Frontiers in Economics and Management Volume 4 Issue 11, 2023
ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0034

China's Intelligent Logistics Case based on Artificial Intelligence Perspective

Yonggang Zuo, Fei Rui*

Management Engineering Department, Anhui Industry Polytechnic, Anhui, China

Abstract

Intelligent logistics is a hot topic in the development of the logistics industry today, and artificial intelligence technology plays a pivotal role in the development of intelligent logistics. The realization of cost reduction and efficiency increase and industrial upgrading in the logistics industry is closely related to the development and landing of artificial intelligence technology. The paper takes the actual case of artificial intelligence empowering the logistics industry to explain the changes brought by artificial intelligence to the logistics industry. And look forward to the future development trend of smart logistics.

Keywords

Intelligent Logistics; Artificial Intelligence; AGV; RFID.

1. Introduction

With the convergence of science and technology and industrial changes, and the deep integration of industrial society and information, artificial intelligence has become a new engine for economic and social development, which will empower all traditional industries. Intelligent hardware represented by RFID, AGV, and drones has greatly changed the existing mode of logistics operations such as warehousing, transportation, and distribution, and has made "data-driven logistics" a reality with computer vision, big data mining, deep learning and other technologies.

Jing Zhao analyzed the application of artificial intelligence technology in the logistics industry, Dapeng Reny studied logistics informatization and logistics information platform construction, and Jiang and Fei used deep learning to fill the gap in the prediction of urban freight volume in the Internet of Things to meet the needs of smart logistics in China. Xiang Feng pointed out that with the support of rich application scenarios and massive data, artificial intelligence will lead the development direction of the new generation of logistics technology. Zhu Shanshan explored the problems existing in smart logistics and how artificial intelligence deals with the development of smart logistics. Liu Xiaona analyzed the upgrading and transformation of logistics enterprises driven by artificial intelligence technology. Xiao Huanbin explored the upgrading and transformation of supply chain logistics enterprises in logistics infrastructure, production tools and logistics operation processes driven by artificial intelligence technology, and analyzed the impact of artificial intelligence on supply chain logistics from five aspects: warehouse location, inventory management, warehousing operations, transportation and distribution, data analysis and prediction. Zhang Li discussed the logistics full chain architecture and scenario application based on artificial intelligence. Explore the deep integration of artificial intelligence technology and traditional logistics industry chain. Xu Ying pointed out that the impact of artificial intelligence in the logistics industry is mainly focused on intelligent search, warehousing planning, intelligent transportation and distribution, robots and other fields. Fu Lemin took artificial intelligence technology architecture as the entry point

ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0034

to elaborate the application countermeasures of artificial intelligence technology in the field of supply chain logistics.

In summary, at present, there are few case studies on artificial intelligence in logistics enterprises. Based on the actual cases of the logistics industry empowered by artificial intelligence, this paper expounds the changes brought by artificial intelligence to the logistics industry, and looks forward to the future development trend of smart logistics.

2. Intelligent Logistics System based on Artificial Intelligence

2.1. Visualization of Logistics Information

In intelligent logistics, computer vision greatly improves logistics automation and promotes the intelligence of the logistics industry. The typical application scenarios of logistics information visualization based on computer vision are:

(1) Warehouse monitoring through RFID technology to achieve real-time intelligent management of the station, can automatically identify the stacking degree and channel conditions in the station, reduce the storage of non-standard storage. Identify and classify damaged goods and be able to take appropriate action to repair them.

(2) Inventory management uses image recognition technology to distinguish the goods on the shelf, so as to achieve full automation of inventory.

(3) Shape recognition The shape recognition technology based on visual recognition can quickly judge the shape of the item, so that the sorting robot can quickly and accurately classify according to the shape of the product, which can not only save space, but also improve the speed of outward distribution of goods.

(4) Behavior recognition Through video recognition technology to automatically monitor the non-standard operation of employees in the station to avoid safety accidents, but also to analyze the behavior of employees, so as to help employees improve the rationality of express actions.

(5) Form identification and electronic entry There are many forms and document data in the logistics industry. The structured identification of form content through computer vision can quickly and easily complete the electronization of paper statements and documents, and greatly avoid manual input.

2.2. Unmanned Driving

The driverless logistics and distribution system can realize fully automated control of logistics transportation and improve the efficiency of logistics transportation. Unmanned distribution can shorten the distribution time and solve the last kilometer of logistics distribution. The typical application scenarios of the driverless logistics distribution system are:

(1) Trunk transportation technology, at present, unmanned trucks will still be in the water test stage.

(2) End delivery Jingdong, Cainiao, Meituan, Suning and other unmanned delivery vehicles are applied and tested in various scenarios such as community distribution and Courier pick-up. These vehicles use AI-based control centers to autonomously plan the route to the destination, find the shortest route, avoid congested sections, actively avoid obstacles, and finally notify the user before arriving at the destination to pick up goods.

(3) Drone technology is now mainly used in areas with relatively small population density, such as rural delivery.

2.3. Intelligent Sorting

In the operation of warehouse, the intelligent development of picking technology improves the overall efficiency and quality of picking operation. Sorting logistics products through artificial

ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0034

intelligence algorithms can liberate labor productivity and save costs for enterprises. The typical application scenarios of logistics warehousing system based on intelligent sorting are: (1) Automatic guided vehicle (AGV), which has the advantages of high degree of automation and convenient use. (2) RFID automatic sorting technology, RFID automatic sorting technology can continuously and in large quantities sort goods, and the sorting error rate is very low, and the sorting operation is basically unmanned.

2.4. Intelligent Scheduling

Through the analysis of basic data such as the quantity and volume of goods, intelligent scheduling of various links such as packaging and transport vehicles is carried out. For example, by calculating the volume data and package size of millions of SKU goods, using deep learning algorithm technology, the system intelligtively calculates and recommends consumables and packaging ordering, so as to rationally arrange the box type and product placement plan.

(1) 3D container packaging.3D container packaging is a combinatorial optimization problem of how to achieve spatial optimization through the decision of packing order, placing position and direction of goods in logistics. For example, the Ali team used the RNN network to solve an optimal sequence problem of item order, position, direction, etc., and then optimized the logistics packaging of Tmall and Cainiao. The results proved that the optimized packaging method could save 5% of the packaging boxes, which greatly saved the cost.

(2) Intelligent scheduling.Meituan Food delivery has Meituan super brain for intelligent scheduling, integrated operation optimization and artificial intelligence methods, can execute nearly 3 billion times/hour algorithm, dispatch 600,000 active riders across the country to complete more than 20 million orders of delivery tasks every day. As another takeout giant, Ele.me's intelligent scheduling system Ark also uses deep neural networks to share intelligent adaptation with multiple scenes, introduces the concept of "big business circle", and establishes different adaptation models for different scenes in Pinggao.

(3)Vehicles are often affected by traffic congestion and other factors in the process of transportation and distribution, resulting in overtime distribution. Vehicle route planning is one of the most important optimization problems in the field of logistics. Logistics path planning based on deep learning and flow computing can introduce the factors of real-time traffic conditions on the road. Cainiao Network independently developed a vehicle route optimization algorithm that integrates large-scale neighborhood search, super-heuristic algorithm, gene algorithm, distributed parallelization and enhanced learning.

3. Smart Logistics Project Case based on Artificial Intelligence

AI+ logistics has been developing rapidly, and logistics has received comprehensive transformation such as artificial intelligence technology in various scenarios such as transportation, warehousing, distribution and management. Promote the transformation of the entire logistics industry from a labor-intensive service industry to a technology-intensive service industry.

3.1. Cainiao Logistics

(1) Intelligent online robot customer service.Intelligent online robots use advanced technology based on the combination of rule statistics and deep learning to achieve accurate intention capture, emotion recognition, and multiple rounds of interaction after sentiment analysis, bringing customers a friendly and novel service experience. Considering that express logistics customer service management is often faced with "three high and two low" business situation, that is, high operating costs, high training costs, high employee turnover rate, low customer service efficiency, and low customer satisfaction. The application digs deeply into the customer service demand points of express logistics, builds an intelligent knowledge graph system for 29

ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0034

business scenarios such as search, prompt, and order, and realizes the context correlation, intent reasoning, and text error correction effect.

(2) The YTO dynamic five-sided DWS system has become an inevitable choice for domestic and foreign logistics enterprises to replace the existing intensive manual operation with the huge number of express transfer pieces, limited space and low labor efficiency. However, in the realization of automated logistics, the pain points of the express delivery industry are mainly the quality of the barcode of the waybill, and the automatic reading of the single-side scanning waybill requires manpower to turn over and cooperate. Yto dynamic five-sided DWS project is mainly composed of artificial intelligence deep learning platform intelligent reader, line laser 3D stereo camera, dynamic logistics platform software to complete core data fusion. It can realize the front, back, left, right and top surface single bar code recognition, and collect the outer contour volume information of the package, and the fusion software binds and fuses the weight data at the same time. In the express logistics site, the five-sided DWS system can be applied in various logistics links such as inbound, transit, sorting and outbound.

(3) Smart delivery bucket - small blue bucket.Unmanned self-service intelligent equipment will be the future public service infrastructure, unmanned self-service intelligent equipment delivery bucket, can be a good solution to the current delivery service in the three end of some problems, the client: uncontrollable waiting, waiting for Courier door-to-door pick up time, waiting for high cost; Unable to meet the overnight delivery demand; Courier door-to-door package, privacy and personal property security risks. Express outlets: random pick up costs are high, people are difficult to recruit, and staff turnover is high. Courier side: upstairs service time cost is high, low efficiency.

The smart mail bucket uses the basic technology of the combination of the Internet of things and the Internet, combined with the application scenario of the express user's mailing, and the user can complete the mailing by himself through the mobile APP registration operation control device. The intelligent order sending system combines big data analysis, intelligent positioning, and other task order calculation and processing of couriers to assign agents intelligently, so as to realize timing and pickup of agents, maximize work efficiency and reduce operating costs.

3.2. Jingdong Logistics Enterprise

Jingdong Intelligent network planning system has built a total of 3 core modules, namely intelligent location, intelligent routing and commodity layout, which carries the internal logistics services of e-commerce logistics business of the mall internally and realizes the lean cost intensive requirements of logistics operations. Externally, the open logistics business also provides high-quality and low-cost supply chain/logistics services for external customers, scientifically balancing the cost and timeliness of Jingdong's complex and large-scale network planning scenarios. The key artificial intelligence technologies involved in the three core modules of Jingdong intelligent network planning system are described in detail as follows:

(1) Intelligent location selection includes the warehouse network planning of the warehousing link, the sorting layout of the transportation link, and the point network layout of the distribution link. Based on the results of big data analysis, reasonable spatial clustering of supply and demand nodes is carried out, and then intelligent algorithms are combined to optimize the solution of alternative sites.

(2) Intelligent routing network planning needs to complete the design of the production wave of the sorting center in the large-scale routing network, the group of the whole network capacity, and the transfer relationship between the sorting, etc. Any adjustment of the wave, capacity and transfer relationship in the network will have a global impact on the entire routing network that can not be predicted manually. Jingdong innovatively abstracts large-scale routing network planning in actual business scenarios into a hybrid hub-and-spoke network design problem, and integrates artificial intelligence technology with the scene to achieve capacity

ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0034

prediction, traffic prediction, transport capacity analysis, single clustering, and mining multi-level hub positioning. The design of sorting wave number, point-to-point transportation capacity organization and sorting transfer relationship is completed at one time, and the time and cost of large-scale routing network are scientifically balanced.

(3) Commodity layout is the key technology needed to study the inventory layout of physical commodities in the space logistics network, including sales forecasting technology and warehouse layout technology. Prediction technology: including machine learning prediction technology and big data prediction engineering technology. Warehouse layout technology includes commodity correlation mining technology and logistics warehouse network decision-making technology. The former performs filtering and short-term prediction based on time series for correlation, and then uses spectral clustering SC to build the "similar category" correlation between commodities. The latter uses Monte Carlo simulation and regional order delivery density to calculate the adaptation value of each warehouse to be selected, and considers the constraints of aging permeability, warehouse number and demorsal rate. Aiming at the lowest overall storage and transportation costs, genetic GA algorithm and gradient descent method are adopted. Quickly find out the current Pareto solution set under the order, cost, warehouse number target for business decision. Intelligent location can reduce the average daily operating cost of specific logistics nodes by 15%-20%; Intelligent routing reduces network cost by 10% and network timeliness by 12%. The commodity layout reduces the order removal rate by about 3%, the overall storage is reduced by 10%, and the commodity inventory turnover is reduced by about 10%.

Since Jingdong unmanned warehouse was put into operation, the intelligent production model has developed rapidly. However, the number of logistics robots is large, the equipment model, interface, and technical characteristics are varied, and the equipment inspection and timely maintenance workload is large, requiring the unmanned warehouse to achieve "efficient operation and maintenance". X Storage Brain is a highly intelligent product to achieve the goal of "more efficient" in unmanned warehouses. The main functions of X storage brain include: monitoring and early warning of order production data, resource optimization allocation suggestions, data statistics and analysis; (2) Robot important data monitoring and early warning, diagnosis and suggestion, data statistics and analysis; (3) Planning algorithm modeling parameter input and automatic modeling process; (4) The PC version adapted to the office scene and the mobile version adapted to the mobile office scene.

Diversified mass sensor data real-time acquisition system: In the scenario of warehousing and logistics, operating unmanned is an urgent difficulty in the industry. The first problem to be solved in realizing unmanned warehouse operation is how to fully grasp the real-time status of unmanned warehouse operation for decision-making. The diversified real-time collection system of massive sensor data developed by Jingdong realizes the real-time collection function of massive sensor data in the unmanned storage scenario.

Data storage based on the combination of centralized technology and big data distribution: the traditional storage method has the advantages of short data processing links and short analysis, development and application cycles. However, in the scenario of automated warehousing, multiple data structures and massive data make the traditional storage architecture unbearable. X Storage brain uses enterprise-class data synchronization tools, data centers (IDC) for synchronous data processing, to achieve centralized data storage; HDFS based on Hadoop cluster can store massive data. MapReduce and Spark computing frameworks make it possible to analyze and calculate massive historical data. Strom, Flink and other streaming computing frameworks combined with Kafka's data middleware will further improve the timeliness of data processing and analysis from T+1 to T+0, making the data analysis, diagnosis and control within the day more timeliness and application value.

ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0034

In the intelligent logistics robot industry, X Storage Brain improves the efficiency of planning, operation monitoring and maintenance up to 80%, reduces labor costs up to 50%, and is expected to save 220 million yuan per year. Jingdong unmanned warehouse, which has applied X storage brain, has been at the leading level in the industry after nearly a year of rapid development, whether it is order processing capacity or the operation and maintenance capacity of automation equipment.

3.3. Suning Logistics

Suning Logistics Intelligent decision system uses operation research optimization, machine learning and deep learning algorithms to establish three core new applications, namely intelligent network planning, intelligent warehousing and intelligent scheduling. Through mining data value, the logistics operation process is reshaped, enabling Suning Logistics to reduce costs, increase efficiency and improve experience, and realize the transformation and upgrading of intelligent logistics.

(1) Intelligent network planning: Firstly diagnose the existing transportation network, warehouse network, distribution network and site network, and find out the network planning that can be optimized to achieve fine management on the logistics operation level; Then, based on the operation and timeliness data, the newly added network planning is evaluated, the layout scheme is adjusted, and the overall operating cost is reduced without reducing the operating efficiency.

In the intelligent logistics scenario based on big data and artificial intelligence, the network layout analyzes the whole logistics process. Among them, the warehouse network layout includes the current situation of the operation analysis and inventory analysis, the planning of the new warehouse opening evaluation model, the selection of goods distribution suggestions. From the current situation to the planning, the health of the warehouse network is diagnosed, the operation of the warehouse network is assisted, and the analysis model is provided for the new opening of the warehouse. Intelligent computing technology for multi-node warehouse network: Using big data technology and operation optimization algorithm, combined with sales data, operation data and effectiveness of warehouse network, optimize and solve, and give analysis results.

Transportation network planning In logistics and express operations, transportation costs and transit costs are the main components of the total operating costs, and the design of the network and routing determines the level of transportation costs and main transit costs, but also determines the speed of service. In the past, the planning of vehicle routes and routes basically relied on manual experience, but because of the large number of distribution centers, the complex structure of cargo volume, and the possibility of planning various routes and routes combination is very many, so it is difficult to achieve global optimization by relying solely on manual experience. In addition, considering the changes in the market environment, the volume of goods is constantly fluctuating, and the planned vehicle routes and routes need to be adjusted in time to ensure and improve the quality of service and reduce the waste of costs. However, it is difficult to rely on manual labor to timely and accurately capture the points that need to be optimized due to changes in arrival volume, and carry out corresponding planning optimization and adjustment. Therefore, Suning has developed a transportation network planning system:

Suning Logistics intelligent network planning system uses a heuristic algorithm to complete the route recommendation function: based on the existing route and schedule planning, a variety of routes are recommended, and the most suitable route can be selected according to the actual business needs. The precise solution algorithm is used to realize the routing planning of the whole network: by adjusting the input future cargo volume and the future alternative transfer field, the future cargo volume and the distribution and transfer cargo volume under the

ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0034

distribution center can be calculated, which provides support for the construction and expansion of the distribution center.

(2) Intelligent storage。Warehouse management has the characteristics of many kinds of commodities, large inventory, large amount of work, and many decision-making links, and the decision result of any link will affect the final operation effect. In view of this feature of warehouse management, Suning has established an integrated solution for warehouse management through the deep combination of artificial intelligence technology and operation scenarios. The scheme covers the algorithm system of seven operation links: warehouse layout, shelf-replenishment, warehouse transfer, cargo tally-picking and packaging, and provides closed-loop feedback service of evaluation, diagnosis, suggestion and re-evaluation, which has obvious improvement effect on warehouse utilization and operation efficiency.

(3) Intelligent scheduling Intelligent scheduling includes the model recommendation of trunk transportation, vehicle route planning of branch transportation and the assignment order allocation at the end. With the help of artificial intelligence technology, the coordination and unification of operational resources such as vehicles, personnel and equipment in logistics transportation and distribution can be realized to maximize operational efficiency. Through historical order information, machine learning algorithms are used to perform portrait analysis of delivery areas, couriers and customers, and assign orders to the most suitable couriers to optimize the experience of couriers and customers. Combined with various constraints and management decision requirements in the real scene, the optimization algorithm of operation research is used to optimize the model and vehicle path of the transportation line.

4. Conclusion

The application of artificial intelligence technology in logistics management can increase efficiency, reduce costs and improve customer satisfaction. Logistics companies should evaluate the costs and benefits of applying AI technologies based on their own business needs and application scenarios, and actively recruit and train professionals to develop and maintain these systems. With the continuous progress of technology and the continuous reduction of costs, the application of artificial intelligence technology in logistics management will be more and more extensive. Logistics intelligence and intelligent transformation are the development direction of the logistics industry in the future, coupled with the increasing maturity of global artificial intelligence, big data and other technologies, the market size of the smart logistics industry will continue to expand.

Acknowledgments

Funding: This work was supported by the Anhui Province Quality Engineering Project (Grant Number : 2022jyxm212);Anhui Province University Philosophy and Social Science Research Project (Grant Number: 2023AH053131);Anhui Industry Plytechnic Quality Engineering Project (Grant Number: 2023jpkc07).

References

[1] Xie, F. , & Zhao, J. . (2020). Cognitive and artificial intelligence system for logistics industry. International Journal of Innovative Computing and Applications, 11(2/3), 84.

[2] Dapeng, & Ren. (2018). Research on Logistics Informatization and Construction of Logistics Information Platform.

[3] Jiang, Fei ,&Ma. . (2018) . A new form of deep learning in smart logistics with IoT environment[J]. The Journal of Supercomputing.

ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0034

[4] Xiang Feng. (2019). Artificial Intelligence will lead the development direction of the new generation of logistics technology . Logistics and purchasing in China.

[5] Zhu Shanshan, Yang Shangxia. (2019). . Artificial intelligence to promote logistics development to explore the wisdom. Journal of information science and technology.

[6] Liu Xiaona. Transformation, upgrading and development trend of logistics enterprises in the era of artificial intelligence [J]. Business Economics Research,2019(04):91-93.

[7] Xiao Huanbin, Chu Liangyong. (2019). , Lin Yunmin. Application in the field of artificial intelligence technology in the supply chain logistics. Value engineering/.

[8] Zhang Li. (2021). "Artificial intelligence +" logistics full chain architecture and scenario application . Business Economics Research.

[9] XU Ying. (2021).Artificial Intelligence: Reshaping the "Logistics World" . Modern Manufacturing.

[10] Fu Leimin, Lin Feng, Li Kai. (2023). Application analysis of Artificial Intelligence technology in Supply chain logistics . Software.