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Analyzing the User's Sentiments of ChatGPT Using Twitter Data

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ABSTRACT: ChatGPT, an advanced language model based on artificial intelligence developed by the OpenAI, was released to internet users on November 30, 2022, and has attracted a great deal of attention. The feelings and thoughts of those who first experienced ChatGPT are valuable feedback for evaluating the success and positive and negative aspects of this technology. In this study, sentiment analysis of ChatGPT-themed tweets on Twitter was conducted to comprehensively evaluate the feelings and thoughts of users during the first two months following the announcement of ChatGPT. Approximately 788.000 English tweets were analyzed using the AFINN, Bing, and NRC sentiment dictionaries. The findings indicate that a large portion of the initial users of ChatGPT found the experience to be successful and was satisfied with ChatGPT. However, negative emotions such as fear and concern were also observed in some users. This study presents the most comprehensive sentiment analysis on ChatGPT. In future studies, specialized research can be conducted on the performance of ChatGPT in a specific field.

Keywords: Artificial intelligence, ChatGPT; Sentiment analysis; Twitter; Natural language processing; NLP

1. INTRODUCTION

The industrial revolution, which began with the process of mechanization, accelerated social development. With advancements in the electronic field and widespread use of the internet, the fourth industrial revolution, known as Industry 4.0, has been experienced. Artificial intelligence (AI), a field of science that focuses on developing systems that think and act like humans, has become the driving force behind information and communication technologies in Industry 4.0. With the increasing use of AI technologies in society, they have been utilized in a variety of fields including industry, healthcare, education, military, cyber security, and defense. It can be argued that AI can be used by all segments of society for purposes such as education, sports, and entertainment [1][2].

The widespread use of mobile internet has enabled users to utilize AI technologies such as image processing and voice recognition in their daily lives through the use of smartphones and tablets, particularly in banking and social media platforms [3]. Additionally, users can also control smart home devices such as televisions, air conditioning systems, boilers, and robot vacuums through the internet both inside and outside of the home [4]. The use of AI in daily life is not limited to these examples. There are also AI-based technologies developed for information access and research purposes such as translation from foreign languages, plagiarism checking, and analysis studies. These technologies encompass the aspects of natural language processing, machine learning, pattern recognition, modeling, and robotics [5]. This study focuses on natural language processing methods and a conversational AI chatbot named ChatGPT.

1.1 TEXT MINING AND NATURAL LANGUAGE PROCESSING (NLP)

With the widespread use of mobile technology, people have started using the internet for various purposes such as education, health, entertainment, and commerce. Over a billion internet users globally share unstructured data such as videos, texts, images, and audio via social media platforms like Facebook, Instagram, Twitter, and YouTube. The rising use of these platforms has brought new challenges and opportunities for service providers, researchers, and companies offering these services [6]. Social media companies need to have more storage infrastructure and internet bandwidth to handle the growing demand for unstructured data shared by users. Researchers and companies face the challenge of making valuable use of the huge amount of data generated by internet use. User comments, links, video and audio

content's clicks, purchase preferences, and online research have become research topics in big data analytics [7]. This has also driven researchers to focus on analyzing and understanding the emotions and opinions expressed in tweets, comments, messages, and other textual content [8]. By using AI techniques, valuable information for sales and marketing goals can be obtained, such as what the author is discussing, their opinion on the topic, and the type of emotions conveyed in the text. Analyzing the meaning and emotions extracted from the text can mathematically represent the general trend for a specific subject, product, or idea on a large scale. The results of these studies have a direct impact on a company's profitability, market share, and competitiveness, leading companies to allocate budgets for text mining research [9].

Text mining is a discipline that involves extracting valuable information from text through the use of data mining and NLP, which deals with human language processing [10]. Text mining employs mathematical and statistical methods for text classification, keyword extraction, headline extraction, idea mining, and sentiment analysis. The text mining techniques used include association analysis, clustering, classification, and knowledge extraction, which fall under four main categories [11][12].

NLP is a field of AI that deals with the development of algorithms and methods for computers to understand and process human speech. NLP aims to improve the understanding of human speech by analyzing the structural features of natural languages and to provide better results in people's languages based on their needs. NLP can be found in almost every area where human speech is used in daily life, such as language recognition and translation, text summarization, automatic speech, speech generation, question answering, spam filtering, sentiment analysis, chatbots, and plagiarism detection. These are some of the most commonly used areas of NLP [13][14][15].

1.2 SENTIMENT ANALYSIS

With advancements in NLP, texts have been regarded as data sources, and research has begun to investigate the subjective meanings in sentences during the process of extracting information from text. For instance, Hatzivassiloglou and Wiebe (2000) addressed the subjectivity of sentences in their study [16]. Tong (2001) presented his research on the followability of ideas in virtual environments [17]. On the other hand, Pang et al. (2002) demonstrated that emotions can be classified using machine learning methods [18]. As a result, opinion mining and sentiment analysis of people's postings about events, situations, products, services, or political opinions on the internet has made it possible to extract information [19]. The insights and information gained from sentiment analysis can serve as a reference for making accurate and effective decisions. In this manner, sentiment analysis can reveal valuable information that adds value to all aspects of social life, ranging from satisfaction with a product or service to political attitudes.

The techniques used in sentiment analysis can be categorized into two categories: Machine learning and lexicon-based, as shown in Figure 1. These techniques are not only used for sentiment analysis, but also for text mining and NLP applications [20].

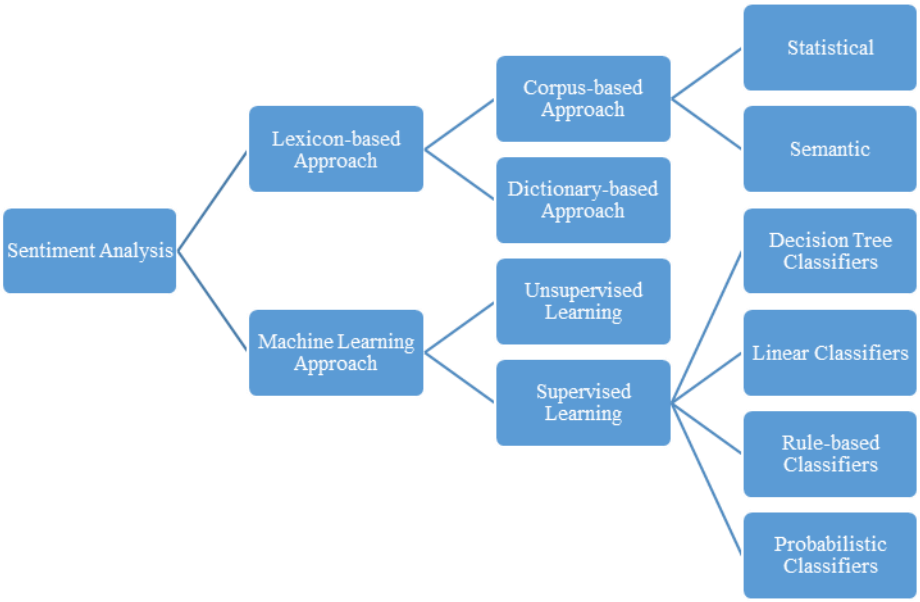

FIGURE 1. Techniques used in sentiment analysis [21]

In sentiment analysis, class models are created through the use of machine learning techniques by training classification algorithms on a pre-labeled set of opinion data. The resulting model can then be utilized to determine the opinion of new instances. In lexicon-based approaches, a dictionary of opinion words is either created or existing dictionaries are utilized to identify the opinions expressed in the existing data set [22]. Some of the commonly used

sentiment dictionaries are LIWC [23], EmosenticNet [24], NRC [25], DepecheMood [26], and Empath [27]. LIWC classifies emotions into four categories: Positive, Negative, Sadness, and Anger. EmosenticNet categorizes emotions into six: Disgust, Joy, Fear, Surprise, Anger, and Sadness. Empath classifies emotions into six: Joy, Fear, Surprise, Anger, Sadness, and Love. NRC categorizes emotions into eight: Trust, Anticipation, Disgust, Joy, Fear, Surprise, Anger, and Sadness [28]. The detection of emotions in texts may not always be fully accurate with these classifications, thus researchers often opt to use multiple dictionaries or create new dictionaries based on existing ones. For instance, Atlı and İlhan (2021) proposed a dictionary called NAYALex that can classify 38 different emotions, including those produced by the NRC, EmosenticNet, DepecheMood, LIWC, and Empath sentiment dictionaries in their studies [28].

Twitter, which was launched in 2006 as a social media platform, provides users with a medium to publicly share messages between 140 and 280 characters according to their language. The use of hashtags, which are tags written after the "#" symbol and called hashtags, are used to indicate the topic-theme of the posts. In this way, tweets can be found when searched according to their hashtags, or for users who share the same hashtag to attract attention. Twitter, which is preferred by users for audience and perception management due to these features, has recently taken an important position in social interaction [29]. Especially, as the tweets of users with a large number of followers are liked and shared by their followers, it becomes easier for the relevant topic to rise to the top of the Twitter agenda. The rapid appearance of a certain topic in the Twitter agenda as a result of shares has aroused more curiosity for analyzing the views or reactions of Twitter users about this topic. Therefore, sentiment analysis research for shares made on Twitter has become popular, especially in recent years.

It can be stated that some studies related to sentiment analysis have been conducted in the literature. For example, Akın and Gürsoy Şimşek (2018) classified tweets sent during a TV program as positive, negative, or neutral by conducting sentiment analysis, while following the program from November 2016 to June 2017 [30]. In another study, Ayan et al. (2019) investigated whether the posts on the Twitter platform were Islamophobic, which is a hate crime, using machine learning approaches and sentiment analysis [31]. On the other hand, Atılgan and Yoğurtçu (2021) analyzed 1138 Twitter posts sent during a certain period about a cargo company to evaluate the opinions of its customers. The researchers emphasized that the posts with the highest proportion of sentiment tags were negatively labeled [32]. Köksal et al. (2021) performed sentiment analysis on Twitter for Bitcoin, a cryptocurrency, to make value predictions. The researchers predicted the daily closing value by using the daily positive tweet rate containing the keyword "Bitcoin" and the daily opening value of Bitcoin [33]. Koca (2021) showed that the feeling of joy stands out in tweets posted by users during times when Bitcoin's value is increasing [29]. Uyaroğlu Akdeniz and Cebeci (2021) investigated citizens' attitudes and satisfaction towards metropolitan and district municipalities in the province of Sakarya by examining tweets sent to the Twitter accounts of these municipalities, using machine learning and deep learning approaches. The researchers aimed to contribute to society by examining citizens' positive and negative feedback and generating solutions for their requests and complaints [34].

1.3 CHATBOTS AND CHATGPT

Another extension of NLP applications is chatbots. Chatbots can be defined as a kind of AI program that aims to provide correct answers to questions asked by mimicking human communication processes through text processing or voice processing methods [35]. Since there is no time limit for interaction with users, chatbots are applications that offer the advantages of AI in marketing and customer relations. ChatGPT (Chat Generative Pre-trained Transformer) is a chatbot that has rapidly gained popularity in this field since its introduction. ChatGPT is an AI chatbot that was released for public use by OpenAI on November 30, 2022, and is an optimized NLP model using supervised and reinforcement learning techniques [36]. With 175 billion parameters, ChatGPT is among the largest language models and has the highest number of parameters [37]. ChatGPT, which uses the GPT-3 text interpreter, is an AI code that can read and write texts [38]. Designed for online customer relations, ChatGPT is also used in many other areas beyond customer service [39][40]. ChatGPT offers more than an advanced question-answering robot, as it can create articles on a specific topic in different languages with its multi-language support. Moreover, it can generate the codes of the program required for a specific algorithm or equation calculation in the desired programming language within a few seconds. Due to these abilities, ChatGPT is an advanced AI tool that can serve many different purposes such as software development, content creation, language translation, education, and health consultancy. The wide range of its application areas indicates that as ChatGPT becomes more well-known, the use of AI chatbots will become more widespread in many areas of life. Scientific studies rapidly carried out in the field of ChatGPT after its release can be seen as a sign of this situation. In the short term, Topsakal and Topsakal (2022) presented a software framework that can be used in foreign language education for children using ChatGPT in conjunction with augmented reality [41]. Kung et al. (2022) measured the performance of ChatGPT by applying it to medical exams used in the United States. Researchers stated that ChatGPT showed a performance threshold in passing three medical exams without any specialized training. This situation indicates that ChatGPT has effective potential in medical education and clinical decision support systems [42]. Gao et al. (2022) asked ChatGPT to generate research summaries based on the titles and journals of research abstracts they collected from five high-impact medical journals. The researchers found that ChatGPT was successful in writing scientific summaries using the compiled abstracts, and the summaries it wrote were not detectable by plagiarism checkers [43].

1.4 THE PURPOSE AND SIGNIFICANCE OF THE STUDY

The big data generated from social media platforms through user posts provides researchers with valuable information for determining the mass attitude towards a specific topic or product. Traditional data collection methods such as face-to-face interviews or surveys can be challenging to reach the target audience and can also be costly. Because, as the amount of data to be collected increases, the cost of reaching that many people will increase in terms of time and finance. Additionally, traditional data collection methods only examine the data of the target audience, making it impossible to determine the thoughts of a broader audience about the research topic. This creates a critical limitation in the research. However, social media platforms provide researchers with easy access to the objective views of the user base on current topics through the posts they make. This situation provides rich content as data that is anonymous, impartial, and easily accessible on public social media platforms for researchers [44]. The data obtained from social media platforms can be used for social research and commercial purposes due to its time and cost efficiency. Additionally, social media is used in mass communication, particularly on television broadcasts. Television programs' social media accounts allow the viewers to share their opinions and suggestions on the program content in real-time, and sometimes the topics or contents of social media are even broadcasted as news on television [45]. This situation ensures the importance of social media tools and the data obtained as an essential competitive element in information management [46].

The Twitter platform's ability to present daily trending topics both nationally and globally, and enable numerous users to share their feelings and thoughts about these topics simultaneously, makes it more current and popular than other social media platforms [47]. This study aims to conduct a comprehensive sentiment analysis of Twitter posts related to ChatGPT during the first two months following its announcement, to evaluate users' thoughts and feelings about this technology. Additionally, the analysis of society's initial evaluations of this technology will enable the identification of ChatGPT's strengths and weaknesses, and provide a comprehensive situational analysis to experts, researchers, and companies that develop and use large language models, contributing to the literature. Twitter was selected for this study due to its global popularity and data-sharing policy. Twitter ranks fourth in Alexa's list of the most visited websites worldwide [48], and unlike other platforms such as Facebook and Instagram, Twitter shares its data and makes tweets public [49], which is a strong reason why it is preferred for sentiment analysis studies. This feature of Twitter providing a public platform increases user interaction and facilitates the creation of a broad network of users who react to social events or trending topics, thereby creating public opinion [50]. For these reasons, researchers, institutions, and companies use sentiment analysis techniques to discover useful information from Twitter posts [32]. It is possible to determine whether a text contains a sentiment, whether that sentiment is positive or negative, or what type of sentiment it contains, through sentiment analysis. As Twitter has millions of unique users with diverse educational and cultural backgrounds from all nations around the world, analyzing the emotional state of this user group is highly valuable as feedback can be obtained for a product or agenda. Emotions and thoughts are important as they influence people's decision-making processes and cannot be ignored. Therefore, competitive firms have started to focus on social media to increase their market share or to conduct research on purchasing preferences, rather than relying on traditional marketing methods. From this perspective, social media as a source of data for sentiment analysis is now shaping many industries as it can provide objective insights on product or service quality or customer satisfaction. This situation directly affects product and service sales and indirectly affects the economy [33][51].

It has been suggested that Microsoft has reached an agreement with OpenAI, the maker of ChatGPT, by offering a partnership investment of 10 billion dollars and valuing the company at 29 billion dollars. In this partnership, Microsoft reportedly requested 75% of AI revenues [52][53]. The multi-billion-dollar investment cost of ChatGPT highlights the importance of revenue expectations from this product. Investment, development, and marketing policies related to this technology product that has entered the sphere of influence of the world's largest companies in the global market contain product quality perception and customer satisfaction in terms of decision-making. Therefore, this study aims to contribute to investors and developers in creating a roadmap by examining the quality perception and satisfaction feedback of users as a customer potential for ChatGPT through sentiment analysis techniques.

In the study, only English tweets were analyzed, and the time period during which the data was collected constitutes an important limitation. While English is the most widely used language in the world, it may not be possible to generalize the study's results to emotional states of ChatGPT users with different languages and cultures. Furthermore, comments made during the initial use of the product may change in new versions developed as the product is used and feedback from users is received. Although this may be seen as a research gap, it cannot be considered a limitation since the study's main objective is to determine the users' initial experiences and observations.

2. METHODOLOGY

In this study, the sentiment analysis method was used to understand the societal perception generated by ChatGPT worldwide. ChatGPT, an AI chatbot that produces outputs that affect many sectors, generates the societal perception that is important to measure the tendency towards such AI robots. In the dictionary-based sentiment analysis, a value is assigned to each word based on its dictionary meaning, beyond its positive or negative connotations. The sum of these values determines the emotional value of the sentence. AFINN, Bing, and NRC dictionaries were used to perform

sentiment analysis of the obtained tweets in this study. The Bing dictionary was created by Liu and Hu (2004) [54], AFINN was created by Nielsen (2011) [55], and NRC was developed by Mohammed and Turney (2013) [25]. While Bing categorizes words into positive-negative categories, NRC also assigns words to their respective emotion categories. AFINN assigns a score to each word ranging from -5 to +5, where negative scores represent negative emotions, positive scores represent positive emotions, and neutral emotions have a score of 0. The trends and changes in emotions over time are reported through figures created in R (v.4.0) software.

2.1 DATA COLLECTION

The data comprising the Tweets used in this study were obtained using the "pandas" and "snscrape" [56] libraries in Python programming. The snscrape library was used to retrieve tweets containing specific keywords or related to certain individuals within a specified date range. The tweets used in the dataset for this study were collected between November 30, 2022, and January 31, 2023, after the availability of ChatGPT. During this period, English tweets containing the term "ChatGPT" were collected. A total of 788.825 tweets were obtained, but only 787.886 English tweets were included in the analysis, excluding tweets in other languages.

2.2 DATA PREPROCESSING

The tweets were preprocessed using word-based dictionaries (NRC, AFINN, and Bing) containing only English words for sentiment analysis. This included converting all tweets to lowercase and removing unnecessary elements such as retweets, punctuation marks, and irrelevant words (e.g. URL links, @users, and #hashtags). A word bag was used to remove commonly used words such as "the" and "an" for greater accuracy.

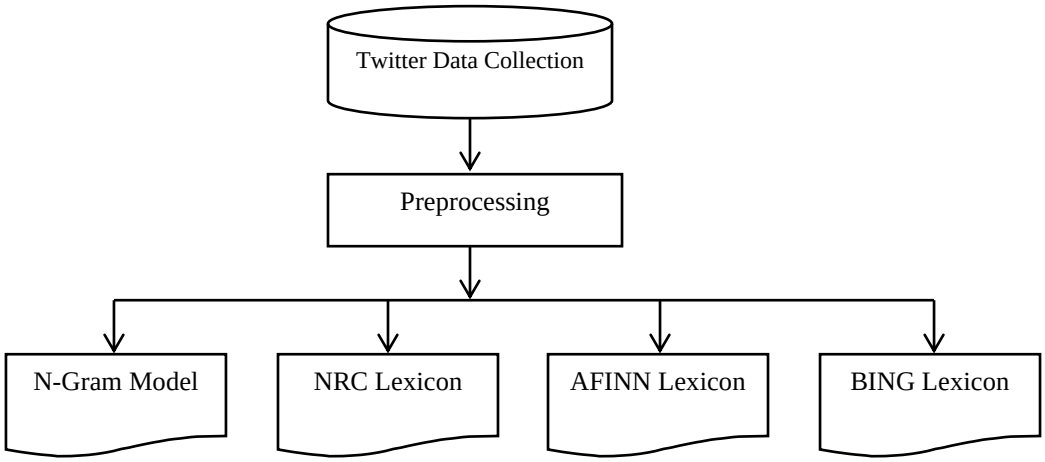

FIGURE 2. Twitter data processing procedure

3. ANALYSIS AND RESULTS

In this section, the analysis results of English tweets containing the word ChatGPT during the data collection period are presented using the NRC, AFINN, and Bing libraries.

3.1 USER INFORMATION ANALYSIS

To obtain reliable results in sentiment analysis using Twitter data, it is essential to ensure the reliability of the collected dataset. In this regard, statistical data related to the account information of the users who constitute the dataset can be used as a validation tool. Table 1 displays an analysis of the users' favorites count, followers count, friends count, and statuses count.

Table 1. Users' favorites count, followers count, friends count and statuses count

	Followers Count	Friends Count	Statuses Count	Favorites Count
Min.	0	0	1	0
1st Qu.	90	156	798	483
Median	454	475	3775	3117
Mean	25867	1540	25591	15724
3rd Qu.	2044	1230	16237	13483
Max.	128008025	1407372	4480237	1435889

The followers count of users who tweeted with the keyword ChatGPT has a minimum of 0 and a maximum of 128.008.025. The average number of followers is 25.867, but the median is only 454, indicating a skewed distribution due to some users having a very high number of followers. The friends count of users has a minimum of 0 and a maximum of 1.407.372. The average number of friends is 1.540, but the median is 475, again showing a skewed distribution. The statuses count of users has a minimum of 1 and a maximum of 4.480.237. The average number of statuses is 25.591, but the median is 3.775, indicating the presence of some highly active users with many tweets. The favorites count of users has a minimum of 0 and a maximum of 1.435.889. The average number of favorites is 15.724, and the median is 3.117, suggesting that some users have liked a significant number of tweets.

Upon examining Table 1, it can be seen that the distribution of followers, friends, statuses, and favorites for users who tweeted with the keyword ChatGPT is skewed due to some users having exceptionally high numbers in these categories compared to the majority. However, the median values for each category provide a more accurate representation of a "typical" user in this dataset.

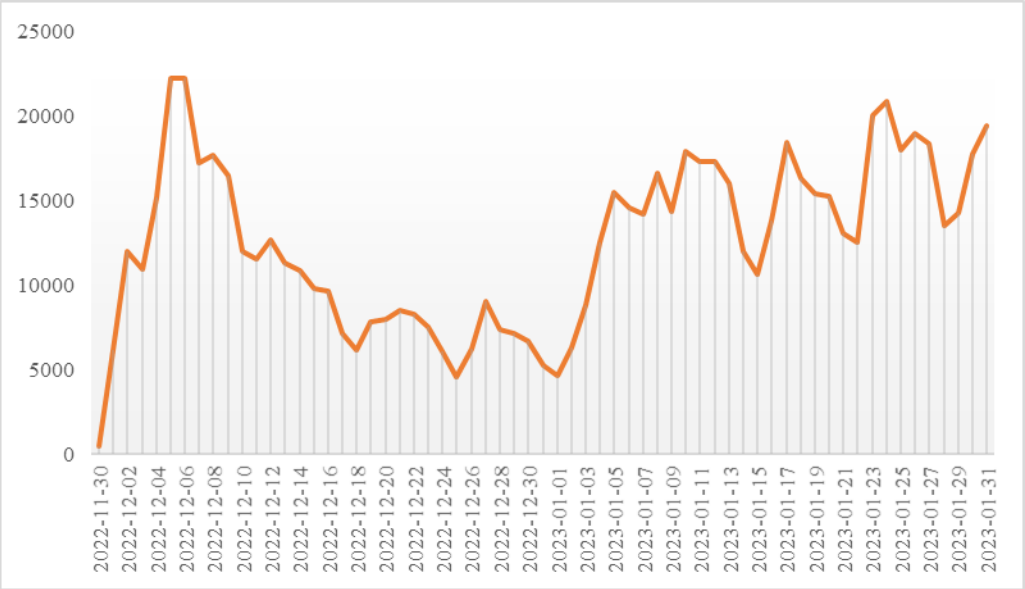

FIGURE 3. Daily number of tweets containing the keyword "ChatGPT"

When examining the daily tweet counts analyzed for social media interaction rates, it was found that the ChatGPT AI application did not experience any interaction in 22.174 tweets on December 6, 2022, one week after its release on November 30. Although there was a decline in this process due to reasons such as the end-of-year holiday, social media interaction has been increasing day by day as of January 2, 2023.

3.2 TWEET ANALYSES

The number of tweets subjected to analysis was 787.886, and the total number of words subjected to sentiment analysis after pre-processing was calculated as 8.746.766. The word cloud of the most frequently used words in these tweets is shown in Figure 4.

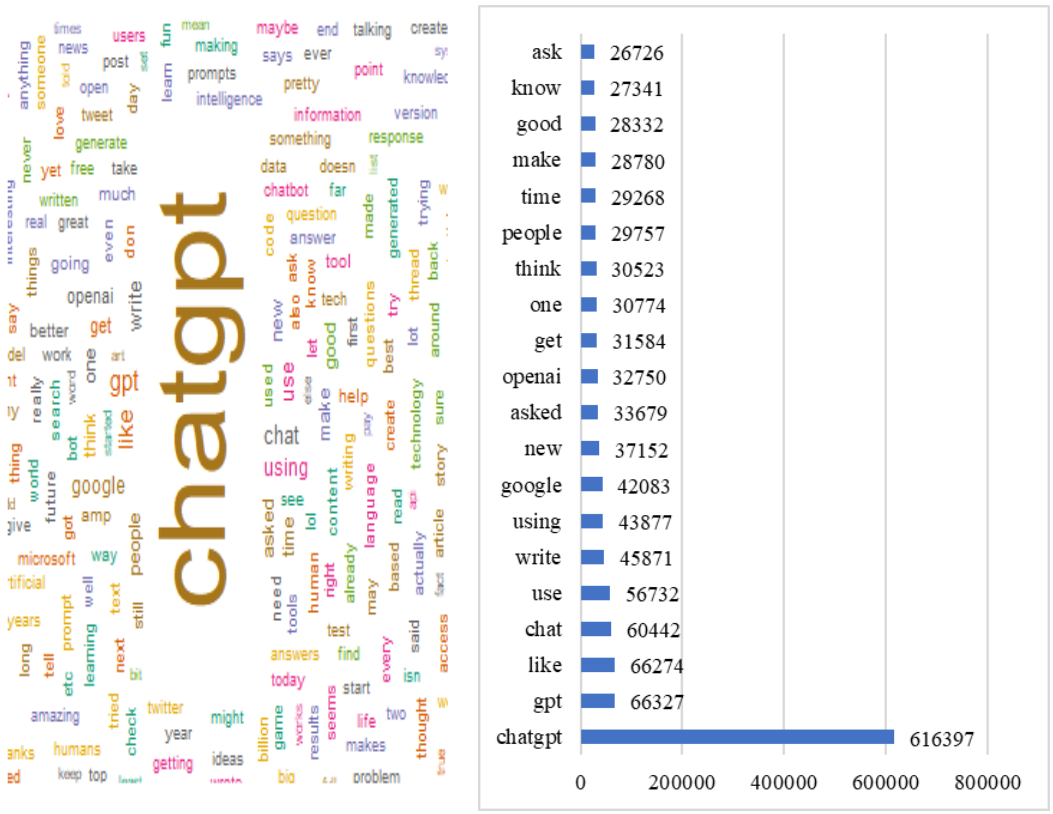

FIGURE 4. Word cloud of the most frequently used words in the tweeted messages and top 20 words

Based on the provided data, it appears that the most commonly used words in tweets containing the keyword "*chatgpt*" are related to the usage, functionality, and comparison of ChatGPT with other AI technologies. Conversations about "*openai*," the company behind ChatGPT, its establishment, and other products, reference to other versions of GPT or the general GPT architecture, and debates comparing ChatGPT with its predecessors or competitors. The term "*chat*" suggests that many tweets discuss ChatGPT's conversational aspect. The word "*new*" refers to discussions about updates, improvements, or recent developments related to ChatGPT. The word "*google*" may indicate comparisons between ChatGPT and Google's AI technologies or mention Google as a platform where users can access ChatGPT.

The words "*use*" and "*using*" indicate discussions about the practical applications and user experiences of ChatGPT. The word "*write*" refers to text creation features such as articles, content, or code writing. The words "*ask*" and "*asked*" indicate that users ask questions to ChatGPT or share their question-asking experiences. The word "*time*" shows the time-saving aspect of using ChatGPT or the time spent using AI. The word "*make*" indicates content creation or ChatGPT's development process. The word "*know*" indicates users seeking information about ChatGPT or sharing information about the usage aspect of the AI tool.

The word "*get*" refers to accessing or obtaining ChatGPT through API keys or subscription plans. The word "*one*" refers to ChatGPT as one of the existing AI technologies. The word "*good*" indicates a positive thought about ChatGPT and its capabilities. The word "*think*" shows content related to opinions, thoughts, or speculations about ChatGPT.

It is observed that the tweets mainly discuss the usage, applications, user experiences, and comparisons with other technologies of AI.

3.3 BING SENTIMENT ANALYSIS

The results of the analysis conducted with Bing sentiment dictionary were presented in Figure 5, showing the top 10 most positive and negative words in terms of sentiment, along with their word cloud.

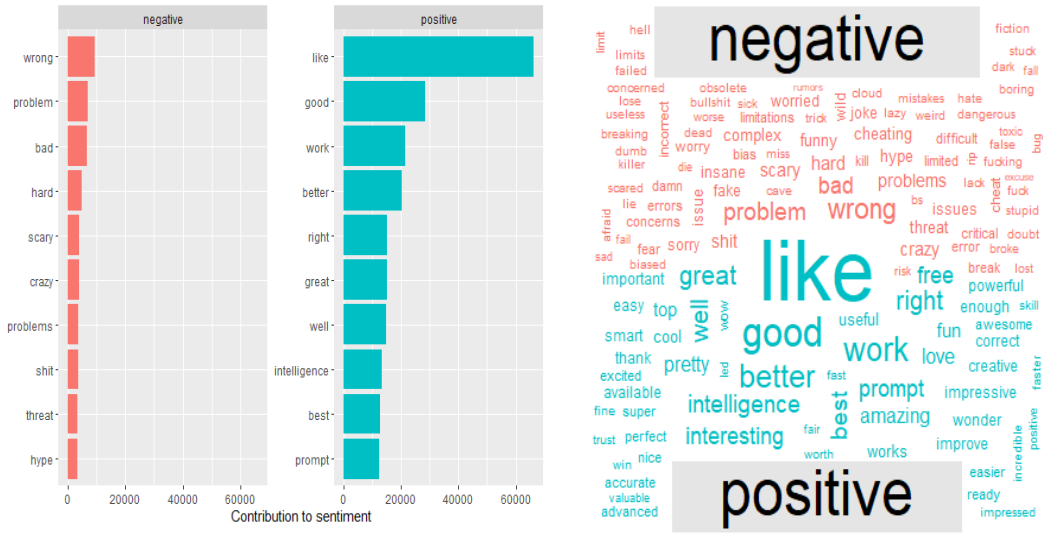

FIGURE 5. The top 10 most frequent words in terms of negative/positive sentiments in the tweeted texts and their word cloud

The presence of negative words in tweets suggests that some users may have encountered problems, difficulties, or concerns while using ChatGPT. The frequency of negative words such as "*wrong*" and "*bad*" indicates that some users may have found ChatGPT results to be incorrect or unsatisfactory. They may have experienced issues with the output of artificial intelligence, found its usage difficult, or perceived the technology as potentially threatening or disturbing in certain contexts. On the other hand, the presence of positive words indicates that many users have a positive opinion of ChatGPT. The appearance of the word "*work*" among positive words such as "*like*" and "*good*" can be considered an indicator that ChatGPT produces accurate and reliable results. Users appreciate its capabilities, performance, and responsiveness. Words such as "*good*," "*great*", "*best*", and "*better*" suggest that users perceive ChatGPT as a valuable and effective artificial intelligence tool. The word "*intelligence*" can be interpreted as an indication that users appreciate ChatGPT's ability to provide human-like results.

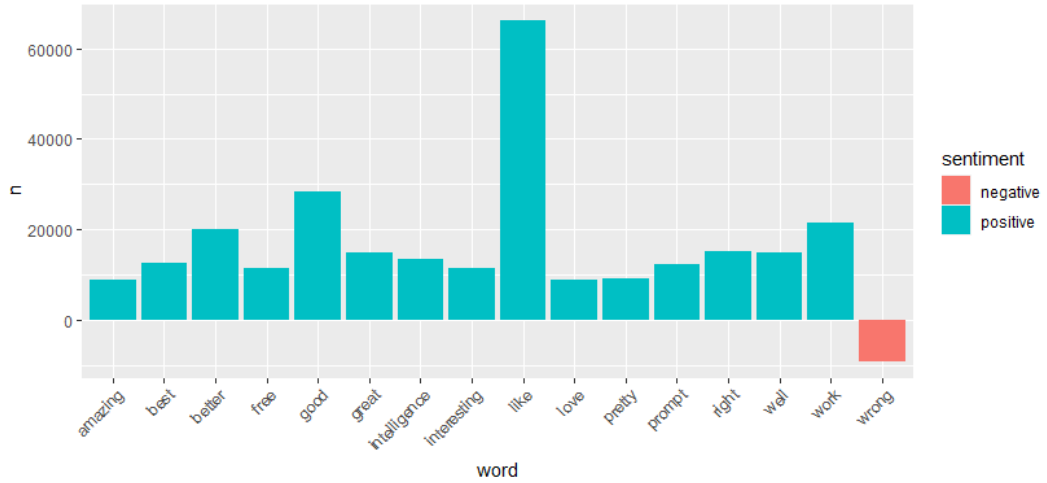

FIGURE 6. Proportional contributions of the most frequent words in tweets to negative/positive emotions

When examining the ratios given in Figure 6 regarding the proportional contributions of the most frequent words in tweets to negative/positive emotions, it can be observed that positive emotions are higher when tweet contents are evaluated as positive or negative. Despite frequently encountering negative words, it can be inferred that users perceive the prevalence of positive emotions in their ChatGPT experience and are satisfied with this interaction.

3.4 NRC EMOTION ANALYSIS

The emotional state of the words in tweets and the overall emotional state of the tweets based on the analysis performed using the NRC lexicon are presented in Figure 7.

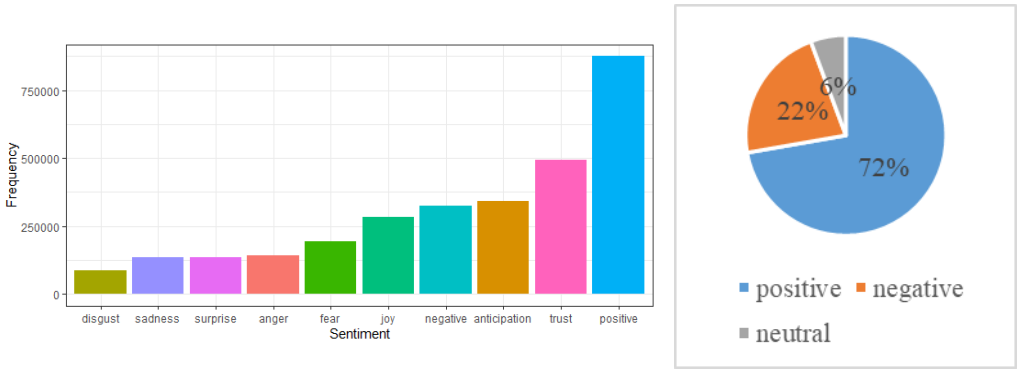

FIGURE 7. Emotion ratios of words and tweets in tweets

For the overall sentiment analysis of tweets, each word in every tweet was matched with the emotions in the NRC dictionary, and +1 was given for every positive word and -1 was given for every negative word. At the end of the process, to determine the sensitivity of each tweet, if the sum of all word scores is greater than 0, it is identified as positive, if it is less than 0, it is identified as negative, and if it is equal to 0, it is identified as neutral. As a result of this analysis, 541.887 tweets were labeled, and it was understood that 72% of the tweets contained positive emotions, 22% contained negative emotions, and 6% were neutral. When the emotional states of the words used in tweets were examined, it was observed that positive emotions such as "*trust*" and "*anticipation*" were more intense. As for negative emotions, "*fear*" and "*anger*" emerged as the most intense emotions. The high positive sentiment bar indicates that the polarity of tweets posted in the context of "ChatGPT" is positive. The analysis results also revealed the presence of very few negative emotions in tweets compared to positive emotions.

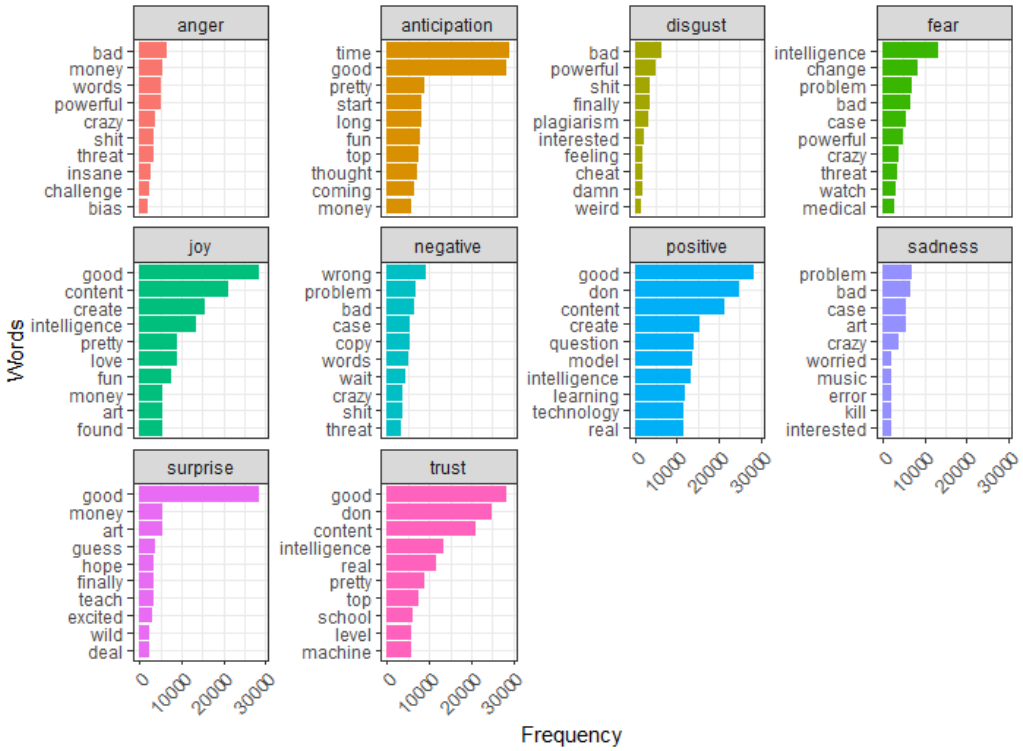

FIGURE 8. The number of uses of the 10 most used words for each emotion

Figure 8 shows the most repeated words in tweets according to the sentiment classification criteria in the NRC dictionary. When the most used words in the context of emotion categories were examined, it was seen that the words "*good, don, content, create, question*" were more prominent in the positive categories, while the words "*wrong, problem, bad, case, copy"* was used more intensely in the negative categories. When the intensity of use is examined, it is seen that positive emotions are much more than negative emotions.

When the emotions are examined, it is seen that the words in the category of "*trust*" among the most positive emotions used by the participants show the feeling of satisfaction with the professionalism and content of ChatGPT services such as "*good, don, content*". Similarly, the words "*time*" and "*good*" in the "*anticipation*" emotion category indicate that users like ChatGPT as a good time-saving application. When the negative emotion is examined, the words

"*intelligence, change, problem, bad*" are frequently used in the "*fear*" category. In this case, it has been determined that the outputs of ChatGPT cause a feeling of fear in users.

3.5 AFINN SENTIMENT ANALYSIS

The words in the tweets were analyzed with the AFINN dictionary, which includes 2477 words with a value ranging from -5 (very negative) to +5 (very positive). The results of the analysis of the emotional intensity of the 20 most used words together with the word "ChatGPT" are given in Figure 9.

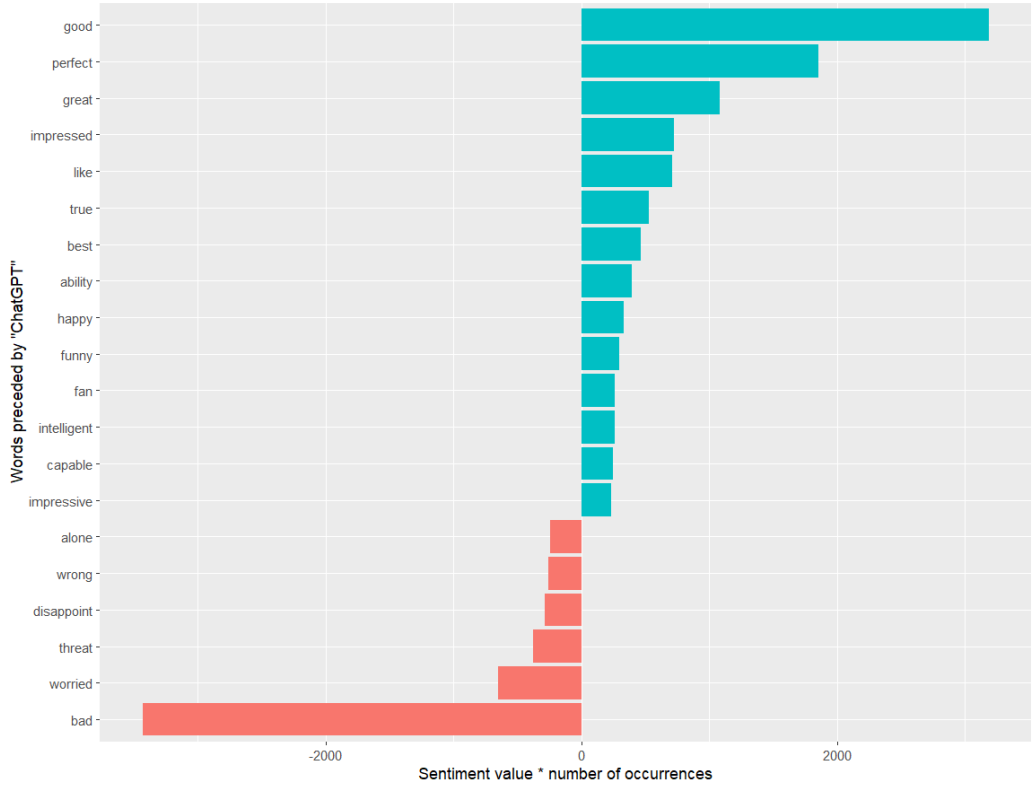

FIGURE 9. The usage rate of the 20 most used Negative/Positive words with the word "ChatGPT"

It shows that many tweets with the keyword "ChatGPT" express positive emotions because words like "*good*", "*perfect*", "*great*" and "*impressed*" have high frequencies. This indicates that users generally have a positive opinion of ChatGPT and appreciate its capabilities, performance, and usefulness. On the other hand, some tweets express negative emotions and have the highest frequency of "*bad*" among negative words. This is because there are users who are experiencing problems or concerns with ChatGPT, this dilemma can be interpreted as ChatGPT does not produce completely error-free results. Other negative words such as "*worried*", "*threat*" and "*disappoint*" suggest that some users may be concerned about the impact or performance of AI in certain contexts.

3.6 BIGRAMS AND TRIGRAMS FOUND IN TWEETS

Unigrams (keywords), bigrams (two-word phrases), and trigrams (three-word phrases) are used to capture the main themes that exist in the body of tweets [57]. For this purpose, we extracted the first 10 bigrams and trigrams from the "ChatGPT" Twitter dataset. Table 2 shows the most common themes used after the tweets were pre-processed.

Table 2. Top 10 bigrams and trigrams from the "ChatGPT" Twitter dataset

	bigram	n	trigram	n
1	chat gpt	52428	i asked chatgpt	5634
2	use chatgpt	19104	asked chatgpt write	3842
3	using chatgpt	18476	notion database tags	1924
4	chatgpt write	15525	use chat gpt	1888
5	asked chatgpt	15254	using chat gpt	1710

6	like chatgpt	11272	saved notion database	1693
7	ask chatgpt	10714	thread saved notion	1691
8	artificial intelligence	10566	tools like chatgpt	1655
9	chatgpt ai	10461	chat gpt write	1507
10	i asked	9413	chatgpt dall e	1497

The most commonly used bigram, "*chat gpt*", occurs 52.428 times, indicating that many tweets directly mention or discuss ChatGPT. By using ChatGPT, bigrams such as "*use chatgpt*", "*using chatgpt*" and "*chatgpt write*" and trigrams such as "*asked chatgpt write*", "*use chat gpt*" and "*using chat gpt*" especially for writing tasks, users often find that ChatGPT shows that you are talking about its use and application. Along with bigrams such as "*asked chatgpt*" and "*ask chatgpt*", the trigram "*i asked chatgpt*" demonstrates the interactive nature of ChatGPT, showing users frequently asking questions or making requests to ChatGPT. The concept and database tags "*notion database tags*" and "*saved notion database*" trigrams imply that some tweets may discuss using ChatGPT in conjunction with Notion, a popular note-taking and editing application. This indicates that users may be integrating ChatGPT with other productivity tools. The trigram "*tools like chatgpt*" indicates that users may be comparing ChatGPT with other similar tools, discussing its advantages or disadvantages, or exploring alternatives in the context of artificial intelligence. Bigrams such as "*artificial intelligence*" and "*chatgpt ai*" related to artificial intelligence and related technologies, as well as the trigram "*chatgpt dall e*" users to Indicate arguing ChatGPT in the context of associated technologies such as DALL-E, another project of Openai.

In this context, the bigrams and trigrams most frequently found in tweets containing the keyword "*chatgpt*" indicate that users actively discuss ChatGPT and its various applications, often in the context of integration with artificial intelligence, typing tasks, and other productivity tools such as Notion. The tweets also show an interest in exploring and comparing similar AI-powered tools.

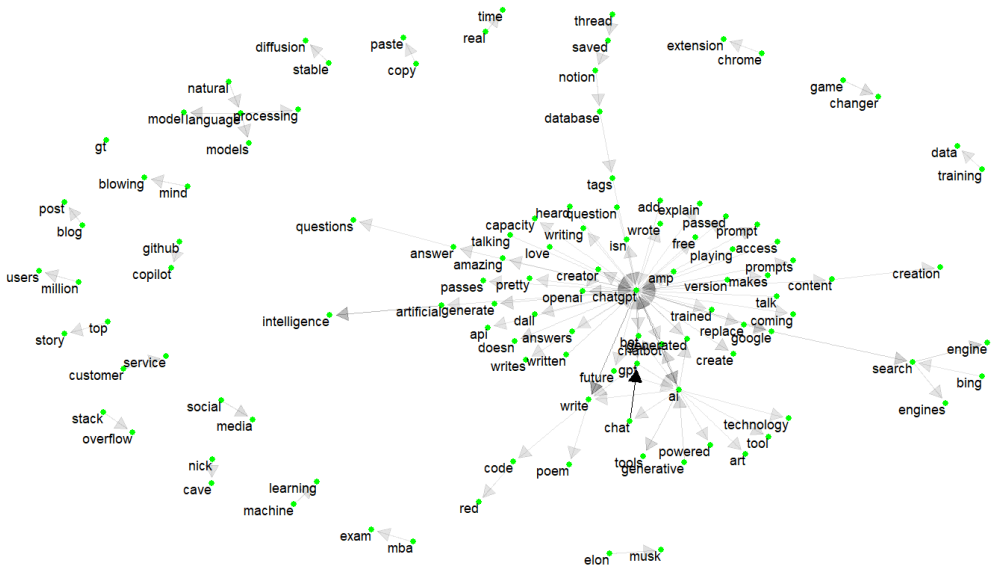

FIGURE 10. The direction of bigrams with over 1000 interactions in tweets

Chatgpt > amazing> answer> questions mean ChatGPT is a great AI model for answering questions. *Chatgpt > write > code > red*, it could mean that ChatGPT was asked to write code, possibly focusing on bug or vulnerability detection. *Chatgpt> write> poem* specifies ChatGPT's request to write a poem. *Chatgpt > content > creation* refers to ChatGPT's ability to create content such as articles, stories, or blog posts. *Chatgpt > dall > api*, it could be a ChatGPT-related API or the post suggesting a specific implementation (like the OpenAI API) for the AI model. *Chatgpt> artificial> intelligence* emphasizes that ChatGPT is an artificial intelligence language model. *Thread> saved> notion> database> tags> chatgpt* indicates that a conversation or conversation containing ChatGPT has been saved to a Notion database with the corresponding tags. *Chatgpt> google> search> engine* can suggest a comparison between ChatGPT and Google Search or the possibility of using ChatGPT in conjunction with a search engine for better results. These bigram interactions are keywords or phrases related to the ChatGPT language model, capabilities, and usage.

4. DISCUSSION AND CONCLUSION

In this study, the analysis of tweets about ChatGPT was carried out by using sentiment analysis techniques from text mining methods. The tweets that constitute the study's data source cover two months after the launch of ChatGPT. AFINN, Bing, and NRC dictionaries were used to analyze tweets. As a result of the studies, it is understood that the majority of ChatGPT users are satisfied with using this AI chat robot and find this experience successful. On the other hand, it was determined in the sentiment analysis that a small portion of the users stated that ChatGPT produced erroneous-false results, and they were not satisfied with this situation. Although it is seen that the majority of tweets have positive emotions, it is seen that there are also tweets corresponding to anger, anticipation, disgust, fear, and sadness. In addition, when the emotional intensity of the most used words in tweets is examined, it is seen that positive and pleasing emotions such as good, perfect, great, impressed, and like are mostly included. However, in the same analysis, it was observed that there were negative emotional intensities such as bad, worried, threat, and wrong, albeit with relatively less intensity.

This study is a comprehensive study that investigates the comments and experiences of internet users about ChatGPT, an artificial intelligence chatbot and language program that attracts worldwide attention. Although sentiment analysis studies on this subject are very new, Haque et al. (2022) draw attention in the study as a similar study in the literature. Researchers looked at approximately 11.000 tweets posted in just two days since ChatGPT was launched. However, the current study examined a two-month timeframe, wide enough to present research from a broader perspective. As a natural consequence of this, the amount of data collected is also reported by Haque et al. (2022), which is approximately 72 times higher [58]. This is an indication that the study includes more generalizable results. On the other hand, the high number of data was the study's most significant limitation. Because the computer hardware capacity was very difficult during the data analysis stages and the analysis took a very long time.

ChatGPT is a system that always improves its inputs with internet-based content. It has also been the subject of many financial investments in the field of artificial intelligence technology. For this reason, it can potentially host some negative situations with its constantly developing and changing structure. Sam Altman, CEO of OpenAI, one of the developers of ChatGPT, stated in a statement to draw attention to this situation that ChatGPT writes more advanced computer code every day. Altman expressed his concern that this situation could lead to counter cyber-attacks. In addition, the CEO is concerned that ChatGPT may also cause massive disinformation. In the academic field, it is stated that ChatGPT can write the introduction or abstract of scientific articles and even be seen as a co-author in some articles [45]. Such situations are already emerging as aspects of ChatGPT that may have negative consequences. The findings and results of this study offer meaningful implications for product developers and researchers as a comprehensive feedback study. In future studies, ChatGPT's translation, exam success, article writing, etc. Sentiment analysis studies can be done about their experiences in a particular field. Or, there may be interest in qualitative studies that examine only the negative aspects of ChatGPT. For future studies, it is thought that analysis is done only on Twitter data in the context of the limitations of the study and better results can be achieved by adding other social media tools.

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CONFLICTS OF INTEREST

The author declares no conflict of interest.

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