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Multi-Aspect Sentiment Analysis on Gojek Application Reviews Using CNN-LSTM Method

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Abstract−Since its initial release in 2010, Gojek has remained the most used online transport service by Indonesians. Multi-aspect sentiment analysis is a method applied to determine user sentiment towards various specific aspects in their comments. By applying this method, there will be deeper understanding of user views regarding various components of the Gojek service. The method employed was data scraping from web crawling of Google Play Store user reviews and data preprocessing, i.e., cleaning, case folding, tokenizing, stopword removal, normalization, and stemming. A hybrid CNN-LSTM model was employed since it is capable of extracting spatial features using CNN and long-term dependencies using LSTM. The seven most crucial aspects of the Gojek service, i.e., access, time, comfort, information, customer service, availability, and safety, were the central themes of this research. The main objective of this research is to analyze user sentiment across these key aspects using a deep learning-based multi-task approach, in order to gain actionable insights for improving service quality. The performance of the models was evaluated on accuracy as the primary metric, and the experiments attempted three model sizes: 32, 64, and 128 hidden units. Among them, the 64-unit model performed best overall consistently, with both aspect and sentiment classification accuracy being satisfactory. While the 128-unit model achieved slightly better accuracy on some sentiment tasks, it exhibited overfitting. The 64-unit model, however, gave the most balanced results and the best trade-off between model complexity and performance. The findings show the potential of multi-task deep learning approaches to extract valuable insights from user reviews. Such findings can be highly valuable to aid business strategy formulation and service quality improvement, and ultimately greater customer satisfaction, as well as consolidate Gojek's market dominance in Indonesia's online transport business.

Keywords: Sentiment Analysis, Multi-Aspect, CNN-LSTM, Gojek Reviews

1. INTRODUCTION

Gojek, established in 2010, is Indonesia's most used online transportation platform [1]. Being a pioneer in the country's ride-hailing industry [2], Gojek has a broad portfolio of services that cater to users' day-to-day activities ranging from transport, food delivery, logistics to digital payments. The company's repeated wins of service excellence awards by the Top Brand Awards for the past five years is a testament to its strength and commitment to service excellence [3].

Collection of user feedback, particularly from platforms such as Google Play, yields insightful information about experience and user opinion [4]. They form a robust corpus of unstructured information, which can be leveraged through sentiment analysis processes to determine the acceptance of people towards a service or product. Sentiment analysis enables wordy sentiments to be classified as positive, negative, or neutral [5] and provides business organizations with feedback that helps improve services and make better decisions [6].

Although sentiment analysis has been widely applied in the evaluation of digital services, a majority of previous studies have leaned towards overall sentiment classification. This prevents them from being capable of capturing users' nuanced opinions across different aspects of a service. In reality, users tend to have opinions towards multiple attributes—such as accessibility, information presence, customer support, and comfort—each of which can have a distinct impact on satisfaction. This points to the necessity of multi-aspect sentiment analysis (MASA) in achieving a richer and actionable understanding of user sentiments.

Several machine learning methods have been employed in previous sentiment analysis studies. Naïve Bayes, for example, was reported to deliver fairly low accuracy when processing Gojek user reviews, mainly because it is not well-equipped to handle the context complexity of long sentences [7]. While Support Vector Machine (SVM) was better—at a highest accuracy of 89.82% on Maxim service review sentiment analysis [4]—its computationally inefficacy with large data sets is a significant disadvantage. K-Nearest Neighbors (KNN) algorithm, which was optimized using Grid Search CV, had an accuracy of 83% on Gojek user reviews based on Twitter [8], but it also is not scalable since it is computationally intensive with increasing size of the dataset.

Deep learning techniques have shown improved performance in text data processing. CNN, for instance, when combined with feature extraction techniques such as Term Frequency-Inverse Document Frequency (TF-IDF) and FastText, achieved 93.14% accuracy on content-related aspects in TikTok reviews [9]**.** However, CNN models are inherently restricted in their capacity to identify long-term semantic relationships in text. To address this, researchers have integrated Recurrent Neural Networks, i.e., Long Short-Term Memory (LSTM), which possess superior sequential data modeling and long dependency capabilities. An experiment with RNN-LSTM with BERT embeddings was found to have excellent performance, 95% accuracy for business features, 91% for content, and 85% for features [10]. LSTM models, however, typically require longer training time.

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To fill the individual weakness of CNN and LSTM, researchers have attempted the combination of CNN-LSTM, leveraging the local feature extraction capability of CNN and the sequential modeling strength of LSTM. The hybrid proved to be beneficial for multi-aspect sentiment analysis. For example, CNN-LSTM on Bukalapak reviews achieved 93.91% accuracy [11]. The hybrid approach is best for problems that must identify granular features and deep context, and as such, it is a perfect method to employ for analysis of advanced user reviews.

From this study, a CNN-LSTM hybrid model is proposed in attempting to conduct multi-aspect sentiment analysis on user reviews for the Gojek app gathered from the Google Play Store. To the best of our knowledge, no existing literature brought these techniques together in one framework specifically for Gojek, nor experimented on as many as seven different service factors simultaneously—i.e., access, time, availability, safety, information, customer service, and comfort. This approach is most likely to yield a deeper understanding of how users evaluate different dimensions of Gojek's services, which is crucial for both research study and business usage.

The novelty of this study does not just reside in its methodology, which integrates CNN for spatial feature learning and LSTM for learning long-term contextual dependencies [12], but also in its domain specificity. Previous research had centered on single-aspect sentiment classification, employed simpler models such as Naïve Bayes [7] or had been conducted on other services or platforms such as Maxim [4], Bukalapak [11], and TikTok [9]. The current study fills this gap by offering a multi-aspect, deep learning–driven sentiment analysis tailored specifically for Gojek, one of the biggest digital platforms in Indonesia, and by analyzing actual user-generated data from a high-volume, real-world dataset.

The aim of this study is to develop a more comprehensive sentiment analysis by making the most out of the CNN-LSTM hybrid model to recognize both local and distant textual features. The research will be able to enhance sentiment classification accuracy and offer practical insights into user satisfaction for specific service types. These insights can be applied to inform strategic business decisions, service quality improvements, and customer retention policies. Finally, this paper will help Gojek maintain its competitive advantage in the rapidly evolving Indonesian online transport industry.

2. RESEARCH METHODOLOGY

2.1. Research Stages

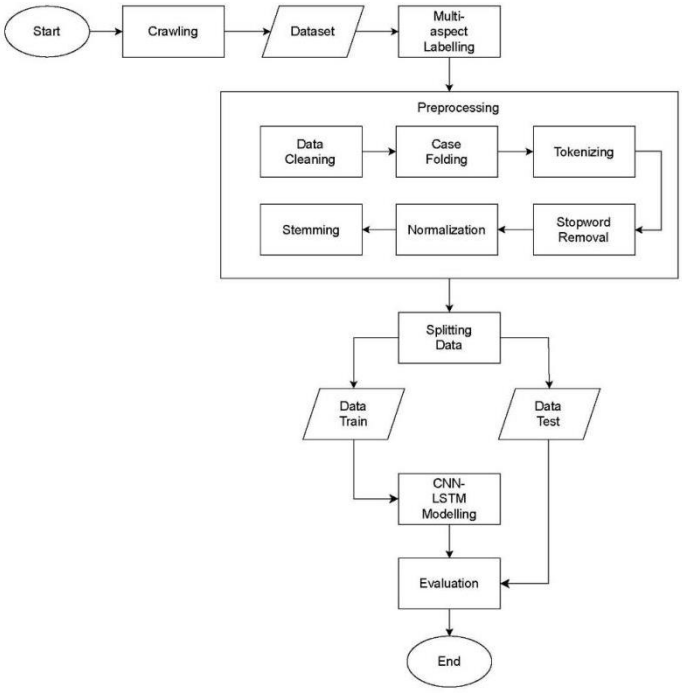

Figure 1. Research Flowchart

Sentiment analysis in this study is conducted using a hybrid Convolutional Neural Network-Long Short-Term Memory (CNN-LSTM) model to determine the sentiment of user reviews in different service fields of the Gojek app. The research process is directed by a straightforward and systematic sequence, which is graphically depicted in Figure 1. The steps begin with Data Crawling, which is the first step to collect user reviews from the Google Play Store. These reviews are then collected systematically into an organized dataset that is the foundation of all the following analysis.

Following data collection, Multi-Aspect Labeling is performed. This is where all the reviews are tagged with tags based on some aspects of the content of the Gojek service being reviewed. These aspects are significant in the