The application of artificial intelligence in logistics and express delivery

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Abstract. With the rapid development of e-commerce, the volume of express goods in China has been increasing explosively. In 2018, China's express delivery business will reach 50.5 billion units. With the increasing popularity of artificial intelligence technology, many modern logistics enterprises try to use artificial intelligence technology to optimize the logistics link and improve the logistics efficiency. This paper will discuss the application status and prospect of artificial intelligence in logistics and express industry.

1. Introduction
With the rapid development of e-commerce, China's express delivery industry shows explosive growth. According to statistics from the state post bureau, China's express delivery service volume reached 50.5 billion pieces in 2018. China's express delivery service volume has been the largest in the world for five consecutive years. During the peak period of "double 11" business in 2018 alone, the national postal and express delivery enterprises handled 1.882 billion pieces of express mail (express mail). With the rapid growth of express delivery volume year by year, the pressure of express logistics is becoming more and more serious.

Now, express logistics companies have entered a new stage of transformation. It is not only mode and capital but also emerging technologies such as artificial intelligence and cloud computing that are leading the explosive fission of the logistics industry. With the increasing popularity of artificial intelligence technology, many modern logistics enterprises try to use artificial intelligence technology to optimize the logistics link and improve the logistics efficiency.

In this era of drastic changes in the logistics industry, unmanned sorting centers, unmanned aerial vehicles delivering goods across the sea and logistics warehouses are emerging one after another. This paper will discuss the application of artificial intelligence in the logistics and express industry.

2. Application status
Artificial intelligence has significantly improved not only logistics efficiency, but also the quality of service. On the one hand, through big data analysis and machine learning, we can continuously optimize and improve the existing operation process and the planning in the warehouse based on the historical data. On the other hand, artificial intelligence technology can bring about the optimization of the transportation path and improve the delivery efficiency. The use of information means can make the whole operation traceable, the process controllable and the result predictable, exclude many uncontrollable factors in the operation, and ensure the quality of logistics operation.
In the following, the application status of artificial intelligence in logistics and express delivery industry is studied mainly from the perspectives of intelligent warehouse, intelligent delivery and intelligent transportation.

2.1. Intelligent Warehouse

Intelligent warehouse is the best embodiment of artificial intelligence to improve the operation efficiency of logistics industry. One robot after another cooperated with the work, so that the warehouse storage density, handling speed, picking accuracy have been greatly improved. Loading, unloading and handling is one of the most basic functional elements in the logistics system. It exists in the process of goods transportation, storage, packaging, circulation, processing and distribution, and runs through the beginning and end of logistics operations. The application of logistics robots directly improves the efficiency and efficiency of the logistics system [1-2].

For example, Suning has experimented with a warehouse robot project that shuttled 200 warehouse robots across a 1,000-square-meter warehouse and loaded nearly 10,000 movable shelves. Instead of people chasing the shelves, they wait for the robots to come with them. According to the actual test, the use of warehouse robot can reduce labor by 50% to 70% if 1000 pieces of goods are selected. The warehouse robot picking small goods, the efficiency can be more than three times the manual picking, picking accuracy of 99.99%.

The first automated warehouse of Cainiao Union opened in Guangzhou, to provide storage and sorting services for Tmall Supermarkets. From the receipt of orders to the delivery of parcels, except for bar code review and other links have been achieved automation. According to the introduction, after the user places an order in the Tmall Supermarket, the warehouse will receive the order and generate a unique barcode. After the carton is labeled with the barcode by the machine, it will be transported to the shelves of different commodity categories by conveyor belt. The electronic display on the shelf will show the goods to be loaded and the quantity, according to which the sorter will put the goods into the carton, and then the carton will enter the next station. After all the goods are installed, they are manually checked and sealed at the "cash register", and then transported to consumers by the logistics service. It is worth mentioning that Cainiao warehouse can know the size and characteristics of different goods before they are put into storage. Based on this, the most suitable carton is automatically allocated for an order, which saves packaging cost and is more environmentally friendly.

In Jingdong Kunshan unmanned sorting center, the huge six-axis handling robot is responsible for rearranging containers with suction cups. AGV (automatic guided transport vehicle) cars use the two-dimensional code navigation on the ground to move shelves [3-4]. When picking small items, the shelf shuttle will remove the boxes containing goods from the two rows of shelves and put on the conveyor belt for sorting robot sorting. The picking robot USES the 3D vision system to identify the goods needed by customers from the turnover box and transfer the goods to the order turnover box through the sucker at the working end. After the picking, the order turnover box will be transferred to the packing area through the conveyor line. The whole sorting center is truly unmanned, and the efficiency is greatly improved. According to the report, the operation efficiency of unattended sorting center in Kunshan is 9,000 pieces per hour, which can save 180 people on the premise of the same site size and sorting quantity.

2.2. Intelligent Delivery

Compared with the closed warehouse environment, the outdoor environment is much more complex, and the threshold for the application of artificial intelligence technology is higher. Unmanned aerial vehicle (uav) and other equipment are used to participate in the final kilometer of distribution.

In October 2017, Cainiao carried out an open group test of drones, which took nine minutes to fly over the nearly 5km strait with six full boxes of goods, providing logistics services for rural Taobao. This is the first time that China has completed the cross-sea express flight of a drone group.
Jingdong, on the other hand, announced on June 28, 2017 that its unmanned aerial vehicle delivery officially entered normal operation after a series of supporting technologies and facilities such as uav flight control and dispatching center, flight clothing center, research and development center and manufacturing center landed.

Shunfeng has placed higher expectations on unmanned aerial vehicles. It and its partners have developed large logistics uavs with an industry load of 300-2000 kg, a range of 500-2000 km and a cruising speed of 200-300 km/h, so as to supplement its regional logistics operation capability in the future.

In addition, Cainiao also developed the terminal distribution robot little G. This is a delivery robot developed to solve the problem of "the last kilometer of express delivery". It has strong independent thinking ability and computing ability. It not only can get on the elevator and perceive the crowded degree of the elevator, but also can recognize the pedestrians and vehicles on the road and intelligently plan the route [5-6]. Little G is a robot that can walk on the land. It is about 1 meter high and can hold 10-20 packages at a time. As long as the user sends the service demand to little G through his mobile phone, he will plan the optimal distribution path with TMS (transportation management system) and deliver the goods to the designated location. The user can sign for the delivery through electronic scanning. Adopted in the process of distribution, small G laser and visual parallel SLAM scheme, to observe the surrounding a complex environment, and the building up of itself in the system of multidimensional world, using adaptive particle filter algorithm, can carry on the accurate track prediction of dynamic entities, avoid pedestrians, vehicles, elevator, or even able to perceive crowding of the lift, choose to take.

2.3. Intelligent Transportation
Mercedes Benz unveiled a concept all-electric logistics car called the Vision Van. The highlight of the concept car is that it is equipped with two drones to deliver goods.

Through intelligent logistics vehicle, how to achieve efficient logistics distribution? After receiving the order, the warehouse will automatically allocate the goods according to the order content, transport the goods to the corresponding machine by conveyor belt, and then assemble them into the "Vision Van" logistics distribution vehicle, according to the company. The intelligent logistics vehicle will cross-reference the delivery location of each piece of goods and calculate the fastest route to send the whole vehicle to the destination. As soon as the driver gets on the vehicle, he can start the navigation immediately and set off without any trouble for planning the route. The car also has a fully automatic loading system in its trunk. The goods shelves are integrated with the rear doors. When loading is needed, the rear door will be removed together with the shelf, and then be sent to the car together after loading. This greatly reduces the time consumed by traditional manual loading, which Mercedes claims can save about 93.5% of the time compared with traditional manual loading. In addition, drones can deliver small parcels to designated places while cars deliver other goods, greatly improving the efficiency of logistics. Users can monitor the status of orders in real time from their mobile phones.

3. Application prospect
In the future, how far will the combination of artificial intelligence and logistics go? We mainly introduce from the following three aspects.

3.1. Intelligent equipment reorganizes logistics production factors.
The research and development of intelligent hardware equipment will enable the logistics industry to develop rapidly from artificial sorting to automation and intelligence. Intelligent perception technology, information transmission technology, mechanical arm, robot, automatic sorting belt, unmanned aerial vehicle and other intelligent hardware equipment will be widely used in various links of logistics operation [7].
3.2. Intelligent computing reconstructs logistics operation process.
The construction of intelligent logistics cloud platform will realize the digitization, intelligence, standardization and integrated management of supply chain and physical logistics. Taking comprehensive logistics as the starting point, modern artificial intelligence technology and logistics technology are applied to synchronize the information flow of all links of the supply chain with physical logistics, generate optimized processes and collaborative operations, realize the nearby warehousing and distribution of goods, and improve the efficiency of the industrial chain.

3.3. Form a new logistics ecosystem.
With the assistance of artificial intelligence, multimodal transport and efficient transportation will be realized [7]. Through artificial intelligence, cloud computing, big data, Internet of things and other technologies, we can achieve the "trinity" of intelligent multimodal transport that integrates railway, highway and aviation. Relying on the railway, highway network entities, aviation, water transport network and logistics park, make full use of cloud computing, big data, Internet of things, such as artificial intelligence technology, for the online logistics transportation, warehousing, commodity trading, financial services, logistics, good faith business such as one-stop, full-service, covering online logistics ecosystem, actively serve economic and social development.

4. Discussion
Compared with traditional logistics enterprises, the transformation of artificial intelligence is both an opportunity and a challenge.

At present, there is still a big gap between the logistics industry and the actual needs of intelligent basic data collection and perception facilities such as logistics big data and logistics cloud related to intelligent logistics, and the coverage and accuracy of logistics Internet are still insufficient.

Technology comes from talents. The logistics industry has massive data, rich business scenarios and a lot of real problems. What it needs most is technology and talents. The lack of professional and comprehensive talents in logistics enterprises greatly affects the development of logistics industry.

In addition, logistics standardization and the lack of integrity system has become a constraint. The effective operation of the combination of artificial intelligence and logistics is established on the basis of common standards and protocols. However, at present, there are huge differences in data coding, transmission documents, bearing units and so on. At the same time, the application of artificial intelligence breaks the traditional familiar relationship model of logistics, maintains numerous unfamiliar relationships, and forms normal market transactions. It is urgent to establish a socialized credit system.

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