Research and Design of Health management system for the elderly

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Abstract. With the rapid development of artificial intelligence and data processing technology, products and personalized services based on artificial intelligence have been widely used in different industries. With the accelerated aging of the social population, the current issue of elderly care has become an important issue that the whole society focuses on and solves. Due to the limited ability of the elderly to accept new things, intelligent products have not yet formed a universal application among the elderly, and currently, traditional home care or institutional care methods are still the main methods for elderly care.Based on artificial intelligence technology, this paper studies and designs a Health management system for the elderly, which mainly includes safety management module, environmental monitoring module, personal information module, disease diagnosis and treatment module, etc.Through this system, intelligent management of elderly people in elderly care institutions has been achieved, and the physical health status of the elderly can be recorded and accumulated in real time, forming a health assessment report, which is of great significance for the health monitoring and guidance of the elderly.It is an effective attempt at intelligent elderly care in the future.

Keywords: artificial intelligence, population aging, health management system, intelligent patrol.

1 Introduction

With the rapid development of artificial intelligence technology, various IoT products have entered our daily lives, such as smart phones, smart watches, smart homes, and wearable devices[1]. Our way of life is constantly changing. At the same time, with the updating and iteration of algorithm models such as deep learning[2], as well as the continuous improvement of computing power, many high-tech enterprises and assembly line workshops have quietly undergone changes in their work modes. Fresh products and things are easily accepted and passed on by young people, but they are difficult to apply in the elderly population and related industries. The current society is in a period of rapid population aging development, and social elderly care is still mainly based on home care and institutional elderly care[3-4], through traditional nursing staff care methods. However, the net growth rate of the social population has slowed down,

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and there is an urgent demand for elderly care professionals. At the same time, due to the inability of elderly caregivers to provide 24-hour professional care, caregivers are unable to fully understand the physical condition of the elderly, and accidents may occur during the care process.

In order to transform the traditional elderly care model and improve the intelligence of modern elderly care, many attempts have been made. Literature 5 designed an application software based on the Android system to prevent the loss of elderly people. Combined with intelligent bracelets and other devices, it can monitor the heart rate, blood pressure and other physical parameters of the elderly in real-time, and obtain the position of the elderly in real-time to prevent their loss, which is helpful for Alzheimer's disease patients[5]. Literature 6 proposed a scheme of Health management system for the elderly based on mobile terminals by using HTML, JavaScript, Web Service and other technologies, which can monitor the physical condition of the elderly in real time, intelligently analyze their physiological data, implement appropriate behavioral intervention and task reminding, and help to prevent and treat chronic diseases and improve the quality of life of the elderly[6]. Reference 7 has designed intelligent products such as smart bracelets and ventilators suitable for the elderly, which can monitor their physiological indicators in real-time[7]. Literature 8 explores the theoretical composition of a new type of healthy elderly care and the design of related intelligent products, mainly focusing on home based elderly care[8]. Most of the previous research focused on elderly individuals, monitoring their physical data and developing relevant preventive measures. However, due to the weak acceptance of electronic products by elderly people, relevant product designs may not necessarily have the desired effect. With the lack of social labor, institutional elderly care has become the mainstream way of social elderly care, and rural happy homes and elderly care institutions in major cities have been accepted by the public. Due to the varying professional levels and management methods of various elderly care institutions, various safety issues often occur frequently[9-10]. At the same time, due to differences in elderly care service levels, the happiness index of the elderly needs to be improved.

This paper studies and designs a set of elderly Health management system for institutional elderly care, mainly including safety management module, environmental monitoring module, personal information module, intelligent patrol module, disease diagnosis and treatment module, etc. The system standardizes and unifies the safety management, environmental monitoring, personal information management and elderly care plan formulation of elderly care institutions. At the same time, information about home based elderly care can also be integrated into the system through smart bracelets and other means to provide personalized services, improving the safety management and service level of elderly care effectively, which is an exploration and attempt towards a smart elderly care model.

2 Characteristics and Principles

2.1 Artificial Intelligence and Health Management

Artificial intelligence refers to the process of simulating human intelligence through computers, which is an important technological means of replacing humans with machines. Algorithms commonly used in the field of artificial intelligence include machine learning, deep learning, Natural language processing, computer vision, Reinforcement learning, etc[11]. Machine learning is one of the core algorithms of artificial intelligence, which simulates the process of human learning through computers to achieve machine autonomous learning and intelligence. Machine learning is divided into Supervised learning, Unsupervised learning and Reinforcement learning. Deep learning is a kind of machine learning. It simulates the process of human neural system through multi-layer neural network, and is mainly used in image recognition, speech recognition, Natural language processing and other fields[12]. Computer vision refers to the process of simulating human vision through computers, which has achieved machine understanding and processing of images and videos. It is mainly applied in fields such as object detection and face recognition[13].

The Health management system is a software system integrating health monitoring, health assessment, health intervention and health management, which aims to help individuals and groups manage health conditions, prevent and control diseases, and improve the quality of life. The current product of combining artificial intelligence technology with health management has emerged in various biotechnology companies, also known as the AI health field. Its main research directions include new drug research, treatment of diseases such as tumors and eye diseases, and human health management. The Da Vinci surgical system, led by the Massachusetts Institute of Technology in the United States[14], can provide more accurate surgical operations through robotic arm systems and imaging systems. This system utilizes various artificial intelligence technologies such as image processing, positioning and registration, automation and control.

2.2 Ensemble learning and Deep Learning

Ensemble learning, namely classifier integration, completes the learning task by constructing and combining multiple learners. Due to the poor generalization ability or robustness of a single learner, some studies combine multiple learners with certain strategies to form an ensemble model to improve the learner's problem-solving ability. Ensemble learning was first used to solve classification problems. Later, this learning method, which integrates multiple sub learners, compensates errors by using the output of group learners, and improves the generalization ability or robustness of the entire learning system, has gradually been extended to solve regression and clustering problems. A typical representative is the Random Forest model, which uses a decision tree as the base learner. When the policy tree is too deep, it can easily lead to overfitting. Usually, the tree is pruned to limit the maximum depth of the tree. The algorithm process is shown in Figure 1.

Deep learning is a method of machine learning based on Feature learning of data. Through feature transformation of original signals layer by layer, the feature representation of samples in the original space is transformed into a new feature space, and hierarchical feature representation is automatically learned, which is more conducive to classification or feature visualization. The key is to establish a model to simulate the neural connection structure of human brain. The mainstream deep learning object detection algorithms are mainly divided into two-stage detection algorithms and single-stage detection algorithms. Goodfellow put forward the Generic Adversary Networks (GANs) in 2014, which is an unsupervised Generative model. It works based on the maximum likelihood principle and uses confrontation training[15]. In 2017, Wang et al. introduced the idea of adversarial networks and proposed the A-Fast-RCNN algorithm for generating difficult positive samples using adversarial networks[16].

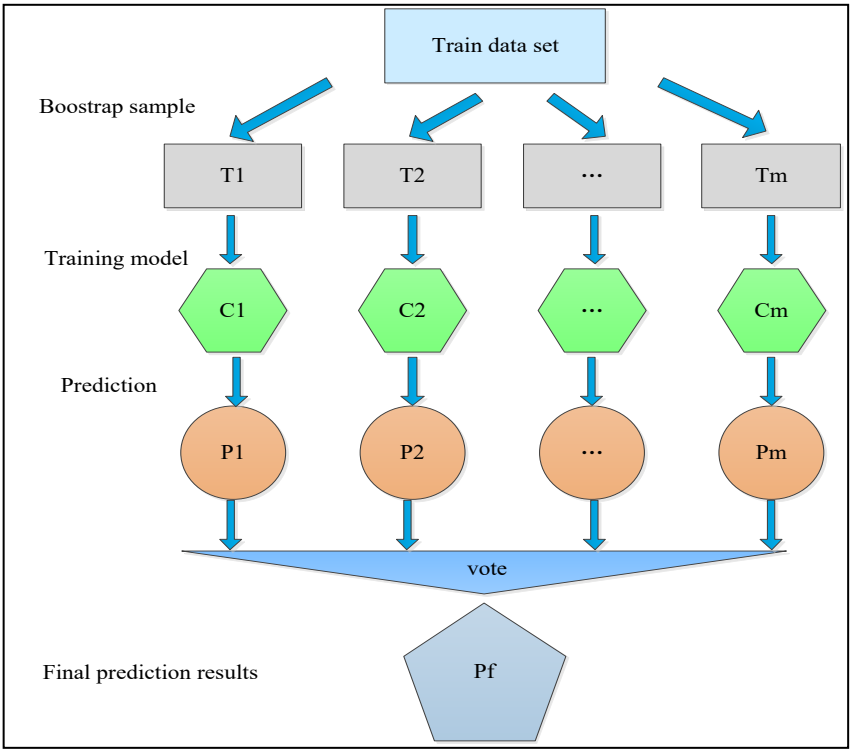

Fig. 1. Random forest model algorithm process diagram

3 Health management system

Based on artificial intelligence technology, this paper designs a set of elderly Health management system for institutional pension, which mainly includes safety management module, environmental monitoring module, personal information module, disease diagnosis and treatment module. The system diagram is shown in Figure 2.

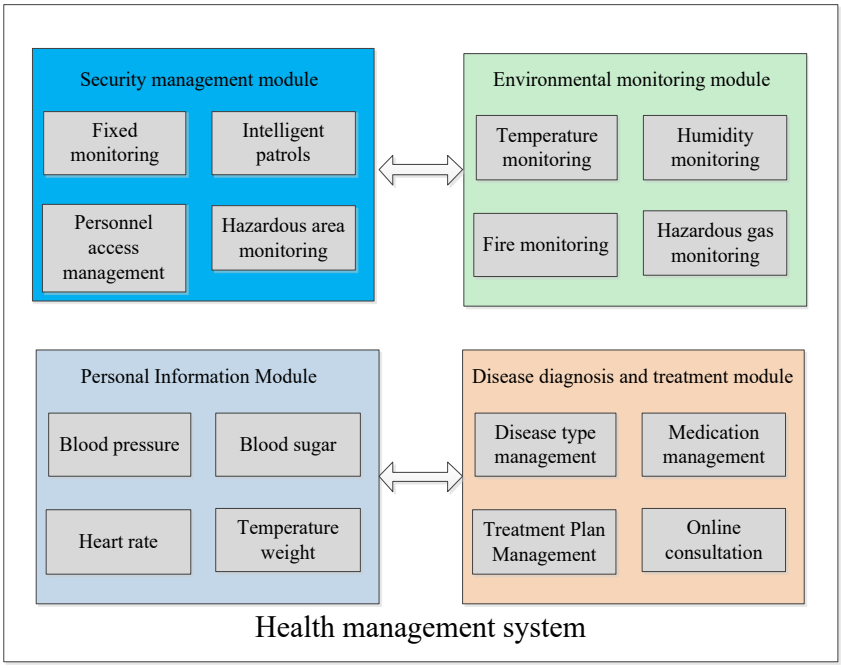

Fig. 2. Diagram of health management system.

The safety management module mainly includes functions such as routine personnel management, illegal personnel entry monitoring, dangerous area intrusion monitoring, elderly fall monitoring, and dangerous behavior monitoring. The environmental monitoring module mainly includes functions such as temperature and humidity monitoring of the living environment, fire monitoring, and hazardous gas monitoring. The personal information module mainly includes monitoring physiological indicators such as blood pressure, blood sugar, heart rate, weight, and activity of the elderly, and issuing warnings for abnormal data. The disease diagnosis and treatment module mainly records the daily physical examination reports, illness and treatment status of the elderly, provides care plans and medication prevention for the elderly, and provides medication reminders for individuals point-to-point.

3.1 Security management module

The security management module mainly includes fixed monitoring, intelligent patrols, personnel access management, hazardous area monitoring, and other parts. Security management monitoring is carried out 24 hours a day through algorithms such as facial recognition and object detection, as shown in Figure 3. The personnel access management module can monitor personnel access in real-time, provide voice prompts to unauthorized or illegal intruders, and promptly report to security personnel. The annular area is an intelligent patrol area. After the patrol task is formulated, the patrol system will conduct a 24-hour patrol and feed back the patrol results to the

Health management system in time to ensure the safety of the elderly and the safety of the activity area. Install fixed cameras in key or dangerous areas of the area, such as toilet entrances, restaurant entrances, stairwells, etc., to monitor the safety situation of the area. Once elderly people fall or other safety hazards are found, they should be promptly reported to relevant personnel through smart bracelets or other forms.

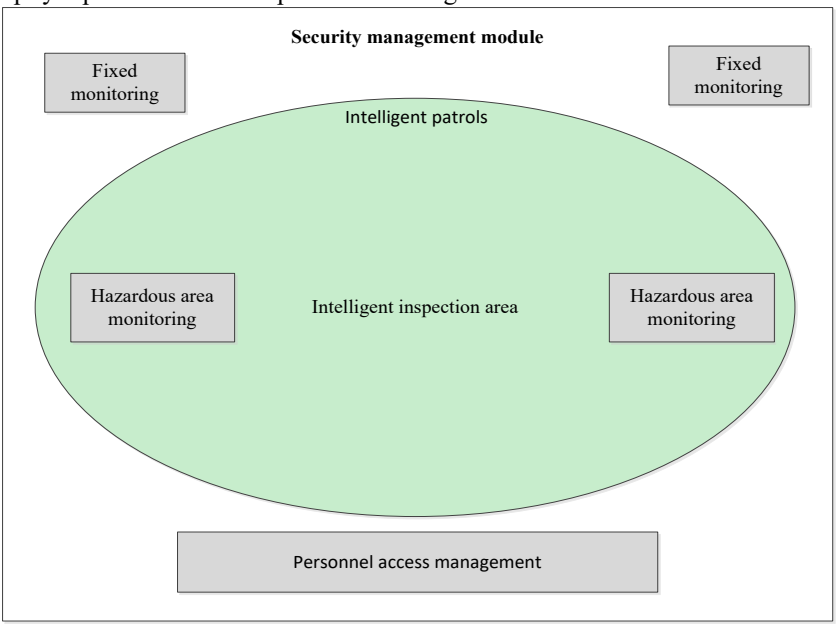

Fig. 3. Layout of Security Management Module

3.2 Environmental monitoring module

The environmental monitoring module mainly monitors the temperature and humidity, fire and dangerous gas within the activity area of the elderly, and sends the environmental conditions in different corners of the activity area to the Health management system by installing sensors. Due to the physical limitations and poor mobility of elderly people, in the event of a fire or other danger, it will cause incalculable losses. The environmental monitoring module can monitor the danger in real time, reduce the time of fire detection, nip the danger in the bud, and improve the Factor of safety of the elderly.

3.3 Personal Information Module

Due to the inability to install cameras and intelligent inspection devices in elderly living areas, the safety of elderly people resting at night is particularly important. The Health management system has developed a personal information module, which can complete data interaction with mainstream smart bracelets and other devices through interface development. During the night break, the personal information module can

collect real-time indicators such as blood pressure, heart rate, and body temperature of the elderly, and generate corresponding indicator curves. Collect blood glucose, body weight, and other parameters of the elderly at a fixed time during the day, and generate a personal health assessment report. Once certain parameter values undergo significant changes, promptly notify caregivers to provide emergency care or send the elderly to the hospital for treatment. This module has also opened external services, and elderly people at home can also access data through smart terminals and other devices to monitor their physical condition in real-time. The workflow of the personal information module is shown in Figure 4.

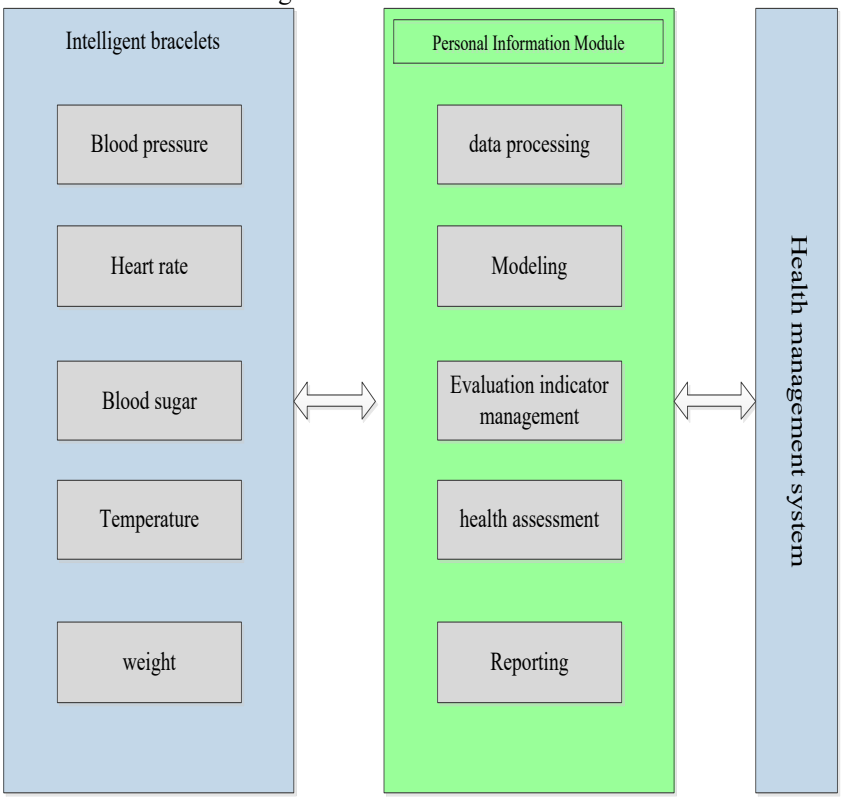

Fig. 4. The workflow of the personal information module

3.4 Disease diagnosis and treatment module

The disease diagnosis and treatment module mainly includes disease type management, medication management for the elderly, treatment plan management for common diseases, condition description and online consultation. This module includes the symptoms of common diseases of the elderly (such as diabetes, hypertension, coronary heart disease, cold) and conventional medication plans, and establishes medical records for each elderly person, including disease history, medication history and current treatment. In case of illness of the elderly, the treatment plan shall be given

according to the disease situation and historical medication situation. Online consultation can also be carried out in case of emergency, so as to Symptomatic treatment and prevent delaying the condition. The block diagram of the disease diagnosis and treatment module is shown in Figure 5.

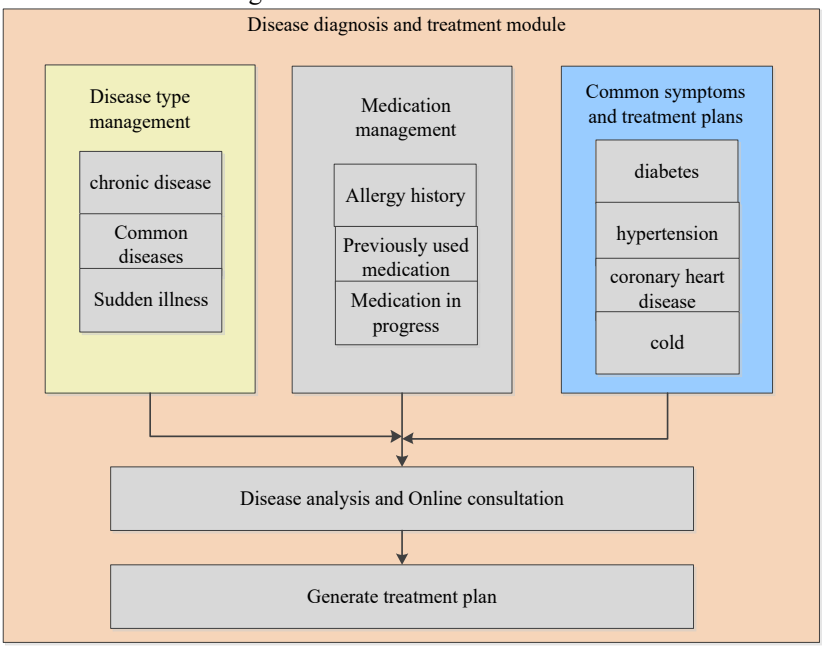

Fig. 5. The block diagram of the disease diagnosis and treatment module

4 Conclusion

Based on artificial intelligence technology, this paper has designed a set of elderly Health management system for elderly care institutions, including safety management module, environmental monitoring module, personal information module, disease diagnosis and treatment module, this system can monitor the environmental safety of elderly care institutions and the safety of elderly activity areas in real time. By collecting physiological parameter data of the elderly, a health assessment report for the elderly can be formed. Once the elderly develop a disease, corresponding treatment plans can be provided based on their physical condition and medication situation, improving the level of elderly care services and ensuring the quality of life of the elderly. It is an effective attempt towards intelligent elderly care.

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