Detection of interaction-based knowledge for reclassification of service robots: big data analytics perspective

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Abstract

With the advancement of artificial intelligence technology, the robot industry in human- robot interactive service has rapidly developed. The purpose of this paper is to uncover user acceptance of human-robot interactive service robots based on online reviews. Extract reviews the public service robots and the domestic service robots from YouTube uses word2vec, sentiment classification, and LDA (Latent Dirichlet Allocation) analysis methods for research. The results show that in the interactive technology, the public service robots, the domestic service robots, and the service robots can well receive the user's speech, gestures, and understanding of emotional states and navigating with and around. However, collaborating with humans, users may be more fearful and worried. At the same time, the positive topic of the public service robots is experience value, and the negative topic is system quality. The positive topic of the domestic service robots is anthropomorphism, and the negative topic is perceived intelligence.

Keywords: Human–robot interactive, service robot, Word2Vec, Sentiment Classification, Latent Dirichlet Allocation.

1. Introduction

With the development of artificial intelligence technology, the field of robots is changing at an unprecedented speed (Butler, 2016). Robots have evolved from fixed robots that perform simple and repetitive actions to intelligent systems that can autonomously sense, learn, and execute actions, and can also cooperate with other robots and humans. At present, although many robots are operating in the industrial environment, with the development of intelligence, many robots provide services for humans in the workplace and home (Murphy et. al, 2017).

In the era of intelligence, the three core elements of service robots are perception, cognition, and action [Stock and Merkle 2017]. The human–robot interaction service robot is the interaction between one or more people and one or more robots [Wirtz et al. 2018]. At present, the human–robot interaction technology has evolved from single-point technology applications such as speech recognition and face recognition to multimodal computing that integrates speech, vision, and semantics [Belanche et al. 2020]. The human–robot interactive service robots are accelerating penetration into various industries. Human– robot interaction service robots can provide various services. Not only can automated services be provided for users in public places, such as hotels, restaurant waiters, public shopping assistants [Chen et al. 2017], etc. At the same time, it can be used in the family, to accompany the elderly and children, as well as for entertainment and education [Fridin and Belokopytov, 2014]. Human-robot interaction service robots can provide users with more convenience, better experience and improve the quality of life of users. Although this type of interactive service robot can be applied to various fields, it also has many shortcomings. Interactive service robots can collect various information of users, there are privacy issues, and the appearance of service robots is very similar to human, but the behavior is not like human, lack of emotional communication with users, and there will also be interruptions in human–robot interaction [Woods et al. 2004], there may be problems such as the occurrence of injury accidents caused by mechanical failures

There are many types of interactive service robots. The practicality of robots in the travel industry mainly uses online survey methods to collect data (Kerwenoael et.al, 2020). The use of robots as

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assistants for medical professionals in hospitals is mainly for quantitative analysis through face-to-face interviews (Turia et.al, 2018). Robots are used in restaurants to study user perception with trust, interactivity, and output quality as variables, and face-to-face surveys are mainly used for research(Lee et. al, 2018). At the same time, retailers use service robots to enhance customer service and improve their operations (Joe and Song, 2019). Through previous research focused on tourism, hospitals, restaurants, retail and other industries, the main research is to understand the user's acceptance of service robots, to have a deeper understanding of the user's acceptance of service robots, this research mainly studies interactive service robots, and divides service robots into two categories: public service robots and home service robots. This part of the research has deficiencies. At the same time, previous studies mainly used survey methods. And text mining can extract a large amount of unstructured data through social platforms to better understand users' attitudes (Salloum et. al, 2017). Therefore, this research mainly uses text mining methods to study interactive service robots.

In this digital age, one of the most powerful promotional tools is the Internet. The Internet can promote users to express their views and opinions on various social media (Reino and Hay, 2016). Among them, YouTube is one of the more popular social media (Ananda and Wandebori, 2016), YouTube is a multicultural platform where people from different parts of the world upload videos. It provides users with various types of videos, users can choose their favorite videos to watch according to their preferences, and can also express their attitude towards watching videos, or recommend favorite videos to other friends, so the YouTube video sharing platform has developed into a marketing communication tool, YouTube platform has a large number of videos and comments. Most of the previous questionnaire survey methods have been used for research on service robots, and the research on service robots by YouTube's text mining method is insufficient. Previous studies have shown that analyzing online reviews can provide insight into users' opinions and attitudes toward products. Therefore, the research purpose is to uncover user acceptance of the human- robot interactive service robots based on YouTube online reviews.

The research questions in this study are as follows: first, what is important to attract users interact with the human-robot interactive service robots? Second, what are the phot sots of the public service robots, the domestic service robots? Third, what are the differences between the public service robots, the domestic service robots?

2. Literature Review

2.1. The human–robot interaction of service robot

The service robots are robots that liberate humans by performing semi-autonomous or fully autonomous operations and performing human tasks. They are used in various intelligent robots in the home or public service field. The application scenarios of service robots are complex and diverse and can be applied in retail, medical, education, entertainment, etc., to achieve diversified and complex functions such as guided reception and accompanying teaching

At present, in the research of human–robot interaction technology, vision-based interactions, such as gesture interaction (Luo and Wu, 2012), face recognition. Research based on auditory interaction, such as speech recognition. Related research based on tactile interaction, such as touch sensing (Kim et. al, 2010). These studies are mainly based on the user's interaction with the robot to conduct a single speech interaction, face recognition, gesture recognition and so on. It does not analyze the multi-dimensional intelligent way of human–robot interaction. To make up for the shortcomings of the above research, this study combines human–robot interaction with user experience, and deeply explores the acceptance of intelligent technology represented by the human–robot interaction service robots.

2.2. The public service robots

The public service robots mainly refer to service robots for public or commercial tasks, including service robots such as hotels robots, restaurants robots, banks robots, retail robot, hospital robot, etc. The public service robots are widely used, such as shopping guide robots in shopping malls, serving customers in hotels, and welcome robots that can provide consultation in banks and so on. With the advancement of robot technology, there will be more and more application scenarios of the public service robots.

The previous research mainly focused on retail, restaurants, hotels, hospitals, and other fields. At the same time, through related research on the public service robots, it was found that the public service robots can improve service quality and efficiency, have practical value, and make the user experience good, the high service efficiency makes users willing to use it. This study integrates related research in various fields, and at the same time, human– robot

interaction technology is added to study the user's acceptance of the public service robots.

3. Conceptual Background

3.1. Human–robot interaction technology

Human–robot interaction technology is a product of the development of intelligence. Human–robot symbiosis can be traced back to Lickliter who in 1960 envisaged a situation where machines could work side by side with humans (Licklider, 1960). To be able to produce interactive behaviors, the basic processes of perception, cognition, processing, and expression are required. Service robots can better perceive the user's emotions through face recognition and better communicate with users. Automatic emotional recognition mainly refers to the process in which the robot can analyze and process the signals collected by the sensor to understand the emotional state of the user. It is not a simple task for service robots to recognize user emotions. Using speech recognition technology to extract emotional words in speech to detect user emotions. For the public service robots, they can be applied to all public places to assist human beings in their work. For the domestic service robot can play the role of assistant in the family, play the role of companion, education, entertainment. Therefore, the use of service robots to work together with users and to assist and accompany users plays an important role in the acceptance of service robots by users.

3.2. Experience Value

Experience value refers to the perceived value in the process of experiencing the product. During the experience of the service robot, the user is attracted by the design, which brings the user a visual and entertaining experience, and at the same time can meet the various needs of the user and make the user have positive emotions. At the same time, it can also provide users with various required knowledge and skills, and provide users with reliable services, so that users can perceive the value when purchasing and using service robots. Providing users with a better experience will generate positive satisfaction for users (Eroglu et. al, 2003) Therefore, experience value can be an important factor for service robots

3.3. System Quality

System quality refers to the quality of the information system processing system itself (Delone and Mclean, 1992). It mainly measures the characteristics of the system in technical processing. System quality is measured by attributes such as usefulness, availability, responsiveness, reliability, and flexibility. For service robots that can provide users with useful, reliable, and flexible services, they will have positive satisfaction. Generally, system quality will have a positive impact on satisfaction. Therefore, system quality can be an important factor for service robots.

3.4. Anthropomorphism

Human–robot interaction technology can promote the interaction between service robots and users. In the process of interaction, it has a human image and may induce users' positive views and attitudes (Tussvadiah and Park, 2018). In other words, anthropomorphism can enhance the things that do not have human actions and emotions into foods that have the same actions and emotions as human, to enhance the interaction with users. Personification can help users have a positive impact on service robots. Therefore, anthropomorphism can be an important factor for service robots.

3.5. Perceived Intelligence

Perceived intelligence refers to the ability of interactive service robots to perceive the knowledge and skills of various service places. When interactive service robots interact with users, they can interact with users flexibly and provide users with various needs. For example, in public places, they can meet the needs of users in different places. Domestic service robots can provide users with companionship, education, and entertainment, to meet various needs of users. The perceived intelligence of service robots mainly depends on their abilities Perceptual intelligence has a positive attitude towards users. Therefore, perceived intelligence can be an important factor for service robots.

3.6. Perceived Enjoyment

Perceived enjoyment mainly refers to the ability to feel happiness when using certain technologies or performing activities through these technologies (Hussain et.al, 2016). For interactive service robots, users are using the services can feel the fun brought by the service robots, which is the user's interest in the service robots. Therefore, the inherent interest in users is an important factor that enables users to use service robots all the time. Perceived enjoyment will produce a positive attitude towards users. Therefore, perceived

enjoyment can be an important factor for service robots.

3.7. Service Quality

Service quality is mainly the gap between the service provided to users and the expected service provided by users (Lewis and Booms, 1983). In other words, the expected service quality is the process by which users describe the overall quality service. For the service provided by the service robot to the user, the user can feel a higher level of service than expected, and the user can better accept the service robot. Providing users with reliable and high-quality services has a positive impact on user satisfaction. Therefore, service quality can be an important factor for service robots.

4. Research Methodology

4.1. Research Procedure

In this study, to verify the research purpose, the first step is pre-processing the public service robots, the domestic service robots, and the service robots of the dataset, mainly to remove stop words. After that, the pre-processed data is fed to Word2Vec skip-gram to learn word embedding. The comments of the public service robots, the domestic service robots and the service robots are used to obtain related word vectors using Word2Vec. Then, the support vector is used to classify emotions of the public service robots, the domestic service robots and the service robots, the positive and negative comments obtained will be analyzed using LDA to get relevant keywords, and then the keywords obtained by LDA will be related to word vectors using Word2Vec. The results obtained are visualized using Multidimensional Scaling (MDS) and explain the purpose of the verification study and the results obtained.

4.2 Data Collection

This research mainly collects data on YouTube. Therefore, this research mainly crawled on YouTube related reviews of various service robots from 2009 to 2020. The main method of collection is to enter keywords classified by service robots on YouTube. According to IFR, service robots are mainly divided into two categories, including the public service robots and the domestic service robots. The public service robots are divided into hotel robots, restaurant robots, bank robots, retail robots, hospital robots, library robots, airport robots, and traffic robots. The domestic service robots mainly include elderly and child support robots and educational and entertainment robots. Among them, elderly child support robots mainly include family companion robots, educational companion robots, mobile assistant robots, and nursing home robots. Educational and entertainment robots mainly include educational robots, classroom robots, multimedia robots, and remote sensing robots. The ID, title, date and comments of the videos are collected, and the duplicate or irrelevant videos are deleted through manual inspection according to the ID and title of the collected videos. The total number of videos and comments collected for public service robots and the domestic service robots are shown in the table 1 and table 2.

Table 1. The data characteristic of the public service robots.

Topics	Number of videos	Number of reviews
Hotels Robots	923	273,622
Restaurants Robots	230	53,233
Banks Robots	452	255,277
Retail robots	490	105,954
Hospital robot	503	208,760
Library robot	540	48,318
Airport robot	495	117,843
Traffic robot	536	93,162

Table 2. The data characteristic of the domestic Service Robots

Topics	**Number of videos**	**Number of reviews**
Family companion robots	561	325,288
Education companion robots	459	211,038
Mobile assistant robots	499	789,304
Nursing homes robots	501	331,246
Education robots	568	436,508
Classroom robot	501	117,854
Multimedia robots	462	139,023
Remote presence robots	561	57,564

5. Data Analysis and Results

5.1. Distributed representation of word meaning

This research mainly visualizes the public service robots, the domestic services robots, and the service robots, and better finds out the hot words and differences of various service robots.

By using Word2Vec to analyze various public service robots. “Unattended” in the highly related words of hotel robots, “Recognition” in the highly related words of airport robots, and “Driverless, Autopilot, Automatic” in the highly related words of traffic robot. Technology accumulation is the key factor in the development of public service robots. At the same time, through Word2Vec analysis, the results obtained show that in the related words of hotel, restaurant, bank, retail, hospital, library, airport, and traffic, each type of scene has different needs for users. For example, Users pay more attention to “Mansion, Clerk, Bedrooms, Downtown, Rent, Licensed, Workspace, Emulators, Lounge” for hotel robots. The words highly related to restaurants robots mainly include “Supplier, Customers, Processed, Cooks, Restaurant, Checkouts, Employing, Manager, Trades, Purchase”. The words highly related to banking robots mainly include “Lending, Investments, Financed, Payments, Banks, Borrowing, Savings, Mortgages, Investors, Fund”. The words highly related to retail robots mainly include “Sourcing, Produce, Trucking, Cashiers, Remuneration, Sales, Checkouts, Customer, Employs, Stores”. The words highly related to hospital robots mainly include “Hospitals, Drug, Alcohol, Patients, Staff, Doctor, Medical, Emergency, Nurses, Injured”. The words highly related to library robots mainly include “Site, File, Server, Websites, User, Browser, Apps, Feature, Installed, Online”. The words that are highly related to airport robots mainly include “Assistant, Device, Stabilized, Airliner, Visits, Crowded, Landings, Functioned, Arrives”. The words highly related to traffic robots mainly include “Vehicles, Road, Engine, Cars, Drive, Passenger, Parking”. It can be seen that accurate industry demand is a key factor for public service robots.

The word vectors obtained by hotel robots, restaurant robots, bank robots, retail robots, hospital robots, library robots, airport robots, and traffic robots in the public service robots were visualized using MDS, as shown in figure 1. The figure shows that various public service robots have obtained different word vectors, and each type of public service robot has different application scenarios.

According to the results of various domestic service robots, among the domestic service robots, “Branded” is mentioned in the multimedia robot. The brand is necessary for the development of domestic service robots. The brand represents safety and quality. Among the mobile assistant robots, there are remote “Controller, Emulator, Bluetooth, Wi-Fi, Projector, Accessories, Developer, Smartphone, Touchscreen, Hotspot”. The word vectors of the multimedia robot include “Illuminating, Shuffle, Vocalists, Streamed, Prompted, Walkman, Emulator, Lidar, Patrol”. The word vector of the remote presence robots includes “Controller, Wheeled, Receiver, Webcam, Tracking, Wireless, Image, Remote, Chip, Monitor”. The results show that the research and development of core technology innovation in domestic service robots are very important. Technological innovation represents the improvement of intelligence and is the basis for providing users with companionship, education, entertainment, and other different uses. The main word vectors of the educational companion robots are “Testing, Educator, Developmental, Teaching, Discipline, Learners, Teach, Educates, Schoolwork, Primary”. The main word vectors of the family companion robots are “Invited, Friends, Families, Wife, Mothers, Lucky, Friendly, Apartment, Bed, Neighbors”. The main word vectors of the nursing homes robots are “Trades, Appointment, Nursing, Diagnostics, Consulting, Upkeep, Surgeries, Supervising, Occupations, Careers”. The word vector of the classroom robots is “Classrooms, Offices, Painstaking, Desks, Schools, Curriculum, Students, Grading, Schooling, Tests”. The research and development of domestic service robots with brand and core technology innovation is a key factor in their development.

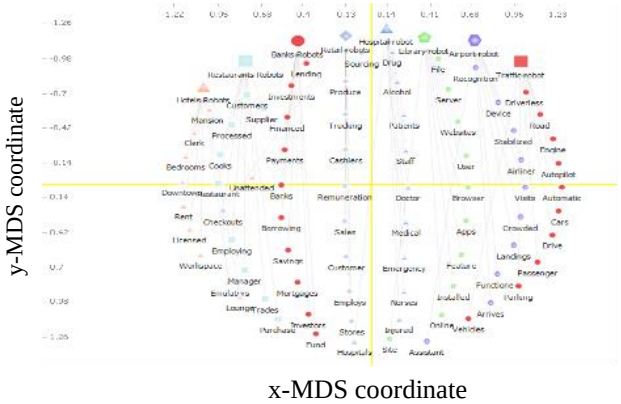

Figure 1. Topic classifications for public service robots.

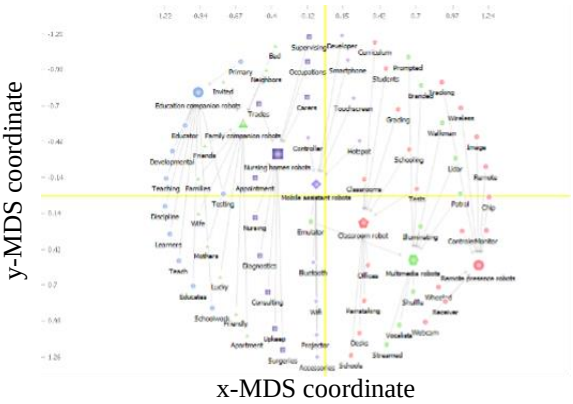

Figure 2. Topic classifications for domestic service robots.

The word vectors obtained by family companion robots, educational companion robots, mobile assistant robots, nursing home robots, classroom robots, multimedia robots, and remote sensing robots in the domestic service robots were visualized using MDS, as shown in figure 2. The figure shows that various types of the domestic service robots have obtained different word vectors, and each type of the domestic service robot has different functions, bringing a good experience to users and meeting user needs.

According to the results of various service robots, the public service robots are highly similar to words such as "professionals, customer, nursing, maintenance, services, manager, volunteer, industries, innovate, sector, purchase, entrepreneurs, providing, demanding, overseas, automatons, relying, cashiers, managing, workplaces, trades, professions, requiring, hiring, automating, schemes, retail, manage, deliver, assistance, competing, secure, roads, workforce". The results show that public service robots are mainly able to meet the needs of different scenarios. Service robots can be more automated, rely on service robots to compete, provide high-quality and safe services, and create a safe and reliable scene. The main word vectors of the domestic service robots are "Automatons, unprofitable, cheaply, costs, upkeep, supplying, occupations, manpower, providers, nursing, oversee, replacements, locations, maintaining, conscientious, schemes, customer, productivity, labors, supplied, unemployed, landscaping, clothing, laboring, employing, apartments, laborer, workplaces, obtains, serviced". The results show that in the household field, there are mainly basic needs such as efficiency improvement, education, entertainment, and leisure, which can be supported by more automated and intelligent technologies to provide users with professional services to satisfice their needs. Highly similar words for service robots include "automated, cashiers, disappear, replacing, maintenance, replaced, customer, repair, manager, repairing, Eventually, entertainment, employ, obsolete, automations, workforce, cheaper, oversee, machines, innovate, manufacture, restaurants, transportation, manufacturing, nursing, purchase, maintaining, machines, Jobs, professions, retail, cashier, occupations, replacement". The results show that service robots are mainly able to automate, replace labor, save costs, and provide experiences for different service industries.

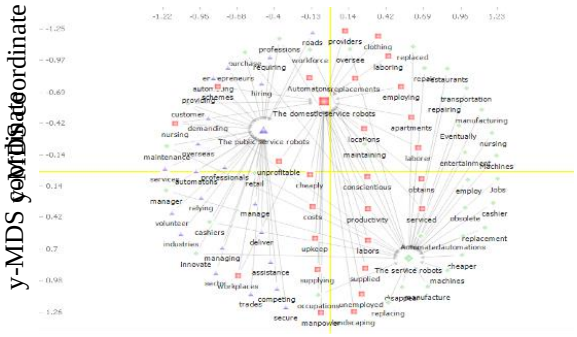

Figure 3. Topic classifications for various service robots

The word vectors obtained by public service robots, the domestic service robots and the service robots were visualized using MDS, as shown in figure 4. The figure shows that public service robots, the domestic service robots, and the service robots have obtained different word vectors. Each type of service robot must meet the needs of users. But the application scenarios of each type of service robot are different. The public service robots are to meet the needs of the public, such as restaurant waiters, public shopping assistants, but the domestic service robots are to meet the needs of user companionship, education, and entertainment.

By using the Word2Vec method to analyze the human–robot interaction the public service robots, the domestic service robots, and the service robots, as shown in Table 9. Automatic speech recognition, Gesture recognition, Expressing and understanding emotional states, collaborating with humans, navigating with and around, the word vectors obtained by the public service robots, the domestic service robots, and the service robots are consistent. Among them, the word vector obtained by automatic speech recognition is "Technique, communication, capture, correctly, connection, precise, user", combined with text corpus, the comment content is concentrated on automatic speech recognition technology to accurately receive user information. The word vectors obtained by gesture recognition include "Operator, sensing, accessories, wiring, imaging, detects, capture". The robot can detect and acquire the user's gestures to understand and satisfice the user's needs. The word vector obtained in expressing and understanding emotional states is "Convey, emotion, anger, express, experiences, personality, perceive ". The result of the word vector obtained shows that the service robot can perceive the user's emotional characteristics, and the user is expressing various emotions, such as anger, etc., and each user has different personality characteristics, service robots can perceive. The word vector for collaborating with humans is "Automatized,

purposeless, unpredictability, tedious, worries, Sentient, frightening". Service robots provide users with automated services, but these services are supported by some technologies. The process of users providing services and automating services is unpredictable. Therefore, users are more worried and afraid of the services provided by service robots. The word vector of Navigating with and around includes "Conscious, foreseeable, automations, adaptable, humanly, cognitively, oversee". In the related technology of avoiding obstacles, service robots can flexibly avoid obstacles and can respond to different obstacles. The environment is highly adaptable to meet the needs of users. Among them, the result of the word vector obtained by the public service robot in facial recognition and the domestic service robot is different. The word vector obtained by facial recognition in the public service robot has "display, precise, capture, codes, connection, designs, intuitive", it can be seen that through intelligent facial recognition and image visualization processing, facial expressions can be recognized. The word vectors obtained by facial recognition in the domestic service robots and service robots mainly include "Responses, interpret, senses, communicating, reflection, visualize, connection". The service robot can understand the user's facial expressions. By understanding the user's facial expressions, it can be users' communication.

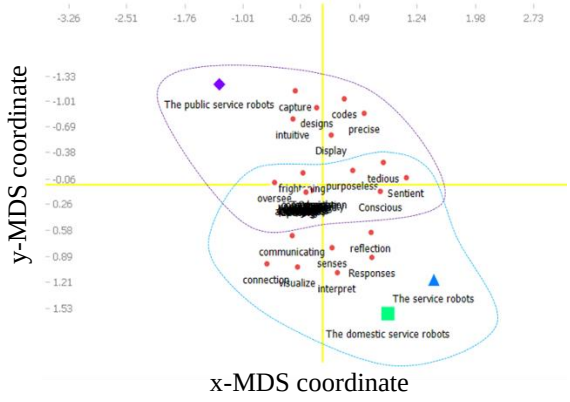

Figure 4. Topic classifications of human–robot interaction service robots

To obtain the difference between human–robot interaction technology in the public service robots, the domestic service robots, and the service robots, MDS is used for visual analysis, as shown in figure 5. The figure shows that there is no difference between the domestic service robots and the service robots in human–robot interaction, while the public service robots are different from the domestic service robots and the service robots. The word vector in the public service robot is "Display, precise, capture, codes, designs, intuitive" and the word vector of the domestic service robot and the service robot "Responses, interpret, senses, communicating, reflection, visualize, connection". The other word vector in the public service robots, the domestic service robots and the service robots are consistent. The public service robots, the domestic service robots, and the service robots have word vectors such as "Technique, communication, capture, correctly, connection, Precise, user, Operator, sensing, accessories, wiring, imaging, detects, capture, Convey, emotion, anger, express, experiences, personality, perceive, Automatized, purposeless, unpredictability, tedious, worries, Sentient, frightening, Conscious, foreseeable, automations, adaptable, humanly, cognitively, oversee" are consistent.

5.2. Support Vector Machines (SVM)

This research is mainly about the two-category problem of emotions, the public service robots and the domestic service robots were crawled by the mark, through the training algorithm, the number of positive comments and negative comments of the public service robots, the domestic service robots and the service robots in this research are obtained. Among them, 30,000 comments are marked for the public service robots and 30,000 comments for the domestic service robots. The data of the public service robots, the domestic service robots obtained through training algorithm are shown in Figure 5.

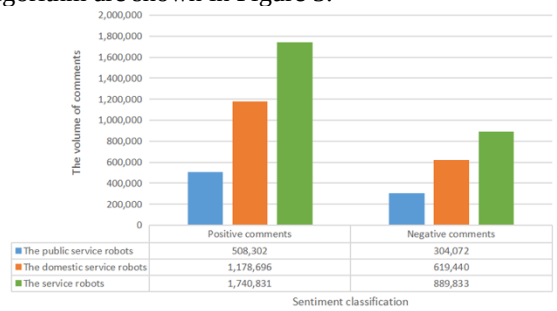

Figure 5. The sentimental analysis of service robot types

As shown in Figure 5, the emotion classification method of support vector is mainly used, and the comments about the public service robots, the domestic service robots, and the service robots crawled by YouTube are divided into positive and negative comments. Among them, there were 508,302 positive comments and 304,072 negative comments on the public service robots. Among the domestic service robots, a total of 1,178,696 positive comments and 619,440 negative comments were collected. There were 1,740,831 positive comments and 889,833 negative comments on the service robots.

5.3. Extracting keyword classifications for factors considering robot sectors

Through the analysis results, it can be obtained that the word vectors obtained by the public service robots, the domestic service robots, and the service robots of experience value, anthropomorphism, perception enjoyment, and service quality are consistent. Among them, the word vector of experience value is "Relationships, fulfillment, psychological, objective, motivations, perception, experiences". The Anthropomorphism word vector is "Usages, imitating, emulated, discovering, independent, recreating, explored". The word vector of perceived enjoyment is "Fulfillment, motivations, pursuits, relationships, striving, transcend, seemingly". The word vectors obtained for service quality mainly include "Offer, customer, accessible, providers, services, priced, cheaper". The public service robots, the domestic service robots, and the service robots are relatively personified, and can provide customers with a good experience, high-quality services, and enable users to enjoy services. The system quality and perceived intelligence are different for the word vectors obtained by the public service robots and the domestic service robots. Among them, in the public service robots the word vectors obtained by system quality are " Tendency, arises, inability, ultimately, consequence, limiting, occurs". The use of public service robots in public places will produce a lot of unstable things and may have destructive consequences. The word vector obtained by perceived intelligence is "Demonstrated, ethics, intellect, observe, sentience, conscience, conscious". The public service robots have developed better intelligence and can provide services to users by perceiving their emotions. In the domestic service robots, the word vector obtained by system quality is " System, improved, motivator, competitive, practically, offer, stable", which shows that the domestic service robots can provide users with accurate and professional services to satisfy users will. The word vector obtained by perceived intelligence is "Observation, qualities, incapable, intuition, behavior, foolish, arrogance ", which shows that the intelligence of the domestic service robots is not perfect enough to satisfice the needs of users. The word vector obtained by the service robots system quality is consistent with that of the public service robot, and the word vector obtained by the other variables of the service robot is consistent with the result of the domestic service robots.

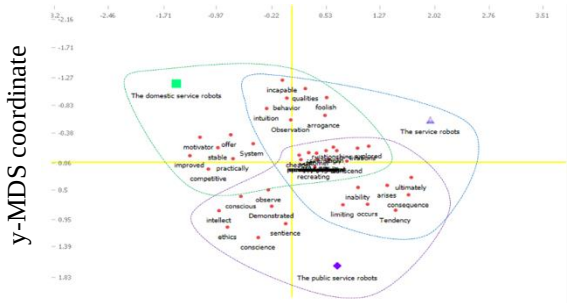

Figure 6. The result of service robots through the perceived factors

The topic words obtained by LDA topic modeling analysis are used to generate word vector analysis results, and MDS was used for visualization, as shown in figure 6. The figure shows the difference between the public service robots, the domestic service robots, and the service robots. The word vector of the public service robots includes " Tendency, arises, inability, ultimately, consequence, limiting, occurs" and “Demonstrated, ethics, intellect, observe, sentience, conscience, conscious”. The word vector of the domestic service robots includes "System, improved, motivator, competitive, practically, offer, stable" and Observation, qualities, incapable, intuition, behavior, foolish, arrogance”. The word vector of the service robots includes “Tendency, arises, inability, ultimately, consequence, limiting, occurs" and “Observation, qualities, incapable, intuition, behavior, foolish, arrogance”. The other word vector in the public service robots, the domestic service robots and the service robots are consistent. The public service robots, the domestic service robots, and the service robots have word vectors such as "Relationships, fulfillment, psychological, objective, motivations, perception, experiences, Usages, imitating, emulated, discovering, independent, recreating, explored, Demonstrated, ethics, intellect , observe, sentience, conscience, conscious, Fulfillment, motivations, pursuits, relationships, striving, transcend, seemingly, Offer, customer, accessible, providers, services, priced, cheaper" are consistent.

6.Discussion

First, using the Word2Vec model, this research analyzes the service robots. The service robots are mainly able to automate, replace labor, save costs, provide experience for different service industries, and enable users to accept the service robots. Using the Word2Vec model, the interaction technology of the service robots is analyzed. The service robots can well receive the user’s speech, gestures, and understanding

of emotional states and navigating with and around. However, collaborating with humans, users may be more fearful and worried, because the interactive service robot looks like a human, but does not act like a human, and there will be some unpredictable problems. Through sentiment classification and topic modeling, the user's acceptance factors of the service robots is studied. The positive topic of the service robots is perceived enjoyment, and the negative topic is service quality. Previous studies have shown that perceived enjoyment, and service quality can help users have a positive impact on service robots. However, service quality are negative topics. The service quality gets the negative topic reason is that it has not reached the service level expected by users. Since the service robots have various functions and use different places, the services required by users are also different.

Secondly, using the Word2Vec model, the interaction technology of the public service robots, the domestic service robots are analyzed. The interaction technology of the public service robots, and the domestic service robots can well receive the user's speech, gestures, and understanding of emotional states and navigating with and around. The interaction technology of collaborating with humans is similar to that of service robots. It looks like humans but behavior is not like human, lack of emotional communication with users, or injury accidents. Based on the results of topic modeling, the analysis results using Word2Vec show that experience value, anthropomorphism, perceived enjoyment, and service quality are positive word vectors for the public service robots, the domestic service robots.

Third, using the Word2Vec model, this research separately analyzes the public service robots and the domestic service robots. the key factors in the development of the public service robots are technology accumulation and accurate industry needs. The accumulation of technology can mainly enable the public service robots to have better intelligent development, in-depth exploration and understanding of the needs of the scene, so that it can quickly iterate products to satisfice the needs of users

7. Conclusions

Interactive service robots can have a huge impact on society. This research is mainly about to uncover user acceptance of human-robot interactive service robots based on YouTube online reviews. The analysis methods of Word2Vec, support vector and LDA are mainly used for research. The results show that in the process of interacting with users, the service robots need to improve their ability to cooperate with humans. System quality, perceived intelligence, and service quality got negative topics. At the same time, system quality, service quality, and perceived intelligence level need to be improved, so that service robots can be intelligent and automated to replace labor, save costs, satisfice the service needs of different industries, and enable users to better accept interactive service robots. The interactive technology of the public service robots needs to establish better interactions with users. At the same time, system quality got a negative topic. To enable users to have a better experience in various scenarios, it is necessary to use technology as the core and improve system quality, establish better cooperation with users. In the process of user interaction, the domestic service robots also need to improve the ability to cooperate with humans. Perceived intelligence got a negative topic. For users to accept the domestic service robots, it is necessary to improve intelligence and make the domestic service robots more professional and efficiently satisfice the needs of users.

The theoretical implications of this study have the following. First, this research mainly studies the user's acceptance of service robots, divides the service robots into the public service robots and the domestic service robots, and adds interactive technology for research. In most of the research, various public service robots and domestic service robots are mainly selected for independent research, or only the service robots are studied, and the service robots are not classified into the public service robots and the domestic service robots for research. Therefore, this research will classify its service robots and add interactive technology to study. Secondly, this research mainly uses text mining methods to analyze the data of various service robots crawled by YouTube. Supplements YouTube's text mining to analyze on service robots. The research of users on service robots mainly uses the method of data survey. The method of data survey cannot fully understand the thoughts and attitudes of more users. Therefore, this research uses text mining to analyze crawled big data. Research to get a more comprehensive understanding of users' attitudes towards service robots. Third, this research mainly uses Word2Vec, sentiment classification, and LDA analysis methods for research. There are many methods of sentiment classification, mainly using support vectors. At the same time, these three methods are not used, so this study selects these three methods for simultaneous analysis and research.

This study also has important practical implications. First, the service robots should strengthen intelligence, system quality and service quality, provide users with efficient, intelligent, and high-quality services that can satisfice the needs of

different users, while being able to effectively handle work and reduce the organization's operating costs. Secondly, the public service robots need to improve various key technical factors according to the needs of differentiated scenarios to provide users with high-quality services and reliable industry needs, which can bring users a better experience. Third, the domestic service robots need to be more intelligent with technology as support, provide users with professional services, improve efficiency, and satisfice user needs. Fourth, with the development of intelligence, speech, gestures, and face Recognition, understanding emotional states and navigating with and around in human–robot interaction technology can be used in combination to provide users with automated and intelligent service robots.

8. References

Ananda, A. F., & Wandebori, H. (2016). The impact of drugstore makeup product reviews by beauty vlogger on youtube towards purchase intention by undergraduate students in Indonesia. In International Conference on Ethics of Business, Economics, and Social Science, 3, 264-272.

Butler, D. (2016). Tomorrow's world: technological change is accelerating today at an unprecedented speed and could create a world we can barely begin to imagine. Nature, (530), 398-402.

Stock, R. M. & Merkel, M. (2017). A service Robot Acceptance Model: User acceptance of humanoid robots during service encounters, IEEE, 339-344.

Wirtz, J., Patterson, P.G., Kunz, W.H., Gruber, T., Lu, V.N., Paluch, S., Martin, A. (2018). Brave new world: service robots in the frontline, Journal of Service Management, 25-9.

Belanche, D., Casaló, L.V., Flavián, C., Schepers, J., (2020). Service robot implementation: a theoretical framework and research agenda, The Service Industries Journal, (40), 203-225.

Chen, Y., Wu, F., Shuai, W., Chen, X. (2017). Robots serve humans in public places—KeJia robot as a shopping assistant, International Journal of Advanced Robotic Systems (14), 1-20.

Fridin, M. & Belokopytov, M. (2014). Acceptance of socially assistive humanoid robot by preschool and elementary school teachers, Computers in Human Behavior, (33), 23-31

Woods, S., Dautenhahn, K., Schulz, J. (2004). The design space of robots: Investigating children's views, In RO-MAN

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. Information systems research, 3, 60-95.

Eroglu, S. A., Machleit, K. A., & Davis, L. M. (2003). Empirical testing of a model of online store atmospherics and shopper responses. Psychology and Marketing, (20), 139-150.

Hussain, A., Mkpojiogu, E. O., & Yusof, M. M. (2016). Perceived usefulness, perceived ease of use, and perceived enjoyment as drivers for the user acceptance of interactive mobile maps. In AIP Conference Proceedings, Penang, Malaysia.

Joe, W. Y., & Song, S. Y. (2019). Applying Human-Robot Interaction Technology in Retail Industries. International Journal of Mechanical Engineering and Robotics Research, 8, 839-844.

Kervenoael, de, R., Hasan, R., Schwob, A., & Goh, E. (2020). Leveraging human-robot interaction in hospitality services: Incorporating the role of perceived value, empathy, and information sharing into visitors' intentions to use social robots. Tourism Management, (78), 1-15.

Kim, Y. M., Koo, S. Y., Lim, J. G., & Kwon, D. S. (2010). A robust online touch pattern recognition for dynamic human-robot interaction. IEEE Transactions on Consumer Electronics, (56), 1979-1987.

Lee, W. H., Lin, C. W., & Shih, K. H. (2018). A technology acceptance model for the perception of restaurant service robots for trust, interactivity, and output quality. International Journal of Mobile Communications, (16), 361-376.

Lewis, R. C., & Booms, B. H. (1983). The marketing aspect of service quality. Emerging Perspectives on Services Marketing, (65), 99-107.

Licklider, J. C. (1960). Man-computer symbiosis. IRE transactions on human factors in electronics, 1, 4-11.

Luo, R. C., & Wu, Y. C. (2012). Hand gesture recognition for human-robot interaction for service robot. In 2012 IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems, Hamburg.

Murphy, J., Hofacker, C., & Gretzel, U. (2017). Dawning of the age of robots in hospitality and tourism: Challenges for teaching and research. European Journal of Tourism Research, (15), 104-111.

Reino, D., & Hay, B. (2016). The use of YouTube as a tourism marketing tool. 42nd Annual Travel and Tourism Research Association Conference, London, Ontario, Canada.

Salloum, S. A., Al-Emran, M., Monem, A. A., & Shaalan, K. (2017). A survey of text mining in social media: facebook and twitter perspectives. Technology and Engineering Systems Journal, 2, 127-133.

Turja, T., Van Aerschot, L., Särkikoski, T.& Oksanen, A. (2018). Finnish healthcare professionals' attitudes towards robots: reflections on a population sample. Nursing open, 5, 300-309.