

Comparison of CNN and SVM Algorithms in Sentiment Analysis of Roblox Game Based on Bug, Loading Asset, and Connection Stability Aspects

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Article Information	ABSTRACT
Article History Received : January 16, 2026 Revised : February 11, 2026 Published : April 04, 2026	Roblox is one of the most popular mobile gaming platforms; however, its rapid growth has led to an increasing number of user complaints related to technical stability, which significantly affects user experience. Common issues such as bugs, asset loading problems, and unstable connections are frequently expressed in user reviews, making sentiment analysis a valuable approach for identifying critical technical problems in mobile games. This study aims to analyze user sentiment toward these technical aspects and to compare the performance of Support Vector Machine (SVM) and Convolutional Neural Network (CNN) in aspect-based sentiment classification. A total of 12,809 Indonesian-language reviews were collected from the Google Play Store during October 2025. The research methodology included data scraping, text preprocessing (cleansing, tokenization, normalization, stopword removal, and stemming), lexicon-based sentiment labeling, and data balancing using the Synthetic Minority Over-sampling Technique (SMOTE). TF-IDF was used for feature extraction in the SVM model, while word embeddings were applied for the CNN model. The results show that the Bug aspect is the most dominant issue (63.91%), followed by Connection Stability (34.41%) and Asset Loading (1.68%). In terms of classification performance, SVM outperformed CNN, achieving 96% accuracy, precision, recall, and F1-score, whereas CNN obtained an accuracy of 80.63% with an F1-score of 0.81. These findings indicate that SVM combined with TF-IDF features is more effective than CNN for classifying short and informal mobile game reviews and provides useful insights for developers in prioritizing technical improvements.
Keywords: <i>Roblox;</i> <i>Aspect-Based Sentiment Analysis;</i> <i>CNN;</i> <i>SVM;</i> <i>SMOTE.</i>	

INTRODUCTION

The mobile game industry in Indonesia is experiencing rapid growth, with 94.5% of internet users aged 16–64 actively engaged in video games (Wulandari et al., 2025). One of the most prominent platforms is Roblox, a community-based online gaming platform that supports not only entertainment but also education and social interaction among users (Ferdiansyah & Suryono, 2025). However, the massive popularity of Roblox has resulted in a large volume of user-generated reviews that reflect various technical issues affecting user experience. Common complaints include software bugs, long asset loading times, and unstable network connections, which frequently lead to frustration and negative sentiment among users (Dewi et al., 2025).

These technical issues bug, asset loading, and connection stability were selected in this study due to their direct impact on Quality of Experience (QoE) in mobile gaming. According to the ISO/IEC 25010 software quality model, bugs indicate failures in reliability and functional suitability, while asset loading performance is closely associated with performance efficiency (Apriana & Jatnika, 2025). Meanwhile, connection stability is a critical Quality of Service (QoS) parameter in online multiplayer games, as unstable connections can significantly disrupt gameplay continuity and user satisfaction (Nakulo, B. et al., 2022).

To systematically analyze user opinions related to these technical aspects, sentiment analysis has become a widely used approach in evaluating user perceptions of digital applications (Cahyani & Ramdani, 2023). More specifically, Aspect-Based Sentiment Analysis (ABSA) has gained increasing attention because it enables the identification of user sentiment toward specific aspects rather than overall opinions (Rahmajati, H. et al., 2025). Several studies have demonstrated that ABSA is more effective than general sentiment analysis in assessing service quality and user experience in mobile and digital applications (Maulana, I. et al., 2023). In the context of mobile gaming, an aspect-based approach allows developers to gain detailed insights into which technical components most frequently generate user complaints, such as system performance, network stability, and content loading efficiency (Mujilawati, S. & Ubaydillah, 2024).

Previous studies comparing classical machine learning and deep learning approaches for sentiment analysis have reported inconsistent results depending on the application domain (Utami, M. et al., 2023). Traditional algorithms such as Naïve Bayes often demonstrate limitations in capturing contextual meaning, whereas Support Vector Machine (SVM) has shown superior performance in classifying short and sparse text data, including sentiment analysis of game and application reviews (Ferdiansyah & Suryono, 2025). Several studies have also confirmed that SVM remains competitive and reliable for sentiment classification tasks involving Google Play Store reviews (Barus et al., 2022).

On the other hand, Convolutional Neural Network (CNN), which was originally developed for image processing, has been adapted for Natural Language Processing with varying degrees of success. While CNN demonstrates strong performance in domains such as medical image analysis (Prasetyo, 2023), its effectiveness in text-based sentiment analysis is highly dependent on data scale and complexity. Some studies report that CNN underperforms compared to SVM in sentiment analysis tasks involving political discourse and social media text, where data are typically short, informal, and noisy (Ladopurab, Y. U. & Kaesmetan, 2025). Furthermore, deep learning models generally require large datasets to learn meaningful representations effectively, which may limit their performance when applied to relatively small or imbalanced sentiment datasets (Taye, 2023).

Despite the growing body of research on sentiment analysis algorithms, a clear research gap remains regarding a direct comparison between SVM and CNN that specifically focuses on technical stability aspects in mobile gaming using an aspect-based approach. Therefore, this study proposes the application of Aspect-Based Sentiment Analysis (ABSA) to examine three critical technical aspects of Roblox user reviews bugs, asset loading, and connection stability using SVM and CNN models. SVM is selected due to its effectiveness in handling high-dimensional and sparse text data, while CNN is employed for its ability to automatically extract semantic features through deep learning architectures (Kim, H. & Jeong, 2019). The results of this study are expected to provide practical insights for game developers in prioritizing technical improvements and to offer methodological guidance for researchers in selecting appropriate sentiment classification algorithms for short and informal mobile game review data.

RESEARCH METHODS

This study employs a quantitative research approach with a comparative experimental design to evaluate the performance of two sentiment classification algorithms, namely Support

Vector Machine (SVM) and Convolutional Neural Network (CNN), in the context of Aspect-Based Sentiment Analysis (ABSA). The research workflow consists of data collection, preprocessing, labeling, feature extraction, data balancing, model training, and performance evaluation.

The sample used in this study consisted of Indonesian-language user reviews that explicitly contained keywords or phrases related to the three technical stability aspects under investigation, namely bug, asset loading, and connection stability. After the data filtering process, a total of 12,809 relevant reviews were selected as the analytical sample, with the following distribution: 8,187 reviews (63.91%) related to Bug issues, 4,407 reviews (34.41%) related to Connection Stability, and 215 reviews (1.68%) related to Asset Loading.

This research utilized two types of data sources, namely secondary data as the primary object of analysis and literature studies as the theoretical foundation. The primary data consisted of 50,000 user reviews of the Roblox mobile application collected from the Google Play Store during October 2025 and stored in .csv format. In addition, this study was supported by a literature review conducted by identifying, analyzing, and synthesizing relevant academic sources to strengthen the theoretical and methodological framework (Dewi et al., 2025).

To support the implementation of the research, both hardware and software instruments were employed. The hardware used in this study consisted of a MacBook Air M2 (2022) equipped with an Apple M2 processor and 8 GB of RAM, which was sufficient to handle large-scale text processing and model training tasks. The software environment included the macOS operating system, with Python as the primary programming language. Development and experimentation were conducted using Visual Studio Code and Jupyter Notebook. Data collection was performed using the google-play-scraper library, while Pandas and NumPy were used for data processing and numerical computation. Text preprocessing was carried out using NLTK, Sastrawi (for Indonesian stemming), and regular expressions (re). Model implementation and evaluation utilized Scikit-learn for the SVM algorithm and performance metrics, as well as TensorFlow/Keras for building and training the CNN model.

Data Collection and Sampling

The study population consisted of user reviews of the Roblox mobile application published on the Google Play Store using the scraping method. A purposive sampling technique was applied to ensure that the collected data were relevant to the research objectives. Purposive sampling is commonly used in sentiment analysis studies when specific content criteria must be met, particularly for aspect-based analysis focusing on predefined topics (Rahmajati, H. et al., 2025). Here is the scraping process and some examples of reviews that were successfully obtained:

```
from google_play_scraper import Sort, reviews
import pandas as pd
app_id = 'com.roblox.client'
JUMLAH_ULASAN = 50000

print(f"1. Mengambil {JUMLAH_ULASAN} ulasan dari Google Play...")
result, continuation_token = reviews(
    app_id,
    lang='id',          # Bahasa Indonesia
    country='id',        # Negara Indonesia
    sort=Sort.NEWEST,    # Mengurutkan dari yang terbaru
    count=JUMLAH_ULASAN
)

print(f"Berhasil mengambil {len(result)} ulasan.")

df_semua_ulasan = pd.DataFrame(result)
df_dipilih = df_semua_ulasan[['userName', 'score', 'at', 'content']]
nama_file_output = 'semua_ulasan_roblox_mentah.csv'
df_dipilih.to_csv(nama_file_output, index=False, header=True)

print(f"\nProses scraping selesai. Data disimpan ke '{nama_file_output}'")
```

Figure 1. Code Scraping using Python

The inclusion criteria were reviews written in the Indonesian language, posted in October 2025, and explicitly containing keywords related to Bug, Asset Loading, or Connection Stability. Data collection was conducted using a web scraping technique implemented in Python with the google-play-scraper library, which has been widely used in mobile application review mining studies (Utami, M. et al., 2023). A total of 50,000 raw reviews were initially scraped. After filtering based on aspect relevance, 12,809 reviews were retained for further analysis.

Text Preprocessing

Text preprocessing was performed to transform raw review data into structured textual input suitable for machine learning and deep learning models. The preprocessing stages followed standard Natural Language Processing (NLP) procedures commonly adopted in sentiment analysis research (Taye, 2023), consisting of:

1. Text Cleansing, which involved removing emojis, punctuation marks, numbers, URLs, and non-alphabetic characters;
2. Case Folding, converting all characters into lowercase to ensure uniformity;
3. Tokenization, splitting sentences into individual tokens (words);
4. Slang Word Normalization, converting informal or non-standard Indonesian words (e.g., “gaje” → “tidak jelas”) using a custom slang dictionary to reduce lexical variability;
5. Stopword Removal, eliminating common Indonesian stopwords such as “dan”, “yang”, and “di”;
6. Stemming, reducing words to their root forms using the Sastrawi library, which is widely adopted for Indonesian-language text processing.

These preprocessing steps were implemented using Python-based NLP libraries, including NLTK and Sastrawi, to enhance data consistency and improve classification performance.

Data Labeling and Sentiment Balancing

Sentiment labeling was conducted using a lexicon-based approach employing a modified InSet (Indonesian Sentiment Lexicon) dictionary. The InSet lexicon was selected due to its suitability for Indonesian-language sentiment analysis and its frequent use in prior studies (Firda et al., 2025). The lexicon was adapted to the gaming domain by incorporating technical terms such as “bug”, “glitch”, “lag”, and “disconnect”, which were assigned negative sentiment weights. This domain-specific modification was necessary to improve sentiment detection accuracy in game-related reviews.

The labeled dataset exhibited a significant class imbalance, with negative sentiment dominating the dataset. To address this issue, the Synthetic Minority Over-sampling Technique (SMOTE) was applied. SMOTE is a well-established resampling method that generates synthetic samples for the minority class based on feature-space similarities, rather than simple duplication, thereby reducing model bias toward the majority class (Barus et al., 2022). Previous sentiment analysis studies have demonstrated that SMOTE improves classifier performance, particularly for recall and F1-score in imbalanced text classification tasks (Ferdiansyah & Suryono, 2025).

Feature Extraction and Model Configuration

Two different feature extraction techniques were employed to accommodate the characteristics of each classification model:

1. TF-IDF (Term Frequency–Inverse Document Frequency) was used for the SVM model due to its effectiveness in representing sparse and high-dimensional textual data (Utami, M. et al., 2023).
2. Word Embedding was applied for the CNN model to capture semantic relationships between words in a continuous vector space (Kim, H. & Jeong, 2019)

The dataset was split into 80% training data and 20% testing data. The SVM model was implemented using a linear kernel, which has been shown to perform well in sentiment classification tasks involving short text reviews (Hidayatul, Q. et al., 2021). The CNN architecture consisted of an Embedding layer, followed by Conv1D, Max Pooling, and Fully Connected layers, optimized for text classification tasks. Model development and experimentation were conducted using Python, with libraries including Scikit-learn, TensorFlow, and Keras.

Model Evaluation

Model performance was evaluated using a confusion matrix, from which accuracy, precision, recall, and F1-score were derived (Sari, Y. et al., 2024). These metrics were selected because they provide a comprehensive evaluation of classification performance, particularly in imbalanced sentiment datasets where accuracy alone may be misleading (Kou & Gui, 2023). Comparative analysis of SVM and CNN performance was conducted to determine the most effective algorithm for aspect-based sentiment classification of technical issues in mobile gaming reviews.

RESULTS AND DISCUSSION

Sentiment Analysis on Technical Aspects

The analysis of 12,809 relevant reviews collected from the Google Play Store reveals the distribution of user complaints regarding the technical stability of the Roblox game. As presented in Table 1, the "Bug" aspect is the most dominant issue reported by users.

Table 1. Distribution of Sentiment Data on Roblox Technical Aspects in Indonesia (2025)

Aspect	Total Data	Percentage	Dominant Sentiment
Bug	8.187	63.91%	Negative
Connection Stability	4.407	34.41%	Negative
Loading Asset	215	1.68%	Negative

Based on Table 1, complaints related to bugs account for nearly 64% of the total technical feedback, indicating that software malfunctions are the primary source of user dissatisfaction. The sentiment labeling results show that negative sentiment dominates across all three aspects. In the Bug aspect, frequently occurring keywords such as *"lag"*, *"error"*, and *"force close"* reflect instability in system behavior. This finding is consistent with the ISO/IEC 25010 software quality model, where bugs represent failures in the Reliability dimension, directly influencing user satisfaction.

For the Connection Stability aspect, users commonly reported *"disconnect"* and *"signal"* issues even when their network conditions were perceived as stable. This suggests that the reported problems are more closely related to server-side performance rather than user connectivity, reinforcing prior findings that connection stability is a critical Quality of Service (QoS) parameter in multiplayer mobile games. Although the Loading Asset aspect accounts for the smallest proportion of reviews (1.68%), complaints such as *"black screen"* and prolonged loading times remain significant, indicating inefficiencies in Performance Efficiency, particularly on certain devices.

The dominance of negative sentiment across all aspects also reflects the effectiveness of the preprocessing pipeline. Text cleansing, slang normalization, and stemming reduced lexical noise from informal and abbreviated Indonesian reviews, allowing sentiment-bearing terms to be identified more consistently during the labeling stage. Without these preprocessing steps, many gaming-specific expressions would likely have been misinterpreted or ignored by the classification models.

Performance Comparison of Classification Algorithms

This study compares the performance of Support Vector Machine (SVM) and Convolutional Neural Network (CNN) in classifying the sentiments discussed above. The evaluation results using the Confusion Matrix on the balanced dataset (SMOTE) are visualized in Figure 1

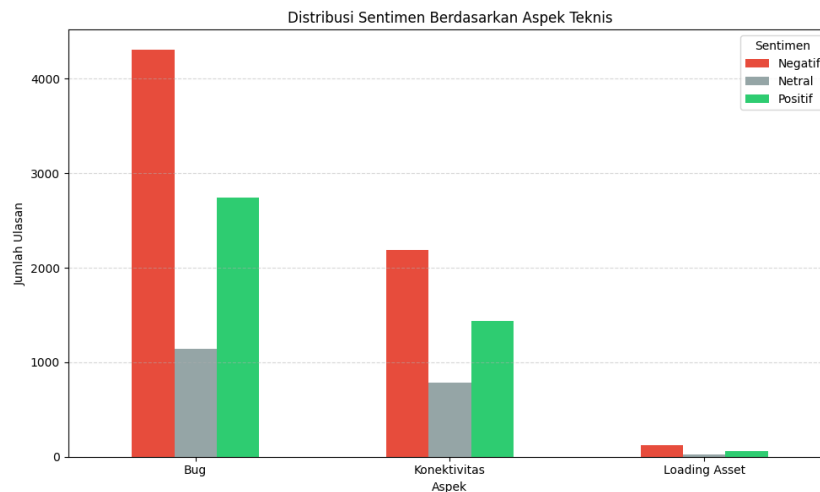


Figure 2. Comparison of Accuracy, Precision, Recall, and F1-Score between SVM and CNN Models (2025)

The results demonstrate that SVM significantly outperforms CNN in this specific domain. SVM achieved an Accuracy, Precision, Recall, and F1-Score of 96% (0.96). In contrast, CNN only achieved an accuracy of 80.63% with an F1-Score of 0.81.

The application of SMOTE played a crucial role in improving model performance, particularly for minority sentiment classes. By generating synthetic samples for underrepresented sentiments, SMOTE helped reduce model bias toward the dominant negative class. This balancing effect is especially evident in the improved recall and F1-score values, which are critical metrics for sentiment classification tasks involving imbalanced data. However, while SMOTE enhances class representation, it does not inherently improve semantic understanding, which may explain why CNN still underperformed despite balanced training data.

Discussion on Algorithm Performance

The superior performance of SVM in this study supports the findings of (Ferdiansyah & Suryono, 2025). Ferdiansyah & Suryono found that SVM (90%) outperformed Naïve Bayes in classifying Roblox reviews. Similarly, Ladopurab's research on political sentiment analysis showed that SVM (92.38%) was superior to CNN (62.86%) for text classification tasks.

However, this finding contradicts the results of (Hidayatul, Q. et al., 2021) and (Prasetyo, 2023), who reported that CNN outperformed SVM. This discrepancy can be explained by the nature of the data (Irfani, M. & Khomsah, 2024). Prasetyo's research focused on image processing (cataract detection), where CNN's architecture is naturally superior. In the context of text, specifically short and informal reviews from the Google Play Store (slang, abbreviations), the deep learning approach of CNN using Word Embedding struggled to capture context effectively.

The analysis of the confusion matrix revealed that CNN failed to detect nearly 30% of the positive reviews (Recall 72%), often misclassifying them as neutral. This indicates that the TF-IDF feature extraction combined with the linear separation of SVM is more effective for handling short, sparse text data compared to the complex feature extraction of CNN, which

typically requires massive datasets to generalize well . Therefore, for Aspect-Based Sentiment Analysis on mobile game reviews with limited sentence length, SVM is proven to be the more robust and accurate model.

Confusion Matrix Analysis

To provide a deeper understanding of the classification performance differences mentioned above, the confusion matrices for both models were analyzed. Figure 2 presents the confusion matrix for the SVM model using the Linear Kernel.

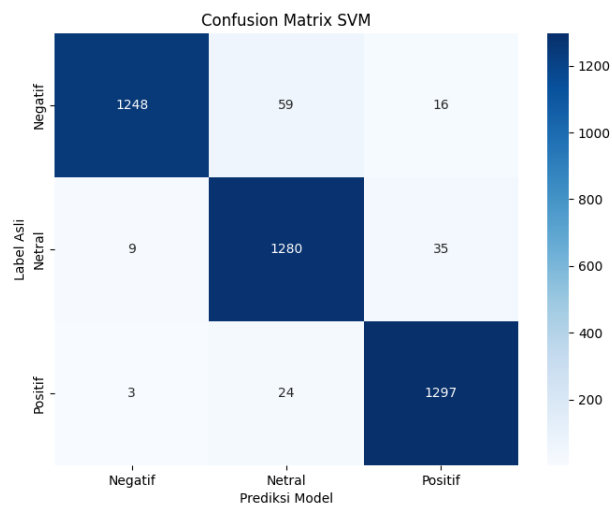


Figure 3. Confusion Matrix of SVM Model (2025)

As shown in Figure 2, the SVM model demonstrates excellent capability in recognizing patterns for each sentiment class. The prediction errors are relatively small; for instance, in the Actual Positive class, only 3 data points were misclassified as Negative and 24 as Neutral, while 1,297 data points were predicted correctly. This indicates that the hyperplane generated by SVM effectively separates the sentiment classes. In contrast, the CNN model shows a different distribution of errors. Figure 3 illustrates the confusion matrix for the CNN model.

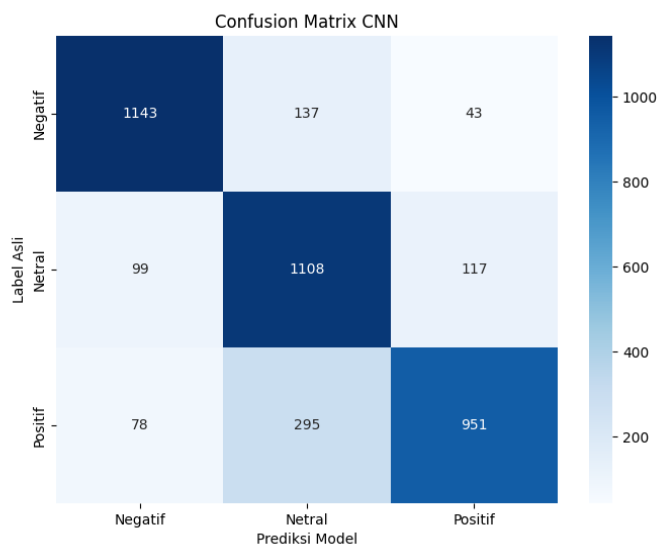


Figure 3. Confusion Matrix of CNN Model (2025)

Based on Figure 3, the CNN model experienced a significant performance decline compared to SVM, particularly in classifying positive sentiment. The confusion matrix shows that 295 data points from the Positive class were incorrectly predicted as Neutral, while 78 data points were misclassified as Negative. As a result, only 72% of positive instances were correctly identified, indicating that 28% of positive reviews were misclassified. This high proportion of misclassification into the Neutral class suggests that the CNN model struggles to distinguish explicit positive sentence patterns from ambiguous or neutral statements in short and informal game review texts.

CONCLUSION

Based on the research and analysis conducted, this study concludes that user sentiment toward the technical aspects of the Roblox mobile application tends to be predominantly negative within the specific context of the analyzed dataset. Among the examined aspects, Bug-related issues constitute the most dominant complaints, accounting for 63.91% of the relevant reviews, primarily associated with lag and application errors. The Connection Stability aspect follows with 34.41%, where users frequently report unexpected disconnections despite having stable internet access. Although the Asset Loading aspect represents the smallest proportion (1.68%), issues such as black screens and prolonged loading times were still identified as factors that negatively affect user experience. These findings reflect the technical concerns expressed by Indonesian users during the observed period and should be interpreted within this contextual scope.

In the comparative evaluation of sentiment classification models, Support Vector Machine (SVM) demonstrated better performance than Convolutional Neural Network (CNN) for the analyzed dataset. The SVM model achieved consistently high scores across accuracy, precision, recall, and F1-score (96%), while the CNN model obtained an accuracy of 80.63% and showed limitations in identifying positive sentiment, as reflected in its lower recall for the positive class. These results indicate that, for relatively short, informal, and domain-specific review texts with limited data complexity, traditional machine learning approaches combined with TF-IDF features can outperform deep learning models. However, this finding does not imply the overall superiority of SVM over CNN in all sentiment analysis tasks, as model effectiveness remains highly dependent on dataset size, feature representation, and contextual characteristics.

The application of SMOTE played an important role in addressing the class imbalance present in the original dataset, which was dominated by negative sentiment. By generating synthetic samples for the minority class, SMOTE contributed to a more balanced training process and helped improve the models' ability to recognize underrepresented sentiments, particularly in terms of recall and F1-score. Nevertheless, the use of synthetic data may also introduce potential noise and should therefore be carefully considered when interpreting the classification results.

Based on these conclusions, several recommendations can be proposed. From a practical perspective, game developers are encouraged to prioritize improvements in server stability and software optimization to reduce lag, application errors, and unexpected disconnections. From an academic and research perspective, future studies may explore larger and more diverse datasets, investigate the impact of different data balancing strategies, or employ advanced deep learning architectures such as LSTM or transformer-based models (e.g., BERT) to further assess their effectiveness in aspect-based sentiment analysis. Additionally, expanding and refining a domain-specific slang dictionary for gaming terminology could enhance preprocessing quality and improve sentiment classification performance in future research.

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