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Sentiment Analysis of Gojek Application Reviews on the Google Play Store Using the Naïve Bayes Method

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***Abstract*— The fast rise of mobile apps has produced a lot of user review data on the Google Play Store that may be utilized to evaluate user views and the caliber of the service. One of the most often used techniques to evaluate this kind of data is sentiment analysis, particularly in transportation applications including Gojek. But before doing more sentiment analysis research, it's crucial to grasp present research trends. Therefore, this study intends to use a bibliometric approach to examine the evolution and trends of sentiment analysis research on application reviews, concentrating on Naïve Bayes method in Google Play Store review investigations. Using bibliometric analysis on scientific publications listed in the Scopus database. Data were gathered using keywords connected to sentiment analysis, user reviews, machine learning, and the Google Play Store, then examined using Biblioshiny and VOSviewer to pinpoint publication trends, research groups, and prominent keywords. The data point to a noticeable rise in publications following 2020, with key themes such as sentiment analysis, machine learning, and user reviews dominating. The results show that Naïve Bayes is still relevant and that mobile application reviews continue to be a key research area for understanding user attitudes and aiding digital service assessment. The findings indicate that the Naïve Bayes model is still pertinent, and reviews of mobile applications remain an essential field of study for analyzing consumer behavior and helping assess digital services.**

Keywords*— *Sentiment analysis; bibliometric analysis; Google Play Store; Gojek; Naïve Bayes; user reviews

I. INTRODUCTION

In recent times, the advancement in digital technology has led to an exponential growth in textual data, especially when sourced from consumer-driven platforms such as the Google Play Store, where users rate applications[1]. This information is vital because it reflects instantly the experiences, satisfaction, and concerns of consumers with the digital product[2].

Apart from traditional software, sentiment analysis has been a popular technique used to transform user reviews into systematic semantic information owing to the rise in user-generated content[3] This area has emerged as a discipline of Natural Language Processing, and its main objective is to categorize emotions, opinions, and sentiments expressed in texts[4]. Sentiment analysis has advanced to serve a broader purpose of aiding evidence-based decision-making processes in several digital sectors other than mere categorization tasks[5].

As indicated by bibliometric analysis, there has been a sharp increase in the number of publications related to sentiment analysis during recent years, particularly from 2020 to 2024[6]. In relation to the assessment of user data indicating opinions, such development indicates an increasing demand for sentiment analysis research in current scientific studies[7]. Moreover, the number of publications on relevant topics in the context of top sources including IEEE, LNCS, and ACM demonstrates the fast-growing popularity of the studied topic among the scientific community associated with IT[8].

Results of the thematic keyword analysis reveal that modern research pays particular attention to natural language processing, machine learning, user reviews, and sentiment analysis[9]. That indicates that scientists do not limit their interest only to classification approaches but also concentrate on user review data as a key tool in assessing quality of digital products[10]. Taking into consideration the amount of literature available and its practical application significance, mobile app reviews have become one of the most researched topics[11].

Sentiment analysis of app reviews has been analyzed through several channels such as e-commerce websites, ride hailing applications, and other similar online services[12]. In the process, the studies have illustrated that reviews can be an excellent source of information for understanding the strengths and potential areas of growth of the application[13]. Besides, sentiment analysis is widely carried out with the aim of gaining insights about user behavior and improving overall service quality provided by apps[14]. Thus, it will be necessary to conduct a review of app reviews, specifically that of Gojek, in order to understand consumer perceptions towards the software[15].

When it comes to research, some of the most common approaches for sentiment analysis, using machine learning models such as Naïve Bayes, include the fact that they are easy to use and efficient at handling textual information[16]. The model is commonly used because of its consistent performance across several data sets[17]. Moreover, machine learning models are constantly compared in terms of their accuracy rates[18].

On the contrary, sophisticated algorithms such as BERT are gaining importance in current research due to their ability to capture language context effectively[19]. Transformers have shown promising results in terms of

performance compared to traditional NLP algorithms in different tasks including sentiment analysis in reviews[20]. However, as sophisticated algorithms require higher computing power, Naive Bayes and other similar algorithms continue to be relevant in most researchesx[21].

In addition to algorithms, there is also the question of preprocessing techniques used in sentiment analysis models that involve such procedures as tokenization, stop-word removal, and term-frequency inverse document frequency weighting of words[22]. Most of the research works have indicated that using appropriate preprocessing techniques may greatly influence classification results[23]. Thus, data and its preprocessing methods are considered crucial in any research involving sentiment analysis[24] .

Finally, research in sentiment analysis has achieved significant success in both methods, data usage and applications in various industries of the internet[25] Most importantly, there has been a stronger focus in recent researches on analyzing the ways in which such findings could be useful in making informed decisions[26]. Concurrently, there is an increased interest among researchers and scholars to employ a combination of multiple approaches in improving the accuracy of the models[27]Moreover, as ways of obtaining deeper and more meaningful insight from users' reviews, there has been a growing interest in employing multiple approaches for analyzing users' reviews[28]. Alongside this trend, there has also been an increasing interest in using transformer models that are capable of providing reliable responses in complex linguistic situations[29]. The integration of multiple approaches in hybrid models has proved to be highly effective in terms of improving sentiment analysis[30].

Considering these trends, it is pertinent to analyze the sentiments in the reviews posted about the Gojek app.

II. METHOD

This section briefly describes the research framework, dataset, model development, and model evaluation.

A. Bibliometric Analysis

The first stage of conducting this study entails doing a bibliometric analysis in order to understand the extent to which sentiment analysis within user reviews has been studied, the common methods used, and whether there are any research gaps that remain. This step is very important because the information obtained will inform the decisions made in the subsequent steps.

The literature on this topic was reviewed by searching through the Scopus database using keywords such as "sentiment analysis," "user reviews," "machine learning," and "natural language processing." The results obtained were stored in the CSV format for future processing.

Two supporting software packages were used for the bibliometric analysis of the data. The first was Biblioshiny, which is an online version of the bibliometrix package from
R. This tool allowed to examine the fundamental statistics of publications, including publication rates per year, publishing journals, key authors, and keywords' development. The second package used to visualize the results was VOSviewer, which was chosen to generate network maps to see correlations between keywords and thus reveal thematic areas. This set of instruments was chosen because Biblioshiny is good for conducting statistical analysis through tables and trends, whereas VOSviewer allows presenting the connections in a visual and easy-to-comprehend manner.

Based on the results of the analysis, we will be able to understand which approaches are the most commonly employed in studies, how often do researchers pay attention to mobile applications, and how this topic is placed among the broader theme.

B. Data Collection

The data were collected from the Scopus database, where some of the key words associated with app review sentiment analysis, Google Play Store, and machine learning were considered. The data were stored in the BIB file format and then converted into CSV file format for further analysis and bibliometric analysis. The collected data were analyzed by bibliometric methods to identify trends in publications, authors, sources, and research on app review sentiment analysis.

III. RESULT AND DISCUSSION

This section presents the results of sentiment analysis on Gojek application reviews and discusses the findings obtained from both sentiment classification and bibliometric analysis.

A. Bibliometrics Analysis

1. VOSviewer Analysis

The network diagram presented in Figure X displays the association of various keywords used in sentiment analysis research. The larger nodes, comprising keywords such as user review, dataset, sentiment classification, and accuracy, highlight the major themes in the literature. It is evident that present-day studies concentrate on classification efficiency and reviewing of data obtained from user reviews. Each of the colors denotes clusters of related concepts, including different machine learning approaches, such as Naïve Bayes, Support Vector Machine, and Random Forest, as well as various fields, such as Google Play Store, user experience, and user feedback. Hence, the information produced by customers is currently being considered an essential tool in evaluating digital service performance and gauging customer satisfaction[31][32]. Moreover, the differences in color indicate the evolution of research over the years. Older studies concentrated primarily on classic machine learning methods, whereas contemporary studies emphasize the usage of state-of-the-art models, such as BERT, transformer architecture, and hybridization. Lastly, the dense connections between nodes demonstrate that there is a strong correlation between algorithmic frameworks, data sets, and application domains. This implies that modern research is shifting from investigating single components to integrating multiple components for sentiment analysis purposes[35][36].

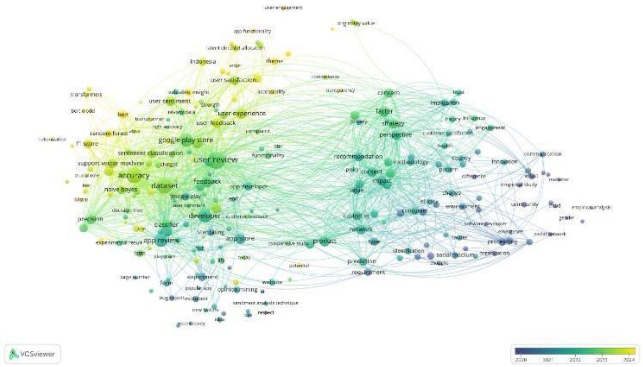

Figure 1. Overplay Visualization

2. Co-occurance Network

The co-occurrence network visualization of the Biblioshiny for research on sentiment analysis is presented in Figure X. Sentiment analysis, user reviews, and mobile apps appear to be key topics, showing how common and popular these topics are in recent research, especially when it comes to analyzing the content created by users on online platforms. As can be seen from the network, there are a few clusters that focus on different aspects of sentiment analysis research. One of those clusters focuses on applications in particular areas like app reviews, app stores, and internet purchases. Another cluster emphasizes the methodology of sentiment analysis, focusing on machine learning and text classification methods. Thus, this network clearly illustrates how successfully the latest research integrates computational and applied approaches to sentiment analysis. Moreover, relationships between the nodes suggest the existence of strong ties between these issues, indicating that recent research usually involves multiple processes like data collection, preparation, and modeling at the same time. However, despite the fact that sentiment analysis remains the main sphere of investigation, it becomes clear that the scope of usage for this topic has expanded considerably. The above finding supports previous research which has found that the use of bibliometric methods like Biblioshiny can aid in the identification of key areas of research, understanding interactions between keywords and tracking research trends over time[37][38].

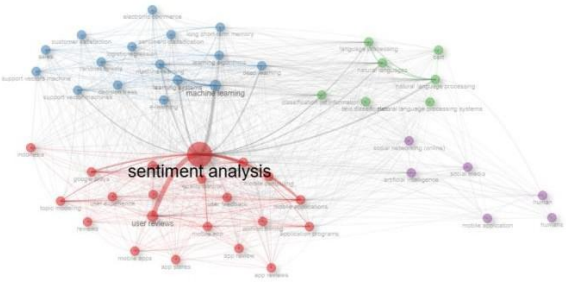

Figure 2. Co-occurrence Network

3. Thematic Map

As illustrated in Figure X, the thematic map generated by Biblioshiny reveals the distribution of research topics in sentiment analysis based on two dimensions, namely, centrality (relevance) and density (evolution). Research topics such as user reviews, mobile applications, and data mining fall into the upper-right quadrant (motor themes) and are highly evolved and relevant. It implies that they are already at an advanced stage of evolution and are currently directing research activities. In the lower-right quadrant (basic themes), topics like machine learning and learning systems are considered extremely relevant yet less evolved. Therefore, the implication is that they are basic concepts that have been used as the basis of numerous studies and offer vast opportunities for future research. In the upper-left quadrant (niche themes), artificial intelligence and mobile applications fall under the category. The topics are highly evolved but less central, suggesting that they have specialized characteristics and are not highly relevant to the research area. Lastly, the bottom-left quadrant (rising or falling themes) is characterized by topics like natural language processing and deep learning, which imply their current evolution or change in direction of research activity. In particular, sentiment analysis is located closer to the middle of the map; therefore, it confirms its role as one of the major topics that connects different research areas. This tendency is also in line with findings from recent bibliometric studies where it was shown that thematic maps can be effectively used to assess the development and significance of research topics and track their evolution over time within a specific scientific field[39].

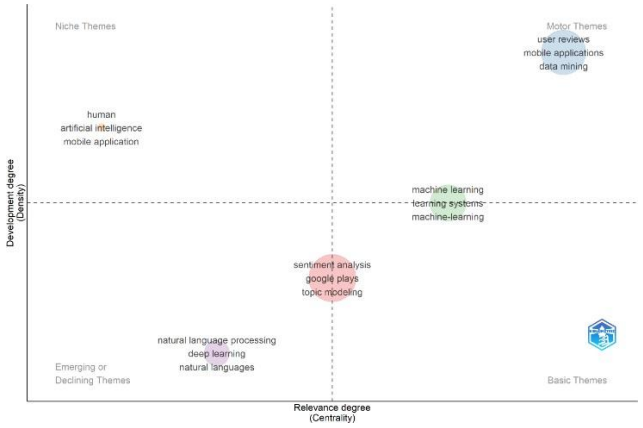

Figure 3. Thematic Map

4. Factorial Analysis

As can be observed from the plot presented in Figure X, the factorial map obtained with the help of Multiple Correspondence Analysis (MCA) represents the conceptual structure of sentiment analysis literature through the arrangement of similar keywords into clusters, with the central keywords including sentiment analysis, text mining, and user feedback. In the left part of the figure, keywords such as Naïve Bayes, support vector machine, decision trees, and random forest can be identified as forming a cluster and referring to traditional machine learning approaches widely used in the classification of sentiments. The top part of the figure consists of such keywords as natural language processing, deep learning, and BERT, suggesting the increasing use of advanced NLP techniques and deep learning approaches in current researches. On the right hand side, the application field is represented by keywords such as mobile applications, app reviews, user experience, and social media. The spatial distinction between these clusters represents the logical connections and evolution of the research field, showing that there was a slow movement from algorithm-focused research studies to more practical and situational analytical tools—something that supports the recent literature that states that MCA is indeed a valuable method for exploring the conceptual framework of a research field and understanding the relationship between its different topics over time[40].

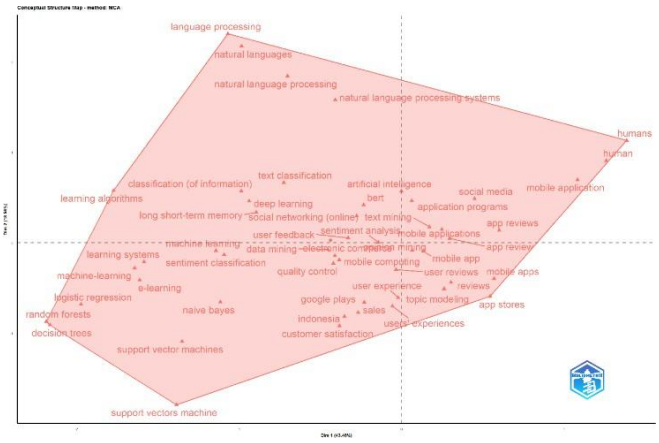

Figure 4. Factorial Analysis

A. Data Collection

The data was sourced from the Scopus database in the form of BIB files and further converted to CSV format. The documents range from 2012 to 2026. For more details on the data, refer to Table 1 below.

Table 1. Details Data Collection

Information	Total
Authors	1,973
Documents	677
Sources	437
Year Range	2012–2026

The dataset is comprised of 677 scientific articles obtained from the Scopus database regarding sentiment analysis of app reviews. In total, there were 1,973 contributors who wrote articles that appeared in 437 different journals. Articles in the database span from the year 2012 through 2026, suggesting an increasing body of literature on the subject of sentiment analysis of application reviews especially for Google Play Store applications.

IV. CONCLUSION

In this research, bibliometric analysis is used to examine research trends related to sentiment analysis for application reviews, especially application reviews of Google Play Store as well as the transportation applications including Gojek. From the result obtained, there is a significant increase in the research trend related to sentiment analysis, specifically after 2020, with the common keywords being sentiment analysis, reviews, user reviews, machine learning, natural language processing. In addition, from this bibliometric analysis using Biblioshiny and VOSviewer, it is evident that sentiment analysis is one of the main subjects among other research themes, where the use of traditional machine learning models such as Naïve Bayes model continues to be common together with other more advanced methods like deep learning and BERT. This implies that naïve Bayes algorithm is still relevant due to its easy nature and effectiveness in text classification problems. All things considered, it can be stated that the sentiment analysis of Gojek application reviews using Naïve Bayes algorithm fits into the current research trends and contributes to the understanding of user opinions.

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