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Research on the Application of Artificial Intelligence Technology in Intelligent Logistics Scheduling

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Abstract: Smart logistics refers to the use of advanced information technology and logistics management methods to optimize and improve the efficiency and service quality of logistics transportation, warehousing, distribution and other links through intelligent and networked means. Artificial intelligence plays an important role in smart logistics. This article deeply explores the key applications of artificial intelligence technology in smart logistics scheduling, including path planning optimization, intelligent warehousing sorting, and real-time monitoring and early warning. These technologies not only highlight their in order to improve transportation. The practical application of efficiency and cost reduction also highlights the great potential of artificial intelligence in the field of smart logistics. Through these studies, this article deeply explores key issues in the fields of digital logistics and smart logistics scheduling, providing important theoretical foundation and practical guidance for further research and practice in the future.

Keywords: Path Optimization; Smart Logistics; AI; Big Data; Machine Vision.

1. Introduction

With the rapid development and application of information technology, the development of digital logistics has become an important trend in the global logistics industry, covering all aspects from procurement, production, warehousing, transportation to final sales, aiming to improve the efficiency and flexibility of logistics operations. , enables enterprises to adapt to market changes more quickly, reduce operating costs, and improve competitiveness[1,2].Furthermore, smart logistics uses advanced technologies such as the Internet of Things, big data analysis, artificial intelligence, blockchain, etc., which has promoted the development of digital logistics. These technologies make data acquisition, analysis and application in the logistics process more efficient and [3 ,4].

Smart logistics scheduling is one of the essential steps in smart environmental protection. Through data collection, analysis and real-time monitoring, the logistics process can be intelligent, efficient and sustainable, so that decision makers can timely grasp the current inventory, market and Route issues help optimize the transportation routes of goods, reduce inventory backlog, improve transportation efficiency, and respond to market demand and changes in a timely manner. Among them, artificial intelligence plays an important role in smart logistics scheduling, and artificial intelligence can process large-scale real-time data[5,6]. Analyzing these data to predict the optimal transportation routes and timing will help optimize delivery plans, reduce shipping time and costs, and make flexible adjustments based on different conditions and needs to adapt to complex markets and transportation environments to the greatest extent possible Reduce inventory backlog and management costs, and can also automatically handle customer inquiries and complaints through intelligent customer service systems, track the status of goods in real time, and update customer information in a timely manner to improve customer satisfaction and loyalty, thereby realizing the dispatching and control of the complete logistics process.

This article conducts research on artificial intelligence technology in smart logistics scheduling, and introduces the application of artificial intelligence technology in logistics task scheduling such as path planning, intelligent warehousing sorting, real-time monitoring and early warning. This describes the application of artificial intelligence in smart logistics scheduling and its huge potential in optimizing resource utilization efficiency, supply chain management and sustainable development.

2. Overview of Artificial Intelligence Technology

Artificial Intelligence (AI) technology refers to the ability to enable computer systems to perform tasks that usually require human intelligence. It is a study and development of theories, methods, technologies and application systems for simulating, extending and expanding human intelligence. New technical science [7].

The development of artificial intelligence can be traced back to the mid-20th century, gradually evolved from the initial conceptual and theoretical exploration to the widely used technology today. The Dartmouth Conference (1956) is regarded as the origin of the field of artificial intelligence, proposing "artificial intelligence". "This term and related concept, the research at that time focused on symbolic logic reasoning, expert systems and basic mathematical models (such as Turing machines). From the 1960s to 1970s, AI research focused on knowledge-based systems such as reasoning, problem solving, and language understanding. In the 1980s, AI entered the era of "knowledge engineering", and scientists tried to achieve learning and cognitive abilities through methods that simulate the human nervous system. Since the 2000s, especially in the past decade, with the rise of big data and the enhancement of computing power, machine learning and deep learning have become the main driving force of artificial intelligence. Currently, artificial intelligence mainly includes computer vision, intelligent agents, multi-intelligent systems and natural language processing. Computer vision is committed to enabling computers to

understand and interpret visual information, including images and videos, and applications include object detection, face recognition, image classification, etc[8,9]. Intelligent agents and multi-intelligent systems are intelligent agent systems that study how to design and implement intelligent agent systems that can perceive the environment, learn, plan and execute actions, and how multiple agents collaborate to solve complex problems. Natural language processing involves the ability to enable computers to understand, interpret and generate human language.

Artificial intelligence technology is increasingly widely used in the field of smart logistics, mainly focusing on path planning, sorting management, real-time monitoring and early warning, and resource optimization management, which greatly enhances the efficiency and reliability of supply chain management. With the continuous development and maturity of artificial intelligence technology, its application in the logistics supply chain will be further expanded and deepened.

3. Current Status of Application of Artificial Intelligence in Smart Logistics

3.1. Transportation Path Planning Based on Artificial Intelligence Technology

With the rapid development of e-commerce logistics, the logistics industry has ushered in a stage of rapid development. Logistics and transportation is an important link. Reasonable path planning can reduce driving distance and time and save fuel and labor costs. Path planning is performed using traditional artificial intelligence methods, such as artificial neural networks, simulated annealing algorithms and fuzzy learning models, which has better results than statistical models. However, with the increase in the amount of data and the increase in the complexity of path planning, the limitations of these models are becoming increasingly apparent, making it difficult to make the optimal solution to deal with complex problems. Therefore, reinforcement learning has been introduced into the use of logistics transportation path planning[10,11],, and a certain goal is achieved through interactive learning between the agent and the environment. This method has received widespread attention.

The logistics transportation path planning method based on reinforcement learning clearly defines path planning problems, including the definition of environmental status, executable actions, goals or reward design, etc. Select the appropriate reinforcement learning algorithm based on the characteristics of the problem, abstract the path planning problem into a reinforcement learning environment, which includes defining the state space, action space, reward function and transfer function. Usually, data structures are used to represent the map or environment and implement the state Transfer and reward calculations. Designing appropriate reward functions is the key to reinforcement learning success. Reward functions should be able to guide the agent to learn the best path to the goal, while avoiding bad path selection. A well-designed reward functions help speed up the learning process and improve path planning. efficiency. Select appropriate strategies through the characteristics and actual needs of the problem, and use the defined environment and reward functions to train reinforcement learning agents. During the training stage, the agent collects empirical data through interaction with the environment and updates its policies based on the collected data to optimize the performance of path selection. After the training, the parameters and strategies of the reinforcement learning algorithm are adjusted and optimized according to the evaluation results to further improve the quality of path planning. Based on the above methods, reinforcement learning technology can be effectively applied to logistics transportation path planning, helping to formulate reasonable transportation routes and improving transportation efficiency.

3.2. Intelligent Warehousing Sorting Based on Artificial Intelligence Technology

With the rapid development of machine vision technology and artificial intelligence, contemporary robots are developing towards collaboration, automation, networking and intelligence. In order to ensure the accuracy and efficiency of robots, machine vision technology in artificial intelligence has received great attention and has been widely used in various fields. The traditional sorting process is greatly affected by the characteristics of objects, while machine vision technology has the characteristics of fast speed, large amount of information and many functions, and can avoid errors caused by worker fatigue. Therefore, machine vision technology has shown in the sorting field. Good application before.

At present, artificial intelligence technology has been widely used in intelligent warehousing and sorting. Qiu Guang used FANUC industrial robot to establish a binocular vision sorting system and proposed a feature matching algorithm based on adaptive thresholds to automatically stack logistics items[12]. Wan Jixiang developed an unmanned logistics sorting system based on 3D vision, using image data collected by TOF cameras for volume and size detection [13]. The unmanned logistics method it uses is basically suitable for shapes, colors and Logistics of different volumes.

3.3. Real-time Monitoring and Early Warning Based on Artificial Intelligence Technology

Key indicators during transportation (such as vehicle location, transportation status, abnormal conditions) often require timely adjustment and feedback to ensure the implementation effect of the scheduling plan and the quality of service. Traditional logistics often relies on manual recording and communication means, which leads to poor real-time information feedback, limited transparency and visibility of information transmission, and managers may not be able to understand the details of all key indicators in real time, making it difficult to fully evaluate transportation. Actual situation and problems in the process. Real-time big data analysis technology based on artificial intelligence can automatically analyze vehicle location, transportation status, and abnormal situations, and provide timely feedback, greatly improving the efficiency and execution effect of transportation.

Real-time monitoring and early warning method based on big data analysis obtains vehicle position data in real-time through GPS tracking equipment, these devices can be integrated into the logistics management system to provide real-time updates and monitoring[14]. Using IoT technology, various sensors are connected to the Internet to achieve real-time monitoring and data collection of various key points during transportation. The collected real-time data is analyzed through the logistics management system, and reports and

real-time alerts are generated. These reports can help managers adjust their transportation plans in a timely manner, optimize routes, and deal with problems and abnormalities that occur during transportation.

4. Conclusion

This article discusses the wide application of artificial intelligence technology in the fields of digital logistics and smart logistics. Artificial intelligence technology has played an important role in logistics and transportation path planning, intelligent warehousing sorting, and real-time transportation monitoring and early warning, significantly improving transportation efficiency and data accuracy. Through artificial intelligence algorithms, valuable information can be extracted from massive logistics data efficiently, providing strong support for smart logistics systems. With the further development and maturity of artificial intelligence technology, it is expected that its application in the field of smart logistics will become more in-depth and extensive. Therefore, the future is of great significance to the continuous research and application of artificial intelligence in the field of smart logistics.

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