

Application of artificial intelligence in international logistics and freight transportation

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Abstract

International cargo transportation and logistics have been developing for a long time in China. As an important part of international trade, it is an indispensable link to promote the development of international trade. In recent years, the cross-border e-commerce developed with the Internet has facilitated the communication between countries, promoted the development of international trade, and provided broad prospects for the development of international cargo transportation and logistics. At the same time, with the development of Internet technology, artificial intelligence, internet of things, big data, cloud computing and other technologies have developed rapidly and are widely used in various industries, and the international cargo transportation and logistics industry has also benefited greatly. Therefore, by combing the development history and current situation of international logistics, cargo transportation and artificial intelligence, as well as the application status of artificial intelligence in the field of international logistics and cargo transportation, this paper understands the integration and development of international logistics, cargo transportation and artificial intelligence, and prospects the future application of artificial intelligence in the international logistics and transportation industry.

Keywords

Artificial intelligence, International logistics and cargo transportation, Application research.

1. Development history and current situation of international freight transport

As the basis of international trade, international cargo transportation and logistics play an important role in the development of international trade. International goods transportation and logistics follow the development of international trade and run through all links of international trade. Without international goods transportation, goods cannot be transferred internationally and international trade cannot be realized. Therefore, it is an indispensable and important part of international trade. International trade plays an important role in improving a country's living standards, promoting the rational allocation of resources and promoting economic development. It is an important part of a country's economy. Therefore, the development of international cargo transportation and logistics can also promote the economic development of a country to a certain extent.

The development of international cargo transportation and logistics in China started earlier. After the Second World War, the increasingly frequent economic exchanges between countries have led to the continuous expansion of the scale of international trade, and the development of international cargo transportation and logistics. The development history of international cargo transportation and logistics is shown in Table 1.

Table 1 Development history of international cargo transportation and logistics

1950s-1980s	There are logistics distribution centers and three-dimensional unmanned warehouses
1980s-1990s	The level of mechanization and automation of logistics has been improved and more widely used
Since 1990s	The importance is widely recognized by all countries

In recent years, with the development of Internet technology, cross-border e-commerce has risen rapidly. The development of cross-border e-commerce has promoted the development of cross-border online shopping. Consumers in different countries can shop anytime and anywhere, but ultimately get goods based on international logistics. Therefore, the development of cross-border e-commerce provides a broad market development prospect for international logistics and cargo transportation. In 2019, China's total international cargo transportation reached 47.1 billion tons. Although affected by the epidemic in 2020 and 2021, the transportation volume decreased by 0.5% year-on-year, but the total volume still accounts for about 2/3 of the world[1]. It can be seen that China's international cargo transportation has a good development prospect.

2. Development history and current situation of artificial intelligence

In 2016, alphago artificial intelligence system stood out in the go man-machine war and became a landmark event in the development of artificial intelligence. The development of artificial intelligence in China has a long history, and its development process is shown in Table 2.

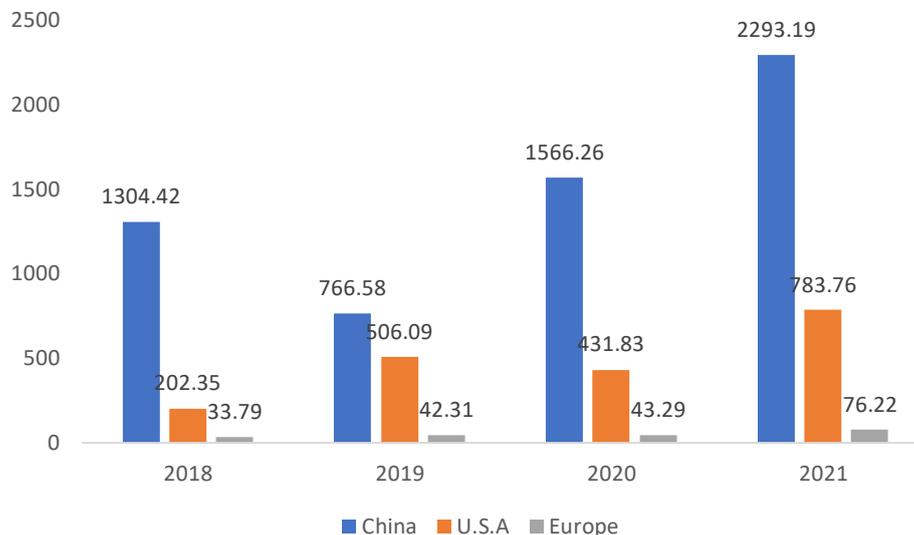
Table 2 Development history of artificial intelligence

1950s-1960s	Some checkers programs designed with artificial intelligence
1960s-1970s	People's high expectations of artificial intelligence lead to the research of artificial intelligence entering a low period
1970s-1980s	Artificial intelligence can simulate human knowledge and experience to solve some practical problems in specific fields
1980s-1990s	With the continuous expansion of application scale, some problems of artificial intelligence have been exposed, and the development of artificial intelligence has fallen into a trough again
Since 1990s	The development of artificial intelligence shows a trend of explosive growth and is widely used in various industries

Global technology giants are seizing the development opportunity of artificial intelligence and investing huge amounts of money in related research and development. Google has three major layouts in the field of artificial intelligence, trying to achieve its next technology explosion point; Facebook spent a lot of money to set up an artificial intelligence laboratory; The deep learning project "Adam" launched by Microsoft is also competing with the human brain. Meanwhile, China's artificial intelligence technologies, such as speech recognition and sensing, have become quite mature and are in the forefront of the world. They have been widely used in the fields of autonomous driving, health, education and so on. China's investment in the artificial intelligence market from 2018 to 2021 is shown in Table 3. It can be seen that China's investment in the artificial intelligence market has been growing since 2019. According to the

report of artificial intelligence frontier research and industrial development report 2021, it is estimated that the scale of China's artificial intelligence core industry will reach 400billion yuan in 2025. Therefore, artificial intelligence has a strong development momentum.

Table 3 Global investment in major AI markets from 2018 to 2021 (unit: RMB 100 million)



(Data source: Prepared by IT orange prospective industry research institute)

The Chinese government attaches great importance to the development and application of artificial intelligence. The 13th five year plan brings artificial intelligence into the national strategic development level, "Artificial intelligence is a strategic technology leading this round of scientific and technological revolution and industrial change. It is an important driving force for the new round of scientific and technological revolution and industrial change. It has a strong 'head goose' effect of spillover".

Artificial intelligence is widely used in manufacturing, medical treatment, education, e-commerce and other industries, injecting new vitality into its development. Especially since the COVID-19, many countries and regions have issued travel bans to prevent the spread of the virus. Traditional industries have been greatly impacted, and many small and medium-sized enterprises have closed down. However, this epidemic is not only a great challenge in human history, but also a great development opportunity. Some industries such as e-commerce, online service platforms, online office platforms, etc. have developed rapidly during the epidemic period relying on the Internet, artificial intelligence and other high technologies. The logistics and transportation industry is also deeply affected by artificial intelligence and has benefited a lot from it. Intelligent machines based on artificial intelligence technology, such as unmanned distribution machines, driverless, handling machines and sorting machines, have changed the traditional logistics operations and transportation modes and improved the efficiency of logistics and transportation.

3. Application of artificial intelligence in international logistics and cargo transportation

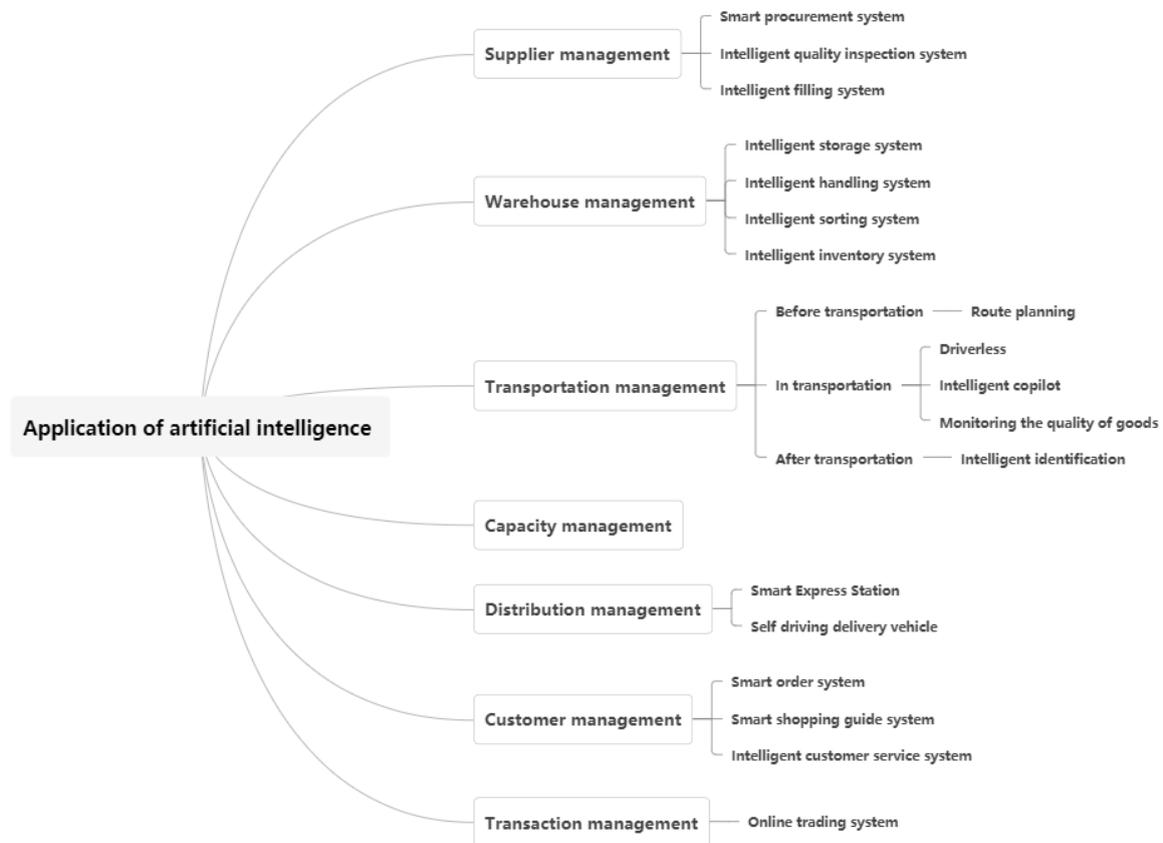


Figure 1 Application of artificial intelligence in international logistics and cargo transportation
 The scenarios in which artificial intelligence is applied to the logistics industry mainly include supplier management, warehouse management, transportation management, capacity management, distribution management, customer management, transaction management, etc. [2]. This paper describes the application of artificial intelligence in international logistics and transportation from these aspects.

3.1. Supplier management

Artificial intelligence technology is applicable to supplier management scenarios, including intelligent procurement system, intelligent quality inspection system and intelligent document filling system. Intelligent procurement system means that artificial intelligence can use image recognition, big data analysis and other technologies to establish a model based on the enterprise's historical procurement data, inventory status, sales status and other information, predict the goods to be purchased and their quantities, and help enterprises purchase appropriately, reduce inventory and save costs. The intelligent quality inspection system can use image recognition technology to quickly count goods and detect the quality of goods, helping enterprises save a lot of labor costs. The intelligent form filling system recognizes the contents of the form through computer vision technology, and then automatically and quickly completes the online form filling task, avoiding manual input and promoting the efficiency of form filling.

3.2. Warehouse management

The scenarios in which artificial intelligence is applied to warehouse management mainly include intelligent storage system, intelligent handling system, intelligent sorting system and

intelligent inventory system. As for intelligent storage system, cold storage, as an important and special field of storage industry, plays a key role in the transportation of fresh food and drugs. In 2021, the state promulgated the special plan for the development of cold chain logistics during the "14th five year plan", which puts forward new requirements for cold chain transportation. [3] The new automatic cold storage based on artificial intelligence can put the goods that need to be frozen into the corresponding area according to the prompt of the display screen, and can put the goods that need different temperatures into different temperature areas, ensuring the quality of products. In addition, AI can also detect the status and safety of storage equipment based on life prediction technology, and carry out regular maintenance. As for the intelligent handling system, the transportation equipment developed based on artificial intelligence, such as AGV, intelligent sorting vehicle and conveyor belt, can automatically control the process of goods in and out of the warehouse, loading and unloading, saving a lot of manpower and material resources. As for the intelligent sorting system, before the package departs, the intelligent system can automatically label the package according to the destination it is going to. When it arrives at the transfer station and network, the staff can also sort the order according to these numbers. As for the intelligent inventory system, artificial intelligence can quickly inventory goods based on visual recognition technology. If any abnormality is found, it will alarm and remind the abnormal data.

3.3. Transportation management

The influence of artificial intelligence technology on the transportation process is reflected in the whole transportation process. Before transportation, the intelligent system can make the best route planning for the whole transportation process according to customer preferences, local regulations, transportation modes and other factors, so as to shorten the transportation time and reduce the transportation cost. In the transportation process, driverless technology and automatic driving technology based on artificial intelligence have completely subverted the traditional cargo transportation process, making the cargo transportation process more safe and efficient, and reducing the number of drivers employed by enterprises. Moreover, the "intelligent co driver" system based on artificial intelligence can monitor the road conditions, vehicle conditions and driver status, and timely remind or alarm abnormal conditions, so as to avoid the losses caused to the enterprise by accidents. In addition, the temperature and humidity during transportation can be monitored and controlled based on sensing, positioning, network communication and other technologies to ensure the quality of transported goods. After the goods arrive at the destination, artificial intelligence can intelligently identify the license plate number, loading rate and other basic conditions.

3.4. Capacity management

Capacity management refers to the management process of matching drivers, goods, vehicles and other logistics elements. The shared transportation platform based on artificial intelligence can accurately match these elements, save matching time, improve matching efficiency, make full use of capacity resources, and improve the transportation efficiency of goods and the efficiency of the whole logistics process.

3.5. Distribution management

Distribution refers to the process of delivering goods to the final customer, and it is the last link of goods transportation. As the distribution faces a variety of users, the distribution scenarios are also diverse. At present, the more common intelligent distribution equipment based on artificial intelligence include intelligent express station and automatic driving distribution vehicle [4]. The smart express station can quickly complete most of the pickup and delivery activities according to the face recognition technology, and improve the distribution efficiency.

The self driving distribution vehicle is also a kind of driverless vehicle in the distribution process. Its use can reduce the use of distribution personnel and save distribution costs.

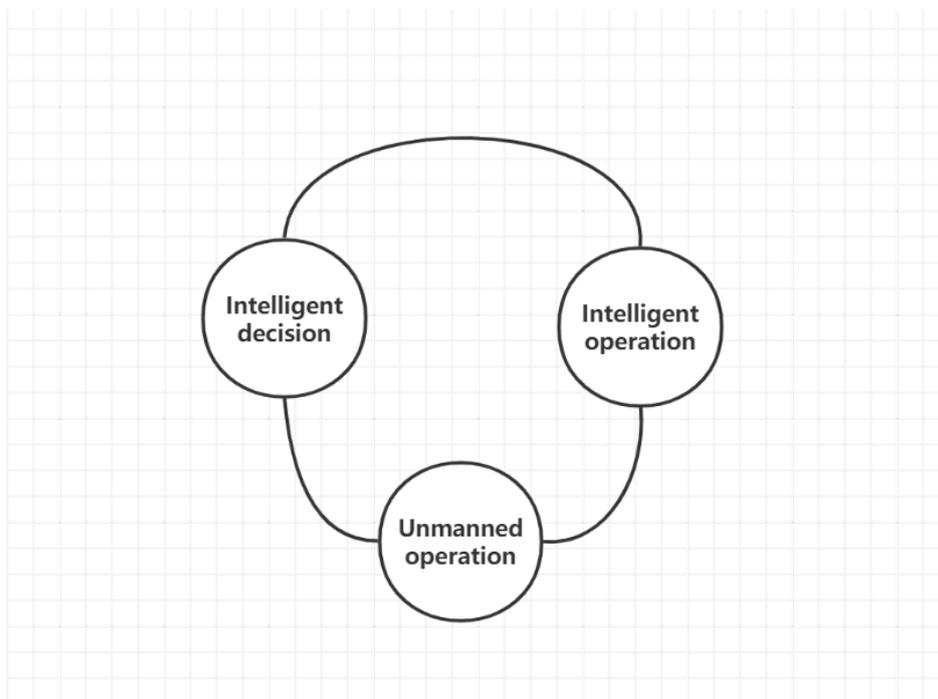
3.6. Customer management

The application of artificial intelligence in customer management process is mainly reflected in smart order system, smart shopping guide system and smart customer service system. Based on image recognition technology and big data analysis, the smart order system can quickly process customers' orders and provide customers with real-time and accurate information. The smart shopping guide system can provide users with accurate recommendations and personalized services according to customer portraits, and improve customers' purchase experience. The intelligent customer service system can provide 24-hour online consulting services for customers based on voice recognition, logical reasoning and other technologies, reducing the number of customer service personnel and improving the efficiency of customer service.

3.7. Transaction management

The online transaction system based on Internet technology has changed the cumbersome process of payment and settlement in the past. Enterprises only need to use the online payment system to make payment and collection to complete the whole transaction, which greatly facilitates the whole logistics process.

4. Application of artificial intelligence to the future development trend of international logistics and cargo transportation industry



4.1. Operation mode "unmanned" development

In the future, artificial intelligence will further develop in the direction of "unmanned". Technologies such as unmanned driving, unmanned express stations and unmanned express vehicles will be more widely used. Some logistics links with low repetition and mental labor will completely realize unmanned operation. The realization of unmanned can help enterprises save the cost of employing labor, make enterprises invest more in innovation, improve the core competitiveness of enterprises, and promote the progress of human society.

4.2. "Intelligent" development of operation process

In the future, the application of artificial intelligence in the international transportation and logistics industry will be more intelligent. Only a small number of people are required to make overall arrangements for supplier management, warehousing management, transportation management, capacity management, distribution management, customer management and other processes. Other tasks can be completely completed by robots, such as receiving, warehousing, storage, outbound, sorting, packaging and other work in the warehousing process, and handling, loading and unloading in the transportation process, The loading and unloading, transportation, sign in and other work in the distribution process will gradually become intelligent, and the whole operation process will be completed independently through self-adaptive ability and self-learning ability [5].

4.3. "Intelligent" development of decision-making process

In the future, artificial intelligence will develop in a more intelligent direction. Based on deep learning, robots will think independently like human brains, and can make corresponding decisions based on empirical data in case of conventional emergencies. This will enable enterprises to further reduce the use of unnecessary labor and spend more money and energy on enterprise innovation and core technology research and development. At the same time, machine decision-making is based on historical experience, which can avoid the subjectivity of decision-making and make decision-making more scientific and reasonable.

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