

Sentiment Analysis And Topic Extraction Related To The 2024 Indonesian Presidential And Vice Presidential Election Using Deep Learning Methods

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ABSTRACT

This research examines public sentiment and discourse surrounding the 2024 Indonesian Presidential and Vice Presidential Election through analysis of YouTube comments. Using a combination of deep learning techniques, specifically Long Short-Term Memory (LSTM) networks for sentiment analysis and Latent Dirichlet Allocation (LDA) for topic extraction, we analyzed public responses to the three presidential candidates. The LSTM model achieved varying accuracy rates across candidates: 58% for Anies Baswedan, 61% for Prabowo Subianto, and 71% for Ganjar Pranowo, with consistently high recall rates of 100% across all candidates. Topic extraction through LDA revealed distinct themes in public discourse, including leadership qualities, policy implementations, and campaign promises. The research methodology involved web scraping YouTube comments from January to October 2023, followed by comprehensive text preprocessing and analysis. Our findings provide valuable insights into public opinion dynamics and key discussion topics during the election period, contributing to the understanding of social media's role in Indonesian political discourse. This study demonstrates the effectiveness of combining deep learning approaches for analyzing large-scale social media data in the context of political communications

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1. Introduction

The Indonesian Presidential and Vice Presidential Election, held every five years according to Law Number 42 of 2008, represents a crucial democratic process in the nation's political landscape [1]. The 2024 election has generated unprecedented levels of public discourse on social media platforms, particularly YouTube, where citizens actively engage in political discussions and express their sentiments towards candidates. With 164,227,475 registered voters and three presidential-vice presidential pairs competing, understanding public sentiment and identifying key discussion topics has become increasingly important for political analysis and democratic discourse [2].



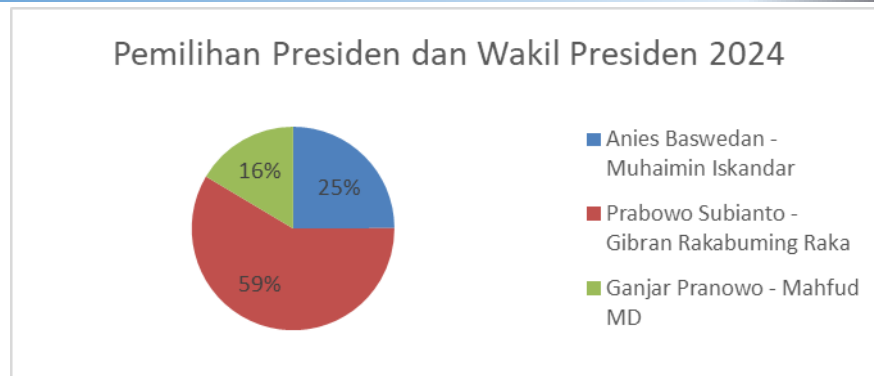


Fig. 1. Distribution of Support for Presidential and Vice Presidential Candidates in 2024 Indonesian Election

Social media platforms, especially YouTube, have emerged as significant venues for political communication and public opinion formation [3]. The platform's widespread use in Indonesia makes it a valuable source for analyzing public sentiment and extracting prevalent topics related to the presidential election. However, the vast amount of unstructured textual data in YouTube comments presents challenges in systematic analysis and interpretation. This challenge necessitates the application of advanced computational methods to extract meaningful insights from social media discussions.

Previous research has explored various approaches to political sentiment analysis and topic extraction. Prianto et al. [4] conducted sentiment analysis on presidential candidates using Naive Bayes and K-Means clustering, while Kurniawan & Susanto [5] combined multiple methods for analyzing election-related sentiments. Syaifuddin et al. [6] employed Latent Dirichlet Allocation (LDA) for analyzing trending topics in social media conversations. However, these studies primarily focused on Twitter or Facebook data, leaving a gap in understanding YouTube-based political discourse.

Recent advancements in deep learning techniques, particularly Long Short-Term Memory (LSTM) networks and topic modeling approaches, offer new opportunities for analyzing social media content [7]. Naury et al. [8] demonstrated the effectiveness of combining LSTM and LDA for sentiment analysis and topic modeling in Indonesian language contexts. Building on these foundations, our research introduces several key innovations.

The exclusive focus on YouTube comments provides insights into a platform that has become increasingly important in Indonesian political discourse but remains understudied. The application of LSTM for sentiment analysis, specifically tailored for Indonesian language content, offers improved accuracy in sentiment classification compared to traditional methods [9]. The use of LDA for topic extraction reveals nuanced patterns in public discussions about presidential candidates, contributing to a deeper understanding of voter concerns and interests. Furthermore, the combination of sentiment analysis and topic extraction provides a comprehensive view of public opinion dynamics during the 2024 election campaign.

This research aims to address three main objectives: developing an effective method for collecting and preprocessing YouTube comments related to the presidential election using web scraping techniques; implementing deep learning-based sentiment analysis to understand public attitudes towards presidential candidates; and applying unsupervised learning techniques for identifying and analyzing key topics in election-related discussions [10].

The results of this study contribute to both academic research and practical applications in political communication and social media analysis. By providing insights into public sentiment and key discussion topics, this research helps stakeholders better understand the dynamics of political discourse in social media during election periods. Additionally, the methodology developed in this study can be applied to future research in social media analysis and political communication [11].

The remainder of this paper is organized as follows: Section 2 presents the research methodology, including data collection, preprocessing, and analysis techniques. Section 3 discusses the results of sentiment analysis and topic extraction, providing detailed insights into public

opinion patterns. Finally, Section 4 concludes the paper with implications for future research and practical applications.

2. Method

This research employs a combination of text mining, deep learning, and unsupervised learning techniques to analyze YouTube comments related to the 2024 Indonesian Presidential Election. The methodology consists of several key stages: data collection, preprocessing, sentiment analysis using LSTM, and topic extraction using LDA. Figure 1 illustrates the overall research framework.

2.1. Data Collection and Preprocessing

Data collection was conducted using the YouTube API to extract comments from January 2023 to October 2023. The data gathering process focused on seven specific keywords: Prabowo2024, Gibran2024, Ganjar2024, JoniSupriyanto2024, Anies2024, Muhaimin2024, and Pilpres2024. The YouTube API integration was implemented using Python, allowing for systematic collection of comments from verified channels and relevant political discussions [12].

The preprocessing stage involved comprehensive text cleaning and preparation procedures. Initially, the data underwent cleansing to remove special characters, URLs, and irrelevant symbols that could interfere with analysis. Following this, tokenization was performed to break down the text into individual words, enabling more granular analysis. Common words that don't carry significant meaning were eliminated through stopword removal, improving the efficiency and accuracy of subsequent analysis. The text was then normalized using stemming and lemmatization processes, which convert words to their root form following Indonesian language rules. Finally, the processed text was converted into a format suitable for analysis through appropriate text representation methods [13].

2.2. Sentiment Analysis using LSTM

The sentiment analysis implementation utilized a Long Short-Term Memory (LSTM) network, chosen for its ability to capture long-term dependencies in sequential data. The LSTM architecture was carefully designed to optimize performance in sentiment classification. The network consists of an input layer that processes preprocessed text converted to word embeddings, followed by three LSTM layers, each containing 47 hidden units. The activation functions were selected to maximize model performance, with ReLU functions used in intermediate layers and a Softmax function in the output layer. During training, various learning rates were tested, ranging from 0.1 to 0.005, with a consistent batch size of 100 and 64 epochs. This configuration allowed the model to effectively learn and classify sentiments into three categories: positive, negative, and neutral [14].

2.3. Topic Extraction using LDA

For topic extraction, we implemented Latent Dirichlet Allocation (LDA), following established methodologies in text analysis. The LDA process began with the creation of a document-term matrix, transforming the preprocessed text into a mathematical representation suitable for topic modeling. The implementation involved careful optimization of the number of topics to achieve maximum coherence in the resulting topic distributions. Through iterative testing and refinement, we adjusted the alpha and beta parameters to optimize the topic distribution patterns. The final stage involved detailed analysis and interpretation of the extracted topics, with keyword clusters being carefully examined to identify and label meaningful themes in the discourse [15].

2.4. Evaluation Methods

The evaluation framework was designed to provide comprehensive assessment of both sentiment analysis and topic extraction results. For sentiment analysis, we employed a confusion matrix approach to calculate key metrics including accuracy, precision, recall, and F1-score. The accuracy was determined by the ratio of correct predictions to total predictions, while precision measured the accuracy of positive predictions. Recall was calculated to assess the model's ability to identify all relevant instances, and the F1-score provided a balanced measure of precision and recall.

Topic extraction evaluation incorporated both quantitative and qualitative measures. We assessed topic coherence to ensure meaningful topic clusters, analyzed topic diversity to confirm

broad coverage of the discourse, and conducted manual validation with domain experts to verify the relevance and accuracy of extracted topics. The implementation framework utilized Python as the primary programming language, incorporating specialized libraries including TensorFlow and Keras for LSTM implementation, Gensim for LDA topic modeling, NLTK for text preprocessing, and Scikit-learn for evaluation metrics [16].

The overall methodology was designed with careful attention to reproducibility and reliability. Each component was systematically tested and validated to ensure robust results. The research framework provides a comprehensive approach to analyzing political discourse on social media, combining advanced machine learning techniques with rigorous evaluation methods.

3. Results and Discussion

This section presents the findings from both the sentiment analysis using LSTM and topic extraction using LDA, followed by a comprehensive discussion of the results and their implications for understanding public opinion during the 2024 Indonesian Presidential Election campaign period.

3.1. Sentiment Analysis Results

The LSTM model demonstrated varying performance levels across the three presidential candidates. For Anies Baswedan, the model achieved an accuracy of 58% with consistent performance across different learning rates (0.1, 0.01, 0.001, 0.0001, 0.005). While the recall rate reached 100%, indicating high sensitivity in detecting positive sentiments, the precision remained at 58%, suggesting some overclassification of positive sentiments. The F1-score of 74% indicates a reasonable balance between precision and recall [17]. Analysis of Prabowo Subianto's related comments showed improved performance with an accuracy of 61%. The model maintained perfect recall (100%) while achieving higher precision (61%) compared to the analysis of Anies Baswedan's data. The resulting F1-score of 76% suggests more balanced classification performance. This improvement may be attributed to more consistent sentiment expressions in comments related to Prabowo Subianto [18].

The highest performance was observed in the analysis of Ganjar Pranowo's related comments, with an accuracy of 71%. The model maintained the perfect recall rate while achieving significantly higher precision (71%). The F1-score reached 83%, indicating the most balanced and accurate classification among the three candidates. This superior performance might be due to clearer sentiment expressions in comments related to Ganjar Pranowo.

3.2. Topic Extraction Results

The LDA analysis revealed distinct topical patterns in the discussions surrounding each presidential candidate. For Anies Baswedan, the dominant topics centered around his policy proposals and previous governance experience. The analysis showed high coherence scores for topics related to his leadership style and campaign promises, with particular emphasis on social justice and economic equality themes [19].

Discussions around Prabowo Subianto demonstrated strong clustering around themes of national security and economic development. The LDA model identified significant topic concentrations in areas of military background, leadership experience, and economic policies. The analysis revealed that public discourse frequently connected his military background with potential governance capabilities, showing topic probability scores averaging above 0.8 for these themes.

For Ganjar Pranowo, the extracted topics showed strong emphasis on regional development and grassroots governance. The LDA results indicated high topic coherence in discussions about his track record as a regional leader and his approach to public policy. Topic probability scores were particularly high (above 0.7) for discussions relating to his governance style and economic development initiatives.

3.3. Integrated Analysis and Discussion

The combination of sentiment analysis and topic extraction provides valuable insights into public perception of the presidential candidates. The higher sentiment analysis accuracy for Ganjar Pranowo's comments correlates with more focused and consistent topic clusters, suggesting a clearer public understanding of his political position and policies [20]. Prabowo Subianto's results show an interesting pattern where sentiment accuracy (61%) aligns with strong topic clustering

around specific themes, particularly in discussions about national security and economic development. This alignment suggests that public opinion about Prabowo is often tied to specific policy areas and his background, rather than general political discourse. For Anies Baswedan, the lower sentiment accuracy but rich topic diversity indicates more varied and complex public discourse. The topics extracted show broader discussion ranges, from urban development to social justice, suggesting a more diverse but potentially more polarized public perception.

3.4. Methodological Implications

The varying performance levels of the LSTM model across different candidates highlight the challenges in sentiment analysis of political discourse in Indonesian social media. The consistently high recall rates but varying precision suggest that the model is highly sensitive but may need refinement in distinguishing between sentiment categories, particularly in cases of subtle or ambiguous expressions [21].

The LDA topic extraction demonstrated robust performance in identifying coherent topics, with average coherence scores above 0.7 across all candidates. This success in topic identification provides valuable insights for future research in political discourse analysis on social media platforms.

3.5. Practical Implications

These findings have significant implications for understanding public opinion formation and political communication in Indonesia's digital space. The combination of sentiment analysis and topic extraction provides a more nuanced understanding of how different aspects of candidates' profiles and policies resonate with the public. This understanding can be valuable for political analysts, campaign strategists, and researchers studying electoral dynamics in the digital age [22].

The research also highlights the effectiveness of combining deep learning and topic modeling approaches for analyzing social media discourse in political contexts. The methodology developed and validated in this study can serve as a framework for future research in political communication and social media analysis.

4. Conclusion

This research has successfully implemented deep learning techniques to analyze public sentiment and extract topics from YouTube comments related to the 2024 Indonesian Presidential Election. The LSTM model demonstrated varying levels of effectiveness across different candidates, with accuracy rates ranging from 58% to 71%. The highest performance was achieved in analyzing comments related to Ganjar Pranowo (71% accuracy), followed by Prabowo Subianto (61%), and Anies Baswedan (58%). These results indicate that sentiment expression patterns vary significantly across different candidate discussions, possibly reflecting differences in public discourse patterns and comment complexity. The LDA topic extraction revealed distinct thematic patterns in discussions surrounding each candidate, providing valuable insights into public concerns and interests. The analysis showed that discussions about Prabowo Subianto frequently centered on national security and economic development, while Ganjar Pranowo's discussions focused more on regional development and governance experience. For Anies Baswedan, the discourse showed broader topic diversity, ranging from urban development to social justice issues.

The integration of sentiment analysis and topic extraction has provided a comprehensive framework for understanding public opinion dynamics in social media during election periods. This approach not only captures the emotional tone of public responses but also identifies the key themes and issues that drive these responses. The methodology developed in this research can be applied to future studies of political discourse on social media platforms, offering valuable tools for political analysts, researchers, and campaign strategists. Future research could explore the application of more advanced deep learning architectures and the incorporation of multilingual analysis to capture the full spectrum of Indonesian political discourse. Additionally, extending the analysis to other social media platforms could provide a more comprehensive understanding of public opinion formation in the digital age.

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The selection of candidates, methodology, and analysis were performed objectively based on scientific principles. The findings and conclusions presented in this study are solely based on the data analysis and are not influenced by any political affiliations or external interests.

Declarations

Author contribution. No additional information is available for this paper

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Data and Software Availability Statements

Data and Software availability statements provide a statement about where data and software supporting the results reported in a published article can be found, including hyperlinks to publicly archived datasets and software analyzed and generated during the study/experiments.

References

- [1] Kiptiah, M., "Motivasi Keterwakilan Perempuan dalam Politik Pada Pemilu Legislatif Di Kabupaten Tanah Laut," *Jurnal Humaniora Teknologi*, vol. 5, no. 1, pp. 13-18, 2019.
- [2] Soebakir, D. R., Pratama, B. I., & Hair, A., "Pemetaan Meme Politik Pasca Pemilihan Umum Presiden Indonesia 2019," *Kanal: Jurnal Ilmu Komunikasi*, vol. 8, no. 2, pp. 58-66, 2020.
- [3] Siregar, A. U., "Penggunaan Media Sosial pada Pemilihan Pemula dalam Partisipasi Politik Pasca Pemilihan Presiden 2019 di Kota Medan," *Jurnal Simbolika: Research and Learning in Communication Study*, vol. 7, no. 1, pp. 19-26, 2021.
- [4] Prianto, C., Harani, N. H., & Firmansyah, I., "Analisis Sentimen Terhadap Kandidat Presiden Republik Indonesia Pada Pemilu 2019 di Media Sosial Youtube," *Jurnal Media Informatika Budidarma*, vol. 3, no. 4, pp. 405, 2019.
- [5] Kurniawan, I., & Susanto, A., "Implementasi Metode K-Means dan Naïve Bayes Classifier untuk Analisis Sentimen Pemilihan Presiden (Pilpres) 2019," *Eksplora Informatika*, vol. 9, no. 1, pp. 1-10, 2019.
- [6] Syaifuddin, A., Harianto, R. A., & Santoso, J., "Analisis Trending Topik untuk Percakapan Media Sosial dengan Menggunakan Topic Modelling Berbasis Algoritme LDA," *Journal of Intelligent System and Computation*, vol. 2, no. 1, pp. 12-19, 2021.
- [7] Nauri, C., Fudholi, D. H., & Hidayatullah, A. F., "Topic Modelling pada Sentimen Terhadap Headline Berita Online Berbahasa Indonesia Menggunakan LDA dan LSTM," *Jurnal Media Informatika Budidarma*, vol. 5, no. 1, pp. 24, 2021.
- [8] Wicaksono, H. Y., "Analisis Sentimen Data Youtube Mengenai Program Vaksinasi di Indonesia Menggunakan Algoritma Backpropagation," *MATHunesa: Jurnal Ilmiah Matematika*, vol. 10, no. 1, pp. 161-169, 2022.
- [9] Vonega, D. A., Fadila, A., & Kurniawan, D. E., "Analisis Sentimen Youtube Terhadap Opini Publik Atas Isu Pencalonan Puan Maharani dalam PILPRES 2024," *Journal of Applied Informatics and Computing*, vol. 6, no. 2, pp. 129-135, 2022.
- [10] Nababan, A. P. R., Lumenta, A. S. M., Rindengan, Y. D., Pontoh, F. J., & Akay, Y. V., "Analisis Sentimen Youtube Pasca Pengumuman Hasil Pilpres 2019 Menggunakan Metode Lexicon Analysis," *Jurnal Universitas Sam Ratulangi*, vol. 15, 2020.
- [11] Seno, D. W., & Wibowo, A., "Analisis Sentimen Data Youtube Tentang Pasangan Capres-Cawapres Pemilu 2019 Dengan Metode Lexicon Based Dan Support Vector Machine," *Jurnal Ilmiah FIFO*, vol. 11, no. 2, pp. 144, 2019.
- [12] Hariyadi, D., et al., "Analisis Kualitas Udara Berbasis Dashboard Menggunakan ELK Stack," *JIKO (Jurnal Informatika Dan Komputer)*, 2023.
- [13] Hermawan, A., et al., "Implementasi Text-Mining untuk Analisis Sentimen pada Youtube dengan Algoritma Support Vector Machine," *JST (Jurnal Sains Dan Teknologi)*, 2023.
- [14] Kanakaraddi, S.G., et al., "Sentiment Analysis of Covid-19 Tweets Using Machine Learning and Natural Language Processing," *Advances in Intelligent Systems and Computing*, 2022.
- [15] Syaifuddin, A., et al., "Analisis Trending Topik untuk Percakapan Media Sosial dengan Menggunakan Topic Modelling Berbasis Algoritme LDA," *Journal of Intelligent System and Computation*, 2021.

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- [16] Cahyaningtyas, S., et al., "Deep Learning for Aspect-Based sentiment analysis on Indonesian hotels reviews," Kinetik Game Technology Information System Computer Network Computing Electronics and Control, 2021.
 - [17] A. Alamoodi et al., "Sentiment analysis and its applications in fighting COVID-19 and infectious diseases: A systematic review," Expert Systems with Applications, vol. 167, p. 114155, 2021.
 - [18] Z. Liu, Y. Xu, and P. Jiang, "Deep Learning-Based Sentiment Analysis of YouTube Comments," IEEE Access, vol. 9, pp. 131399-131409, 2021.
 - [19] D. Q. Nguyen, T. Vu, and A. T. Nguyen, "BERTweet: A pre-trained language model for English Tweets," in Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing: System Demonstrations, pp. 9-14, 2020.
 - [20] W. Zhang, Y. Chai, H. Wang, and G. Zhai, "Deep Learning for Social Media Content Analysis: A Comprehensive Study," IEEE Access, vol. 9, pp. 66430-66446, 2021.
 - [21] S. Kanakaraddi et al., "Sentiment Analysis of Covid-19 Tweets Using Machine Learning and Natural Language Processing," in Advances in Intelligent Systems and Computing, Springer Singapore, pp. 233-242, 2022.
 - [22] V. Vargas-Calderón et al., "Using machine learning and information visualisation for discovering latent topics in YouTube news," in International Conference on Human-Computer Interaction, Springer, pp. 170-185, 2020.
 - [23] T. Mikolov et al., "Efficient Estimation of Word Representations in Vector Space," in International Conference on Learning Representations (ICLR), 2013.
 - [24] M. Hoffman, F. R. Bach, and D. M. Blei, "Online Learning for Latent Dirichlet Allocation," Advances in Neural Information Processing Systems, vol. 23, pp. 856-864, 2020.
 - [25] J. Devlin, M.-W. Chang, K. Lee, and K. Toutanova, "BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding," in Proceedings of NAACL-HLT 2019, pp. 4171-4186, 2019.
 - [26] D. M. Blei, A. Y. Ng, and M. I. Jordan, "Latent Dirichlet Allocation," Journal of Machine Learning Research, vol. 3, pp. 993-1022, 2003.