that has been trained (testing set). This division aims to measure the extent to which the model can generalize to new data that was not used during the training process, this split data proportion plays an important role in measuring the performance and generalization of the classification model. Test results include evaluation of accuracy, precision, recall, f1-score, support with the aim of achieving optimal results for the classification model. The results of split data testing with four ratios can be seen in table 4.

Table 4. Performance evaluation result with SVM and Word2vec

Ratio	Accuracy	Precision	Recall	F1-Score
60:40	88,03%	85,98%	91,04%	87,89%
70:30	89,88%	88,01%	92,35%	89,95%
80:20	90,75%	88,94%	93,08%	90,43%
90:10	90,47%	89,37%	92,42%	90,47%

Based on the test results in Table 4, it can be concluded that the data split ratio of 80:20 produces the best testing performance. Using the SVM algorithm and Word2Vec feature extraction, the model achieves a precision score of 88.94%, recall of 93.08%, f1-score of 90.43%, and accuracy of 90.75%. This proportion indicates an optimal balance between training and testing data, allowing the model to effectively classify sentiment in new data with high accuracy and performance.

Sentiment Result

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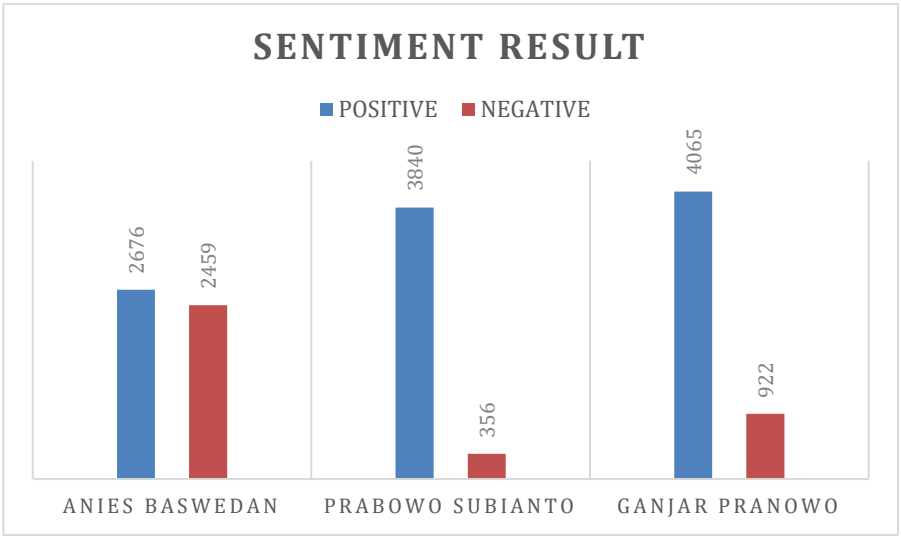

Figure 2. Sentiment result.

Based on Figure 2, sentiment analysis of 14.318 tweets related to the 2024 presidential candidates was performed using SVM with keywords corresponding to each candidate's name, namely "Anies," "Prabowo," and "Ganjar.". Anies Baswedan received 2.676 positive labels and 2.459 negative labels. Prabowo Subianto received 3.840 positive labels and 356 negative labels, while Ganjar Pranowo received 4.065 positive labels and 922 negative labels. The sentiment data was collected from tweets posted during the period from February 27, 2023, to September 28, 2023.

Figure 3. Sentiment positive and negative.

According to Figure 3, sentiments vary among people regarding the 2024 presidential candidates, as predicted from labeling 14.318 tweet data. The results indicate that Anies Baswedan 23%, Prabowo Subianto received a positive sentiment of 41% and Ganjar Pranowo 36%. Conversely, negative views towards the candidates were reported as 64% for Anies, 11% for Prabowo Subianto, and 25% for Ganjar Pranowo.

Analysis of Test Result

From the conducted tests utilizing the SVM model algorithm and Word2vec extraction feature with data split across four ratios namely 60:40, 70:30, 80:20, and 90:10 a significant disparity in model performance was observed. The objective was to optimize accuracy, precision, recall, and F1 score. The test results indicate that the 80:20 ratio strikes a suitable balance between training and testing data. Allocating a larger portion (80%) for training allows for a more thorough exploration of features within the data. Employing 20% of the data for testing the SVM model with Word2vec feature extraction on an oversampled dataset yielded the most favorable outcomes. This configuration resulted in a precision score of 88,94%, recall 93.08%, f1-score 90,43% and accuracy of 90,75%. The Confusion Matrix generated, as presented in Table 5, corroborates these findings.

Table 5. Confusion matrix

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		Actual Class	
		positive	negative
Predict Class	Positive	982	73
	Negative	122	933

Based on table 5, the SVM and Word2vec models have produced a fairly accurate classification in identifying public sentiment towards the 2024 presidential election with positive and negative labels. The resulting confusion matrix values:

1. True Positive (TP) = 982, meaning that the model succeeded in classifying 982 positive class data points correctly
2. True Negative (TN) = 933, meaning that the model succeeded in classifying 933 negative class data points correctly.
3. False Positive (FP) = 122, meaning that the model incorrectly classifies 122 negative class data as belonging to the positive class.
4. False Negative (FN)= 73, meaning that the model incorrectly classifies 73 positive class data as belonging to the negative class.

CONCLUSION

In the research on sentiment analysis using the Support Vector Machine (SVM) algorithm and the Word2Vec feature extraction model for the 2024 Presidential Election, four different data propositions were compared in each test. The test results demonstrate that employing the SVM algorithm and Word2Vec feature extraction with an 80:20 ratio yields a precision score of 88,94%, recall 93.08%, f1-score 90,43% and accuracy of 90,75%. This indicates an improvement compared to previous research, which achieved an accuracy of 82,3% using the SVM algorithm (Nugroho et al., 2021) and in research using the SVM and TF-IDF algorithms achieved 74% accuracy, precision of 75%, recall of 92%, and an f1-score of 83% (Isnain et al., 2021). The analysis of public sentiment towards the 2024 presidential candidates revealed positive and negative results for each candidate. Among the three candidates, Anies Baswedan 23%, Prabowo Subianto received a positive sentiment of 41% and Ganjar Pranowo 36%. Conversely, negative views towards the candidates were reported as 64% for Anies, 64% for Prabowo Subianto, and 25% for Ganjar Pranowo.

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