

Case Study on AI Robotics in Senior Living in China

Xiajie Zhao, Ruiyu Li

Hanyang Univ., Seoul, Korea

Currently, in China, as the elderly population rapidly increases due to the increase in aging, the importance of the elderly's living environment and quality of life is increasing. Accordingly, the development of technology presents the possibility of providing a better life to the elderly. This study is conducted to investigate and analyze the current status and performance of artificial intelligence robot technology introduced in the elderly residential space in China, and contribute to the improvement of the living and convenience of the elderly. First, we investigate the cases of various types of artificial intelligence robots currently being used in the residential environment for the elderly in China. Second, by evaluating the technical performance and function of each artificial intelligence robot, we will look at how it meets the needs of the elderly's special bedfall, health care, and social interaction. Third, we analyze the impact of artificial intelligence robots on the daily life of the elderly and investigate users' experiences and effects to understand social effects. Fourth, based on the obtained results, suggestions and future prospects for effectively introducing artificial intelligence robots into the residential environment for the elderly in China are presented. Through this, it is expected to contribute to understanding how artificial intelligence robot technology is being applied in the residential environment of the elderly in China, and to find ways to improve the convenience and quality of life of the elderly.

Keywords: aging population, artificial intelligence (AI), residential space for the elderly

Introduction

With the progress of the global economy and societal advancement, health and medical technologies are rapidly evolving. Consequently, improvements in nutrition, safety, and hygiene environments have led to an increase in life expectancy, inevitably resulting in a growing elderly population. As of the year 2023, the nationwide population of individuals aged 60 and above in China is approximately 255 million, constituting around 17.8% of the total population. It is anticipated that this proportion will continue to rise, prompting China to actively address the challenges posed by population aging (Chen, 2014).

In response to the aging population, China is making proactive efforts. The country is implementing innovative elderly care systems and incorporating artificial intelligence (AI) robots to effectively address the multifaceted issues associated with aging population. Specifically, China is focusing on providing care services for the elderly with intelligent robot technology. Consequently, China's elderly care service robots possess distinctive features.

Therefore, this study is grounded in the aging situation in China, aiming to analyze the characteristics of intelligent robots in China and other countries. Based on this analysis, the research seeks to summarize the

direction in which China's elderly care service robots are likely to develop. Through these efforts, it is anticipated that China will continue to enhance the care and welfare of the elderly population in the future.

Theoretical Background

Definition and Characteristics of Artificial Intelligence Robotics

As a branch of computer science, AI attempts to understand the nature of intelligence and produce new smart machines that can respond in a similar way to human intelligence. Research in this field includes robotics, language identification, image identification, natural language processing, and expert systems. Since the birth of artificial intelligence, its theory and technology have matured day by day, and its application fields are constantly expanding, so the scientific and technological products that artificial intelligence will bring in the future will be the "container" of human wisdom. Artificial intelligence can simulate the information process of human consciousness and thought. Although artificial intelligence is not human intelligence, it can think like a human being and can even transcend human intelligence.

AI is a very challenging science. People working in this field must learn computer knowledge, psychology, and philosophy. AI is a very broad science. It consists of many different fields, such as robotics and computer vision. The main goal of AI research is to enable machines to perform complex tasks that would normally require human intelligence to complete. However, because there are different minds in different times, not everyone has the same understanding of this "complex business" of artificial intelligence.

The State of Senior Housing in China

The current state of space in senior housing generally covers the following aspects.

First, some housing projects specially designed for the elderly take into account the special needs of the elderly, such as accessibility facilities, emergency call systems, handrails, and hills. These facilities are meant to improve the quality of life for seniors and make it easier for them to live independently. Second, some senior housing is built in senior communities or specialized senior communities. These communities usually provide social activities, medical services, and other support to meet the physical and psychological needs of the elderly. Third, some senior housing may have special plans to adapt to seniors' mobility and other health issues. These may include larger bathrooms, barrier-free entrances, and easy-to-operate switches and outlets. Fourth, the price and affordability of senior housing is an important issue. Some seniors may choose to live in a retirement village or senior-only apartment, while others may choose to age in place in a home that provides the assistance they need through homemaker services and community support.

Types of Artificial Intelligence Robotics in China's Senior Living Spaces

The Chinese government recently announced plans to develop various types of artificial intelligence robots and related technologies to provide specialized services to the elderly in their living quarters as a key strategy for dealing with the aging population. There are four specific types of AI robots that will be developed: safety guard robots that record the life trajectory of the elderly, interactive learning robots that provide mental satisfaction and comfort to the elderly, medical health robots that provide rehabilitation and massage to the elderly, and life service robots that help the elderly with basic life skills.

First, a safety-supervised robot can mainly record the daily routine of the elderly. At the same time, they can detect the physical indicators measured by medical science, such as heart rate and blood pressure. They are suitable for independent and semi-independent seniors. For the independent elderly, physical problems need to

be detected in real time, as the elderly are fully capable of self-sufficiency, but their physiological functions gradually begin to degenerate. For the semi-independent elderly, the ability of a safe-guarded robot to record daily routines is crucial. Especially when the children go to work and the elderly are at home alone, the safety-enclosed robot can transmit the situation of the elderly at home to the children in real time, and if the elderly fall or have abnormalities at home, it can call for rescue in time to prevent emergencies.

Second, interactive learning robots mainly refer to robots with smart voice functions. This type of robot can play music, have the ability to talk and record, and is mainly applicable to independent elderly people. Interactive learning robots are mainly developed to meet the mental needs of the elderly. When the children go to work and are not around, the interactive learning robot can bring a sense of mental stability to the elderly.

Third, medical healthcare robots are mainly used to provide medical healthcare services to the elderly, such as physical training, massage, and rehabilitation. They can provide medical health services such as physical training, massage, and rehabilitation. It is mainly applicable to the semi-independent elderly. Medical healthcare robots can replace professional masseurs or nurses to provide services such as massage and rehabilitation. They can restore the partial physiological functions that the elderly have lost, and help them avoid further deterioration.

Fourth, life service robots refer to robots that help the elderly in daily life, which are mainly applicable to non-independent elderly people. They can help non-independent elderly people who do not have the ability to live independently with basic daily needs such as waking up, feces, and walking. Non-independent elderly people need to pay high nursing fees to receive care from a specialist, and they may not want to be assisted by staff due to pride issues. Living service robots can save the cost of specialist care, protect the pride of the elderly, and ensure a dignified life for the non-independent elderly.

Case Analysis of Artificial Intelligence Robotics in Senior Living in China

State of the Artificial Intelligence Robotics Industry

In a world that is currently facing an aging population, the AI robotics industry is developing into elderly care services. It can provide long-term care for the elderly while reducing mental and economic stress for them and their families. These AI robots play an important role in improving the quality of life of the elderly.

Various robots have been developed around the world. Denmark's SILBOT is designed for the elderly and has the ability to learn from their brain power to maintain their thinking and judgment skills and improve their memory. In Japan, Hospier is an artificial intelligence robot launched by Panasonic in 2013. In Japan, Hospier is remotely controlled and can be used in hospitals to perform functions such as delivering medication through a sophisticated sensing system and automatic navigation system.

Israel's ReWalk robot is the only Food and Drug approved exoskeleton robot that uses a sensory chip to capture a patient's gestures and help them walk. The UK's i-Snake is a snake-like surgical robot that combines image sensing and motor skills to specialize in surgery. The Da Vinci robot from the United States is already in many hospitals and consists of a surgeon's console, a bedside mechanical arm system, and an imaging system.

In South Korea, a safety robot called AnsimBot improves the safety of elderly care institutions through patrol and surveillance functions, and in China, Remebot is a cervical rehabilitation robot that provides smart traction, quantitative therapy, massage, heat therapy, etc., based on traditional Chinese medicine, and can monitor and record the rehabilitation process in real time. These various robots are developing alongside the growing elderly population, contributing to improving the health and convenience of the elderly (Table 1).

Table 1

Artificial Intelligence Robot Industry Status

Country	Name	Image	Characteristic
Denmark	SILBOT		Strengthen your athletic ability, memory buildup
Japan	Hospier		Delivery of medication on its own
Israel	ReWalk		Imitate the walking pace of natural walking, adjust the speed of walking
UK	I-Snake		It has an image sensitive navigation function
U.S.	Da Vinci		Go through surgery
Korea	AnsimBot		Indoor environmental patrol, monitor abnormalities
China	Remebot		Smart towing quantitative therapy, a massage of oriental medicine

Addressing the Aging of Artificial Intelligence

Artificial intelligence is a science and technology that has become a kind of service in modern society. Its development trend has become more diversified, and it is closely related to people's lives and has a great impact. An example is the community wisdom medical service (Dahman & Parkval). It can provide services such as medical advice, medical examination, and drug delivery to residents through information technology, and can

create one-to-one electronic health documents on the Internet in connection with the physical condition of residents. The fact is that combining social work and AI can not only improve the efficiency of the service business, but also adapt to the development trend of the times. Currently, social work for the elderly is facing complex and diverse problems, and we need to constantly inject new energy and develop it.

Social work helps people by using rational science as a theoretical basis and effective business methods in the context of altruism. Therefore, social work is a scientific and effective human aid activity. Social work revolves around the recipient of aid, and the act of helping others is especially important (Fu, 2012). When gerontological social workers are faced with a huge social workload, the quality of their services can decline. Involving AI in geriatric social work can replace some human workers, inevitably freeing up more labor to do more work. In addition, the refinement and intelligence of artificial intelligence is beneficial to improving the quality of social services, and combining artificial intelligence and elderly social work to form a professional social work intelligence entity. Harmonizing aspects such as community management services and daily care for the elderly will improve service efficiency and finally create a new look. Due to the different characteristics of the service objects, social workers need to observe and analyze the needs of the rescued subjects from different angles. To be more specific, the role of artificial intelligence in the field of social work for the elderly can be described in several aspects. First, as the physical strength of the elderly decreases, the ability of their sensory organs also decreases, and they need effective help with self-care. We can use AI to replace social workers to provide daily living services. AI can not only provide manual, artificially controlled intelligence services, but also provide automatic intelligence services that mimic complex human behavior (Liu, 2017). Examples include food preparation and bathing care. In addition, automated driving systems and navigation functions with intelligent equipment can help the elderly live independently even when they are away from home. Second, in terms of home services, the health of the elderly can be monitored and measured in real time. Comprehensive data from home assistants, intelligentized case processing, and physical fitness testing equipment can be collected on social workers' terminals through artificial intelligence systems, and the automatic uploading and comprehensive analysis of information can reduce the supervision stress of social workers and shorten their working hours, freeing them up for more projects. Third, the elderly have been living independently for a long time, so the help and services they need must be highly effective. By applying intelligent processing, service items such as home healthcare and intelligent home hospital rooms can be established. While enhancing the effectiveness of services, it also reduces the energy consumption of the elderly, simplifying the process and creating a comfortable living environment. In addition, AI can provide notification services to the children of the elderly so that they can communicate with them, so that the children can have a good understanding of the living conditions of the elderly, and establish a harmonious family environment to improve the psychological health of the elderly.

AI Technology Application Status and Case Analysis

The Chinese government recently announced a plan to develop various types of artificial intelligence robots and related technologies to provide specialized services to the elderly in senior living spaces as a key strategy for dealing with aging (Smale, 2017). There are four specific types of AI robots that will be developed: safety guard robots that record the life trajectory of the elderly, interactive learning robots that provide mental satisfaction and comfort to the elderly, medical health robots that provide rehabilitation and massage to the elderly, and life service robots that help the elderly with basic life skills.

First, safety-supervised robots can mainly record the daily routines of the elderly (Figure 1). At the same time, they can detect the physical indicators measured by medical science, such as heart rate and blood pressure. Safeguarded robots are suitable for independent and semi-independent seniors. For the independent elderly, physical problems need to be detected in real time, as the elderly are fully capable of self-sufficiency, but their physiological functions gradually begin to degenerate. For the semi-independent elderly, the ability of a safe-guarded robot to record daily routines is crucial. Especially when the children go to work and the elderly are at home alone, the safety-enclosed robot can transmit the situation of the elderly at home to the children in real time, and if the elderly fall or have abnormalities at home, it can call for rescue in time to prevent emergencies.

Second, this type of robot can play music, have conversations and recordings, and is mainly applied to independent elderly people (Figure 2). Interactive learning robots are mainly developed to meet the mental needs of the elderly. When the children go to work and are not at the elderly person's side, the interactive learning robot can bring a sense of mental stability to the elderly person, helping them not be lonely in their old age. Therefore, interactive learning robots are often made in the shape of cartoons or animals to make them visually more accessible to the elderly.

Third, medical healthcare robots can provide medical healthcare services such as physical training, massage, and rehabilitation for the elderly (Figure 3). It is mainly applicable to the semi-independent elderly. Medical healthcare robots can replace professional masseurs or nurses to provide services such as massage and rehabilitation training. Medical healthcare robots can restore the partial physiological functions that the elderly have lost, and help them avoid further deterioration.

Fourth, assisted living robots refer to robots that help the elderly in their daily lives (Figure 4), which are mainly applied to non-independent elderly people. For non-independent elderly people who do not have the ability to live independently, assisted living robots can provide great help in basic daily activities such as waking up, defecating, walking, etc. Living service robots can save the cost of professional care, protect the pride of the elderly, and ensure a dignified life for the non-independent elderly.



Figure 1. Caged robots.



Figure 2. Interactive learning robots.



Figure 3. Healthcare robots.



Figure 4. Living as a service robot.

Conclusion

From the perspective of artificial intelligence, we deeply analyze how artificial intelligence robots can be applied to solve problems such as the demand for nursing care services for the elderly and labor shortages, and provide development strategies.

Therefore, based on the research results of the current status of the artificial intelligence robot industry for the elderly in China, four suggestions for the development of artificial intelligence for the elderly in the future are as follows.

First, descriptive statistics show that safety-sensitive robots that record the daily routines of all elderly people are in the highest demand. They are suitable for use by all types of elderly people and have been applied the most. In particular, the real-time rescue function of safety-sensitive robots has the highest demand. Therefore, future robot development should focus on safety-sensitive robots. Second, assisted living robots are suitable for semi-independent and non-independent elderly people, and the demand for functions that help the elderly walk is particularly high. This makes the development of assistive living robots a relatively high priority. Third, healthcare robots that provide massage and geriatric training are suitable for use by semi-independent elderly people. The most important function of healthcare robots is to replace medical staff and provide services such as rehabilitation training to the elderly. However, due to the limited scope of application, the development priority may be somewhat lower. Fourth, interactive learning robots with smart voice function are mainly applied to independent elderly people, and the application group is relatively small. Interactive learning robots are mainly designed to meet the mental needs of the elderly. In a situation where an elderly person is left alone at home, an interactive learning robot can provide mental comfort to the elderly.

Therefore, it is expected that China will be able to solve the current severe elderly care problem by establishing policy-related plans and rationalizing AI research and development. In addition, effective services for the elderly and robotics technology can be developed to respond to the problem.

References

- Chen, O. X. (2014). Exploring the CCRC retirement model in the United States and its prospects in China.
- Dahman, E., & Parkval, S. *5G NR: The next generation wireless access technology*. Beijing: China Machine Press.
- Fu, Z. H. (2012). Space environment creation of elderly care facilities in Southern Fujian Province (Doctoral dissertation, Huaqiao University, 2012).
- Liu, Y. J. (2017). Research on the market development of China's aging industry (Doctoral dissertation, Jilin University, 2017).
- Smale, (2017). An efficiently operated nursing home architectural design.