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Analysis of the Application of Big Data Technology in the Smart Elderly Care Industry

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Abstract: Big data technology has inestimable value for the smart elderly care industry, which can not only achieve accurate monitoring and analysis of the health data of the elderly, provide a scientific basis for personalised aging services, but also improve the level of intelligence and efficiency of the aging services, and meet the growing diversified needs of the elderly. This paper proposes strategies such as strengthening technology research and development, optimising ageing-friendly design, enriching product supply, strengthening data security protection, as well as cultivating interdisciplinary talents and promoting the formulation of industry standards, aiming to comprehensively promote the healthy development of the smart elderly care industry. The implementation of these strategies is of great significance in promoting the innovation and application of smart elderly care technologies, enhancing the quality of life and well-being of the elderly, as well as promoting the transformation and upgrading of the aging service industry. At the same time, it will also lay a solid foundation for the construction of an intelligent and humane senior care service system, so that technology can truly serve the elderly and realise the beautiful vision of smart senior care.

Keywords: big data technology; smart elderly care; personalised service; ageing-friendly design; data security

Introduction

Smart elderly care is a sensor network system and information platform for the elderly at home, community and senior care institutions, and on this basis to provide real-time, fast, efficient, low-cost, IOT, interconnected and intelligent senior care services. With the rapid development of information technology, especially the wide application of big data technology, the smart elderly industry has ushered in unprecedented development opportunities. Big data technology plays a crucial role in the smart elderly care industry. It not only collects and analyses the health data of the elderly to support medical decision-making, but also predicts the risk of diseases through in-depth analysis and develops personalised health management plans. In addition, big data technology can also help the development of precision and personalisation of smart elderly services, and improve service quality and efficiency. Through the empowerment of big data technology, the smart elderly care industry can better meet the diversified needs of the elderly, promote the transformation and upgrading of elderly care services in the direction of high-end and intelligent, and provide strong support to meet the challenges of population aging.

1. The Current Situation of the Application of Big Data Technology in the Smart Elderly Industry

With the increasing number of the elderly population and the increasingly diversified demand for senior care services, big data technology plays a crucial role in smart elderly care. At present, the application of big data technology in the smart elderly care industry is mainly reflected in the monitoring of health data, personalised health management, service resource allocation and other aspects. By collecting information on the physiological data, living habits, and health status of the elderly through smart devices, big data technology can deeply analyse this massive data, provide support for medical decision-making, predict disease risks, and develop personalized health management programs accordingly. Take the “Big Data + Smart Elderly” model in Qinyuan County, Shanxi Province, for example, which uses big data, cloud platforms and other technologies to provide a full range of smart elderly care services for the elderly. By equipping the elderly with smart wristwatches, smart sleep straps and other equipment,

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their health is monitored in real time, and they are equipped with anti-lost and "one-key call" functions. At the same time, safety equipment such as smoke and flood sensors are installed to ensure the safety of the elderly at home. The application of big data technology in the smart elderly industry not only improves the intelligent level of elderly services, but also provides the elderly with more convenient, efficient and personalised elderly services, and promotes the rapid development of the smart elderly industry.

2. The Core Advantages of Big Data Technology in the Smart Elderly Care Industry

2.1. Precision service provision

Traditional senior care services often adopt a "one-size-fits-all" approach, making it difficult to meet the diverse needs of the elderly. Big data technology can build a personalised portrait of each elderly person by collecting and analysing their health data, living habits, interests and other information (Zhang & Rui, 2023). Based on these portraits, the smart elderly care system can provide tailor-made service solutions for the elderly. For example, for the elderly with chronic diseases, the system can recommend suitable diet, exercise and treatment plans based on their medical history and health conditions; for the elderly who like to socialise, the system can organise corresponding activities to make them feel the warmth and care of the community. This kind of precise service not only improves the quality of life of the elderly, but also enhances their satisfaction and trust in elderly services. At the same time, the continuous development and improvement of big data technology also makes this service more and more intelligent and personalised. In the future, with the in-depth integration of big data technology with artificial intelligence, Internet of Things and other technologies, the smart elderly care system will be able to more accurately predict the needs of the elderly and provide them with more intimate and thoughtful services, so that the elderly can truly enjoy the convenience and well-being brought by technology.

2.2. Efficient resource management

As the number of elderly people continues to grow, the demand for resources for senior care services is also increasing, and how to efficiently manage and distribute these resources has become an urgent problem. Big data technology can accurately grasp the distribution of resources, the efficiency of their use and changes in demand by monitoring and analysing the use of elderly service resources in real time (Zhao, 2023). This enables senior care service providers to dynamically adjust the distribution of resources according to the actual situation, ensuring that the resources can maximally meet the needs of the elderly. Big data technology can also optimise the elderly service process, reduce unnecessary links and waste, and improve service efficiency. For example, through data analysis, it is possible to predict the peak demand for the services of the elderly and make preparations in advance to avoid a shortage or excess of resources. This kind of efficient resource management not only improves the quality and efficiency of elderly services, but also reduces operating costs, providing strong support for the sustainable development of elderly service organisations. With the continuous progress and application of big data technology, the resource management of the intelligent senior care industry will be more intelligent and refined, providing the elderly with more high-quality and efficient senior care services.

2.3. Intelligent risk warning

Due to the gradual decline of physical functions, the elderly population often faces many health risks, such as sudden illnesses and accidental falls. The use of big data technology provides the possibility of early warning of these risks. By collecting and analysing the health data, behavioural patterns and other information of the elderly in real time, big data technology is able to establish a risk warning model. When the health indicators of the elderly show abnormal fluctuations, or when their behavioural patterns are not in line with the usual, the system can quickly identify and send out an early warning signal. This intelligent risk warning mechanism enables elderly service providers to take the first intervention measures and provide timely medical care and services to the elderly. This not only effectively reduces the threat of health risks to the lives and safety of the elderly, but also improves the emergency response capability and processing efficiency of elderly services. At the same time, the continuous learning and optimisation of big data technology has made the risk warning model more and more accurate and reliable. With the deep integration of big data technology with IoT, artificial intelligence and other technologies, intelligent risk early warning will play a more important role in the

smart elderly care industry, providing more powerful protection for the health and safety of the elderly.

3. Challenges Faced by Big Data Technology in the Smart Elderly Care Industry

Although the application of big data technology in the smart elderly care industry is promising, it also faces many challenges. First, the maturity of the technology needs to be improved, especially in terms of data stability, security and reliability. Since smart elderly care systems need to process and analyse a large amount of elderly health data in real time, it is crucial to ensure data stability and security. Second, age-appropriate design is lacking. The operating interfaces of many smart elderly care products are too complex and difficult for the elderly to use, which reduces their acceptance and willingness to use the products. Third, market demand diversification and insufficient supply. The needs of the elderly are very different, but the current smart elderly care products and services are unable to meet such diverse needs, and the matching of supply and demand still needs a longer period to reach a balance (Chen, 2024). Fourthly, the issue of data security and privacy protection should not be ignored. smart elderly care system needs to collect and analyse a large amount of personal health data, how to ensure the privacy and security of these data has become an urgent problem to be solved. Fifth, cognitive bias and acceptance issues are also a major obstacle to the promotion of big data technology in the smart elderly care industry. Many older people are sceptical of new technologies and have low acceptance, which affects the popularity and application of the technology. Sixth, the shortage of talents and the lack of uniformity in industry standards are also important factors restricting the development of big data technology in the smart elderly care industry. The shortage of interdisciplinary composite talents and the imperfection of industry standards have made the application and development of big data technology in the smart elderly industry face many difficulties.

4. The Development Path of Big Data Technology in the Smart Elderly Care Industry

4.1. Strengthen technical research and development, improve data processing capacity

With the continuous development of the smart elderly industry, the demand for big data technology is growing. In order to better meet the service needs of the elderly, it is necessary to continuously increase investment in technology research and development to improve the efficiency, accuracy and reliability of data processing. Specifically, it is necessary to optimise big data algorithms and models for the special needs in the smart elderly care scenarios, and improve the real-time and accuracy of data processing. At the same time, it is also necessary to strengthen the research and development of data security and privacy protection technologies to ensure that the personal health data of the elderly are adequately protected during the collection, storage and analysis process. The smart elderly industry also needs to pay attention to the integration and innovation of big data technology with other emerging technologies, such as artificial intelligence and the Internet of Things (Gu & Hu, 2024). Through the integration and innovation of technology, the intelligent level of smart elderly care services can be further enhanced to provide a more convenient and efficient service experience for the elderly. Strengthening technological research and development and improving data processing capabilities are important strategies for the development of big data technology in the smart elderly care industry. Only by continuously improving the level of technology can we better meet the service needs of the elderly and promote the sustainable and healthy development of the smart elderly care industry. At the same time, this will also provide useful exploration and experience for the application of big data technology in more fields.

4.2. Optimising ageing-friendly design and enhancing user experience

In the process of integrating big data technology into the development of the smart elderly care industry, it is crucial to optimise the ageing-friendly design and enhance the user experience. The service object of smart elderly care products is mainly the elderly, therefore, the design of the products must fully consider the use habits and needs of the elderly. The smart elderly care industry needs to have a deep understanding of the physical and mental characteristics of the elderly, such as vision and hearing loss, memory loss, etc., and design products for these characteristics. The operation interface should be simple and clear, avoiding too many complex functions and steps, so that the elderly can easily get started (Sun, 2024). At the same time, fonts and icons should be large and clear, and colour contrast should be sharp, so that it is easy for the elderly to read and identify. The smart elderly care

industry should also focus on the interaction design of the product to ensure that the elderly can easily interact with the product. For example, simple and easy-to-use interaction methods such as voice recognition and touch control can be used to reduce the difficulty of operation for the elderly. In the process of optimising the ageing-friendly design, we should also listen to the opinions and suggestions of the elderly, and continuously improve and perfect the products. By continuously optimising the ageing-friendly design and enhancing the user experience, more elderly people can enjoy the convenience and comfort brought by intelligent ageing, and promote the in-depth development of big data technology in the intelligent ageing industry.

4.3. Enriching product supply to meet diversified needs

In the process of applying big data technology to the smart elderly care industry, enriching product supply and meeting diversified needs is a key link. As the number of elderly people continues to grow and the degree of aging deepens, the needs of the elderly for senior care services are becoming increasingly diversified. In order to meet this demand, the smart elderly industry must continue to enrich the supply of smart elderly products. On the one hand, it is necessary to conduct in-depth research on the actual needs of the elderly to understand their specific needs in life, health, entertainment and other aspects, so as to provide a strong basis for product development. On the other hand, it is necessary to actively innovate and combine the advantages of big data technology to develop more intelligent and personalised smart elderly products (Liu & Jin, 2022). These products can cover a variety of aspects such as health monitoring, emergency rescue, life care, spiritual comfort, etc., providing comprehensive and multi-level services for the elderly. For example, the "silver hair" intelligent service platform in Tianjin monitors the health status of the elderly and the use of water and electricity in the home in real time through intelligent devices, and warns the grid operator to deal with abnormalities in a timely manner. At the same time, the intelligent voice system provides follow-up services to meet the daily needs of the elderly, such as ordering meals, housekeeping and so on. Smart bracelets and fall detection devices in the homes of the elderly in Tianjin make their lives convenient and safe. This platform guards the elderly with technology, realises the intelligence and personalisation of elderly services, and greatly enriches the supply of elderly products. On this basis, the smart elderly care industry should also focus on the customisability and expandability of products, so that they can be personalised and expanded according to the actual needs of the elderly. By enriching the product supply, it can better meet the diverse needs of the elderly and improve their quality of life and sense of well-being. At the same time, this will also help promote the innovative development of the smart elderly industry, facilitate the deep integration of big data technology and elderly services, and inject new momentum into the sustainable development of the smart elderly industry. Therefore, the industry as a whole must continue to strengthen product research and development and enrich product supply to meet the growing diversified needs of the elderly.

4.4. Strengthening data security protection and safeguarding user privacy

The smart elderly care system involves a large amount of personal information and health data of the elderly, which, once leaked or abused, will cause immeasurable losses to the elderly (Tang, 2023). Therefore, the smart elderly care industry must attach great importance to data security protection. Firstly, the application of data encryption technology should be strengthened to ensure the security of data during transmission and storage. Secondly, it is necessary to establish a strict data access rights management system, so that only authorised personnel can access the relevant data to prevent the data from being illegally obtained. Once again, the smart elderly care industry must also strengthen the supervision of the data use process to ensure that the data is only used for legitimate elderly care service purposes and not for other commercial or illegal uses. Finally, security vulnerability scanning and repair of the system should be carried out on a regular basis, so that potential security risks can be identified and dealt with in a timely manner. In conclusion, strengthening data security protection and safeguarding user privacy is the bottom line that must be adhered to in the development of big data technology in the smart elderly care industry. Therefore, it is necessary to continuously improve the data security protection mechanism to ensure that the personal information and health data of the elderly are adequately protected, so that the elderly can enjoy the convenience and services brought by smart elderly care with peace of mind.

4.5. Cultivate interdisciplinary talents and

promote the formulation of industry standards

In the process of applying big data technology to the smart elderly care industry, cultivating interdisciplinary talents and promoting the development of industry standards is a crucial step. As an emerging field, smart elderly care integrates the knowledge and technology of multiple disciplines such as big data, artificial intelligence, and healthcare, so the demand for interdisciplinary talents is particularly urgent. The smart elderly care industry needs to cultivate a group of talents who understand both big data technology and are familiar with the aging service industry, and who are able to combine the technology with the actual needs to promote the innovation and optimisation of smart elderly care products (Wang et al., 2024). At the same time, these talents can also play an important role in technology research and development, product design, marketing, etc., to promote the comprehensive development of the smart elderly care industry. At the same time, promoting the development of industry standards is also an important guarantee for the development of big data technology in the smart elderly care industry. At present, there is a lack of uniform standards and norms in the smart elderly care industry, which restricts the healthy development of the industry. Therefore, the government, social organisations, and enterprises need to actively participate in the development of industry standards to clarify the technical requirements, safety standards, and service specifications of smart elderly care products, so as to provide strong support for the standardised development of the industry. In conclusion, cultivating interdisciplinary talents and promoting the formulation of industry standards are important paths for the development of big data technology in the smart elderly care industry. By strengthening the cultivation and introduction of talents and actively participating in the formulation of industry standards, it will contribute to the sustainable and healthy development of the smart elderly care industry, so that the elderly can enjoy safer, more convenient and efficient smart elderly care services.

Conclusion

Big data technology has entered the smart elderly care industry and is increasingly highlighting its importance, becoming a key means to improve the quality and efficiency of elderly care services. By monitoring and analysing the health data and living habits of the elderly in real time, big data technology provides accurate support for personalised elderly care services. Its core advantage lies in its ability to achieve customised, intelligent and efficient services to meet the diverse needs of the elderly, while improving the accessibility and convenience of elderly care services. However, the development of the smart elderly care industry still faces many challenges and requires the joint efforts of the government, enterprises, research institutions and all sectors of society. At present, interdisciplinary talent training should be strengthened to promote technological innovation and industrial upgrading; at the same time, sound industry standards should be established to safeguard data security and user privacy. Looking to the future, drunken parties work together to promote the healthy development of the smart elderly industry, which will be supported by big data technology to create a better, more convenient and smarter elderly life for the elderly, so that science and technology can truly benefit every elderly person who needs care.

Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

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