



Public Sentiment Dynamics: Analysis of Twitter/X Data on the 2024 Indonesian Election with NB-SVM

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Abstract—This research analyzes the dynamics of public sentiment towards three pairs of presidential candidates in the 2024 Indonesian Election. This research was conducted using Twitter data as a source of information to gain a deeper understanding of the pattern of public sentiment during six crucial phases in the context of the election. The data is analyzed periodically during the election period. Sentiment analysis was carried out using the Naïve Bayes-Support Vector Machine classification approach to understand the sentiment patterns that emerged in each phase. NB-SVM utilizes class frequency information from NB to weight features, then trains separate SVMs for each class using these weighted features, improving classification accuracy. Models using NB-SVM classification produce better accuracy than models using NB and SVM classification, with an average accuracy of 76%. In Pair 01, a dynamic pattern was formed, namely a decrease in the level of positive sentiment during the debate and increasing again at a later time. Meanwhile, for Pair 02 and 03, a pattern was not formed for different reasons, namely sentiment that was too stable for Pair 02, and unstable sentiment for Pair 03. While Pair 01 obtained the most positive sentiment, Pair 02 received the most negative, with an average of 65.19% during the election process. This research proves that the results of sentiment analysis on Twitter/X contradict the official results by KPU of the general election in Indonesia.

Keywords: General Election; Naïve Bayes; Public Sentiment; Sentiment Analysis; Support Vector Machine; Twitter

1. INTRODUCTION

The 2024 Indonesian General Election has become an interesting topic for social media users, especially X (or Twitter). This election is the biggest democratic party in Indonesia which includes the election of the president and vice president by all the people in Indonesia [1][2][3].

X or Twitter is a social media that can be used to share various opinions with the public with features such as retweeting, taking photos and videos, as well as sharing them on several other social networks. "People share news, discuss political events, and provide commentary on certain global events. "Therefore, social media is also often used in political campaigns to promote social and development activities, as well as express sentiments about elections." [4] especially in expressing public opinion towards the Indonesian presidential candidates in the 2024 general election. Thus, this research was conducted to analyze public sentiment towards the presidential and vice-presidential candidates in the 2024 election using data on the Twitter application.

Research on sentiment analysis regarding elections was carried out by Rengga Asmara et al [1] using the Naïve Bayes Method for the 2019 Election which obtained results of 62% accuracy while Lingga Aji Andika et al [2] produce an accuracy of 82.9%. Then Safitri Juanita [5] got an accuracy of 76%. Aprillia Rizki Adiaty et al [6] obtained an accuracy of 78.03% Then Mohammed Hafizh Al-Areef et al [3] obtained an average accuracy of 83.7% in the 2024 elections.

Nur Hayatin et al [7] obtained an accuracy of 90.74% while Akhmad Muzaki et al [8] produce an accuracy of 92.2% Both in the 2019 elections. Then Fadli Nurriziky et al [9] using SVM getting an accuracy of 97% while NB getting 95%. Bobby Andika Putra et al [10] with an average SVM accuracy of 89.24% while NB with an average of 83.79% and Lisvana Damayanti et al [11] obtained an accuracy of 90.75% on the 2024 elections with sentiment prediction using unlabeled data yet to be done.

Then other researchers such as Danar Wido Seno et al [12] obtained an accuracy of 92.5% using a combination of Lexicon Based and SVM methods in the 2019 Election. But sentiment prediction using unlabeled data yet to be done. Okky Zoellanda et al [13] obtained an accuracy of 91.5% using Support Vector Machine (SVM) in the same election, sentiment prediction using unlabeled data yet to be done.

Even though different methods are used to predict sentiment with different levels of accuracy, the sentiment prediction labeling results produced from several studies are quite similar. The method used succeeded in predicting the data quite well. From research that has been carried out previously, SVM is a method with a better level of accuracy than NB, however, from both studies, no one has carried out prediction tests on new, raw data. On the other hand, Naïve Bayes has slightly lower accuracy than SVM and Lexicon-SVM, but from several studies that have been carried out, this method is successful in predicting raw data and still maintains the performance of the model used. Therefore, the use of a combination method between NB and SVM is carried out, in order to increase the accuracy achieved and also obtain research results on new raw data.

From various studies, no research was found that carried out comparisons from the beginning of the election, several time periods during the election process, until the release of the election results. Where [1], [3], [5], [7]–[14] are studies created to analyze tweet data before the election, while [2] and [6] analyze data after the election.



The method used in this research is Naïve Bayes-Support Vector Machine. Naïve Bayes utilizes Bayes' theorem to calculate the probability that an input data falls into a certain class [14]. While, Support Vector Machine is a model known for its accuracy in classifying data [15]. NB-SVM utilizes class frequency information from Naïve Bayes to weight features, then trains separate SVMs for each class using these weighted features, improving classification accuracy.

In this research, an analysis of the dynamics of public sentiment towards presidential candidates in the 2024 election has been carried out using Twitter data.

Different from previous works, this dataset has been taken at eighteen different times so that it can analyze the dynamics of public opinion towards each presidential and vice-presidential candidate for the 2024 elections. By looking at the dynamics of sentiment that occurs, questions regarding the patterns formed will be answered, such as, what patterns are formed when official KPU events are taking place, and when will sentiment stabilize for each candidate or whether sentiment will stabilize.

The objective of this research is as follow, first, what are the dynamics of public sentiment towards each presidential and vice-presidential candidate in the 2024 Indonesian Election in several time periods and what kind of pattern will be formed when the official KPU event is held using Naïve Bayes-Support Vector Machine. Second, what is the accuracy, precision, recall and f1-score of the model designed to measure public opinion sentiment in the 2024 Indonesian Election. And finally, whether public opinion on Twitter social media is in line with the results of the 2024 Indonesian Election.

Based on the problem formulation above, the aim of this this research is to determine the dynamics of public sentiment towards each presidential and vice-presidential candidate in the 2024 Indonesian Election in several time periods using NB-SVM model.

2. RESEARCH METHODOLOGY

2.1 Research Stages

Figure 1 is the flowchart system that will be carried out in this research, starting from crawling data and ending with result evaluation. Each part will be explained in this research methodology chapter.

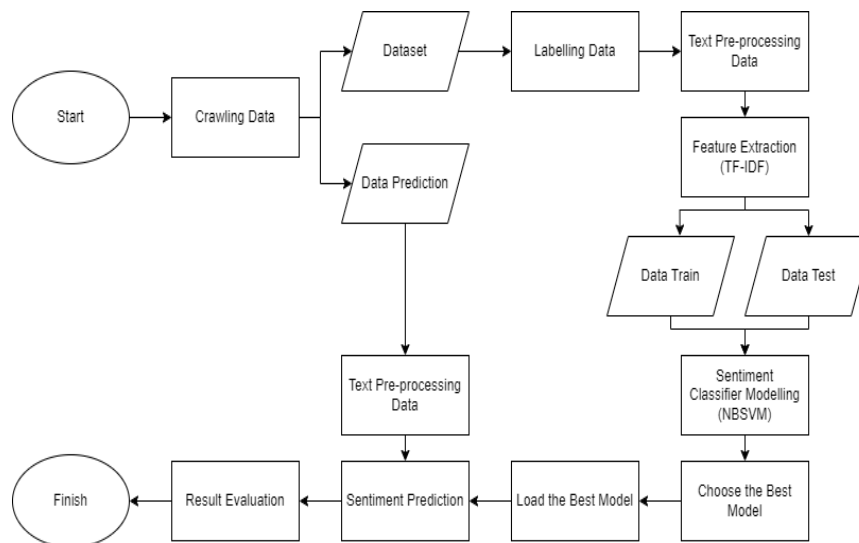


Figure 1. Flowchart System

The use of datasets in this research is limited to certain keywords, namely: "Anies-Cak Imin", "Prabowo-Gibran", "Ganjar-Mahfud MD" as well as "El Chef", "El Slepet", "El Gemoy", "El Sulfat", "El Chudai", and "El Professor". Meanwhile, data collection is limited to certain points in time starting on October 19 2023 or the date of registration of Candidate Pair 01 and Candidate Pair 03 with the KPU and ending on March 20 2024, namely the date the election results are released by the KPU. This research uses the NB-SVM method as the main model and Multinomial NB, Gaussian NB, SVM and Linear Kernel as comparison methods for accuracy, precision, recall and f1-score values.

2.2 Related Work

Dynamics is a pattern or process of growth, change or development of a particular field, or a system of interconnected ties and mutual influence between one element and another. If one element of the system experiences a change, it will also bring changes to the other elements [16].

In this research, dynamics is defined as changes in the positive rate and negative rate of public sentiment resulting from a classifier model designed with the Naïve Bayes-Support Vector Machine algorithm. This



classification model will classify data on its predictions and will produce numerical data in the form of 0 (neutral value), -1 (negative value) and 1 (positive value). Positive rate is the level of positive sentiment (in percent) obtained by each presidential and vice-presidential candidate at the stage of predicting public sentiment at predetermined points in time.

Research on sentiment analysis regarding elections was carried out by Rengga Asmara et al [1] using the Naïve Bayes Method for the 2019 Election which obtained results of 62% accuracy, 45% recall and 45% precision with a comparison of 22.66% positive statements and 39.39% . % negative statements, while Lingga Aji Andika et al [2] used the same method to produce an accuracy of 82.9% with a comparison of 34.5% positive and 65.5% negative statements. Then the journal by Safitri Juanita [5] got an accuracy of 76%, a recall of 72.3% and a precision of 81.6% with a division of positive sentiment of 18% and negative sentiment of 52%. The work of Aprillia Rizki Adiati et al [6] obtained an accuracy of 78.03% with a division of positive sentiment of 53.8% and negative of 46.13%. Then the work of Mohammed Hafizh Al-Areef et al [3] obtained an average accuracy of 83.7%, precision 86.3%, recall 94.3% and f1-score 90.3% in the 2024 elections.

Nur Hayatin et al [7] obtained an accuracy of 90.74%, precision 97%, recall 91.58% and f1-score of 94.06% while Akhmad Muzaki et al [8] produce an accuracy of 92.2% and getting more negative sentiment than positive. Both in the 2019 elections. Then Fadli Nurriziky et al [9] using SVM getting an accuracy of 97% while NB getting 95%. Bobby Andika Putra et al [10] with an average SVM accuracy of 89.24% while NB with an average of 83.79% and Lisyana Damayanti et al [11] obtained an accuracy of 90.75%, precision 88.94%, recall 93.08% and f1-score of 90.75% resulting in positive statements divided into 23% for Anies Baswedan, 41% Prabowo Subianto, and 36% Ganjar Pranowo. Meanwhile, negative statements were divided into 64% Anies Baswedan, 11% Prabowo Subianto, and 25% Ganjar Pranowo on the 2024 elections.

Then other researchers such as Andar Wido Seno et al [12] obtained an accuracy of 92.5%, precision between 85.7% - 97.2% and recall 78.2% - 93.5% using a combination of Lexicon Based and SVM methods in the 2019 Election. Okky Zoellanda et al [13] obtained an accuracy of 91.5% using Support Vector Machine (SVM) in the same election. The positive and negative sentiment values obtained in previous research were obtained from training data and test data, namely data that had all been labeled. Not coming from new, unlabeled raw data.

Naïve Bayes is a probabilistic method that uses Bayes' theorem to classify data. It assumes features (words in a document) are independent, which simplifies calculations. The system will be trained using new data (training data and test data) and then given the task of guessing the value of the target function from this data [2]. Naïve Bayes methods are classified into several types based on their function, such as Multinomial NB, Bernoulli NB and Gaussian NB.

Support Vector Machines (SVM) are a supervised learning method known for their high classification accuracy. They excel at separating data points belonging to different classes, making them popular for various classification tasks. The working mechanism is to find an appropriate hyperplane to classify the data samples that have been collected [17]. In Support Vector Machine there are several types of kernels that can be used such as Linear Kernel, RBF Kernel, Polynomial Kernel and Sigmoid Kernel [18].

Naïve Bayes excels at understanding the probability of a document belonging to a class based on individual features (like words). However, it assumes these features are independent, which isn't always true. NBSVM leverages Naïve Bayes' ability to analyze class frequencies within the training data. It calculates how often each feature appears in documents belonging to different classes.

NBSVM then uses these class frequencies to create informative weights for the features. Features that appear more frequently in a specific class get a higher weight, indicating their potential importance for predicting that class. Finally, NBSVM employs SVM, which excels at learning decision boundaries to separate data points. NBSVM utilizes separate SVMs for each class, training them with the weighted features. This combination aims to address limitations in either method individually.

2.3 Crawling Data

Data crawling will be done using a tool called Tweet-Harvest by Helmi Satria. The author uses keywords that are directly related to the 2024 Election, namely the names of presidential candidates and deputy presidential candidates, namely: "Anies-Cak Imin", "Prabowo-Gibran", "Ganjar-Mahfud MD" and "El Chef", "El Slepet", "El Gemoy", "El Sulfat", "El Chudai", and "El Professor" during the debate.

The data to be taken is divided into two, namely dataset and prediction data. The Dataset will contain data that will be taken during the campaign period which will then be used for sentiment classifier modeling which can be seen in Table 1.

Table 1 is the result of data crawling for testing data, each pair of candidates received 5,000 Tweet data for testing data. Where the total is 15,000 Tweet data.

Table 1. Data Crawling Results for Dataset

No.	Description	Keywords	Total Data
1.	Candidate Pair Number 1	"Anies" "Cak Imin"	1500 1500



No.	Description	Keywords	Total Data
2.	Candidate Pair Number 2	“El Chef”	1000
		“El Slepét”	1000
		“Prabowo”	1500
		“Gibran”	1500
		“El Gemoy”	1000
3.	Candidate Pair Number 3	“El Sulfat”	1000
		“Ganjar”	1500
		“Mahfud MD”	1500
		“El Chudai”	1000
		“El Professor”	1000

Meanwhile, prediction data will be taken at eighteen different times. Namely, from the presidential and vice presidential nomination period, the time between the nomination and the campaign period, the campaign period begins, the time between the campaign and the first debate, the first debate, the time between the first debate and the second debate, the second debate, the time between debates second and third debate, third debate, time gap between the third debate and fourth debate, fourth debate, time gap between the fourth debate and fifth debate, fifth debate, time gap between the fifth debate and general election day, general election day, vote count for election results begins, the interval between the vote count, and the general election results to compare public opinion before and after the general election [19].

Table 2 is the result of data crawling for prediction data, each candidate pair gets a different amount of Tweet data. Data collection starts from October 19, 2023 and ends on March 20, 2024.

Table 2. Data Crawling Results for Sentiment Prediction

Data Crawling Results	Candidate Pair		
	01	02	03
19-Oct-23	2866	0	4746
25-Oct-23	0	5489	0
11-Nov-23	3478	4484	5376
28-Nov-23	4149	5128	6543
05-Dec-23	5045	3326	3567
12-Dec-23	5542	6684	4845
17-Dec-23	3453	2388	1353
22-Dec-23	4072	2797	3846
30-Dec-23	4645	4507	1672
07-Jan-24	4240	3355	1613
14-Jan-24	3622	1976	1828
21-Jan-24	6217	2957	5561
28-Jan-24	5617	1428	3342
04-Feb-24	5181	2090	1380
09-Feb-24	3361	1544	1989
14-Feb-24	2917	3229	5111
15-Feb-24	4107	7453	6446
03-Mar-24	6483	6784	5440
20-Mar-24	4547	5036	5970
Total Data	79.542 Data	70.655 Data	70.628 Data

The results of data crawling for prediction data can be seen in Table 2. The total data that was successfully crawled was 220,825 data which was divided into 79,542 data for Candidate Pair 01, 70,655 data against Candidate Pair 02, and 70,628 data against Candidate Pair 03.

2.4 Labelling Data

Data obtained from data crawling is then labeled with 1 if the tweet obtained shows opinions, support, ideas, statements or positive information for one of the presidential and vice-presidential candidates, while the label -1 will be used if the tweet obtained shows disagreement, opinion, idea or statement negative for one of the presidential and vice-presidential candidates. Data labeling will be carried out by 3 people. The data that has been labeled will then go through a label validation process by looking at the most votes for each tweet. The type of tweet with the most votes is taken as the appropriate label. Examples of data labeling results can be seen in Table 3. The amount of data labeled is 15000 data, which is divided into 5000 data for each pair of candidates. The results of data labeling can be seen in Table 4.



Table 3 is an example of the data labeling that will be carried out. In this table, the example used is data from candidate pair number 3.

Table 3. Example of Labelling Data

Tweet	Sentiment	Explanation
Solo is not Samsul, Solo is full Ganjar Friends for Ganjar Mahfud 2024 🙌 https://t.co/45TzOng6Jf	1 (positive)	This tweet is positive because it contains a message of support for candidate pair 3 which can be concluded from the sentence "... Solo full Ganjar Friends for Ganjar Mahfud 2024..."
Vice presidential candidate number 3 Mahfud MD responded to questions regarding President Joko Widodo's alignment in the 2024 elections. #Polhuk #AdadiKompas https://t.co/1vItphC4y6	0 (neutral)	This tweet is neutral towards candidate pair 3 because the tweet sent is a piece of news so it cannot be concluded whether it is positive or negative.
Thank God kiayi and ulama shift support to Prabowo-Gibran from Ganjar Mahfud, more confident in supporting 02, with a line of kiayi and ulama #YukAllPilih02 PakBowoMasGib The Best https://t.co/RKNI3UQpcj	-1 (negative)	This tweet is negative because it contains the sentence "... Transfer support to Prabowo-Ginbran from Ganjar Mahfud..." which can be concluded as a negative message due to the shift in support for candidate pair 3.

Table 4 is the result of labeling training data from data crawling that was carried out previously, each candidate pair has a total of 5,000 tweet data. However, the results achieved by each pair are different.

Table 4. Labelling Data Results

No.	Description	Results	Total Data
1.	Candidate Pair Number 1	Positive	3201
		Neutral	1700
		Negative	279
2.	Candidate Pair Number 2	Positive	412
		Neutral	1366
		Negative	3222
3.	Candidate Pair Number 3	Positive	2296
		Neutral	2505
		Negative	199

The results of labeling the data in Table 4 show that candidate pair 1 has the most positive data, while candidate pair 2 has the most negative data, while candidate pair 3 has more neutral data than positive or negative data.

2.5 Text pre-processing Data

At the text pre-processing data stage, the data that has been labeled and the prediction data obtained from the data crawling process will be managed to become more structured before the classification process is carried out. The purpose of pre-processing is to prepare the data so that it is ready for use by removing elements that are considered irrelevant [20]. In text pre-processing data, there are several methods that will be carried out, such as text cleaning, case folding, stop word removal, normalization, stemming and tokenization [3].

The first stage in text pre-processing involves text cleaning. The goal of text cleaning is to remove noise such as URLs, emojis, or symbols that have no meaning in the text classification process. Then, case folding aims to harmonize the letter shapes in the text data. All sentences in the tweet data that were originally written in uppercase will be changed to lowercase. This is done to ensure that there are no variations in letter writing that could interfere with the subsequent sentiment analysis process.

Next, stop word removal, namely removing meaningless words such as conjunctions which can later affect the speed of the sentiment analysis process. This process requires a dictionary list as a reference for deleting these words. In this case, the Sastrawi library will be used to provide a list of Indonesian conjunctions as a reference in the stop word removal process. The next step in text pre-processing is normalization. At this stage, sentences that use abbreviated or extended spellings of words will be adjusted to become standard words according to the Big Indonesian Dictionary (KBBI).

Stemming is the process of finding the basic words of words that have gone through the stop word removal process. Words will be trimmed to base words by removing prefixes or prefixes. The Sastrawi Library is able to provide a list of basic words in Indonesian to be used as a reference in the stemming process. Tokenizing is the process of dividing text into smaller units, namely tokens. These tokens are generally interpreted as individual words in the text. Tokenizing has an important role in text analysis as it helps in calculating the frequency of words in a text and allows analysis of the context of those words. During the tokenizing process, not only words are



separated, but also numbers and punctuation. This is important because numbers and punctuation also have the potential to influence the interpretation of a sentence or word.

2.6 Feature Extraction

Data that has passed the previous pre-processing stages will be processed to become numerical data. To change data to numeric, you can use TF-IDF Weighting. The Term Frequency Inverse Document Frequency (TF-IDF) method is a method used to determine how far words (terms) are connected to a document by assigning a weight to each word [1].

TF-IDF is a method that calculates the weight of a word. The successfully calculated weight values will be used to obtain features for a topic. The representation of data depends on the number of features obtained in all topics.

2.7 Splitting Data

The training data and test data will be divided randomly using K-10 cross validation. In each iteration, one-fold is chosen as the validation set, and the remaining k-1 folds are combined for training. The model is trained on the training data and evaluated on the validation set.

2.8 Sentiment Classifier Modelling

Figure 2 shows the process carried out in sentiment classifier modeling with K-Cross Validation. Where there are 2 looping divisions, such as Inner Loop (Training) and Inner Loop (Evaluation). The model that has been formed from this process will be saved and can be recalled for the data prediction process.

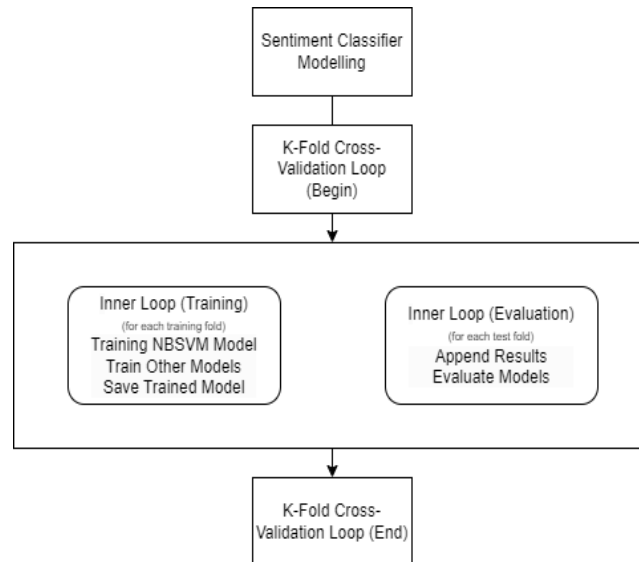


Figure 2. Sentiment Classifier Modelling with K-Fold Cross-Validation

At this stage, the model for conducting sentiment analysis will be designed using a hybrid algorithm, namely the Naive-Bayes-Support Vector Machine (SVM) algorithm. This algorithm will produce a model which will later be used to predict sentiment.

Models will be built for each candidate pair in the 2024 elections, so that three NB-SVM models will be formed. This is done in order to get more accurate results regarding public opinion towards each candidate pair because positive opinions for one candidate pair are not always positive for other candidate pairs.

From Figure 2, the modeling stage begins with the process of training NBSVM model and other models in Inner Loop (Training). In this step data will be divided as discussed in the previous sub-chapter, namely data splitting. After that, the results of the trained model will be saved to the Inner Loop (Evaluation) for calculating the performance of each model. Each model will be saved and can be recalled when making data predictions.

2.9 Model Performance

At this stage, the performance of the previously designed model will be evaluated using a confusion matrix based on the testing process of the data that has been divided in the previous sub-chapter, splitting data. The test data that has been previously separated will carry out a testing process, namely predicting sentiment from the dataset.

After that, the results of the predictions will be compared with the sentiment values that have been done manually in the labeling data to see the values contained in the confusion matrix such as accuracy, precision, recall, and F1-Score.

Table 5 is a form of evaluation of the model that will be used, namely the confusion matrix. The model that has been formed in sentiment classifier modeling will be evaluated to determine the best model to use.



Table 5. Confusion Matrix

Class	Positive	Negative
Positive	True positive (TP)	False negative (FN)
Negative	False positive (FP)	True negative (TN)

Model evaluation using Naïve Bayes-Support Vector Machine will be calculated using Accuracy, Precision, Recall and F1-Score which can be seen in the Table 5. Confusion Matrix is a 2x2 matrix that represents the results of binary classification on a dataset. There are several general formulas that can be used to calculate classification performance. The results of the accuracy, precision, recall and f1-score values are displayed in percentages.

Accuracy calculations can be done with $TP+TN / TP+FP+TN+FN$. Accuracy is the proportion of correct predictions [1][2]. Precision is the proportion of the number of relevant text documents among all text documents selected by the system which can be calculated with $TP / TP+FP$ [1][2]. Meanwhile, recall is the proportion of the number of controlled relevant text documents among all text documents selected by the system that can be obtained with $TP / TP+FN$ [1][2]. And finally, the f1-score which is a weighted comparison of the average precision and recall. F1-score can be found by doing the following equation, $F1-Score = ((Recall * Precision) / (Recall + Precision)) * 2$ [1][2].

2.10 Sentiment Prediction

At this stage, sentiment analysis will be carried out from a model that has been designed at the sentiment classifier modeling stage at certain times so that the results can be compared to see the dynamics of each presidential and vice-presidential candidate from these sentiments.

In this context, dynamics refers to changes in public sentiment conveyed in the form of tweets on Twitter regarding presidential and vice-presidential candidates from time to time within a predetermined time period, namely from the presidential and vice-presidential nomination period until the vote count results. This change can be caused by the programs and methods of each presidential and vice-presidential candidate for the 2024 Indonesian Election in carrying out campaigns either directly or via social media, one of which is Twitter or X.

The stages that will be carried out in the sentiment prediction process start from loading the model that has been previously designed. Then import data from the test data that has been crawled previously. After that, it continues with the same process when creating the model, namely from text data preprocessing such as data cleaning, case folding to tokenization. Continued with weighting of words by TF-IDF and ended by carrying out sentiment prediction from the test data that had been prepared and calculating the results achieved. Such as positive, negative, neutral, positive rate and negative rate.

Then the values obtained from sentiment prediction will be reprocessed to see the dynamics of public opinion towards each candidate pair using tables and graphs. The table will contain the values achieved (number of positive values, negative values, neutral values, positive rate values and negative rate values) along with the time and description of the data collection. Meanwhile, the graph will contain changes in dynamics in the form of a line diagram divided into eighteen different time points. This point starts from the registration process for each candidate pair until the election results are officially issued by the KPU.

3. RESULT AND DISCUSSION

3.1 Model Result

Testing was carried out to determine the level of success in the performance of the model created and to see the performance of the sentiment classification model. Table 6 displays the test results for the models built for each candidate pair, this result was obtained from taking the best model value from sentiment classifier modeling using K-Cross Validation.

Table 6. Performance results of the NB-SVM model with other models

Candidate Pair	Classification Methods	Evaluation Matrix			
		Accuracy	Precision	Recall	F1 Score
1.	Naïve Bayes-Support Vector Machine	72%	79%	50%	51%
	Multinomial Naïve Bayes	67%	51%	49%	50%
	Gaussian Naïve Bayes	38%	44%	42%	34%
	Support Vector Machine	63%	21%	33%	26%
	Linear Support Vector Classification	69%	45%	41%	40%
2.	Naïve Bayes-Support Vector Machine	75%	70%	53%	57%
	Multinomial Naïve Bayes	70%	54%	52%	52%
	Gaussian Naïve Bayes	39%	45%	47%	36%
	Support Vector Machine	68%	23%	33%	27%
	Linear Support Vector Classification	74%	55%	42%	41%



Candidate Pair	Classification Methods	Evaluation Matrix			
		Accuracy	Precision	Recall	F1 Score
3.	Naïve Bayes-Support Vector Machine	81%	87%	58%	60%
	Multinomial Naïve Bayes	76%	58%	59%	58%
	Gaussian Naïve Bayes	56%	49%	45%	44%
	Support Vector Machine	74%	51%	50%	49%
	Linear Support Vector Classification	76%	51%	52%	51%

From Table 6 it can be concluded that the performance of the NB-SMV model is the best compared to other algorithm models. The classification results using the NB-SVM model obtained an average accuracy value of 76%, precision of 78.67%, recall of 53.67% and F1-Score of 56%.

3.2 Sentiment Prediction Result

Sentiment prediction is carried out using the NB-SVM model designed for each candidate pair. The blue line will show the positive rate (positive sentiment value in percent) for each candidate pair, while the red line will show the negative rate (negative sentiment value in percent) achieved by each candidate pair. The points on the graph indicate the date the data was taken along with an explanation, such as the data collection was carried out on February 14 2024, namely the day of the general election. The results of each candidate pair can be seen in Figure 3 for Candidate Pair 01, Figure 4 for Candidate Pair 02, and Figure 5 for Candidate Pair 03.

Figure 3 shows the results of predictions of public sentiment towards Candidate Pair 01, namely Anies-Muhaimin from the start of the election until the release of the official election results.

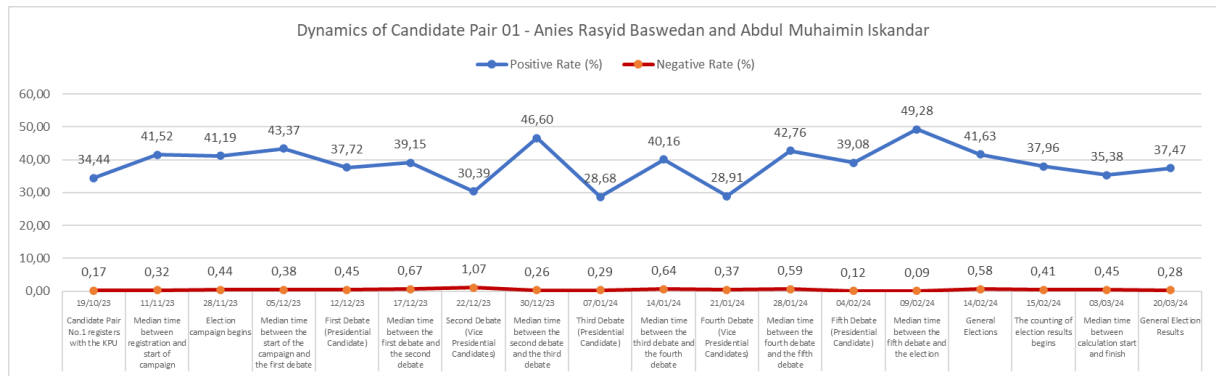


Figure 3. Chart of Sentiment Prediction Results for Candidate Pair 01

In Figure 3 the highest sentiment value occurs during the median time between the fifth debate or third presidential debate and the general election process which reaches 49.28% positive sentiment, while the lowest value appears during the third debate or during the second presidential debate with only 28.68% positive sentiment.

These dynamics can be seen in Figure 3, where the positive sentiment achieved decreases when testing the data on the day of the debate. Meanwhile, the negative sentiment achieved was very small and only reached 1.07%, the highest achieved during the second debate or the first vice presidential debate. A pattern can be seen depicted in Figure 3 where the positive rate of Candidate Pair 01 always decreases on the day the debate takes place compared to the data taken at the previous time. The sentiment pattern began to stabilize starting on the counting of election results begins until the general election results were officially released by the KPU.

Figure 4 shows the results of predictions of public sentiment towards Candidate Pair 02, namely Prabowo-Gibran from the start of the election until the release of the official election results.

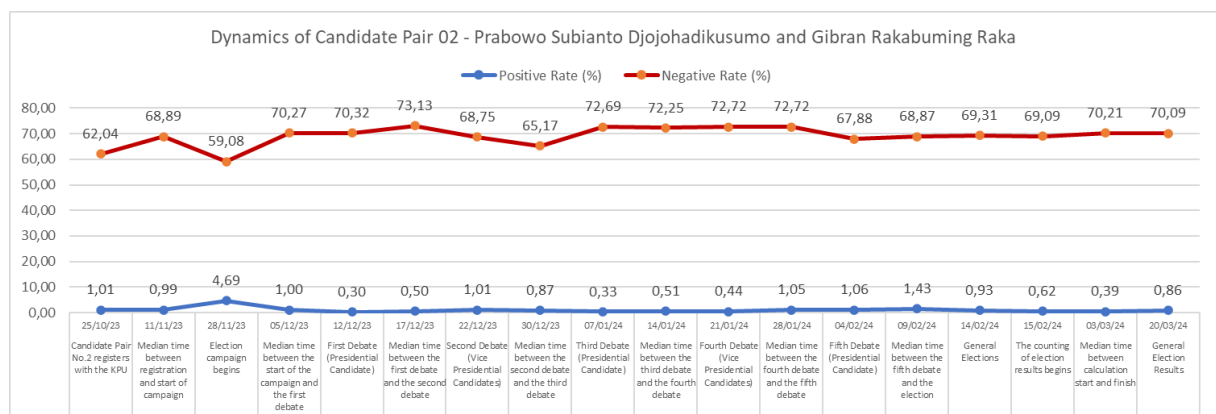


Figure 4. Chart of Sentiment Prediction Results for Candidate Pair 02



In Figure 4 the sentiment value achieved is very negative. The highest negative sentiment was achieved during median time between the first debate and the second debate, reaching 73.13% negative sentiment. Negative sentiment had a fairly large average during the general election process, namely 65.19% of sentiment was negative.

These dynamics can be seen in Figure 4, where negative sentiment is stable over time (starting from the third debate until the official election results were released by the KPU). Meanwhile, the greatest positive sentiment was achieved when the election campaign began and only reached 4.69% for the highest positive sentiment achieved during the election process.

There is no significant pattern in Figure 4, only a few small points, such as the negative sentiment achieved, decreased when the election procession started. What was quite surprising was the high negative sentiment achieved by Candidate Pair 02.

Figure 5 shows the results of predictions of public sentiment towards Candidate Pair 03, namely Ganjar-Mahfud from the start of the election until the release of the official election results.

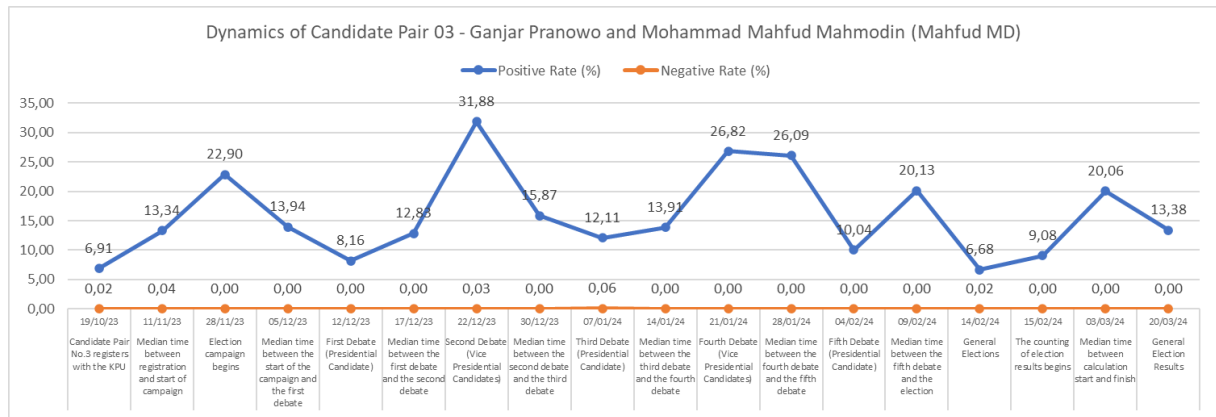


Figure 5. Chart of Sentiment Prediction Results for Candidate Pair 03

In Figure 5 the highest sentiment value was found during the second or first vice presidential debate which reached 31.88% positive sentiment, while the lowest value appeared during the day of general elections which only reached 6.68% sentiment positive.

These dynamics can be seen in Figure 5, where the dynamics change from time to time, quite large changes can be seen starting from when the campaign started where Candidate Pair 03 achieved positive sentiment of 22.90% then fell to 8.16% during the first debate. Then, another quite significant change occurred when the median between the first and second debates with the day of the second debate experienced a change in positive sentiment from 12.83% to 31.88% and quite large changes were obtained during the median of the forth debate-fifth debate, fifth debate, the median of the fifth debate-general election and the day general election where positive sentiment changed from a high 26.09% to 10.04% then went up to 20.13% to experience a decline to 6.68%. However, this change did not have an impact on the negative sentiment of Candidate Pair 03, but rather a change from positive sentiment to neutral sentiment. The changes in dynamics from each point are very extreme, so it cannot be concluded that a pattern is formed, however there are certain times that can be concluded as patterns, such as increasing positive sentiment during the vice-presidential candidate debate, which resulted in more positive sentiment than the previous time. Then, the median time between events is also more stable compared to event-to-event.

The 2024 Presidential and Vice-Presidential Election was won by Candidate Pair 02 Prabowo-Gibran with 96,214,691 votes or equivalent to 58.59%, followed by Candidate Pair 01 Anies-Muhaimin with 40,971,906 votes or equivalent to 24.95% and Candidate Pair 03 in the final position, Ganjar -Mahfud with 27,040,878 votes or the equivalent of 16.47% [21]. The results achieved in the election contradict the assessment of the dynamics of public sentiment on the Twitter/X application because on the Twitter/X application, Candidate Pair 02 achieved very negative sentiment during the general election process until the end of the election.

This is also illustrated by the other two candidate pairs, where Candidate Pair 03, who had very minimal negative sentiment from candidate pair registration to the election results which can be seen in Figure 5 above, experienced the opposite result where Candidate Pair 03 received the lowest number of votes. Also, with Candidate Pair 01 who always received high positive sentiment during the election process and positive dynamic changes reaching nearly 50% positive sentiment at one time, the official vote tally did not even touch half of the vote count of Candidate Pair 02.

3.3 Result Analysis

Candidate Pair 01 has a pattern that always appears, namely a decrease in the level of positive sentiment when the debate takes place on the day the data is collected. Candidate Pair 02 does not have a pattern, because the level of negative sentiment is quite stable from the beginning of the election to the end of the election, the biggest change from one point to another reaches approximately 11%, while for other points it is considered stable. Candidate



Pair 03 also does not have a pattern, but in contrast to Candidate Pair 02 which is too stable, Candidate Pair 03 has a very unstable sentiment, changes always occur from one point to another. The largest change reached 19% on one occasions and 16% on two different occasions.

Based on the test results and official results from the KPU, the sentiment test results are in contrast to the election results, where Candidate Pair 02 as the winner of the election had very negative sentiment on the Twitter application. On the other hand, Candidate Pair 03, which had very little negative sentiment, also failed to win the 2024 election. Classification using the NB-SVM model achieves much better accuracy and precision than models using the NB algorithm and SVM algorithm, and is also slightly better in recall and F1-Score compared to models with other methods.

4. CONCLUSION

This study analyzed public sentiment on Twitter towards three Indonesian presidential candidates of the 2024 Election using a combined NB-SVM. The use of the method produces a better model compared to models using the NB method and the SVM method with over 75% accuracy and precision. The results obtained stated that Candidate Pair 01 had more positive sentiment than the other two candidate pairs, but there was a decrease in positive sentiment during the debate, causing dynamics to occur in the data for Candidate Pair 01, positive sentiment would increase again at the next time the data was collected. Meanwhile, a dynamic pattern was not formed for Candidate Pair 02 or Candidate Pair 03. This was caused by different reasons, dynamics that were too stable for Candidate Pair 02, and very unstable dynamics for Candidate Pair 03. There is only a slight pattern that forms in Candidate Pair 02, namely an increase in positive sentiment on the day of the vice-presidential debate. Candidate Pair 03 achieved quite positive results, but had more significant dynamic changes than Candidate Pair 01. On the other hand, Candidate Pair 02 received very high negative sentiment with an average more than 65% during the election process. However, Candidate Pair 02 won the election with enough votes to win Candidate Pair 02 in one round, with 58.59% votes. Sentiment analysis can then use other keywords that are more varied and specifically aimed at each candidate pair, in addition to carrying out analysis on other social media besides Twitter/X, for example in the YouTube column, on Facebook and so on. As well as balancing the data that will be labeled because in this research the data that is labeled is not balanced so it can affect the final results of the sentiment prediction. Therefore, further research can improve performance with more even data and more varied keywords when collecting data.

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