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which works by adjusting the class weights based on the existing data distribution, also shows an improvement compared to the baseline, but the results are not as significant as those obtained with SMOTE. This reflects that SMOTE provides a stronger approach to addressing data imbalance issues. Additionally, the application of feature expansion techniques on BiLSTM, using TF-IDF and FastText, demonstrates that while embedding-based features can provide richer word representations, the results are highly dependent on the balancing technique used. In other words, although TF-IDF and FastText provide better word representations, the application of data balancing techniques such as SMOTE has a much greater impact on improving classification performance.

Previous research on geo-sentiment analysis has largely focused on specific social issues, such as responses to government programs or community dynamics [24], [25]. However, this study expands that approach by integrating BiLSTM techniques with data balancing methods to develop a model for location-based sentiment analysis on complex datasets. The improvements in accuracy and F1-Score achieved in this study demonstrate the effectiveness of the applied approach, particularly in addressing the challenge of data imbalance, which is often a limitation in sentiment analysis. These findings contribute to advancing methodologies in sentiment analysis, emphasizing the importance of integrating natural language processing (NLP) techniques with geographical dimensions.

5. CONCLUSION

This research highlights the importance of geo-sentiment analysis in understanding public opinion, especially regarding politically sensitive topics like the documentary film Dirty Vote. By incorporating geographic information, we can observe how sentiment varies across different regions, with a notable concentration of negative sentiment in urban areas such as Jakarta. This geographic perspective is crucial for gaining deeper insights into how public sentiment is influenced by regional factors and how it evolves over time, particularly during significant events such as the documentary release and presidential elections.

Based on the results of the three testing scenarios conducted, it can be concluded that the application of data balancing techniques has a considerable influence on the accuracy of the classification model. The use of the SMOTE technique has proven to provide better results compared to Class Weight in terms of accuracy and F1-Score, particularly in imbalanced datasets. While TF-IDF and FastText provide richer and deeper word representations, the application of data balancing techniques such as SMOTE has a greater overall impact on improving classification performance. The results of this study indicate that when addressing class imbalance, data balancing techniques are a key factor that supports the effectiveness of the classification model, even more significantly than enriching embedding feature representations. Therefore, to improve model performance on imbalanced datasets, a combination of techniques such as SMOTE and FastText can be an optimal approach.

This research contributes to the field of informatics by showing that the combination of the Bi-LSTM model with data balancing techniques can significantly improve the accuracy of sentiment analysis on geotagged data. The integration of geographic information with sentiment analysis offers a new approach that can be applied to various fields. Future research can explore other deep learning models, such as transformers or hybrid models that can improve classification performance.

REFERENCES

[1] F. Esfandiari and N. Hidayah, “General Elections in Indonesia : Between Human Rights and Constitutional Rights,” European Alliance for Innovation n.o., Feb. 2021. doi: 10.4108/eai.1-7-2020.2303622.

[2] Inayatulloh, I. K. Hartono, and D. L. Kusumastuti, “The Blockchain Conceptual Model to Prevents Fraud and Increase Transparency in the Presidential Election in Indonesia,” *2023 IEEE*

P-ISSN: 2723-3863| E-ISSN: 2723-3871 Vol. 6, No. 6, December 2025, Page. 1530-1537
https://jutif.if.unsoed.ac.id DOI: https://doi.org/10.52436/1.jutif.6.6.3540

9th International Conference on Computing, Engineering and Design, ICCED 2023, 2023, doi: 10.1109/ICCED60214.2023.10425635.

[3] K. Kurnia, "Measuring the Concept of Deliberative Democracy in the Indonesian Election Supervision System," Dec. 2020, doi: 10.4108/EAI.26-9-2020.2302602.

[4] F. Agung, J. Ayomi, and K. E. Dewi, "Analisis Emosi pada Media Sosial Twitter Menggunakan Metode Multinomial Naive Bayes dan Synthetic Minority Oversampling Technique," *Komputa : Jurnal Ilmiah Komputer dan Informatika*, vol. 12, no. 2, pp. 9–19, Sep. 2023, doi: 10.34010/KOMPUTA.V12I2.9454.

[5] R. DAHIYA, A. Dhankhar, and A. DHANKHAR, "Sentimental Analysis Of Social Networks :A Comprehensive review(2018-2023)," Nov. 20, 2023. doi: 10.21203/rs.3.rs-3625172/v1.

[6] D. F. Putra and Y. Sibaroni, "Sentiment Analysis For The 2024 Presidential Election (Pilpres) Using BERT CNN," *Eduvest - Journal of Universal Studies*, vol. 4, no. 11, pp. 11042–11056, Nov. 2024, doi: 10.59188/EDUVEST.V4I11.49961.

[7] L. Chaudhary, N. Girdhar, D. Sharma, J. Andreu-Perez, A. Doucet, and M. Renz, "A Review of Deep Learning Models for Twitter Sentiment Analysis: Challenges and Opportunities," *IEEE Trans Comput Soc Syst*, vol. 11, no. 3, pp. 3550–3579, Jun. 2024, doi: 10.1109/TCSS.2023.3322002.

[8] R. Cahyani, I. S. Rozas, and N. Yalina, "Analisis Sentimen Pada Media Sosial Twitter Terhadap Tokoh Publik Peserta Pilpres 2019," *MATICS: Jurnal Ilmu Komputer dan Teknologi Informasi (Journal of Computer Science and Information Technology)*, vol. 12, no. 1, pp. 79–86, Apr. 2020, doi: 10.18860/MAT.V12I1.8356.

[9] R. F. Ananda, A. Syahri, and F. N. Hasan, "SENTIMENT ANALYSIS OF CUSTOMER SATISFACTION IN GOJEK AND GRAB APPLICATION REVIEWS USING THE NAIVE BAYES ALGORITHM," *Jurnal Teknik Informatika (Jutif)*, vol. 5, no. 1, pp. 233–241, Feb. 2024, doi: 10.52436/1.JUTIF.2024.5.1.1680.

[10] G. Radiena and A. Nugroho, "ANALISIS SENTIMEN BERBASIS ASPEK PADA ULASAN APLIKASI KAI ACCESS MENGGUNAKAN METODE SUPPORT VECTOR MACHINE," *Jurnal Pendidikan Teknologi Informasi (JUKANTI)*, vol. 6, no. 1, pp. 1–10, Apr. 2023, doi: 10.37792/JUKANTI.V6I1.836.

[11] I. Sinanto Ate, A. Nuraminah, and P. Studi, "Komparasi Algoritma Feature Selection Pada Analisis Sentimen Review Film," *Jurnal Ilmiah Teknik Informatika dan Komunikasi*, vol. 2, no. 2, pp. 96–102, Jul. 2022, doi: 10.55606/JUITIK.V2I2.326.

[12] S. Puad, G. Garno, and A. S. Y. Irawan, "ANALISIS SENTIMEN MASYARAKAT PADA TWITTER TERHADAP PEMILIHAN UMUM 2024 MENGGUNAKAN ALGORITMA NAÏVE BAYES," *JATI (Jurnal Mahasiswa Teknik Informatika)*, vol. 7, no. 3, pp. 1560–1566, Oct. 2023, doi: 10.36040/JATI.V7I3.6920.

[13] A. Raup, W. Ridwan, Y. Khoeriyah, S. Supiana, and Q. Y. Zaqiah, "Deep Learning dan Penerapannya dalam Pembelajaran," *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, vol. 5, no. 9, pp. 3258–3267, Sep. 2022, doi: 10.54371/JIIP.V5I9.805.

[14] Sudianto, P. Wahyuningtias, H. W. Utami, U. A. Raihan, H. N. Hanifah, and Y. N. Adanson, "COMPARISON OF RANDOM FOREST AND SUPPORT VECTOR MACHINE METHODS ON TWITTER SENTIMENT ANALYSIS (CASE STUDY: INTERNET SELEBGRAM

P-ISSN: 2723-3863| E-ISSN: 2723-3871 Vol. 6, No. 6, December 2025, Page. 1530-1537
https://jutif.if.unsoed.ac.id DOI: https://doi.org/10.52436/1.jutif.6.6.3540

RACHEL VENNYA ESCAPE FROM QUARANTINE)," *Jurnal Teknik Informatika (Jutif)*, vol. 3, no. 1, pp. 141–145, Feb. 2022, doi: 10.20884/1.JUTIF.2022.3.1.168.

[15] L. Xiaoyan and R. C. Raga, "BiLSTM Model With Attention Mechanism for Sentiment Classification on Chinese Mixed Text Comments," *IEEE Access*, vol. 11, pp. 26199–26210, 2023, doi: 10.1109/ACCESS.2023.3255990.

[16] A. I. Safitri and T. B. Sasongko, "SENTIMENT ANALYSIS OF CYBERBULLYING USING BIDIRECTIONAL LONG SHORT TERM MEMORY ALGORITHM ON TWITTER," *Jurnal Teknik Informatika (Jutif)*, vol. 5, no. 2, pp. 615–620, Apr. 2024, doi: 10.52436/1.JUTIF.2024.5.2.1922.

[17] E. Subowo, F. A. Artanto, I. Putri, and W. Umaedi, "Algoritma Bidirectional Long Short Term Memory untuk Analisis Sentimen Berbasis Aspek pada Aplikasi Belanja Online dengan Cicilan," *JURNAL FASILKOM*, vol. 12, no. 2, pp. 132–140, Aug. 2022, doi: 10.37859/JF.V12I2.3759.

[18] A. Muzakir and U. Suriani, "Model Deteksi Berita Palsu Menggunakan Pendekatan Bidirectional Long Short-Term Memory (BiLSTM)," *Journal of Computer and Information Systems Ampera*, vol. 4, no. 2, 2023, doi: 10.51519/journalcisa.v4i2.397.

[19] H. Akbar, D. Aryani, M. Kadhim, M. Al-Shammari, and M. B. Ulum, "SENTIMENT ANALYSIS FOR E-COMMERCE PRODUCT REVIEWS BASED ON FEATURE FUSION AND BIDIRECTIONAL LONG SHORT-TERM MEMORY," *Jurnal Teknik Informatika (Jutif)*, vol. 5, no. 5, pp. 1385–1391, Oct. 2024, doi: 10.52436/1.JUTIF.2024.5.5.2675.

[20] Fuad Amirullah, Syariful Alam, and M.Imam Sulistyo S, "Analisis Sentimen Terhadap Kinerja KPU Menjelang Pemilu 2024 Berdasarkan Opini Twitter Menggunakan Naïve Bayes," *STORAGE: Jurnal Ilmiah Teknik dan Ilmu Komputer*, vol. 2, no. 3, pp. 69–76, Aug. 2023, doi: 10.55123/STORAGE.V2I3.2293.

[21] A. Almaslukh, A. Almaalwy, N. Allheeib, A. Alajaji, M. Almukaynizi, and Y. Alabdulkarim, "Top-k sentiment analysis over spatio-temporal data," *PeerJ Comput Sci*, vol. 10, p. e2297, Sep. 2024, doi: 10.7717/PEERJ-CS.2297/FIG-5.

[22] Z. Gong, T. Cai, J. C. Thill, S. Hale, and M. Graham, "Measuring relative opinion from location-based social media: A case study of the 2016 U.S. presidential election," *PLoS One*, vol. 15, no. 5, p. e0233660, May 2020, doi: 10.1371/JOURNAL.PONE.0233660.

[23] D. Tas and R. P. Sanatani, "Geo-located Aspect Based Sentiment Analysis (ABSA) for Crowdsourced Evaluation of Urban Environments," *arXiv preprint*, Dec. 2023, Accessed: Jan. 05, 2025. [Online]. Available: https://www.alphaxiv.org/abs/2312.12253v1

[24] A. Mushofy Anwary, A. ID Hadiana, and P. Nurul Sabrina, "ANALISIS SENTIMENT PENGGUNAAN VAKSIN COVID-19 MENGGUNAKAN GEO-TAGGED TWEETS DAN ALGORITMA NAIVE BAYES," *Informatics and Digital Expert (INDEX)*, vol. 3, no. 2, pp. 75–83, Nov. 2021, doi: 10.36423/INDEX.V3I2.876.

[25] T. Hu, B. She, L. Duan, H. Yue, and J. Clunis, "A systematic spatial and temporal sentiment analysis on geo-tweets," *IEEE Access*, vol. 8, pp. 8658–8667, 2020, doi: 10.1109/ACCESS.2019.2961100.

[26] E. Veltmeijer and C. Gerritsen, "SentiMap: Domain-Adaptive Geo-Spatial Sentiment Analysis," *Proceedings - 17th IEEE International Conference on Semantic Computing, ICSC 2023*, pp. 17–24, 2023, doi: 10.1109/ICSC56153.2023.00010.

P-ISSN: 2723-3863| E-ISSN: 2723-3871 Vol. 6, No. 6, December 2025, Page. 1530-1537
https://jutif.if.unsoed.ac.id DOI: https://doi.org/10.52436/1.jutif.6.6.3540

[27] I. F. Ramadhy and Y. Sibaroni, "Analisis Trending Topik Twitter dengan Fitur Ekspansi FastText Menggunakan Metode Logistic Regression," *JURIKOM (Jurnal Riset Komputer)*, vol. 9, no. 1, p. 1, Feb. 2022, doi: 10.30865/jurikom.v9i1.3791.

[28] N. Silalahi, J. Josh, and G. Leonarde Ginting, "Analisa Sentimen Masyarakat Dalam Penggunaan Vaksin Sinovac Dengan Menerapkan Algoritma Term Frequence – Inverse Document Frequence (TF-IDF) dan Metode Deskripsi," *Journal of Information System Research (JOSH)*, vol. 3, no. 3, pp. 206–217, Apr. 2022, doi: 10.47065/JOSH.V3I3.1441.

[29] K. Pamungkas, K. T. Pamungkas, L. Aridinanti, and W. Wibowo, "Analisis Sentimen Pelaporan Masyarakat di Situs Media Centre Surabaya dengan Naïve Bayes Classifier," *Jurnal Sains dan Seni ITS*, vol. 11, no. 2, pp. D197–D203, Jul. 2022, doi: 10.12962/j23373520.v11i2.72566.

[30] M. Das, S. Kamalanathan, and P. Alphonse, "A Comparative Study on TF-IDF feature Weighting Method and its Analysis using Unstructured Dataset," *CEUR Workshop Proc*, vol. 2870, pp. 98–107, Aug. 2023, doi: 10.48550/arXiv.2308.04037.

[31] M. F. D. Putra and E. B. Setiawan, "Influence of Sentiment on Mandiri Bank Stocks (BMRI) Using Feature Expansion with FastText and Logistic Regression Classification," *ICACNIS 2022 - 2022 International Conference on Advanced Creative Networks and Intelligent Systems: Blockchain Technology, Intelligent Systems, and the Applications for Human Life, Proceeding*, 2022, doi: 10.1109/ICACNIS57039.2022.10055450.

[32] M. Liebenlito, A. A. Yesinta, and M. I. S. Musti, "Deteksi Clickbait pada Judul Berita Online Berbahasa Indonesia Menggunakan FastText," *Journal of Applied Computer Science and Technology*, vol. 5, no. 1, pp. 56–62, Mar. 2024, doi: 10.52158/jacost.v5i1.655.

[33] M. Rahman, M. D. Rahman, A. Djunaidy, and F. Mahananto, "Penerapan Weighted Word Embedding pada Pengklasifikasian Teks Berbasis Recurrent Neural Network untuk Layanan Pengaduan Perusahaan Transportasi," *Jurnal Sains dan Seni ITS*, vol. 10, no. 1, pp. A1–A6, Aug. 2021, doi: 10.12962/j23373520.v10i1.56145.

[34] B. G. Marcot and A. M. Hanea, "What is an optimal value of k in k-fold cross-validation in discrete Bayesian network analysis?," *Comput Stat*, vol. 36, no. 3, pp. 2009–2031, Sep. 2021, doi: 10.1007/S00180-020-00999-9/METRICS.

[35] M. Jaiswal, H. Tiwari, and S. Kumar, "Diabetes Prediction using Optimization Techniques with Machine Learning Algorithms," *Int J Electron Healthc*, vol. 13, no. 1, p. 1, 2023, doi: 10.1504/ijeh.2023.10054229.

[36] D. I. Puteri, "Implementasi Long Short Term Memory (LSTM) dan Bidirectional Long Short Term Memory (BiLSTM) Dalam Prediksi Harga Saham Syariah," *Euler : Jurnal Ilmiah Matematika, Sains dan Teknologi*, vol. 11, no. 1, pp. 35–43, May 2023, doi: 10.34312/euler.v11i1.19791.

[37] R. Annas Sholehat, E. B. Setiawan, and Y. Sibaroni, "Aspect-Based Sentiment Analysis on Twitter Using Bidirectional Long Short-Term Memory," *JURNAL MEDIA INFORMATIKA BUDIDARMA* , vol. 7, pp. 999–999, 2023, doi: 10.30865/mib.v5i1.2293.

[38] E. Erlin, Y. Desnelita, N. Nasution, L. Suryati, and F. Zoromi, "Dampak SMOTE terhadap Kinerja Random Forest Classifier berdasarkan Data Tidak seimbang," *MATRIK : Jurnal Manajemen, Teknik Informatika dan Rekayasa Komputer*, vol. 21, no. 3, pp. 677–690, Jul. 2022, doi: 10.30812/MATRIK.V21I3.1726.

P-ISSN: 2723-3863| E-ISSN: 2723-3871 Vol. 6, No. 6, December 2025, Page. 1530-1537
https://jutif.if.unsoed.ac.id DOI: https://doi.org/10.52436/1.jutif.6.6.3540

[39] T. Wongvorachan, S. He, and O. Bulut, "A Comparison of Undersampling, Oversampling, and SMOTE Methods for Dealing with Imbalanced Classification in Educational Data Mining," *Information (Switzerland)*, vol. 14, no. 1, Jan. 2023, doi: 10.3390/info14010054.

[40] E. Sutoyo and M. A. Fadlurrahman, "Penerapan SMOTE untuk Mengatasi Imbalance Class dalam Klasifikasi Television Advertisement Performance Rating Menggunakan Artificial Neural Network," *Jurnal Edukasi dan Penelitian Informatika (JEPIN)*, vol. 6, no. 3, p. 379, Dec. 2020, doi: 10.26418/JP.V6I3.42896.

[41] D. Elreedy, A. F. Atiya, and F. Kamalov, "A theoretical distribution analysis of synthetic minority oversampling technique (SMOTE) for imbalanced learning," *Mach Learn*, vol. 113, no. 7, pp. 4903–4923, Jul. 2024, doi: 10.1007/s10994-022-06296-4.

[42] H. Akbar and W. K. Sanjaya, "Kajian Performa Metode Class Weight Random Forest pada Klasifikasi Imbalance Data Kelas Curah Hujan," *Jurnal Sains, Nalar, dan Aplikasi Teknologi Informasi*, vol. 3, no. 1, Dec. 2023, doi: 10.20885/SNATI.V3I1.30.