

Sentiment Analysis of Political Discourse on Platform X using Graph Neural Network (GNN)

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Abstract— Social media has become an essential platform for disseminating information in this fast-paced digital era, particularly in political discourse. Sentiment analysis of political discourse is a compelling study area, as it plays a crucial role in influencing policies within a country. Numerous studies have been conducted to examine sentiment across a variety of platforms and different conditions. Graphs machine learning enables the modeling of complex relationships between words and entities, thereby enhancing accuracy in capturing sentiment patterns within text. This research presents a comparison between the Graph Attention Network and the Graph Convolutional Network for sentiment analysis of political discourse on platform X. The results show that GAT performs slightly better across all evaluation criteria, namely, precision, accuracy, recall, and F1-Score, achieving an accuracy of 92.41% using 50 epochs. GCN also presents acceptable and consistent results, with an accuracy of 91.85%, which is comparable to that achieved when using GAT. However, GAT requires a longer training time due to the complexity of computing attention between two nodes. This makes GCN particularly suitable for tasks where faster training speed is prioritized over achieving maximum performance. Applying GNN facilitates sentiment analysis not only from individual texts but also through graph structures that capture communication and influence patterns among users, thereby offering deeper and more accurate insights. This represents one of the significant achievements in uncovering underlying sentiments and gaining a deeper understanding of public perception.

Keywords— social media, platform X, Sentiment Analysis, GNN, graph machine learning

I. INTRODUCTION

In the digital age, social media has become an integral part of everyday life. It provides users with various benefits, including the facilitation of personal needs and desires [1]. Social media is an online platform where users create profiles, interact, share information, and view others' profiles [2]. Twitter, now known as X, is one of the social media platforms that has been popular since 2007 and continues to be widely used. This social media platform continues to expand alongside technological innovations and competes globally with other social media networks. A report from We Are Social states that, as of July 2023 [3], there were 564.1 million users of X globally.

The platform X is utilized by users to disseminate information and express opinions, including political issues. In the context of the 2024 presidential election, Indonesian users of Platform X demonstrated significant engagement, actively sharing their perspectives on presidential candidates and contemporary political topics. The analysis of sentiment

expressed on social media has become an invaluable tool for understanding public opinion and predicting political trends. Consequently, social media is becoming an increasingly popular online platform for individuals to establish social networks and social relationships with others who share similar interests, activities, personal or professional backgrounds, or real-world connections [4]. Several studies have demonstrated that sentiment analysis can provide valuable insights into voter preferences and the dynamics of political campaigns in Indonesia.

Sentiment analysis involves the application of various techniques, including computational linguistics, text analysis, natural language processing, and biometrics, to systematically evaluate and interpret emotions and subjective data [5]. With the advancement of technology and social media, we can certainly analyze public sentiment on various social media platforms available today. But with the advanced use of technology and social media today, it is now possible to analyze public sentiments for various social media with full precision. According to The Encyclopaedia of Language & Linguistics (2006) [6], "*Sentiment analysis refers to frames of meaning and their regular and irregular tendencies. This gives importance to each sentence as a form of meaning, both of which are very different forms of power. Sentiment analysis itself is the result of events being narrated, structured, interpreted, and made into a collective master narrative individually by intermediaries who, through processes of retrieval and projection, oral and written, narrative and text, can read events as social texts. This narrative construction of reality relies heavily on events as signifiers, particularly as metaphors and metonyms*".

Based on the above statement, it can be concluded that sentiment analysis is crucial for understanding the impact of a narrative and the underlying emotions that shape our interpretation of events, especially those shared on social media. Therefore, this study aims to analyze political discourse, particularly focusing on the social media platform X. How to determine the results of digital text analysis, identifying whether the messages express negative, neutral, or positive sentiments. An example of previous works conducted in sentiment analysis for political discourse was by Bakliwal, A., et al. 2013 [7]. The study reviews some of the challenges in determining the sentiment of political tweets. The authors describe informal language, sarcasm, and the brevity of tweets as key challenges. This study focuses on various linguistic features and machine learning algorithms that improve the accuracy of sentiment classification related to the political

discourse about platform X. The main conclusion drawn from this work is that the linguistic features, combined with carefully curated training data, substantially improve the performance of the classifiers.

Several prior studies support the reasoning behind selecting this topic. For instance, an article highlights the use of Graph Neural Network (GNN) for stock market prediction [8], it is helpful in the introduction of complex structures of GNN architecture. Previous research on political discourse on platform X has generally used traditional text analysis methods, such as sentiment analysis and topic analysis. GNN is a machine learning model designed to model relationships between entities in a network, such as the connections between users or tweets [9]. It is particularly effective at representing these relationships within a network [10]. GNNs have also been applied to explore the detection of cyberbullying on platform X [11].

Furthermore, while existing studies are exploring the application of GNNs across various domains, a gap in literature is the comparative analysis of the effectiveness of Graph Convolutional Networks (GCN) and Graph Attention Networks (GAT), particularly in the context of sentiment analysis. Most available studies either focus on traditional machine learning models or do not explore how attention mechanisms of GAT affect the performance in sentiment classification and how GCN using layer Convolutional for modelling. This experiment fosters curiosity and questioning. How does GCN compare to GAT in terms of metrics and computational efficiency for tasks dealing with the analysis of sentiment? How can these models be made to scale to larger sets of data or more complex environments, such as those found in political discourse on social media? The present paper, therefore, undertakes answering these questions by conducting an extensive evaluation of state-of-the-art GCN and GAT architectures for sentiment analysis. his paper aims to contribute meaningfully by highlighting the strengths and limitations of each model, emphasizing that subsequent informed choices in modeling and further improvements can be more effectively implemented using the GNN architecture for sentiment analysis.

Therefore, this research aims to enhance the understanding of sentiment dynamics in the digital age. The GNN method proposed in this study is expected to address these limitations and offer deeper insights into political discourse on platform X, while also fostering a more constructive and inclusive political discourse. The use of GNN in sentiment analysis on X will produce better performance in comparison to methods like Naive Bayes that were used before, Support Vector Machine (SVM), and Convolutional Neural Network (CNN) [12].