ABSTRACT

Mangrove forests play a key ecological role in protecting coastal areas and sustaining ecosystem resilience; however, diverse public perceptions toward mangroves indicate the need for sentiment analysis to understand public opinions. To model sentiment in short, informal texts, this study employs the IndoBERTweet–BiGRU model because IndoBERTweet matches the characteristics of Indonesian social media language, while BiGRU strengthens contextual understanding through bidirectional sequential processing. However, the use of deep learning models as black boxes highlights the need for an approach that is not only accurate but also transparent, so that decision-making processes can be accounted for. Therefore, this research aims to develop a sentiment analysis model for mangrove-related posts on platform X using IndoBERTweet–BiGRU, focusing on improving performance and prediction transparency through the integration of Explainable AI with LIME and SHAP, which includes hyperparameter optimization, performance monitoring and evaluation, as well as local and global interpretation. The method involves data collection, semi-automatic labeling based on few-shot learning, text preprocessing, imbalance handling, tokenization, training the IndoBERTweet–BiGRU model optimized using Bayesian Optimization with the TPE algorithm, and applying LIME and SHAP to generate explanations for model decisions. The results show that the best configuration achieves a validation F1-score of 0.85, while evaluation on the test set yields an accuracy of 0.86 and an F1-score of 0.85. LIME and SHAP interpretations reveal that emotionally charged words contribute most strongly to the classification process. These findings enhance model transparency, as users can understand the rationale behind each classification decision, thereby reducing the black-box nature of deep learning. Overall, this study produces a sentiment analysis model that is not only accurate but also interpretable, providing an important contribution to monitoring public opinion and supporting decision-making in the context of mangrove conservation.

Keywords: sentiment analysis, IndoBERTweet-BiGRU, Bayesian Optimization, LIME, SHAP.