



SENTIMENT ANALYSIS OF INDONESIAN CIVIL SERVAN CANDIDATES 2023 TWITTER NETWORK WITH NAIVE BAYES ALGORITHM METHOD

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ABSTRACT

The main objective of this research is to uncover the important role played by the social media platform Twitter in shaping public opinion regarding the 2023 Civil Servant Candidate (CPNS) selection process in Indonesia. Using advanced techniques such as social network analysis and Python language processing, as well as the application of the Naive Bayes algorithm, this research carefully examines the conversation patterns and topic trends prevalent on Twitter during the CPNS selection phase. The findings of this research unequivocally highlight the enormous influence of Twitter on public sentiment related to CPNS selection, as demonstrated by the classification model's impressive accuracy rate of approximately 95.19%. In addition, this research successfully identifies the influential roles played by key actors, prominent accounts, and narratives in shaping public perceptions. These groundbreaking insights foster a comprehensive understanding of the dynamic nature of public opinion in the context of CPNS selection, providing an invaluable basis for designing more effective communication strategies for the government and prospective civil servants.

Keywords: *Social Network Analysis, CPNS, Twitter, Social Media, Naive Bayes Algorithm.*

1. INTRODUCTION

In recent decades, the information technology revolution has changed the way we communicate, interact and share information. One of the most significant developments in this digital age is the rise of social media, which has become an integral aspect of the daily lives of people around the world (Broo et al., 2022). One social media platform such as Twitter has taken a central role in this change, shaping the way we relate to the world (Azzaakiyyah, 2023). In addition to networking, Twitter is also a tool for advertising, marketing products and doing promotions (Vahleffi, 2022). Users of certain platforms take the information they encounter based on their interests or needs. The presence of information flows makes users able to fulfill their information needs by choosing what kind of social media can provide information needs, such as when users search for info about the announcement of the selection of prospective civil

servants, the platform algorithm they use will bring up various pages of info (Athwal et al., 2019).

Technological developments have also drastically changed the way Civil Servant Candidate (CPNS) recruitment is conducted. In the past, the CPNS selection process often involved complicated and time-consuming physical files. However, now everything has moved to the digital world. CPNS registration is done online through an official portal, allowing prospective applicants to fill out forms and upload documents with ease. Interviews or competency tests can be held via video conference, facilitating the participation of prospective applicants from various regions. Selection results can be accessed quickly through a computerized system, increasing transparency and efficiency (Yuningsih et al, 2021).

This is in line with Law Number 14 of 2008 concerning Public Information Disclosure, fulfilling the right to freedom of access to information for each citizen as a form of transparency. The existence of freedom and the right to view, obtain and access information certainly increases public trust relating to the interests of the community (Suhendar, 2020). This is stated in the state constitution of the 1945 Constitution Article 28F which states that "Everyone has the right to communicate and obtain information to develop themselves and their social environment and has the right to seek, obtain, own, and store information by using all types of channels available including the use of social media.

According to a report by We Are Social, by January 2023, there will be approximately 167 million active social media users in Indonesia 1. This is equivalent to 60.4% of the population in the country. This figure reflects the tremendous penetration of social media in the country, creating a dynamic and important digital environment for communication and social interaction. With the majority of the population connected to these platforms, Indonesia offers great opportunities for businesses, governments, and individuals to deliver messages, promote products, and participate in extensive social dialog through social media (Digital-2023-Indonesia @ Datareportal.Com).

At the same time, CPNS selection is often a topic of intense discussion on social media, with diverse views, perceptions, and individual experiences contributing to the formation of public opinion. Therefore, Twitter social media network analysis is a relevant approach to exploring an in-depth understanding of how the CPNS selection process is reflected in online conversations, as well as how it impacts public perceptions and attitudes towards this selection.

Social media has become an integral part of Indonesians' daily lives. Twitter is a very popular social media platform, with millions of active users across the country (Kusumasari et al., 2020). Social media has played an important role in the Civil Servant Candidate (CPNS) recruitment process in various ways (Kamhar et al., 2019). Many government agencies use social media platforms such as Facebook, Twitter, and Instagram to announce information related to the opening of CPNS registration, test schedules, and applicant requirements. In addition, prospective applicants can utilize social media to search for the latest information, share experiences, and network with those who have previous experience in the CPNS selection process. CPNS-specific groups and communities also often form on social media platforms, allowing for the exchange of tips, learning resources, and support between applicants. This



makes social media a valuable source of information and a collaborative platform in the preparation and implementation of CPNS selection (Najib et al., 2023).

Social media is a digital platform that allows users to interact, share content, and communicate online. Users can create personal profiles, send messages, share their photos, videos, or thoughts, and connect with friends, family, or even strangers (Fitriani, 2021). Social media is also used for news, business promotion, political campaigns, and building online communities (Baum et al., 2019). They influence culture, public opinion, and behavior patterns, but they also raise privacy and security issues that need to be addressed. Social media has become an essential part of modern life, changing the way we interact and communicate (Leli et al., 2023).

The selection of Civil Servant Candidates (CPNS) 2023 is much talked about by the Indonesian people, both directly and through social media. Government agencies in Indonesia regularly organize CPNS recruitment and selection. The enthusiasm of prospective applicants for the 2023 CPNS selection is estimated to have reached a total of 4.5 million applicants who registered online as reported by Kompas.com on 25/9/23. The opening of this year's CPNS selection is a moment that is much awaited by most people, especially those who are at the age level of 23 years and over.

Based on this background, the purpose of this study is to identify and analyze the formation of public opinion on the Twitter social media usage network on the issue of the selection of civil servant candidates (CPNS). This is very interesting to analyze and find public opinion about public enthusiasm, whether the reaction is positive, negative, or neutral to the issue of CPNS 2023.

2. THEORY

2.1 Social Network Analysis

Social network analysis (SNA) is a methodology used to study the relationships and behavior of individuals in a social group. The social network analysis (SNA) method describes these relationships as a network consisting of nodes and edges. Nodes are useful for describing an entity such as an individual, group or organization. While edges are useful for describing the relationship that exists between one nodes and other nodes (Rabbani et al., 2020), while according to Mau et al. (2022), social network analysis itself is a method that serves to analyze and has a focus on measuring relationships and interactions that are owned and described in some information, and according to Novovanica et al. (2022) SNA is a mapping and, at the same time, ensures the relationship and flow of relationships between a person, group, or organization. Data from the results of Twitter itself can be analyzed or visualized in the form of a graph. The function of the graph itself is a structure that functions to model the relationship between one object and another. Social Network Analysis (SNA) is a method to visualize the activity and strength of connections between users on social networks, as well as a step to identify knowledge sharing. SNA is the modeling of users symbolized by points and interactions between users symbolized by lines (Camacho et al., 2020).

According to the aforementioned notion, social network analysis may be defined as a strategy or research approach employed to comprehend and examine the connections between

individuals or entities inside a social network. Social networks comprise diverse elements, including individuals, organizations, and concepts, which are linked by specific ties or interactions, such as friendship, cooperation, or interaction.

2.2 Social Media

Social media is a medium on the internet that allows users to represent themselves as well as interact, cooperate, share, communicate with other users, and form virtual social bonds. Social media is a digital medium where social reality occurs, and space-time users interact. The values that exist in society and communities also appear in the same or different forms on the internet (Rangkuti, 2023). Social media is a media platform that focuses on the existence of users who facilitate their activities and collaboration (Karim & Yulianita, 2021). Social media is an online medium where users can easily participate, share, and create content, including blogs, social networks, wikis, forums, and virtual worlds. Blogs, social networks, and wikis are the most common forms of social media used by people around the world (Rafiq, 2020). Based on the definition of social media that has been stated above, it can be concluded that social media is media on the internet that allows users to interact, cooperate, share, and communicate. As well as facilitating them in activities and collaborating and connecting with each other.

2.3 Communication Online

According to Graham et al. (2019), online communication is the process of exchanging information, messages, or interactions between individuals or groups conducted over the internet or computer networks. It includes various forms of communication, such as email, online chat, video calls, social media, forums, and others. Online communication allows people to communicate instantly, share digital content, and engage in discussion or collaboration without having to be in physical contact. It has become an important aspect of personal communication, business, education, entertainment, and many aspects of modern life, while according to Apranto (2021), online communication is the process of delivering messages that are carried out online, which means that it occurs within the internet network and is usually carried out on electronic facilities and media. For example, on cell phones (cellphones), computers, laptops, and various devices that use online systems in the process and how they work. Online communication is the process of delivering messages online through internet media such as websites, email, and social media. Online communication allows users to communicate with each other through computer networks (Bangun et al., 2022).

2.4 Twitter

Twitter is one of the social media platforms that allows users to share messages, images, and videos in a short format with followers and a "like" feature for interaction between users (Umbara, 2021). Twitter is an online social networking and microblogging service that allows users to send and read text-based messages of up to 280 characters, known as tweets (Tweet) (Silitonga et al., 2019). Meanwhile, according to Zuhdi et al. (2019) Twitter is a social media site where many people from all over the world can express their opinions.

2.5 Public Opinion

According to Clarkson and Oxley (2020), public opinion is the view, attitude, belief, or evaluation held by most members of society about certain issues or topics at a given time.



Public opinion reflects how individuals in society respond to various events, government policies, social problems, or the news they receive. Meanwhile, according to Sarihati et al. (2022) Public opinion or public opinion is the opinion of a group of people or a synthesis of opinions and is obtained from a social discussion of parties with related interests. Public opinion refers to a collective and unified view of a particular issue. Public opinion involves the participation of several individuals and involves interactions that involve discussion and the exchange of ideas about the issue being debated. This allows for pros and cons before consensus is reached (Rim et al., 2020). Public opinion is the result of a process by which a collective audience or public responds to a message because of a shared interest in its content. Typically, the selection of public opinion is based on an effective majority rather than an overall majority. Public opinion uses new and controversial subjects (Huang et al., 2019). So, it can be concluded that public opinion is the prevailing views, attitudes, beliefs, or evaluations held by the majority of members of society regarding a particular issue. Public opinion reflects responses to events, policies, and news, involves interaction and discussion, and is generally based on an effective majority. The public's attention is focused on controversial issues.

2.6 Naive Bayes Algorithm

The naive Bayes algorithm is a data classification method that uses Bayes' theorem to calculate the probability of a data class based on the probability of features associated with that class. This method is assumed to be "naive" because of the independence between features, although in real situations, features can be interrelated. Naive Bayes is used for text classification, sentiment analysis, and other tasks involving data categorization (Chen et al., 2021). The naive Bayes algorithm is one of the machine learning algorithms used in various classification tasks. This algorithm is based on the Bayes theorem (Dey et al., 2020). According to naive Bayes, each decision class calculates the probability on the condition that the decision class is true, given the object information vector. This algorithm assumes that object attributes are independent. The probabilities involved in producing the final estimate are calculated as the sum of the frequencies of the "master" decision table. The Naive Bayes classifier works very well compared to other classifier models (Wijaya & Giap, 2021). The advantage of using the Naive Bayes algorithm is that this method only requires a small amount of training data to determine parameter estimates, which are assumed to be independent variables, so only the variance of a variable within a class is needed to determine classification, not the entire covariance matrix (Watratan et al., 2020).

3. METHOD

The research method is a scientific way to obtain data with the aim of being able to describe, prove, develop, and discover knowledge and theories to understand, solve, and anticipate problems in human life (Wulandari et al., 2021). The research method used in the research is the Social Network Analysis (SNA) method. Social Network Analysis, or SNA, is one of the analytical methods in studies that concentrate on relationship research and is often used to measure a relationship and describe some information from individuals (Akbar et al., 2022). The SNA method is used in this study to analyze CPNS data tweets on Twitter to find public opinion about the 2023 CPNS registration.

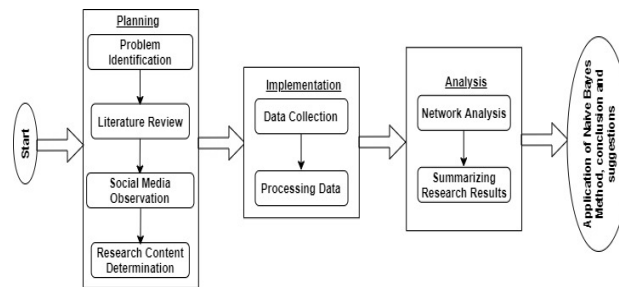


Figure. 1 Research Framework

3.1 Problem Identification

In problem identification, the method which can be carried out at the first time is to look for information, news and topics of problems that will be researched to see the role that influences the twitter platform in a hashtag (#) by using the social network analysis (SNA) approach method.

3.2 Literature Study

Literature study is a series of activities in the method of collecting references, recording, managing, and reading as a tool for research (Fatmawati et al., 2023). Meanwhile, according to the literature study, a research approach is carried out by looking for references to the theoretical basis that are relevant to the case or problem found. This stage aims to develop various theories and collect relevant data related to ongoing problems or as material to be investigated, as well as a reference in the research report (Snyder, 2019).

3.3 Social Media Determination

Social media determination is a step in determining the social media platform that will be used to collect strategic and important data in improving work effectiveness through the use of social media platforms such as Twitter.

3.4 Determination of Research

The determination of research content will focus on identifying and analyzing conversations and trends related to CPNS selection in 2023 on the Twitter platform.

3.5 Data Crawling

Data crawling, or web crawling, is a data collection technique used to index information on a page using a uniform resource locator (URL) by including an application programming interface to add larger datasets (Serra et al., 2023). Data that can be collected through web crawling can be text, audio, video, and images (Capuano et al., 2020). Data crawling can also be defined as an automated process for collecting and indexing data from various sources, such as websites, databases, or documents. This process uses software for applications called "crawlers" to access data sources and retrieve the information needed (Bifulco et al., 2021).

Data crawling was conducted with the aim of obtaining information that would be used in the research analysis. The data collection process includes using tools, determining themes or topics such as 'CPNS,' and generating text codes from the Google Research Colab application. After that, we were able to use the prepared data scraping code in the Python programming language to sample data from our Twitter account that used the hashtag #CPNS.

3.6 Data Processing



Data processing is a method for converting or translating raw data into usable information (Jan et al., 2019). Raw data that is not processed first is useless for any organization, so the data is processed first to become useful information (Naeem et al., 2022). The data processing process includes several stages, such as raw data collection, data preparation, data input, data processing, and data output (Krishnamurthi et al., 2020).

In the data processing process for Twitter social media network analysis related to the 2023 Civil Servant Candidate Selection (CPNS), the first step is to convert the scanned data from Twitter in.json format to.csv format. The.csv data is then divided into two separate sets: node data and edge data, which refer to the relationships between entities in the network.

3.7 Network Analysis

Network analysis is a data analysis technique used to study the relationships between entities in a network. These entities can be people, organizations, or even concepts (Valeri & Baggio, 2021). Network analysis can help us understand how information, knowledge, or resources flow through a network, as well as identify entities with key roles in the network (Sayles et al., 2019). In network analysis, line segments or features are used as a way to analyze relationships and movement within the network. To build a network database, we need connected lines with naming fields that follow rules (Feng et al., 2021).

Network Analysis of Twitter social media on Civil Servant Candidate Selection (CPNS) 2023,' network analysis refers to a data analysis method used to examine and identify patterns, relationships, and interrelationships between entities, topics, and information spread in conversations related to CPNS on the Twitter platform. Network analysis helps in revealing how information and influence of one entity on another in the context of CPNS selection in 2023.

3.8 Summarizing the Research Results

The results of this study illustrate that the analysis of Twitter social media networks related to the Selection of Civil Servant Candidates (CPNS) in 2023 using the SNA method and data collection through Google Colab and the GHEPI application.

4. RESULTS AND DISCUSSION

Public opinion on an issue or phenomenon can be obtained through the public opinion measurement method (Septa & Kusumasari, 2023). The discussion of the CPNS issue, which has been increasingly crowded on social media lately, has generated various responses from the public. The issue of CPNS 2023 selection has been increasingly discussed lately and has led to the hashtag #CPNS2023 becoming a trending topic. The rise of the hashtag was triggered by general public discussions related to the issue of CPNS selection, which were grouped under the hashtag #CPNS2023. The conversations with the hashtag #CPNS203 are the database for this research.

The following are the results of observations of social network analysis (SNA) using the Gephi.0.10.1 software. This observation uses Twitter social media as an object, using the hashtag #CPNS2023 as the data. The data drawn and filtered has a total of 3949 nodes and 4943 edges. This network graph has an undirected type, which is a type of graph that has no

direction in its interactions. The following is an image of the Visualiasi abstract network and the network with the #CPNS2023 hastag.

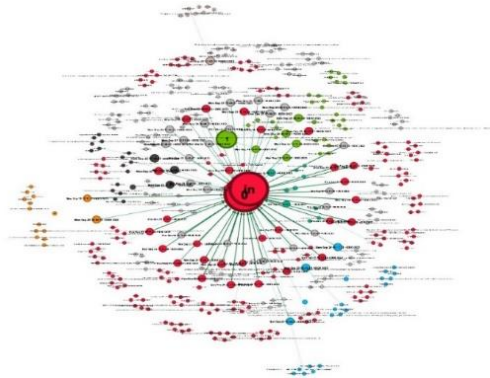


Figure. 2 Network visualization view #CPNS2023

Figure 3 is the result after analysis with existing data: a word cloud is produced with the highest word, which is often discussed or often comes out, the word with light green text, and then the second highest word with purple text.



Figure. 3 Word Cloud

Figure 4 above shows a graph about the frequency of words that most often appear in the results of tweets or are often discussed on the topic under study, namely the word "and."

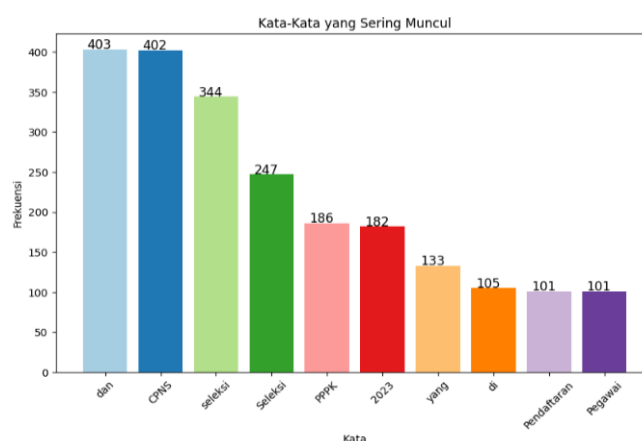


Figure. 4 Frequently occurring words.

Figure 5 is the result of the sentiment analysis of the 2023 CPNS selection above using the naive Bayes method to see the results of the reaction or public opinion of Twitter users to the issue of the 2023 CPNS selection conversation and get results like the picture above with three public responses, namely neutral, positive, and negative. The users of the Twitter account on the CPNS 2023 issue chose to be neutral on the CPNS 2023 issue by 91.3%, and 6.2% considered the CPNS 2023 issue positive, while 2.5% considered the CPNS 2023 issue negative.

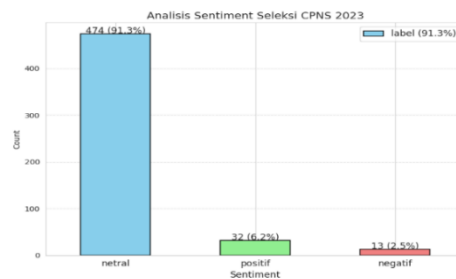


Figure. 5 Sentiment Analysis of CPNS Selection 2023

The 5 accounts in figure 6 are Twitter social media accounts that often provide information to the public on the issue of CPNS 2023, including @Kpk_RI, @Kemenag_RI, @Noprendiwira, @Chilbrow, and @adindavebri. @Kpk_RI and @Kemenag_RI are official accounts of the Corruption Eradication Commission (KPK) and the Ministry of Religious Affairs of the Republic of Indonesia, which provide official views and updates related to the CPNS selection process and requirements. Meanwhile, @Noprendiwira, @Chilbrow, and @adindavebri are Twitter users who actively share insights, tips, and the latest news surrounding the CPNS appointment, helping candidates with valuable information in facing the selection process.

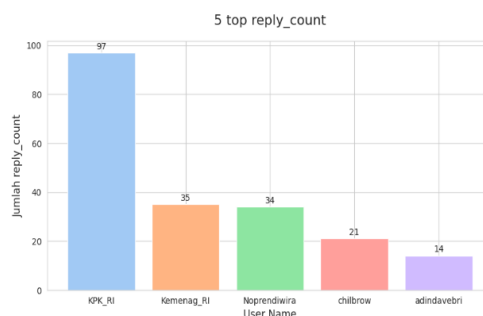


Figure. 6 Top Reply Count

In Figure 7, there are 5 Twitter social media accounts, namely @Noprendiwira, @Kpk_RI, @Kemenag_RI, @Bapas_Pkpinang, and @lppmmartapura, which are active in retweeting information about CPNS 2023. These five accounts frequently disseminate important information about the CPNS selection process and requirements to a wide audience, ensuring that the latest news and detailed guidance are accessible to all prospective civil servants. With their efforts in sharing information related to CPNS 2023.

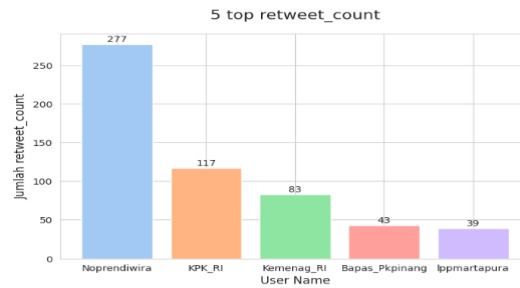


Figure. 7 Top Retweet Count

Figure 8 displays a graph of how many posts there were on social media in 2023 about the selection of civil servant candidates (CPNS).

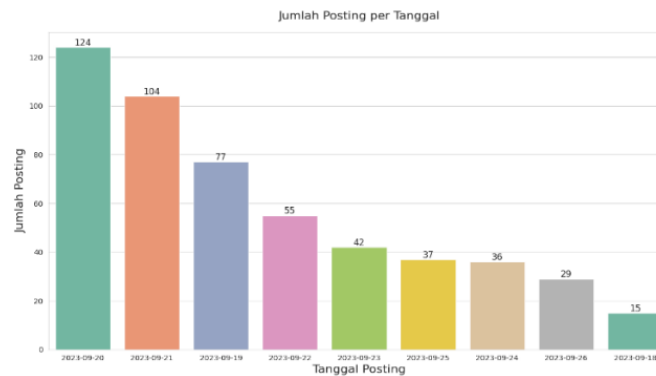


Figure. 8 Number of Posts by Date

The accuracy of this classification model is about 95.19%, which indicates that about 95.19% of the total test data has been classified correctly. However, when looking at the classification report in more detail, the model has problems identifying the "negative" and "positive" classes. The precision for the "negative" and "positive" classes is zero, which means that the model was unsuccessful in classifying the data into these two classes correctly. In addition, the recall for the "positive" class is also low, only about 33%, which means that the model fails to identify most of the data that belongs to the "positive" class. In contrast, the model has good precision and recall for the "neutral" class, with values around 95% to 100%. The F1-score value used to measure the balance between precision and recall also showed low performance for the "negative" and "positive" classes, while performing well for the "neutral" class. In conclusion, although the overall accuracy is high, the model has difficulty classifying the "negative" and "positive" classes and needs to be improved to enhance its performance in both classes.

accuracy: 0.9519230769230769				
Classification Report:				
	precision	recall	f1-score	support
negatif	0.00	0.00	0.00	1
netral	0.95	1.00	0.97	97
positif	1.00	0.33	0.50	6
accuracy			0.95	104

Table.1	macro avg	0.65	0.44	0.49	104	Clasification
Report	weighted avg	0.94	0.95	0.94	104	

Figure 9 is the result of the Naïve Bayes algorithm, with the given confusion matrix showing the performance of the model in the classification task. In this case, three classes (neutral, positive, and negative) were considered. The model managed to correctly classify most of the data into the middle class (second class) with 97 true positives, while having difficulty identifying data in the first class (first class has only 1 true positive) and third class (only 2 true positives). The model produced no false positives or false negatives for the first and third classes.

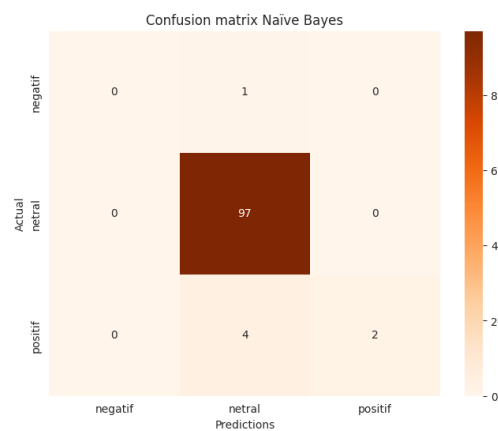


Figure. 9 Confusion Matrix Naive Bayes

5. CONCLUSIONS AND SUGGESTIONS

5.1 CONCLUSIONS

The findings of this research indicate that social media, specifically Twitter, exerts a substantial influence on public sentiment in 2023 about the selection procedure for civil servant candidates (CPNS). By employing python language processing and social network analysis, this study effectively unveiled conversation patterns, interactions, and topic trends that exerted an impact on the general public's perceptions concerning the CPNS selection. Additionally, influential accounts and key actors were recognized as crucial components in this procedure. This study demonstrates that social media serves as a critical forum for discourse and the interchange of opinions, in addition to being a conduit for disseminating information. The emergence of

narratives on Twitter can significantly influence individuals' assessments and perceptions of the CPNS selection procedure. Hence, a comprehensive comprehension of these social media dynamics is critical for CPNS candidate and government stakeholders, as well as for CPNS personnel, alike. By utilizing the findings of this study, governing bodies can formulate enhanced communication tactics to uphold transparency, furnish precise information, and more effectively control public sentiment throughout the CPNS selection procedure. Furthermore, this study makes a further contribution to the collective comprehension of how social media influences public sentiment regarding the way government policies are received by the public and the process of selecting employees.

5.2 Suggestion

Drawing from the findings of this study, it is suggested that to enhance public opinion management throughout the 2023 Civil Servant Candidate (CPNS) selection process, governing bodies engage in proactive surveillance and interaction on social media platforms, promptly address inquiries and apprehensions from the public, and cooperate with influential users to distribute precise information. Furthermore, it is recommended to incorporate natural language processing (NLP) technology for the purpose of examining sentiment and news trends, execute social media campaigns that promote the values of transparency, and maintain continuous assessments of the communication strategies employed to enhance public comprehension and mitigate the spread of potential misinformation.

REFERENCES

- Akbar, M. A., Amril, M. A. B., Syahira, R., Latisha, F. R., Jihan, N., & others. (2022). Analisis Struktur Jaringan Komunikasi\# Seagames2022 Di Twitter Menggunakan Pendekatan Social Network Analysis (Sna). *Jurnal Studi Komunikasi Dan Media*, 26(1), 1–16. <https://doi.org/https://doi.org/10.17933/jskm.2022.4780>
- Aprianto, N. E. K. (2021). Peran Teknologi Informasi dan Komunikasi dalam Bisnis. *International Journal Administration Business \& Organization*, 2(1), 8–15.
- Athwal, N., Istanbuluoglu, D., & McCormack, S. E. (2019). The allure of luxury brands' social media activities: a uses and gratifications perspective. *Information Technology \& People*, 32(3), 603–626. <https://doi.org/https://doi.org/10.1108/ITP-01-2018-0017>
- Azzaakiyyah, H. K. (2023). The Impact of Social Media Use on Social Interaction in Contemporary Society. *Technology and Society Perspectives (TACIT)*, 1(1), 1–9. <https://doi.org/https://doi.org/10.61100/tacit.v1i1.33>
- Baum, D., Spann, M., Füller, J., & Thürridl, C. (2019). The impact of social media campaigns on the success of new product introductions. *Journal of Retailing and Consumer Services*, 50, 289–297. <https://doi.org/https://doi.org/10.1016/j.jretconser.2018.07.003>
- Bifulco, I., Cirillo, S., Esposito, C., Guadagni, R., & Polese, G. (2021). An intelligent system for focused crawling from Big Data sources. *Expert Systems with Applications*, 184, 115560. <https://doi.org/https://doi.org/10.1016/j.eswa.2021.115560>
- Camacho, D., Panizo-LLedot, Á., Bello-Orgaz, G., Gonzalez-Pardo, A., & Cambria, E. (2020). The four dimensions of social network analysis: An overview of research methods, applications, and software tools. *Information Fusion*, 63, 88–120. <https://doi.org/10.1016/j.inffus.2020.05.009>
- Capuano, A., Rinaldi, A. M., & Russo, C. (2020). An ontology-driven multimedia focused crawler based on linked open data and deep learning techniques. *Multimedia Tools and Applications*, 79, 7577–7598. <https://doi.org/https://doi.org/10.1007/s11042-019-08252->



- Chen, H., Hu, S., Hua, R., & Zhao, X. (2021). Improved naive Bayes classification algorithm for traffic risk management. *EURASIP Journal on Advances in Signal Processing*, 2021(1), 30. <https://doi.org/10.1186/s13634-021-00742-6>
- Cicilia Sriliasta Bangun, Suryari Purnama, & Aropria Saulina Panjaitan. (2022). Analysis of New Business Opportunities from Online Informal Education Mediamorphosis Through Digital Platforms. *International Transactions on Education Technology (ITEE)*, 1(1), 42–52. <https://doi.org/10.33050/itee.v1i1.184>
- Clawson, R. A., & Oxley, Z. M. (2020). *Public opinion: Democratic ideals, democratic practice*. CQ Press.
- Dey, S., Wasif, S., Tonmoy, D. S., Sultana, S., Sarkar, J., & Dey, M. (2020). A comparative study of support vector machine and Naive Bayes classifier for sentiment analysis on Amazon product reviews. *2020 International Conference on Contemporary Computing and Applications (IC3A)*, 217–220. <https://doi.org/https://doi.org/10.1109/IC3A48958.2020.233300>
- digital-2023-indonesia @ datareportal.com*. (n.d.). <https://datareportal.com/reports/digital-2023-indonesia>
- Fatmawati, M., Alvira, E. M., Raharjo, M. K. N., & Pratiwi, H. N. (2023). Analisis Pengelolaan Sampah di Tempat Pembuangan Sementara (TPS) Kelurahan Kedungsoko Kabupaten Tulungagung. *Harmoni: Jurnal Ilmu Komunikasi Dan Sosial*, 1(2), 66–75. <https://doi.org/https://doi.org/10.59581/harmoni-widyakarya.v1i2.345>
- Feng, Z., Li, H., Zeng, W., Yang, S.-H., & Qu, H. (2021). Topology Density Map for Urban Data Visualization and Analysis. *IEEE Transactions on Visualization and Computer Graphics*, 27(2), 828–838. <https://doi.org/10.1109/TVCG.2020.3030469>
- Fitriani, Y. (2021). Pemanfaatan media sosial sebagai media penyajian konten edukasi atau pembelajaran digital. *JISAMAR (Journal of Information System, Applied, Management, Accounting and Research)*, 5(4), 1006–1013. <https://doi.org/https://doi.org/10.52362/jisamar.v5i4.609>
- Graham, M., Scarborough, H., & Goodwin, C. (2019). *Implementing computer mediated communication in an undergraduate course-A practical experience*. <https://doi.org/https://doi.org/10.24059/OLJ.V3I1.1924>
- thinking engineering education at the age of industry 5.0. *Journal of Industrial Information Integration*, 25, 100311. <https://doi.org/10.1016/j.jii.2021.100311>
- Huang, L., Clarke, A., Heldsinger, N., & Tian, W. (2019). The communication role of social media in social marketing: a study of the community sustainability knowledge dissemination on LinkedIn and Twitter. *Journal of Marketing Analytics*, 7(2), 64–75. <https://doi.org/10.1057/s41270-019-00053-8>
- Jan, B., Farman, H., Khan, M., Imran, M., Islam, I. U., Ahmad, A., Ali, S., & Jeon, G. (2019). Deep learning in big data analytics: a comparative study. *Computers & Electrical Engineering*, 75, 275–287. <https://doi.org/https://doi.org/10.1016/j.compeleceng.2017.12.009>
- Jovanica, C., Rahmintaningrum, D. D., Nuradni, H. A., & Salsabila, A. (2022). Analisis Pengaruh Aktor Pada Tagar #Roketchina Di Media Sosial Twitter Menggunakan Social Network Analysis (Sna). *Jurnal Ilmiah Komunikasi Makna*, 10(1), 43. <https://doi.org/10.30659/jikm.v10i1.15644>
- Kamhar, M. Y., & Lestari, E. (2019). Pemanfaat Sosial Media Youtube Sebagai Media Pembelajaran Bahasa Indonesia DI Perguruan Tinggi. *Inteligensi: Jurnal Ilmu Pendidikan*, 1(2), 1–7.

- Karim, I. Y., & Yulianita, N. (2021). Peran Instagram@ greenarationid sebagai Media Kampanye Ramah Lingkungan. *Jurnal Riset Public Relations*, 120–129.
- Krishnamurthi, R., Kumar, A., Gopinathan, D., Nayyar, A., & Qureshi, B. (2020). An overview of IoT sensor data processing, fusion, and analysis techniques. *Sensors*, 20(21), 6076. <https://doi.org/https://doi.org/10.3390/s20216076>
- Kusumasari, B., & Prabowo, N. P. A. (2020). Scraping social media data for disaster communication: how the pattern of Twitter users affects disasters in Asia and the Pacific. *Natural Hazards*, 103(3), 3415–3435. <https://doi.org/https://doi.org/10.1007/s11069-020-04136-z>
- Leli, N., Nurhadiah, N., Handayani, R. T., Suhairi, S., & others. (2023). Pemanfaatan Media Sosial sebagai Alat Komunikasi Massa dalam Memperluas Jangkauan dan Meningkatkan Interaksi dengan Konsumen. *Jurnal Mirai Management*, 8(2), 436–444. <https://doi.org/https://doi.org/10.37531/mirai.v8i2.5018>
- Mau, S. D. I., Sembiring, I., & Purnomo, H. (2022). Analisis Pengguna Media Sosial Terhadap Isu UU Cipta Kerja Menggunakan SNA dan Naive Bayes. *Building of Informatics, Technology and Science (BITS)*, 4(1), 149–155. <https://doi.org/https://doi.org/10.47065/bits.v4i1.1610>
- Naeem, M., Jamal, T., Diaz-Martinez, J., Butt, S. A., Montesano, N., Tariq, M. I., De-la-Hoz-Franco, E., & De-La-Hoz-Valdiris, E. (2022). Trends and future perspective challenges in big data. *Advances in Intelligent Data Analysis and Applications: Proceeding of the Sixth Euro-China Conference on Intelligent Data Analysis and Applications, 15--18 October 2019, Arad, Romania*, 309–325. https://doi.org/https://doi.org/10.1007/978-981-16-5036-9_30
- Najib, M. A., & Bahfiarti, T. (2023). Crisis Communication Management of The Government Public Relations of The National Civil Service Agency in Handling Crisis on Negative News in Online Media. *Proceedings of the 2nd International Conference on Social Sciences, ICONESS 2023, 22-23 July 2023, Purwokerto, Central Java, Indonesia*. <https://doi.org/http://dx.doi.org/10.4108/eai.22-7-2023.2335416>
- Rabbani, A. P., Alamsyah, A., & Widiyanesti, S. (2020). Analisa Interaksi User di Media Sosial Mengenai Industri Fintech Menggunakan Social Network Analysis (Studi Kasus: GoPay, OVO dan LinkAja). *Jurnal Mitra Manajemen*, 4(3), 341–351. <https://doi.org/https://doi.org/10.52160/ejmm.v4i3.352>
- Rafiq, A. (2020). Dampak media sosial terhadap perubahan sosial suatu masyarakat. *Global Komunika: Jurnal Ilmu Sosial Dan Ilmu Politik*, 3(1), 18–29.
- Rangkuti, F. A. (2023). Implementasi Support Vector Machine Untuk Mendeteksi Kalimat Pelecehan Seksual Pada Media Sosial Facebook. *Djtechno: Jurnal Teknologi Informasi*, 4(1), 275–284. <https://doi.org/https://doi.org/10.46576/djtechno.v4i1.3374>
- Rim, H., Lee, Y., & Yoo, S. (2020). Polarized public opinion responding to corporate social advocacy: Social network analysis of boycotters and advocates. *Public Relations Review*, 46(2), 101869. <https://doi.org/10.1016/j.pubrev.2019.101869>
- Sarihati, T., Si, M., Luthfie, H. M., Kurniadi, B., & Si, M. (2022). *Komunikasi Politik, Media Massa dan Opini Publik*. PT. RajaGrafindo Persada-Rajawali Pers.
- Sayles, J. S., Mancilla Garcia, M., Hamilton, M., Alexander, S. M., Baggio, J. A., Fischer, A. P., Ingold, K., Meredith, G. R., & Pittman, J. (2019). Social-ecological network analysis for sustainability sciences: a systematic review and innovative research agenda for the future. *Environmental Research Letters*, 14(9), 093003. <https://doi.org/10.1088/1748-9326/ab2619>
- Septa, R. R., & Kusumasari, B. (2023). Opini Publik Terkait Tren Isu Kesehatan: Analisis Konten pada Twitter dan Portal Berita di Yogyakarta. *PESIRAH: Jurnal Administrasi*



- Publik, 2(2). <https://doi.org/10.47753/pjap.v2i2.34>
- Serra, A. M., Estima, J., & da Silva, A. R. (2023). Evaluation of Maestro, an extensible general-purpose data gathering and data classification platform. *Information Processing & Management*, 60(5), 103458. <https://doi.org/https://doi.org/10.1016/j.ipm.2023.103458>
- Silitonga, Y. R., Munawar, I., & MMSI, M. C. (2019). Analisis Dan Penerapan Datamining Untuk Mendeteksi Berita Palsu (Fake News) Pada Social Media Dengan Memanfaatkan Modul Scikit Learn. *Digilib Esa Unggul*.
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- Suhendar, A. (2020). Keterbukaan Informasi Publik Bentuk Keseriusan Pemerintah Menuju Good Governance (Implementasi Undang Undang Nomor 14 Tahun 2008). *Jurnal Wacana Kinerja: Kajian Praktis-Akademis Kinerja Dan Administrasi Pelayanan Publik*, 13(2), 243–251. <https://doi.org/http://dx.doi.org/10.31845/jwk.v13i2.315>
- Umbara, F. W. (2021). User Generated Content di Media Sosial Sebagai Strategi Promosi Bisnis. *Jurnal Manajemen Strategi Dan Aplikasi Bisnis*, 4(2), 572–581. <https://doi.org/https://doi.org/10.36407/jmsab.v4i2.366>
- Vahleffi, I. A. (2022). TA: Efektivitas Penggunaan Sosial Media Dalam Penjualan Produk Madu Suhita Di Pt Suhita Lebah Indonesia [Politeknik Negeri Lampung]. <http://repository.polinela.ac.id/id/eprint/3157>
- Valeri, M., & Baggio, R. (2021). Italian tourism intermediaries: a social network analysis exploration. *Current Issues in Tourism*, 24(9), 1270–1283. <https://doi.org/10.1080/13683500.2020.1777950>
- Watratana, A. F., Moeis, D., & others. (2020). Implementasi Algoritma Naive Bayes Untuk Memprediksi Tingkat Penyebaran Covid-19 Di Indonesia. *Journal of Applied Computer Science and Technology*, 1(1), 7–14. <https://doi.org/https://doi.org/10.52158/jacost.v1i1.9>
- Wijaya, S., & Giap, Y. C. (2021). Twitter Opinion Mining Analysis of Web-Based Handphone Brand Using Naïve Bayes Classification Method. *Bit-Tech*, 4(2), 56–60. <https://doi.org/https://doi.org/10.32877/bt.v4i2.287>
- Wulandari, Y., Rahmawati, A. E., Handriani, S. Z., Setyaningsih, A. A., Baidowi, A. L., & Darmadi, D. (2021). Penerapan dan Pemahaman Siswa SMP Kelas VIII terhadap Materi Pembelajaran Matematika dalam Kehidupan. *Jurnal Review Pendidikan Dan Pengajaran (JRPP)*, 4(1), 85–89. <https://doi.org/https://doi.org/10.31004/jrpp.v4i1.1819>
- Yuningsih, Y., & Rejeki, P. W. A. (2021). Kompetensi Peserta Pelatihan Sebelum dan Saat Masa Pandemi Covid-19: Studi Kasus Latsar CPNS. *Jurnal Administrasi Publik*, 17(1), 1–36. <https://doi.org/https://doi.org/10.52316/jap.v17i1.56>
- Zuhdi, A. M., Utami, E., & Raharjo, S. (2019). Analisis sentiment twitter terhadap capres Indonesia 2019 dengan metode K-NN. *Jurnal Informa: Jurnal Penelitian Dan Pengabdian Masyarakat*, 5(2), 1–7. <https://doi.org/https://doi.org/10.46808/informa.v5i2.73>