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SOCIAL PERCEPTIONS ON THE USE OF ROBOT WAITERS IN RESTAURANTS: SENTIMENT AND CONTENT ANALYSIS ON SOCIAL MEDIA

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Abstract

In this study, it is aimed to determine the opinions of online user comments written on videos about robot waiters used in restaurants on the YouTube platform. For this purpose, online user comments on the top fifteen most commented YouTube videos about service robots and robot waiters used in restaurants were analyzed through sentiment analysis and content analysis. In sentiment analysis, a Lexicon (NLP)-based approach was used to polarize the comments into positive, neutral, and negative sentiments. To support the results of sentiment analysis, MAXQDA was used in the content analysis method. According to the results of the analysis, 37.1% of user comments were positive, 32.5% were negative, and 30.4% were neutral. This study is particularly important given that the implementation of robot waiters in restaurants is still in its infancy, as online reviews contribute to the understanding of new services and entities. Methodologically, this research offers an innovative approach, such as sentiment analysis, in determining society's acceptance and opinion of technology in robot-human interaction. The findings are considered important as they will provide theoretical contributions to the literature and practical contributions to sectoral applications.

Keywords: *Robot, Restaurant, YouTube, User reviews, Sentiment analysis.*

RESTORANLARDA ROBOT GARSONLARIN KULLANIMINA YÖNELIK TOPLUMSAL ALGILAR: SOSYAL MEDYADA DUYGU VE İÇERİK ANALİZİ

Öz

Bu çalışmada restoranlarda robot garsonların kullanımına yönelik toplumsal görüşü çevrimiçi kullanıcı yorumları ile belirlenmesini amaçlamaktadır. Bu amaç kapsamında, restoranlarda kullanılan hizmet robotları ve robot garsonlarla ilgili en çok yorum alan ilk on beş YouTube videosundaki çevrim içi kullanıcı yorumları duygu analizi ve içerik analizi yöntemiyle incelenmiştir. Duygu analizinde, Lexicon (NLP) tabanlı bir yaklaşım kullanılarak yorumlar olumlu, nötr ve olumsuz olarak duygu kutupları belirlenmiştir. Duygu analizinin sonuçlarını desteklemek için ise içerik analizi yönteminde MAXQDA kullanılmıştır. Analiz sonuçlarına göre, kullanıcı yorumlarının %37,1'i olumlu, %32,5'i olumsuz ve %30,4'ü nötr olarak belirlenmiştir. Bu çalışma özellikle robot garsonların restoranlarda uygulanmasının henüz yeni olduğu göz önüne alındığında, çevrim içi yorumlar yeni hizmetlerin ve oluşumların anlaşılmasına katkı sağlaması bakımından önemlidir. Metodolojik olarak bu araştırma robot-insan etkileşiminde toplumun teknoloji kabulü ve görüşünün belirlenmesinde duygu analizi gibi yenilikçi bir yaklaşım sunmaktadır. Elde dilen bulguların ise, alan yazına teorik, sektörel uygulamalara ise pratik katkılar sunması açısından önemli görülmektedir.

Anahtar kelimeler: *Robot, Restoran, YouTube, Kullanıcı yorumları, Duygu analizi.*

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1. INTRODUCTION

Studies on the development of service robots in food and beverage services have increased in recent years (Seyitoğlu and Ivanov, 2022; Zhong et al., 2020; Pieska et al., 2013; Tussyadiah and Park, 2018). Depending on their technological features, restaurant robots can serve, cook, collect dirty dishes, entertain guests, dance, communicate with customers, etc. (Berezina et al., 2019). Robot waiters, especially frontline robots in restaurants, perform various tasks such as greeting, seating, taking orders or bringing food to the table (Gaur et al., 2021; Tuomi et al., 2021). The idea that robots will be more involved in both production and service delivery has made it more important for researchers to examine robotization applications in tourism and robot-human relationships and interactions (Özgürel, 2021). However, given that the application of robot waiters in restaurants is still in its infancy, it is stated that research on understanding human-robot interaction is limited (Byrd et al., 2021; Ivanov and Webster, 2017; Murphy et al., 2017). In this context, as a first reference, online reviews are seen as an effective source for understanding new services and formations (Kim et al., 2022). Therefore, online comments are seen as an important data source to understand whether consumers accept the use of robots in the food and beverage sector positively or negatively, along with the reasons. At the same time, it is stated that online comments influence other audiences. According to a study, 84% of internet users take online comments as personal advice, and 68% state that they make a judgment after reading between one and six online comments (Bloem, 2017).

Especially service industry and tourism researchers have adopted sentiment analysis to analyze online reviews (Bagheri et al., 2014; Li, Yuan and Zhao, 2024). Online user comments and social media posts often reflect happiness, disappointment, sadness, joy, and other emotions (O'Leary, 2011). Such emotions can help tourism businesses manage customers and increase profits (Alaei et al., 2019). However, there are limited studies that consider online reviews in the context of robotic services (Luo et al., 2021; Li et al., 2024). Liu (2010) and Shin et al. (2016) specifically focused on user comments on YouTube, stating that YouTube is the most powerful social media platform. Kim et al. (2022) stated that a data collection technique based on YouTube data application programming interfaces (APIs) provides more accurate data compared to survey results.

In this study, it is aimed to determine the opinions of online user comments written on videos about robot waiters used in restaurants on the YouTube platform, which is one of the social media environments. Therefore, the study focuses on the feelings and thoughts towards robot waiters based on the online user comments written on the top fifteen videos with the most comments and the highest popularity on the YouTube platform. In the new normal that occurred with the Covid-19 pandemic process experienced in our world, robots are more visible in the service sector in both production and consumption areas, and the idea that they can replace humans has made it more necessary to understand the human-robot relationship. Therefore, research is important in terms of examining the reflections of human-robot relations, which is a new and constantly renewing field, in the service sector and providing researchers with a different perspective for the future.

Methodologically, by adopting an innovative approach such as text mining, this research adopts a dimension-based (positive, negative, and neutral) grouping of sentiments about the use of robot waiters in restaurants. The sentences with positive and negative recurring words were content analyzed to understand the reasons why they were liked or criticized. This study provides a useful methodological perspective for research on new topics that are not very common to produce and use in practice. Our results have practical implications for future robot restaurant managers and theoretical implications for literature.

2. METHOD

In this study, it is aimed to determine the opinions of online user comments on the videos shared on the YouTube platform about robot waiters used in restaurants. Within the scope of this purpose, answers to the following questions were sought: How is the distribution of positive, negative, and neutral opinions in YouTube online user comments on videos shared about robot waiters used in restaurants (RQ1)? What concerns do users express about the use of robot waiters in restaurants in the most frequently recurring words (RQ2)? Which of the most frequently recurring positive words do users use to express their appreciation for the use of robot waiters in restaurants (RQ3)?

Research on sentiment analysis is categorized under three headings: lexicon-based approaches, machine learning approaches, and hybrid approaches (Maynard and Funk, 2011). In this study, a lexicon-based approach (NLP) was preferred for the classification of online user comments by sentiment analysis. Lexicon-based approaches are divided into two: corpus-based approaches and dictionary-based approaches. In corpus-based approaches, statistics and semantic methods are used to determine the opinion pole, while in lexicon-based approaches, the antonyms and synonyms of the words are found based on the set of sentiment words created, and classification is performed based on the sentiment terms in the analyzed sentences. In order to identify the emotion expressions in the data set, the created emotion terms word is used (Yousef, Medhat and Mohamed, 2014). In this study, analyses were carried out using the lexicon-based approach in relation to the topic under investigation.

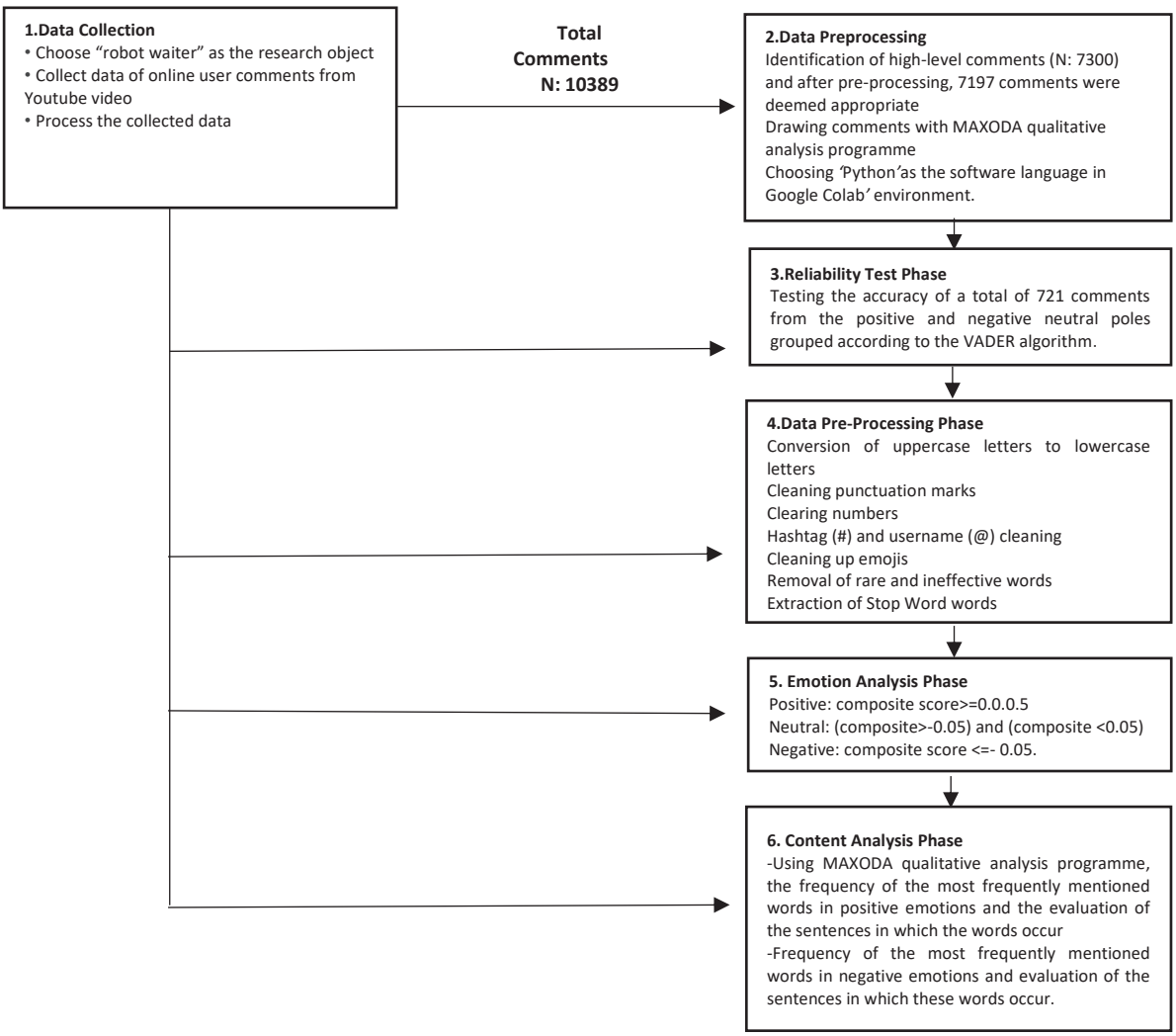

Figure 1: **Methodological approach**

While the population of the study consists of social media environments, YouTube, one of the social media environments, constitutes the sample. The reason for choosing only YouTube among social media environments in the research is that YouTube has a video-dominated infrastructure compared to other social media environments, based on the fact that each social media environment has its own characteristics. This is a rich source of data for the research, especially since users can freely share their views and opinions on the subject of the research under news videos. Especially in recent years, the number of researches on analyzing the content in social media environments has increased considerably, and many different methods have been proposed for sentiment analysis. Among these proposed methods, *"VADER (Valence Aware Dictionary and Sentiment Reasoner)"*, a simple rule-based model developed by Hutto and Gilbert (2014), is used to analyze the texts and

symbols used in texts in social media environments and provides the most reliable results. VADER was compared with other machine learning techniques such as LIWC, Naive Bayes (NB), Support Vector Machines Regression (SWM-R), Support Vector Machines Classification (SWR-C), Maximum Entropy (ME), and eleven dictionary-based algorithms such as LIWC, GI, Hu-Liu04, ANEW, SentiWordNet, and SenticNet. As a result of the comparison, VADER uses 7,500 dictionaries as a basis for evaluating sentiment in social media texts and was found to be the best performing algorithm with an F1 accuracy of 0.96 and 0.84 (better than human evaluation) (Hutto and Gilbert, 2014).

2. 1. Data Collection, Data Set and Preprocessing

In the study, firstly, in order to obtain the data, the data was extracted from YouTube on July 24, 2024. MAXODA qualitative analysis program was used for this process. The steps required for sentiment analysis were carried out by using *"Python"* as the software language in the *"Google Colab"* environment.

In this study, "YouTube" website, one of the social media environments, was used as the data set. In the research, the top fifteen news videos with the most comments were selected by typing *"robot waiters"* and "*robot restaurant*" on the YouTube search engine. The data set of the research is based on the top comments[1] made on these videos on the YouTube platform on July 24, 2024. The YouTube videos that make up the dataset and the number of user meta-comments on these videos are shown in Table 1.

Table 1: **News videos on robot waiters, number of comments**

News Names and URLs (Foreign)	Total Number of Comments	Number of High-Level Comments
1. A Pop-Up Japanese Cafe with Robot Servers Remotely Controlled by People with Disabilities Url: https://www.youtube.com/watch?v=7HB6xLe2f3U	584	464
2. Restaurant of the Future 2024 | Food Robots on The Rise Url: https://www.youtube.com/watch?v=KQkmFZQ-2SA&t=9s	435	169
3. In Beijing, Robot Waitresses Are Happy to Serve Url: https://youtu.be/ZCBbejvb7jA?si=SMiPDALY1l4_Jyx6	86	50
4. Restaurant in China hires robots as waiters Url: https://www.youtube.com/watch?v=3OgFZovYS9U	128	63
5. Dallas Restaurant Turns to Robots to Help Manage Labor Shortage Url: https://www.youtube.com/watch?v=upA6eJJvSLM&t=7s	168	86
6. Robots Shuttle Food to Customers Just Like 'The Jetsons' Url: https://www.youtube.com/watch?v=LshN3QMm0pA	517	341
7. Food delivery robots under attack from vandals, thieves Url: https://www.youtube.com/watch?v=X3C_rpUTYuk	6395	4912
8. Robot restaurant: machines prepare, cook and serve all the food at eatery in China Url: https://www.youtube.com/watch?v=aoJuGDepeZY	569	282
9. Will robots take our jobs and if so which ones? BBC News Url: https://www.youtube.com/watch?v=skG3okhx2TU	80	31
10. Inside China's new robotic restaurant in Guangzhou Url: https://www.youtube.com/watch?v=YPoAjRxyBQQ	373	204
11. Disabled people in Japan control cafe robots from the comfort of their own zhomes Url: https://www.youtube.com/watch?v=6MGPEjeGgj4	369	257

[1] The main comments made on the videos were taken as a basis. Sub-comments that were responses to other users were not included in the research.

12. Local restaurant using robot waiter Url: https://www.youtube.com/watch?v=tJaj3_54S_E&t=22s	107	59
13. Bellabot robot cat server helping customers at restaurants across NYC Url: https://www.youtube.com/watch?v=AwQuZP8i5J0	137	87
14. Restaurants turn to robots to deal with worker shortage Url: https://www.youtube.com/watch?v=8rmj8AvtpM4	129	71
15. Robot-dancing' waitress goes viral online Url: https://www.youtube.com/watch?v=CSm_YyoBLYA	312	224
TOTAL NUMBER OF COMMENTS	**10.389**	**7300**

In the research, all the procedures performed to increase data consistency and quality are called preprocessing. The comments were converted into an Excel file with the help of MAXQDA qualitative analysis program. The preprocessing stages for sentiment analysis were carried out using *"Python"* as the software language in the *"Google Colab"* environment. The preprocessing steps applied to the data set are shown in the diagram below:

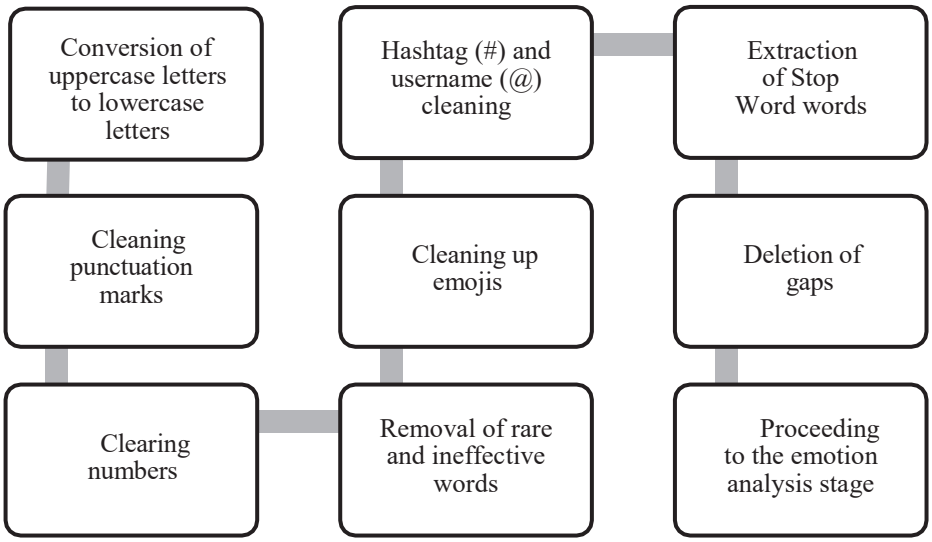

Figure 2: Data preprocessing stages

After the 7300 YouTube user comments obtained for the research were pre-processed, 7197 comments were determined as suitable for performing sentiment analysis. For 7197 positive, negative, and neutral comments, 10% of the number 7197 was taken as a basis to scale the validity and reliability of the sentiment analysis. Accordingly, 240 positive (33 incorrect), 240 negative (15 incorrect), and 241 neutral (42 incorrect) comments were selected equally from each pole, resulting in a validity and reliability of 87.49%.

In the study, "pandas," "numpy," "nltk," "demoji", and "matplotlib" libraries were utilized in data preprocessing stages. Pandas is a library that allows the processing of .csv and .txt files. In the research, it was used to process and analyze the data set converted into .csv files. NumPy library is used for scientific computation. In the research, it was used in various mathematical calculations of emotion values in relation to emotion analysis. The Ntlk library is an open-source library developed in Python language to work with natural human language data. In the research, it was used to clean English stop words. Demoji is used to convert facial expressions (emojis) used to express emotion into text. In the research, the emojis in the data set were identified and cleaned. Matplotlib is a library used to create various visuals and graphics. In the research, it was used to visualize the emotion analysis results obtained from the data set.

2. 2. Data Analysis

In the research, after preprocessing the dataset for sentiment analysis, the operations were performed using *"VADER"*, one of the popular libraries of NLP (Natural Language Processing). The VADER algorithm provides four values for the research dataset: positive, negative, neutral, and compound. Positive, negative, and neutral values indicate how positive, negative, and neutral the texts in the dataset are. The compound value is a total score value that includes positive, negative, and neutral values. According to the Vader algorithm, the composite value is a metric that calculates the sum of all dictionary ratings normalized between -1 and +1. Between the two values, -1 indicates the most extreme negative, +1 indicates the most extreme positive, and 0 indicates that the text contains a neutral sentiment. In this study, each YouTube comment in the dataset was processed through VADER to obtain sentiment scores, which were then categorized according to a standard threshold value specified below: 1- Positive: composite score > = 0.0.5 2- Neutral: (composite > -0.05) and (composite <0.05) 3- Negative: composite score <= - 0.05. These values are the most useful metrics for identifying sentiment in a given text (Bonta, Kumaresh and Janardhan, 2019).

In the study, the data obtained from the results of the sentiment analysis (positive, negative, and neutral) for content analysis were transferred to the MAXQDA qualitative analysis program. The program was used to obtain the frequency values of the most frequently used words in the positive, negative, and neutral sentences obtained as a result of the sentiment analysis and, at the same time, to reveal the relationship of these words with the sentences in the sentiment analysis. In addition, a word cloud was created by visualizing the words according to their sizes and colors with the MAXQDA program to support the sentiment analysis based on the words in positive, negative, and neutral sentences.

3. FINDINGS

It is important to determine the emotional states of consumers in the field of gastronomy, which is a constantly developing field, especially in terms of seeing the current reflection of robot-human relations in food and beverage businesses and gaining a perspective on the future. In the study, 7300 top comments were selected from the data set consisting of 10,389 user comments obtained through the YouTube social media environment, and after these top comments were preprocessed, it was determined that 7197 comments were suitable for emotion analysis. As can be seen in Figure 3, 7197 comments are grouped into three different sentiment classes as positive, negative and neutral and are also expressed as numbers and percentages.

Figure 3: Sentiment classification of user comments

Within the scope of the research, the sentiment analysis of user comments under 15 video content about robot waiters on the YouTube platform is shown in Figure 1. In this direction, within the framework of the word-based "VADER" classification, it was determined that 37.1% of the comments were positive, 32.5% were negative, and 30.4% were neutral.

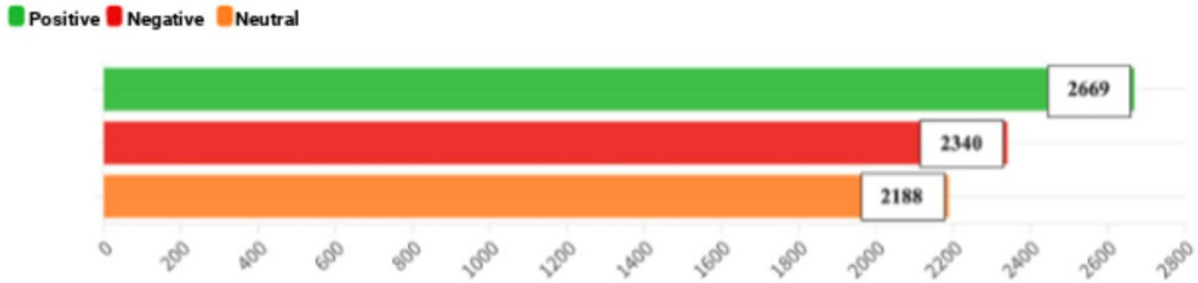

Figure 4: Frequency frequencies of user comments

After pre-processing 7300 top comments about the use of robots in restaurants, it was determined that 2669 of the remaining 7197 comments were positive and 2340 were negative, while 2188 comments were neutral. Thus, it was concluded that there was a predominantly positive attitude towards the robot waiters discussed within the framework of the research, with negative and neutral emotional states in the second and third places, respectively. In addition, it can be said that there are not very serious differences between the emotional states, and these states are almost equal or very close to each other.

Table 2: Examples of user comments, scores and labels for robot waiters

User Comments	Emotion Analysis Scores	Tags
give big shout thought really robotic awesome	{'neg': 0.0, 'neu': 0.578, 'pos': 0.422, 'compound': 0.6573}	Positive
cool wish much success great idea	{'neg': 0.0, 'neu': 0.135, 'pos': 0.865, 'compound': 0.9153}	Positive
best human robot beautiful	{'neg': 0.0, 'neu': 0.198, 'pos': 0.802, 'compound': 0.8442}	Positive
want nothing robots ai boxes table order bad enough talk complete lack service	{'neg': 0.339, 'neu': 0.585, 'pos': 0.076, 'compound': -0.6705}	Negative
humans sent unemployment line,	{'neg': 0.492, 'neu': 0.508, 'pos': 0.0, 'compound': -0.4404}	Negative
seriosly dont make robots working humans end badly	{'neg': 0.307, 'neu': 0.693, 'pos': 0.0, 'compound': -0.4767}	Negative
robot	{'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0}",Neutral	Neutral
robots turning humans turning humans turning robots,"	{'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0}", Neutral	Neutral
ai everywhere now a days	{'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0}", Neutral	Neutral

As can be seen in Table 2, there are sample user comments, sentiment analysis scores, and tags of the comments made on the YouTube platform for the use of robots in restaurants. In line with the sample user comments in the table, the polarity score of the comments, in which no emotional state is specified and mostly question statements are included, is stated as "0". This indicates that the comment is neutral, and a neutral label is assigned as a label. On the other hand, the different scores assigned to comments other than neutral comments are the result of calculating the words in positive or negative sentences during sentiment analysis.

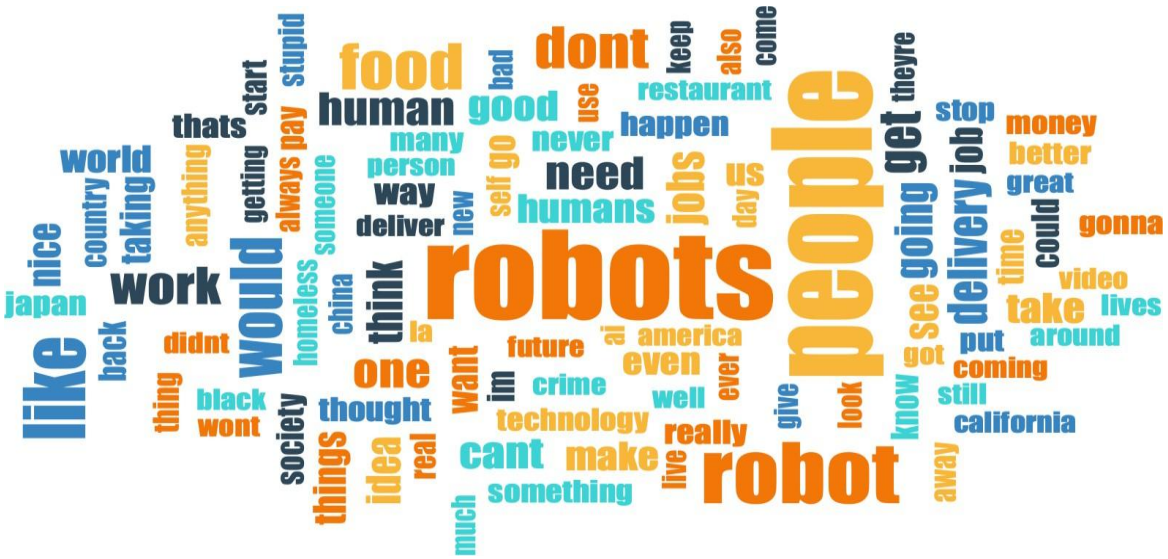

Figure 5: Word cloud of user comments on the use of robots in restaurants

A word cloud was created from user comments about the robot waiters considered in the research. As can be seen in Figure 5, in the word cloud created in MAXQDA, the words in the user comments were visualized according to their size and color. While the most frequently used words in the cloud are visualized as dark and large, it is understood that the words visualized as light and small are used less frequently in the comments (Yaşa, 2022). In this direction, if an evaluation is made on the word cloud, it is seen that the most frequently repeated word is "robots", while the other words are "people, robot, like, food, would, don't, get, work, delivery". On the other hand, the frequencies and percentage distributions of these words are given in Table 3 below.

Table 3: Frequencies and percentages of the top 10 most frequently used words

Total Word Count= 52434	Frequency	%
Robots	998	1,90
People	960	1,83
Robot	622	1,19
Like	524	1,00
Food	418	0,80
Would	394	0,75
Don't	357	0,68
Get	306	0,58
Work	290	0,55
Delivery	256	0,49

When the frequency and percentage distribution of the most frequently used words in user comments are evaluated, it is found that the word "robots" is used n=998 (1.18%) times, while the most frequently used frequency order of the other words are "people" n=960 (1.83%), "robot" n=622 (1.19%), "like" n=524 (1%),00), "food" n=418 (0.80%), "would" n=394 (0.75%), "don't" n=357 (0.68%), "get" n=306 (0.58%), "work" n=290 (0.55%) and "delivery" n=256 (0.49%) times, and were among the top 10 most frequently used word groups in user comments. In connection with the research topic, it can be said that it is usual that the most frequently used words are "robots" and "people". The emotional experience of the service recipient in restaurants is an issue that should be evaluated together with the interaction between human and robot. This situation also reveals the reliability of the analysis.

Table 4: **Frequencies and percentages of the top 10 negative words in comments**

Word Frequency in Total Number of Negative Comments=2340	Frequency	%
Don't	357	0,68
Job	248	0,47
Stupid	92	0,18
Homeless	89	0,17
Destroy	82	0,15
Lost	39	0,07
Crime	26	0,05
Unemployment	21	0,04
Expensive	19	0,04
Damage	11	0,02

The total number of words in user comments about robot waiters on the YouTube social media platform is 2340. When the frequency and percentage distributions of the most frequently used negative words in user comments are examined, it is found that the word "don't" is used the most n=357 (0.68%) times, while the percentage distributions of the other words are "job" n=248 (0.47%), "stupid" n=92 (0,18%), "homeless" n=89 (0,17%), "destroy" n=82 (0,15%), "lost" n=39 (0,07%), "crime" n=26 (0,05%), "unemployment" n=21 (0,04%), "expensive" n=19 (0,04%) and "damage" n=11 (0,02%).

As a result of the content analysis of users' negative online comments, it was determined that the use of robots in the service sector is seen as absurd, and the use of robots in many professions may cause unemployment in the sectors. Posts that people will have livelihood problems and crime rates will increase due to robots come to the fore. *(Humans sent unemployment line*). On the other hand, it was mentioned that they found robots more expensive and slower (*Things objectively stupid slower expensive hiring human)*, that robots can replace human labor (*Robots way world break damage quit trying to replace real people*), and that they will cause unemployment in the waiter profession in the future (*Things objectively stupid slower expensive hiring human).* In addition, before robots, with the emergence of the concept of self-service, the need for labor force decreased with the emergence of the concept of self-service, and similarly, they mentioned that this technology could cause similar problems in the specified occupational group (*Robots replaces human work force many fields already bit worrying tbh dont understand many people cant see yet demand human workforce already went dramatically factories stores banks sectors follow banking uk example many people lost jobs self service),* However, they stated that it will not be preferred to the human factor in the service sector (*Dont see permanent solution trendy think customers prefer waiter pulse)* and that it may cause destruction by negatively affecting the country's economy (*Robots will show us* destroy economy*).*

Table 5: Frequencies and percentages of the top 10 positive words in comments

Word Frequency in Total Number of Positive Comments=2669	Frequency	%
Like	524	1,00
Good	375	0,71
Idea	192	0,37
Modern	113	0,22
Wage	55	0,10
Employ	49	0,10
Service	49	0,10
Cool	42	0,08
Tip	40	0,08
Fast	38	0,07

When the frequency and percentage distributions of the most frequently mentioned positive words in 2669 positive user comments are analyzed, it is determined that the word "like" is used the most n=524 (1.00%) times, while the percentage distributions of the other words are "good" n=375 (0.00%),71%), "idea" n=192 (0,37%), "modern" n=113 (0,17%), "wage" n=55 (0,10%), "employ" n=49 (0,10%), "service" n=49 (0,10%), "cool" n=42 (0,08%), "type" n=40 (0,08%) and "fast" n=38 (0,07%).

As a result of the content analysis of the positive online comments of the users, they expressed positive opinions that it is a creative idea that robots look like humans (*Thought china created human **like** robot), that* it is a good idea to use *robots* in unsafe areas (*Robots used **good** areas unsafe places*) and especially during pandemic periods such as covid (*Limit **employees** robots free least robots cant catch covid)* (*Really thought good **idea** seriously)*. They also mentioned that the fact that there is no increase in salary compared to normal employees will provide minimum expense for the business (*Im engineer good news im also pro worker minimum **wage)*** and, at the same time, there will be no tip payment for customers (*Always looking **tip** bye bye).* On the other hand, there were positive comments about the robot waiters in terms of the speed of speech in service and mutual communication with the customer (*Wow creator speaks really **fast fastest** fastest ive seen japanese person speak oh robots cool*).

4. DISCUSSION AND CONCLUSION

This study, using sentiment classification with VADER, provides an overview of robot waiters through YouTube comments. Previous studies have shown that sentiment analysis of user feedback provides important insights into understanding the social perception of technological products. For example, Jain and Katkar (2015) examined user comments on social media using sentiment analysis methods and provided findings on how such analysis can be used to improve consumer satisfaction. In another study, Jain et al. (2023) used sentiment analysis techniques to evaluate the impact of reviews on customer satisfaction with technology products. Such studies emphasize that user feedback is an important source for improving technology products. Therefore, this study shows the distribution of positive, negative, and neutral user comments about robot waiters and helps to improve user experiences. The findings of this study can be used as a basis for future research to better understand the social acceptance and impact of robotics.

Looking at the results obtained from the study; the fact that positive comments stand out with a high rate of 37.1% indicates that robot waiters are liked by some users and offer a positive experience. On the other hand, 32.5% of negative comments indicate that robot waiters are criticized by some users and various negatives are expressed. The 30.4% rate of neutral comments indicates that users do not have a significant emotional state about robot waiters.

The frequency of use of terms such as "food", "delivery" and "work" in the most frequent words used in the research emphasizes that user experiences in food service and delivery services are important. Improvements should be made on how robot waiters can provide these services better, and strategies should be developed to increase customer satisfaction. The frequencies of the words "like" and "don't" in user comments show that positive and negative emotions are expressed intensely.

The finding of the most frequent negative words within the scope of the research shows that users find the use of robot waiters in the service sector "stupid" and express their concerns that this application may have various negative consequences. In particular, the words "job" and "unemployment" reflect concerns that robots will cause unemployment problems by replacing the human workforce. In addition, words such as "homeless" and "crime" reveal concerns about the socioeconomic effects of robotics. Similar previous studies have generally examined the societal impacts of technological developments in terms of the labor market and social security. Brynjolfsson and McAfee (2014), in their book "The second machine age", discuss the changes in the labor market caused by technological automation and its social impacts. Chui, Manyika and Miremadi (2016) emphasize in their study that automation may destroy some professions, but it may also create new job opportunities. These findings, in line with other studies, show the importance of developing strategies to balance both the positive and negative aspects of technological changes.

The positive user comments in the study reveal that robot waiters are accepted as a creative and modern solution in sentences with words such as “good”, “modern”, “cool”, and that cost-effectiveness is seen as an important advantage in sentences with the words “type” and “wage”. Therefore, it positively emphasizes that robot waiters reduce costs and don’t require tip payments. For example, in a study conducted by Wadawadagi and Pagi (2020), both functional and cost advantages of robot technologies were emphasized. At the same time, it was determined that the sentences containing the words “service” and “fast” emphasized the positive features of service quality and efficiency. Naik et al. (2023) also stated that robot waiters can provide consistent and reliable service with their ability to work without the need for breaks or rest. It is stated that since it can carry more than one meal at the same time in terms of service, it can reduce the waiting time of customers and help them save time.

Another finding was that the use of robots was evaluated positively during pandemic periods. In such situations, the safety and hygiene advantages provided by robot technologies can be introduced more widely, and strategies can be developed for these usage scenarios. Research in the literature on the safety and hygiene advantages of technology in extraordinary situations such as pandemics shows that these features are considered an important factor by users (Bai et al., 2020).

4. 1. Practical Implications

In practical terms, the study helps businesses, policymakers, and users to develop strategies to use robot technologies more effectively and efficiently. The research findings emphasize the need to develop concrete strategies to improve user experiences of robot waiters. In order to increase positive user experiences, technical and design improvements should be made to make robots more effective in food service and delivery processes. In addition, information campaigns and training programs should be developed to address users’ concerns about the unemployment problem in the labor market, the disadvantage in the economy, the negativity in service quality, and negative comments about the cost of acquiring a robot. In this way, social acceptance of robotics can be increased and its potential negative impacts minimized.

4. 2. Theoretical Implications

The aim of this study was to analyze the social perception of robot waiters and user feedback. The results obtained using the VADER sentiment analysis method provide important theoretical contributions in terms of the acceptance of technological products and the development of user experiences. The research findings show that robot waiters are evaluated both positively and negatively by users. While the high rate of positive comments supports the acceptance of the advantages of the technology, such as innovation and cost-effectiveness, negative comments reflect users’ concerns about possible negative impacts on the workforce. This provides an important framework for understanding the societal impacts of technological automation. The findings are in line with previous studies such as Brynjolfsson and McAfee (2014) and Chui et al. (2016) and reinforce the debate in the literature on the effects of automation on labor dynamics. The research results contribute to the understanding of the factors that drive user perception of robotics and offer a rich perspective to the technology acceptance literature by proposing new theoretical frameworks. In particular, suggestions for improving user experiences shed light on future research.

4. 3. Limitations and Future Studies

This research is limited to online user comments on news videos shared on the YouTube platform about robot waiters. Therefore, future research can extend these findings to analyze a more comprehensive user perception and experience. Segmenting users according to their demographic characteristics, technology acceptance levels, and experiences can provide a more detailed analysis of different user groups’ perceptions of robot waiters. For a deeper understanding of the user experience, user satisfaction surveys and in-depth interviews can be conducted. This can better reveal the reasons behind positive and negative perceptions. In this context, future studies should investigate which strategies can be effective to increase social acceptance of such technologies.

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