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USE OF ARTIFICIAL INTELLIGENCE IN THE SUPPLY CHAIN OF LOGISTICS

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ABSTRACT

Today, artificial intelligence technologies are used in a number of applications. The study found that the logistics sector is one of the sectors with many companies actively using machine-building processes. The main reason for this conclusion is that new business models have been used more significantly in the highly competitive logistics sector than in previous stages due to rapid digitalization. While the logistics industry has had to deal with many new challenges over the years, it has had to withstand the external influences of factors that are increasingly competitive.[1] As a result of solving these problems, the intentions of consumers, such as delivery and availability of permanent goods, will also be realized in over-the-counter trading. In addition, there is a growing trend to order smaller volumes of products at higher frequencies.

Keywords: Simulation models, artificial intelligence, supply chain, logistics providers, OCaPi (optimal cart pick) algorithm, autonomous robots, digital twin.

Ключевые слова: имитационные модели, искусственный интеллект, цепочка поставок, поставщики логистических услуг, алгоритм OCaPi (optimal cart pick), автономные работы, цифровой двойник.

АННОТАЦИЯ

Сегодня технологии искусственного интеллекта используются в ряде приложений. Исследование показало, что сектор логистики является одним из секторов, в котором многие компании активно используют процессы машиностроения. Основная причина такого вывода заключается в том, что новые бизнес-модели используются в высоко конкурентном секторе логистики в большей степени, чем на предыдущих этапах, из-за быстрой цифровизации.

These changes require a reorganization of existing business models and strategies of logistics companies. The only way to solve this problem is to automate all logistics processes on a large scale and integrate and manage them into a standardized IT system. However, such a system is based on direct human participation, even if the individual process stages are already functioning autonomously.[2] It is here that as the volume and complexity of logistics operations increase, or with the need to make time-consuming decisions, even pre-installed mathematical optimization algorithms can be justified. The time interval for decision making is shorter and the size of the problem increases at the same time.

When logistics providers use artificial intelligence technologies, their competitiveness increases as well as their revenue. Reasonable analysis of the data that emerges at all stages of the supply chain allows identifying previously unseen relationships, to develop realistic scenarios and quality goods for the near future.

The use of artificial intelligence in the supply chain results in an ecological system in which different value chains are interconnected. For many years, simulations have played a key role in logistics systems and process planning. Simulation models determine the results by evaluating the dynamic motion of the system for the defined parameters.

Nowadays, the concept of "digital twin" is entering the field of simulation. Almost the same offline presentation of a particular system, with the introduction of correspondingly comprehensive data, the study of artificial intelligence-based algorithms, the continuous organization of learning and re-learning in the event of changes in the logistics environment gives the opportunity. [3]

Another area where artificial intelligence is already in use is to optimize logistics processes that can adapt independently and dynamically to changing market demands.

An artificial intelligence-based algorithm of logistics processes produces a solution that allows for a more efficient distribution of assembly work among warehouse workers in warehouses and speeds up the collection process. First, the picker gets a collection list and moves around the carousel carrier to pick up what he needs from the aisles. In fact, the combination of a selection list and a route is a complex activity for a traveling salesperson.

The OCaPi algorithm (optimal cart pick), developed by information technology experts, considers not only the routes of employees, but also the paths of carousel carriers, which sometimes stop at pedestrian crossings, while workers pick things up from sidewalks or they bring. In this case, the OCaPi algorithm offers the shortest path.

Unfortunately, the OCaPi algorithm only takes a few seconds to calculate the optimal collection list. To reduce this time to a few milliseconds, a million random collection lists is created and labeled with the peak time of the calculation using the OCaPi algorithm. This information is passed to the neural network in the next step. In this way, network architecture has been developed in the region that is capable of calculating travel times with an error rate of just over 32 seconds per hour.

To test the artificial intelligence system, a simple optimization algorithm was written, starting with more than 40 orders, each consisting of several elements, randomly separated between two selection lists. There are more than 69 billion ways to register items for orders in two selected registrations. The calculated routes resulted in an 11 percent reduction in travel time for the selected item.

It is known that today there are warehouses, the principles of which can not be organized without the supervision of human observers. Their general characteristics are usually based on the automated control of robots and vehicles. In these warehouses, which provide us with supermarket services, the products are not grouped by category and are simply placed side by side. They are placed on different shelves and in the aisles and can be in a chaotic look. When an autonomous robot takes an order, the first robot available exists to pick up an item that is stored close to its position and deliver it to the customer.

Today, big data technologies are elements of a fast supply chain. Only by using these technologies has it been possible to process a very large amount of data, depict the real world, and then make decisions. Large information technologies allow the analysis of forecasts and

complex scenarios, thereby allowing precise power planning and optimization of supply chains and stocks. [4]

Predictive analysis is mainly based on data identification for artificial intelligence, which includes the use of statistical calculations, methods of studying semantic processes and operations, and potential elements of game theory.

The stages of predictive analysis, called descriptive analytics and receptive analysis provide recommendations for actions based on the interactions identified by artificial intelligence.

In conclusion, given that a high level of data integrity is a prerequisite for a meaningful outcome, it is important that every system in the supply chain be able to respond to information generated by artificial intelligence. It is very important that the data is processed only for the system so that the prediction gives optimal results. Although it is observed that data entry is still done manually, resulting in data loggers making mistakes even if they are unaware of it, in the field of logistics, the system has been adapted to the changed environmental conditions. The data that is constantly created for reconfiguration serves as an excellent framework.

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