

Analysis of Intelligent Waste Classification Technology

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Abstract

The application of artificial intelligence technology to the field of garbage classification can reduce labor costs and improve the efficiency of garbage classification. Under the background of the gradual promotion of compulsory classification of domestic waste, a large number of artificial intelligence products serving garbage classification have emerged. Most of these products are based on computer vision technology. main. At this stage, artificial intelligence in the field of garbage classification has shown trends such as whole-process integration, platform-based management, and diversification of technical solutions.

Keywords: *Artificial Intelligence; Technology and Risk; Trend*

1 TECHNICAL BACKGROUND

In recent years, with the rapid development of society and economy, the expansion of urban scale, and the continuous progress of production and life, the amount of garbage produced in daily life is also increasing. Although trash cans can be seen everywhere in the streets and alleys, such ordinary trash cans are already overwhelmed by garbage disposal. More intelligent and advanced equipment is needed to improve them, so that garbage classification can be more environmentally friendly and society can achieve sustainable development.

Nowadays, the concept of garbage classification is widely popularized in the society, and more and more people have the awareness of garbage classification. It is under this trend that smart garbage classification bins were born, which greatly facilitates the cleaning and Cleaning, and the management system and professional technical requirements contained in this are also very strict. The equipment needs to test whether the program of each module is correct, and whether the entire software system can well meet the needs of design functions and performance, and it is necessary to ensure the stability of the system. performance and reliability, and then it can be circulated in the market and promoted. It can be seen that the complexity of the technical requirements behind this is far beyond our imagination.

AI smart trash cans play a very important role in promoting garbage classification. The garbage with recycling value is recycled and reused through the steps of garbage classification, classified collection, classified transportation, and classified processing, so that garbage can be turned into treasure. The use of smart trash cans can not only improve the efficiency of garbage sorting, but also reduce the workload of cleaning workers. The correct use of intelligent classification garbage bins for garbage classification is an important way and means to achieve garbage reduction and recycling, a very useful scientific management method for garbage disposal, and an important way to achieve the goal of ecological optimization.

2 TECHNOLOGY RESEARCH AND DEVELOPMENT LEVEL

From the technical perspective, the technical directions of artificial intelligence include computer vision, speech processing, natural language processing, planning decision-making systems, big data statistical analysis, etc. The main technical direction of artificial intelligence in the field of garbage classification is computer vision. The premise and foundation of garbage classification is garbage identification. The traditional artificial intelligence

garbage sorting technology mainly uses magnetic and weight sensing equipment to simply sort garbage, which has less application scope and poor classification effect. The application of computer vision technology for garbage identification has the advantages of a wide range of applicable items, small size and weight of equipment, and fast recognition speed. The maturity of computer vision technology has also greatly improved the accuracy of garbage identification. With the help of deep learning algorithms, computer vision has ushered in rapid development after 2010. In the world's most authoritative computer vision competition (ILSVR), the lowest error rate of 1,000-category object recognition decreased from 25.8% in 2010 to 2012. 3.7% of the year. The maturity of computer vision technology makes the application of artificial intelligence for garbage classification quickly practical. Computer vision technology mainly includes specific technical directions such as image processing, image recognition monitoring, analysis and understanding, and image recognition technology applied to garbage identification and classification. Due to the relatively high maturity of this type of technology, relatively low technical threshold, and relatively low input cost, practical products can be quickly formed and put on the market. Therefore, a large number of computer vision-based garbage identification software and artificial intelligence garbage have appeared. For example, the garbage identification software launched by China's Alibaba, the smart trash cans launched by the US Bangbelly Solar and Poland's Bin-e company, etc. Waste sorting equipment is also gradually using computer vision as the main technical solution for waste sorting.

3 APPLICATION OF ARTIFICIAL INTELLIGENCE IN GARBAGE CLASSIFICATION

3.1 Intelligent Software for Publicity and Education

The auxiliary classification intelligent software is mainly based on machine vision technology to identify and compare objects to realize the classification of garbage. Most of them are presented in the form of small programs, APPs and new platform functions, relying on the original user groups as promotion and AI database reserves. Take the three BAT giants (Baidu, Ali, and Tencent) as an example. The three have launched smart garbage sorting programs and "Scan AI to identify garbage" on their respective platforms: WeChat, Taobao, Alipay and Baidu APP. 's new features. In addition, many large global enterprises, small and medium-sized enterprises and start-up companies also have their own auxiliary garbage classification software, with roughly the same research and development ideas, but with occasional special functions. For example, the American company Intuitive AI has designed the Oscar intelligent garbage classification system featuring human-computer interaction and reminding residents of misclassification; domestic vivo's AI assistant Jovi has added the function of voice interactive garbage classification.

3.2 Intelligent Terminal Serving the Collection Link

In the process of garbage collection, smart trash cans are currently the most popular artificial intelligence products on the market. Using RFID radio frequency technology, AI monitoring and GPS positioning, combined with intelligent hardware equipment, small area garbage collection sites, trash cans, garbage transportation vehicles, garbage transfer stations and terminal weighing equipment can be formed into a complete set of "Internet of Things", so as to form a set of intelligent supervision solutions for the whole process of receipt and transportation, and check the on-site situation of each node in real time.

3.3 Intelligent Sorting Equipment Serving the Waste Link

At present, China's waste treatment requires reduction, recycling, and harmlessness, and waste sorting is the final and most critical link. The waste sorting and collection link serves for the final sorting and processing. The mechanization and intelligent research of this link is still in its infancy, and its R&D investment and difficulty are relatively high.

4 TECHNICAL RISK

Although the current smart trash has been promoted in the market and gradually popularized, it has not yet achieved full coverage. Because there are still many technical aspects that need to be improved, and there are some technical

risks. At present, the industrial chain of the domestic intelligent waste classification industry has the characteristics of high capital barriers and technical barriers. The upstream participants of the industry chain are mainly suppliers that provide related technologies, the midstream participants are intelligent waste classification manufacturers, and the downstream is garbage recycling and application. .

In general, the technology industry is not perfect. The operational risks and market competition risks of enterprises in the industry are also relatively high: due to the lack of unified industry standards and a standard business model that has not yet been established in the short term, there will be operational risks. , including environmental protection cross-border enterprises and small and medium-sized enterprises, this situation will lead to excessive competition, which will affect the technical level to a certain extent.

In this era with the development of the Internet as the main aspect, technology still needs to be constantly updated, and continuous updating will cause certain difficulties in technology. It will bring great difficulty to equipment update and application technology update. Therefore, relevant industries should adhere to innovation-driven development as the company's strategy, increase the investment ratio of capital in innovation projects and technology research and development, expand the application market of the company's innovative products, and reach cooperation with companies with mature technology and high reputation in the market. In order to join the joint research at the relevant technical level, improve the company's strength.

5 THE TREND OF ARTIFICIAL INTELLIGENCE APPLICATION IN THE FIELD OF GARBAGE CLASSIFICATION

5.1 Whole Process Integration and Platform Management Become Mainstream

The recycling and reduction of waste requires not only the classification of the collection end, but also the coordination and cooperation of multiple links such as collection, clearing, transportation, and processing. At present, artificial intelligence is mainly used in the front-end classification and collection link. With the institutionalization of garbage classification and the popularization of related knowledge, the demand for artificial intelligence in this link has gradually decreased. With the aging of sanitation workers and the shortage of labor, as well as the continuous improvement of refined requirements for garbage classification and treatment, the demand for intelligence in garbage removal and treatment will gradually increase. The application of artificial intelligence in the field of garbage classification will gradually extend from the front-end collection link to the back-end clearing, transportation and other links. In the garbage clearing and transportation process, artificial intelligence is used to assist in planning garbage removal routes to improve the timeliness of garbage removal. and efficiency; in the waste sorting process, more refined waste sorting and terminal processing can be achieved by integrating intelligent sorting and robotic technology. Under this trend, enterprises are not only suppliers of smart devices in a single link, but also have the ability to integrate smart devices in all links and provide smart solutions covering the entire chain. At present, the Beijing-based "Love Classification" company has already launched an attempt in this regard, and has formed a full-chain intelligent solution by integrating front-end garbage classification and recycling, mid-end logistics transportation, end-end self-operated sorting centers and renewable resources trading systems. The whole-process integration of garbage classification also needs to rely on an intelligent information management platform. At present, each link of garbage classification is relatively independent, and it is difficult to give full play to the advantages of artificial intelligence technology in information processing, path planning and data analysis. Under the trend of the integration of the whole process of waste classification and treatment, many enterprises have begun to pay attention to the platform management of smart devices, and integrate various smart devices through the Internet of Things and cloud computing technologies to realize the overall management and optimization of all aspects of waste classification. In the future, the information platform for waste classification and treatment will also be integrated into the smart city system to further enhance the ability of urban environmental management.

5.2 Technical Solutions for Waste Classification Are More Diverse

At present, the core technologies of artificial intelligence in the field of garbage classification are machine vision and image analysis technology. Although this visual analysis system has greatly improved the accuracy of garbage

classification and recognition under the training of machine learning algorithms and massive data, the visual analysis system still has its limitations, and the error rate of the visual analysis system is very high for mixed-fouled garbage, and objects with the same appearance but different materials. Therefore, many sorting robot R&D companies try to integrate vision, metal, weight and other sensors into sorting robots, and use more diversified garbage identification technology solutions to improve the accuracy of garbage identification and classification. The development of new technologies and new materials also provides more technical options for garbage identification and classification. For example, the Massachusetts Institute of Technology and Yale University have developed more sensitive tactile sensors, using tactile sensors made of auxetic polymer materials to detect the size of the object and the force required to grasp the object, the material of the object is judged by the size and stiffness, and the current accuracy rate has reached 85%. This tactile sensor will provide new technical solutions for garbage identification. In the future, sorting robots integrating tactile, visual and other sensors will further improve the accuracy and efficiency of garbage sorting.

6 IMPACT OF ARTIFICIAL INTELLIGENCE GARBAGE CLASSIFICATION

6.1 Save Manpower and Material Costs

In many cases, sanitation workers have to run around every garbage spot because of the garbage in the trash can, but then there will be a situation where sanitation workers cannot know which garbage spots contain garbage, which leads to sanitation workers running empty, waste a lot of time. However, if a smart trash can is used, sanitation workers can be monitored in real time according to the notification of the mobile phone software, which reduces the consumption of many human resource management levels. The use of sorted trash cans can solve the problem of garbage sorting at the source, which can reduce the difficulty of sanitation workers.

6.2 Save Land

Landfilling and stacking are the main waste disposal methods in China at present, and the essence of this method is to move the waste to a house. By implementing garbage classification, garbage that can be used as renewable resources will no longer enter landfills. As the proportion of recyclables increases, more and more land will be liberated.

6.3 Reduce Pollution

Waste sorting can avoid environmental pollution caused by landfill or incineration

6.4 Recycle

Garbage is a resource that is not properly disposed of, and the resources wasted by incineration or landfilling are immeasurable. Through garbage classification, recyclable garbage can be turned into new resources.

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