

4. CONCLUSIONS

The conclusion of this study provides information that the use of SMOTE can help overcome class imbalance by increasing precision, recall, and F1 score in minority classes. However, the results also show a trade-off, as the overall accuracy and recall of the model are slightly lower than when SMOTE is not used. However, the LSTM model with SMOTE showed strong performance, achieving 88% accuracy, 90% precision, 88% recall, and 89% F1 score. These results show that SMOTE contributes to balancing the distribution of each class without significantly reducing classification ability. Additionally, the use of word clouds based on sentiment predictions provides valuable insights into user feedback. Positive sentiment often highlights ease of use and helpful features, while negative sentiment focuses on login issues and technical errors with OTP codes. Neutral sentiment reflects areas where the application is performing well but there is still room for improvement.

This study shows the importance of effectively handling imbalanced datasets while maintaining high model performance. Mobile JKN application developers can leverage these insights to improve user experience by addressing key issues identified through sentiment analysis. Future research could explore alternative techniques for dealing with class imbalance, such as ensemble learning or advanced sampling methods, and focus on optimizing models for better generalization on imbalanced datasets, especially on classification on neutral classes.

REFERENCES

- [1] L. N. Hapsari and N. Rokhman, "Anomaly Detection of Hospital Claim Using Support Vector Regression," *IJCCS (Indonesian J. Comput. Cybern. Syst.*, vol. 18, no. 1, p. 1, 2024, doi: 10.22146/ijccs.91857.
- [2] A. Ramadhan and H. R. Sari, "BPJS kesehatan meluncurkan aplikasi 'Mobile JKN,'" ANTARA. [Online]. Available: <https://www.antaranews.com/berita/665018/bpjs-kesehatan-luncurkan-aplikasi-mobile-jkn>
- [3] W. M. E. Lumi, R. A. Musak, F. F. Tumiwa, M. Y. Waworuntu, and W. S. Surya*, "Edukasi Tentang Penggunaan Aplikasi Mobile JKN Pada Pasien Rawat Jalan RSUD Anugerah Tomohon," *J. Pengabd. Kpd. Masy. Nusan.*, vol. 4, no. 3, pp. 1620–1626, 2023.
- [4] S. F. Maulani *et al.*, "Analisis Costumer Service Post Transaction Melalui Google Ulasan Pada PT Indah Logistik Cargo cabang Serang : Product Tracking," vol. 4, pp. 5395–5404, 2024.
- [5] J. Menengah, "Peraturan Presiden (Perpres) Nomor 49 Tahun 2024 tentang Strategi Nasional Perlindungan Konsumen," *Bpk Ri*, no. 198461, 2024.
- [6] N. L. Ratniasih and N. W. Ninik Jayanti, "Sentiment Analysis of Stakeholder Satisfaction Measurement," *IJCCS (Indonesian J. Comput. Cybern. Syst.*, vol. 16, no. 2, p. 217, 2022, doi: 10.22146/ijccs.72245.
- [7] H. Utami, "Analisis Sentimen dari Aplikasi Shopee Indonesia Menggunakan Metode Recurrent Neural Network," *Indones. J. Appl. Stat.*, vol. 5, no. 1, p. 31, 2022, doi: 10.13057/ijas.v5i1.56825.
- [8] R. Md, R. D. Restiyan, and H. Irsyad, "Analisis Sentimen Masyarakat terhadap Perilaku Lawan Arah yang diunggah pada Media Sosial Youtube Menggunakan Naïve Bayes," *BANDWIDTH J. Informatics Comput. Eng.*, vol. 02, no. 02, pp. 75–83, 2024.
- [9] I. K. A. G. Wiguna, P. Sugiartawan, I. G. I. Sudipa, and I. P. Y. Pratama, "Sentiment

- Analysis Using Backpropagation Method to Recognize the Public Opinion,” *IJCCS (Indonesian J. Comput. Cybern. Syst.*, vol. 16, no. 4, p. 423, 2022, doi: 10.22146/ijccs.78664.
- [10] M. Z. Rahman, Y. A. Sari, and N. Yudistira, “Analisis Sentimen Tweet COVID-19 menggunakan Word Embedding dan Metode Long Short-Term Memory (LSTM),” *J. Pengemb. Teknol. Inf. dan Ilmu Komput.*, vol. 5, no. 11, pp. 5120–5127, 2021, [Online]. Available: <http://j-ptiik.ub.ac.id>
- [11] E. Tasci, Y. Zhuge, K. Camphausen, and A. V. Krauze, “Bias and Class Imbalance in Oncologic Data—Towards Inclusive and Transferrable AI in Large Scale Oncology Data Sets,” *Cancers (Basel)*, vol. 14, no. 12, 2022, doi: 10.3390/cancers14122897.
- [12] E. F. Saputra and M. R. Pribadi, “Analisis Sentimen Komentar Pada Kanal Youtube The Lazy Monday Menggunakan Algoritma Naive Bayes,” *MDP Student Conf.*, vol. 2, no. 1, pp. 17–23, 2023, doi: 10.35957/mdp-sc.v2i1.4283.
- [13] N. S. Sediatmoko, Y. Nataliani, and I. Suryady, “Sentiment Analysis of Customer Review Using Classification Algorithms and SMOTE for Handling Imbalanced Class,” *Indones. J. Inf. Syst.*, vol. 7, no. 1, pp. 38–52, 2024, doi: 10.24002/ijis.v7i1.8879.
- [14] Eskiyaturrofikoh and R. R. Suryono, “Analisis Sentimen Aplikasi X Pada Google Play Store Menggunakan Algoritma Naive Bayes Dan Support Vector Machine (Svm),” *JIPi(Jurnal Ilm. Penelit. dan Pembelajaran Inform.*, vol. 9, no. 3, pp. 1408–1419, 2024, [Online]. Available: <https://www.jurnal.stkipppgritulungagung.ac.id/index.php/jipi/article/view/5392>
- [15] N. Istiqamah and M. Rijal, “Klasifikasi Ulasan Konsumen Menggunakan Random Forest dan SMOTE,” *J. Syst. Comput. Eng.*, vol. 5, no. 1, pp. 66–77, 2024, doi: 10.61628/jsce.v5i1.1061.
- [16] C. Candra, K. W. Chandra, and H. Irsyad, “Efektifitas SMOTE dalam Mengatasi Imbalanced Class Algoritma K-Nearest Neighbors pada Analisis Sentimen terhadap Starlink,” *J. Ilmu Komput. dan Inform.*, vol. 4, no. 1, pp. 31–42, 2024, doi: 10.54082/jiki.132.
- [17] G. Tamami and M. Arifin, “Penggunaan LSTM dalam Membangun Prediksi Penjualan untuk Aplikasi Laptop Lens,” vol. 14, no. 2, pp. 301–308, 2024.
- [18] M. Fadli and R. A. Saputra, “Klasifikasi Dan Evaluasi Performa Model Random Forest Untuk Prediksi Stroke,” *JT J. Tek.*, vol. 12, no. 02, pp. 72–80, 2023, [Online]. Available: <http://jurnal.umt.ac.id/index.php/jt/index>