

Performance Analysis of Public Sentiment Towards Electric Vehicles in Indonesia on Social Media X Using Word2Vec and Graph Neural Network

1st Alya Selynindya
School Of Computing
Telkom University
Bandung, Indonesia

alyaselyn@student.telkomuniversity.ac.id

2nd Fitriyani
School Of Computing
Telkom University
Bandung, Indonesia

fitriyani@student.telkomuniversity.ac.id

Abstract— The issue of climate change and air pollution represents a significant global challenge that demands critical attention. In 2017, the transportation sector in Indonesia accounted for approximately 46.58% of total energy consumption and contributed 53% of total exhaust emissions. Despite an 82.8% public interest in Electric Vehicles (EVs), doubts and concerns persist regarding the viability of battery technology, the availability of supporting infrastructure, and the cost of ownership. This study conducted a sentiment analysis of public perceptions of Electric Vehicles. The approaches employed in this study are Word2Vec and Graph Neural Network (GNN). The combination of Word2Vec and GNN was selected due to its advantages in understanding the semantic meaning of text and enhancing accuracy through the utilization of relational information between words. The objective of this sentiment analysis is to gain insights into public perceptions of Electric Vehicles (EVs) in Indonesia. The results of Word2Vec and GNN achieved an F1-score of 78.81% with an embedding size of 100, a window size of 9, and 200 epochs, higher than other comparable methods, including Word2Vec and CNN (70.50%), SVM (69.28%) and Naive Bayes (61.52%). The most effective model could serve as a reference for future studies on public acceptance of EVs.

Keywords—sentiment analysis, electric vehicle (EVs), Word2Vec, graph neural network (GNN), social media x

I. INTRODUCTION

Climate change and air pollution are global challenges that require urgent and effective solutions. Indonesia's energy consumption continues to rise annually. In 2017, the transportation sector accounted for the largest proportion of energy consumption, at 46.58%, with most of this energy derived from fuel oil. Furthermore, approximately 53% of the total emissions in Indonesia are attributed to the transportation sector [14]. Given that 82.8% of the public expresses interest in electric vehicles (EVs), with 67.29% indicating a willingness to purchase an EV in the future and 15.51% intending to do so in the near term, the Indonesian government faces both a significant challenge and opportunity in transitioning from internal combustion engines (ICEs) to EVs [1].

The use of electric vehicles (EVs) powered by rechargeable batteries represents a potential alternative for transitioning from fossil fuels to environmentally friendly energy sources. EVs produce minimal emissions during usage, with carbon emissions of only 67.8 grams per kilometer. This represents a significant reduction compared

to internal combustion engines (ICEs), which emit 179.1 grams of carbon per kilometer [2]. Therefore, the potential of EVs to reduce Indonesia's total emissions and air pollution is significant. A comparison of emissions from Electric Vehicles (EVs) and Internal Combustion Engines (ICEs) suggests that EVs could offer an effective solution for reducing air pollution and dependence on fossil fuels, thereby accelerating the transition to renewable energy sources.

Despite the environmental benefits of Electric Vehicles (EVs), public perceptions and concerns continue to be a significant barrier to their adoption. A recent survey found that 62.27% of the public expressed concerns about battery lifespan, while 61.13% cited infrastructure limitations as a major issue. Furthermore, 57.8% of the public perceive the cost of Electric Vehicles (EVs) as relatively high, 37% express concerns about safety, 29.2% hesitate due to the limited availability of sales, 26.2% cite the lack of variety in available models as a decision factor, along with several other considerations. Public acceptance of Electric Vehicles (EVs) remains low, as evidenced by findings from the Research and Development Agency of ESDM in 2021, which indicated that only 22.3% of respondents demonstrated an understanding of EVs [1]. Social media platforms, particularly X, have emerged as a primary source of information about EVs, with a large volume of content being created and shared on these platforms.

A previous study on the sentiment analysis of electric cars was conducted using a combination of Word2Vec and Bidirectional Long Short-Term Memory (Bi-LSTM) with an embedding size of 200, resulting in an F1-score of 95.49% [15]. The findings indicated a positive perception of electric cars among the Indonesian public. In the analysis of Weibo comments, a combination of Graph Neural Network (GNN) and Long Short-Term Memory (LSTM) achieved an F1 score of 95.22%, with the results indicating that most comments on Weibo were positive [16]. The sentiment analysis of the installation of American military bases in Ghana using the Word2Vec word embedding method with the Skip Gram model resulted in an F1-score of 81%, indicating a predominance of negative perceptions among the public [17].