STUDYING HUMAN ROBOT INTERACTION AND ITS CHARACTERISTICS

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ABSTRACT

The process of human-robot interaction focuses on the analysis of different forms of communication between humans and the robots through the application of technologies like artificial intelligence and machine learning. However, there can be different challenges associated with the process like security risks and challenges related to mapping environment and manufacturing procedures.

For analysis of the process of mitigation of the challenges, secondary qualitative data have been collected from different journals and websites. Theoretical analysis has been done for the collected data and the application of a cognitive modelling model has been done for this study. The main results include that application of a cognitive model can help in simulating the human problem-solving process and can help to improve the human cognition techniques.

Keywords: Robot, Human Robot Interaction, cognitive modelling

INTRODUCTION

The process of human-robot interaction is associated with the communication process between the robots and the humans through the application of different techniques like artificial intelligence and computer modelling. Proper understanding of the human-robot interaction process can help to make robotics effective by solving numerous real-world challenges. However, in the process of human-robot interaction, there can be different problems like privacy and security risks, challenges related to teaching the robots and mapping the environment [1,2,3]

The basic approach for solving the problem shall be through the collection of secondary data from previous researches and focus on the process of creating social interactions with the robots. The basic results of this study shall focus on the analysis of the ways by which challenges related to human-robot interaction can be resolved like the application of cognitive modelling and focusing on behaviour recognition technologies. Moreover, this study shall also focus on the ways

by which mixed-initiative interaction that includes information exchange in the complex environment can be implemented to solve the problems of human-robot interactions.

Problem definition

The process of human-robot interaction can help in eliminating dangerous jobs for humans and can help in physical interactions with the humans in shared workplaces. The problem for this study is associated with the challenges related to the human-robot interaction process like understanding the emotional state and verbal communication of humans for the robots and privacy issues [2]. The problem is interesting and important as mitigation of the challenges related to human-robot interaction can help in solving the complex tasks of the humans in a short period of time and designing exoskeleton rehabilitation robots.

Problem solution

Mitigation of the challenges related to human-robot interaction can help in the successful application of robots in different fields like industry and medicine. For addressing the problem of this study, the collection of secondary qualitative data shall be done and analysis of the data shall be done by the creation of themes. The application of the 'Cognitive modelling model' can help in mitigation of the challenges related to human-robot interaction as it focuses on psychological notions and helps in the understanding of the ways by which people can go about problem-solving and performing tasks.

Moreover, it can help in the creation of realistic expectations and form the basis of communication between humans and robots. As per the opinion of Galin & Meshcheryakov [3]. the application of interactive learning technologies can help in improving the perceptual ability, autonomy and the process of communication between the humans and robots. Thus, it can be said that the application of these techniques can help in solving the challenges related to the human-robot interaction process like challenges related to social interactions as well as privacy risks (Schulz *et al.* 2019). Thus, the problem of this study shall be solved by proper analysis of secondary qualitative data collected by previous researches and application of different interactive modelling techniques [78,79,80,81,82,83,84].

Related Work

Previous researches were conducted on different topics like safety bounds in human-robot interactions and success factors for human-robot collaboration. In the previous research, the methods that were taken into consideration include the collection of secondary qualitative data on the topics and usage of different models like the human-robot interactive model (Galin & Meshcheryakov 2020). From the previous studies, it has been found out that for improving the process of human-robot interaction it is essential for the robots to communicate and establish a set of shared beliefs. As per the opinion of Esterwood & Robert (2020), the challenges associated with the human-robot interaction process also includes the way people share and interpret information with the robots [33,34,35,36,37].

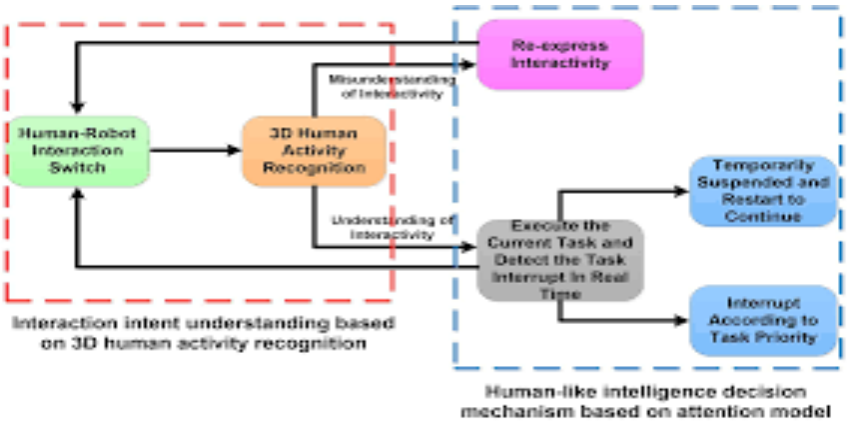
From the analysis of the study conducted by Schulz *et al.* (2019), it has been found out that the application of secondary qualitative data can help in understanding the robot personality and human-robot interactions. Based on the comparison of the present approach of this study to the related works associated with the topic it can be said that usage of cognitive modelling can help in mitigation of the challenges associated with the human-robot interaction process.

RESEARCH METHODOLOGY

For the understanding of the ways by which challenges related to human-robot interaction can be mitigated **'Positivism Research Philosophy'** has been taken into consideration as it supports the gathering of factual knowledge through observation. The chosen approach is **'Deductive'** as it is a top-down approach and helps in the process of understanding of the role of artificial intelligence and natural language understanding in the human-robot interaction process (Schulz *et al.* 2019). The choice of **'descriptive research design'** has helped in better understanding of the concepts related to the importance of human-robot interaction by taking into consideration of the previous theories. The criteria that are used for the evaluation of the method includes the collection of '**secondary qualitative data'** about the topic and analyzing them properly (Camargo *et al.* 2019). The criteria that are used for the evaluation of the proposed method includes the collection of data only from those journals and websites that contain relevant information about the topic.

The claims that are being tested include mitigation of the challenges associated with human-robot interaction like security risks and challenges associated with mapping environment can help in improving the process. **Theoretical analysis** has been taken into consideration for this study and secondary data have been collected from different journals, books and websites that contain relevant information about the topic. The process of conduction of theoretical analysis includes identification of specific themes of the collected data and classifying the data based on codes (Sanders *et al.* 2019).

Figure 1: Cognitive modelling model of human-robot interaction.

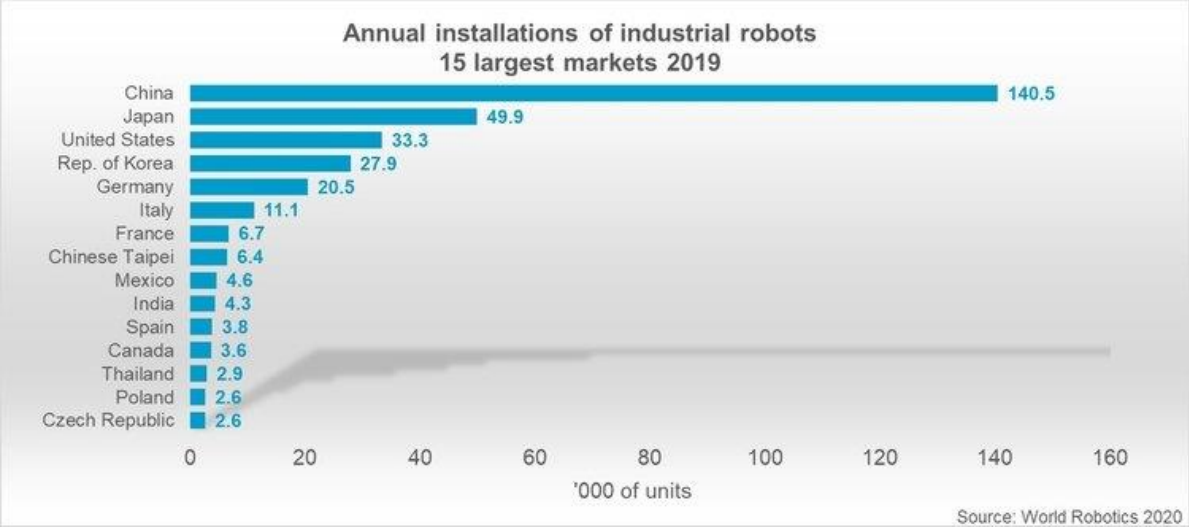


From the analysis of the above figure, it has been found out that the cognitive model of human-robot interaction can help in better analysis of the challenges associated with it. As per the opinion of Filippini *et al.* (2020), the cognitive model is a type of model that behaves like a human being by using the cognitive processes to complete a task. The model can include different processes like human-robot interaction switch, 3-D human activity recognition and executing the current tasks. Thus, it can be said that the data that are used are realistic and interesting as it helps to train the robots to understand the human emotions and interpret the information associated with it [51,52,53,54,55,56,57].

As stated by Malik & Bilberg (2019), the secondary data that have been collected for this topic are realistic and interesting as it can help in the application of techniques like imitation learning and artificial intelligence to make the robots adapt to the complex tasks of the human. Thus, it can be said that proper focusing on the challenges of human-robot interaction can help in the deployment of the robotics technology in any hazardous environment [60,61,62,63,64,65,66]. As per the opinion of Oliff *et al.* (2020), different methods have been taken into consideration by the previous researches that address the same problem like the 3-D model for perceiving humans as well as models for motion planning. Thus, it can be said that the application of this model helps to consider cognition, objects and tasks as interrelated components in human-robot interaction process [67,68,69,70].

It has been found out that the application of neuroscience can help to develop joint action in the human-robot collaboration process. Thus, through the cognitive model application of various methods can be implemented for controlling the mechanisms of the robots including eye-tracking and making interferences about the human task [71,72,73].

Figure 2: Annual installations of a number of industrial robots across the globe [74,75,76,77]



From the analysis of the above graph, it has been found out that the number of industrial robots' installation is highest across different countries of the globe like China, Japan and the USA. The basic differences that have been revealed in the data collected from different secondary sources include the process of conduction of the study and the model that has been taken into consideration for different studies [3,4,5,6]. The cognitive model is based on the fact that during initial interactions the people are uncertain and they are responsible for attributing personality characteristics to the robots [7].

DISCUSSION

The strengths of the method of collection of secondary qualitative data include that it can help in better understanding of the challenges related to human-robot interaction and in what ways the cognitive model can help in mitigation of the challenges. The strength of the conduction of theoretical analysis in this study includes finding out the gaps and deficiencies in previous research. As stated by Khoramshahi & Billard [8], the application of qualitative research method helps in the analysis of the non-numerical data and understanding of the concepts related to improving the collaboration between the humans and robots more easily. Moreover, this process requires less time than the quantitative method and helps in a better understanding of the ways by which the cognitive modelling model of human-robot interaction can help to mitigate the challenges associated with the process [9].

From the analysis of the findings of the study, it has been found out that the interactive behaviour of the robots is associated with a combination of information access and solving the mutual constraints associated with it [10,11] The cognitive model of human-robot interaction is an interactive system and can properly represent the steps associated with providing mental commands to the robots. As per the opinion of Oliff *et al.* [12,13, 14], improvement in the process of human robot interaction can contribute significantly in different areas like agriculture, industry and medicine.

However as stated by Clarke & Visser (2019), the weakness of the chosen qualitative research methods includes that it can lead to misleading findings and can lead to generalization of the study. As per the opinion of Newman & Gough [3], the creation of real systems like robot autonomy and interaction modes can help in a proper understanding of the usage of robotics technology in different sectors. The conclusions from the results of this study support the fact that the application of cognitive modelling and usage of technologies like artificial intelligence can help in simulating human problem solving and mental processing techniques within the robots [15,16].

The application of the cognitive model is associated with the principle of changing the user as a guide for adaptive interaction and can help to improve the process of group interactions with the robots. It has been found out that remote interaction with mobile robots is associated with the

technology of telemanipulation and it can help the robots to better understand the commands of humans [17,18]. Thus, it can be said that the application of the qualitative research method can help in providing insights into the challenges associated with the process of interaction of the humans with the robots.

Previous researches were conducted on different processes associated with human-robot interaction and the methods that have been taken into consideration include the usage of the PRISMA model for the understanding of human-robot interaction and application of quantitative data. The weakness of theatrical analysis for this study as compared to other methods include getting not specific answers to the research questions and requiring a lot of effort [19,20] Based on the underlying properties of the collected secondary data the results can explain in better understanding of the processes associated with human-robot interaction [26,27,28,29]. The underlying properties of qualitative data include that it lacks numerical characteristics and it takes into consideration the researcher as the key instrument of this study. Thus, the application of secondary qualitative data in this study has helped in a proper understanding of the ways by which cognitive models can help in designing and evaluating of the alternative interfaces associated with the human-robot interaction process [23,30,31,32,50,51,52].

The results of this study can be properly explained in terms of underlying properties of the data as it is found out that the robots perform a proactive behaviour and thus it becomes easier to operate them from a safe distance [33,34,35,36]. Thus, it can be said that the application of the cognitive model can help in predicting the human behaviours and implementation of adaptive interactions with the robots. Thus, the results can be [387,38,39,40] explained in terms of the underlying properties of the collected secondary qualitative data as the robots mainly perform a proactive behavior [41,42,43,44,45,46].

CONCLUSION AND FUTURE WORK

Thus, in conclusion, it can be said that proper understanding of the human-robot interactions can help in understanding and evaluating the robotics system and improve the process of communication between the robots and humans [47,48,49]. Secondary qualitative data has been taken into consideration for this study and theoretical analysis has been done for finding out the solutions of the problems related to human-robot interaction. The most important points illustrated in the work include that application of the cognitive modelling model can help the robots to understand human psychology and behaviours in a proper way. It has been found out from this study that improvement in the areas of human robot interaction can play a vital role in improvement of industrial production and manufacturing.

The results can be improved in future research by focusing more on the ways by which collaboration can be done with the robots in a more logical way. Thus, it can help in better understanding of the issues associated with human-robot interactions and understanding of how

the interactions can be shaped for achieving specific goals. If I had more time for the conduction of this study, I can focus on taking into consideration of other models related to human-robot interaction like 'Motion planning' and transfer the learning process. The major limitations of this project include scarcity of sufficient budget and time. Because of these constraints, a large number of journals cannot be taken into consideration and the research has been conducted based on limited websites and journals. Thus, improving the process of human-robot interaction can help in the process of application of the robots in different fields like automatic driving, space exploration and rehabilitation process.

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