A NEURAL NETWORK MODEL FOR AUTOMATED LOGISTICS PROVIDER SELECTION

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Abstract: In the article, using artificial intelligence technologies in the digital economy, the problems of organization of logistics flows were identified and scientific proposals aimed at solving them were developed

Keywords: digital economy, logistics, logistics system, information logistics, logistics chain, internet, remote services.

Introduction

According to the World Bank, in 2018, the logistics efficiency index rose from 99 positions to 75.1. At the same time, at the end of 2019, the volume of express delivery of parcels (BTS) in the logistics market for online stores increased significantly) by 67.2% via Uzbekistan Post. By the end of 2019, the volume of online purchases amounted to more than 2 million. This is 18% more than last year. According to the forecasts of the analytical agency DataInsight, by 2024, online shopping should make up 8.5% of the country's retail turnover. However, the 2020 coronavirus pandemic has brought significant changes. In 2020, the forecast increased to 193% by 2024. During the pandemic period (March-April 2020) when restrictions on the movement of individuals were imposed, the volume of courier deliveries increased sharply, for example, for EMU (delivery company) it increased by 17.0%, BTS - by 40%. [1].

The most effective way to ensure competitiveness of logistics is to gain the trust of customers and create all the conveniences for them, as well as to increase the type, quality and speed of services. In order to ensure the competitiveness of logistics, they feel a greater need to introduce modern services and use new technologies. In the 2020 state program "Development of Science and Digital Economy" by the President of our Republic, Sh. Mirziyoyev, we must make a radical change in the development of the "digital economy" this year. Also, it is necessary to critically review the "Electronic Government" system, implemented programs and projects, and comprehensively solve all organizational and institutional issues. [2].

Literature review. Jamiyatning yangi texnologik tartibga o'tishi faoliyatning barcha sohalarida tub o'zgarishlarga olib keladi. Biroq, asosiy tushunchalar o'zgarishsiz qolmoqda. Ulardan biri biznesning asosiy maqsadi – tovarlar va xizmatlarni tarqatish uchun mijozlar bazasini yaratishga asoslangan korxonaning raqobatbardoshligi. Bundan tashqari, iqtisodiyotning har qanday tarmoqlari va ishlab chiqarish, yuqori texnologiyali, logistika provayderlari korxonalari uchun.

So'nggi o'n yilliklarda iqtisodiy rivojlanishning asosiy xususiyati shakllangan virtual muhit bo'lib, bir qator biznes jarayonlar ushbu yangi haqiqatga aylandi. Uning naqshlari, asboblari mavjud. Va shuni ta'kidlash kerakki, ba'zida virtual muhit o'z qonunlarini belgilaydi. Masalan, har qanday kompaniya o'z veb-saytiga, elektron pochtasiga ega bo'lishi, naqd pulsiz shaklda hisob-kitoblarni amalga oshirishi kerak. Savdo markazlarida, do'konlarda xaridlar iste'molchilarga tovarlarni yetkazib

berish bilan onlayn xaridlar bilan almashtirildi.

Methods

In accordance with the "Uzbekistan-2030" strategy of the Republic of Uzbekistan, deepening the integration into the global transport and logistics networks and increasing the potential of the national transport system is the fulfillment of the tasks specified in the state program and defined in the regulatory and legal documents. Scientific research data of international experts were used in writing the scientific article.

Resut and Discussion

The next important task in the implementation of the adaptive integrated logistics methodology is the automation of the second stage - obtaining the weighting coefficients. Although the weighting factors can be manually entered into the system by a subject matter expert in the first iteration of the process, this is not entirely suitable for industrial implementation, where the number of such operations is not considered, as they must be performed continuously. Automating the process of obtaining weighting coefficients for the flow of incoming messages is possible only with the use of the most modern technologies and with the use of sufficiently powerful equipment. According to the author, the most suitable technology for this purpose is the technology of artificial intelligence: neural networks and machine learning.

If the task is computationally difficult, for example, it is difficult to algorithmize, or the algorithm for solving it is not known in advance, then the most optimal solution is to use neural networks. In its simplest form, the structure of a neural network can be expressed as a sequence of the simplest "if-then" conditions, and the decision is made by repeating all the options in a row, multiplying the weight coefficients and choosing the maximum result.

Neural networks are a general name for mathematical algorithms that are able to learn using examples (images, sets of parameters, situations, etc.). After training, neural networks are able to "recognize" similar objects (situations, parameters, etc.) even from its parts. This feature of neural networks is used to solve problems such as classification, recognition, signal processing, decision making, etc. A neural network is a collection of neurons connected by connections, also called synapses. A computer neural network is a very simplified model of a biological neural network, but at the same time it has very interesting possibilities.

He has the ability to analyze and remember information, and in some cases reproduce information. The neural network is used in cases where it is necessary to model the work of the analyst (human brain), for example, to solve the problems of classification, recognition of patterns, prediction of the development of the situation, observation of the dynamics of changes of any factors. A neuron is a basic computing discrete element, the input of which receives data for elementary operations and further transmits it. A set of neurons at a level is a layer.

A simple neural network consists of several layers, three of which are most commonly used. However, the number of layers may vary depending on the accuracy requirements of the solution. For example, there can be four, five or more layers. Choosing a neural network architecture is a separate task that is not part of the research topic, but with an increase in the number of layers, the risk of retraining the network increases, which leads to distortion of the output data.

The input layer of the neural network includes neurons that are only responsible for receiving data and do not participate in further calculations. Internal layers process signals using special algorithms that take into account the weighting coefficients of connections between neurons. The output layer is responsible for decision making. The inner layers of a neural network can contain different algorithms that can be described by different mathematical models. As part of this dissertation research, fuzzy logic methods, which are easy to algorithmize, are used.
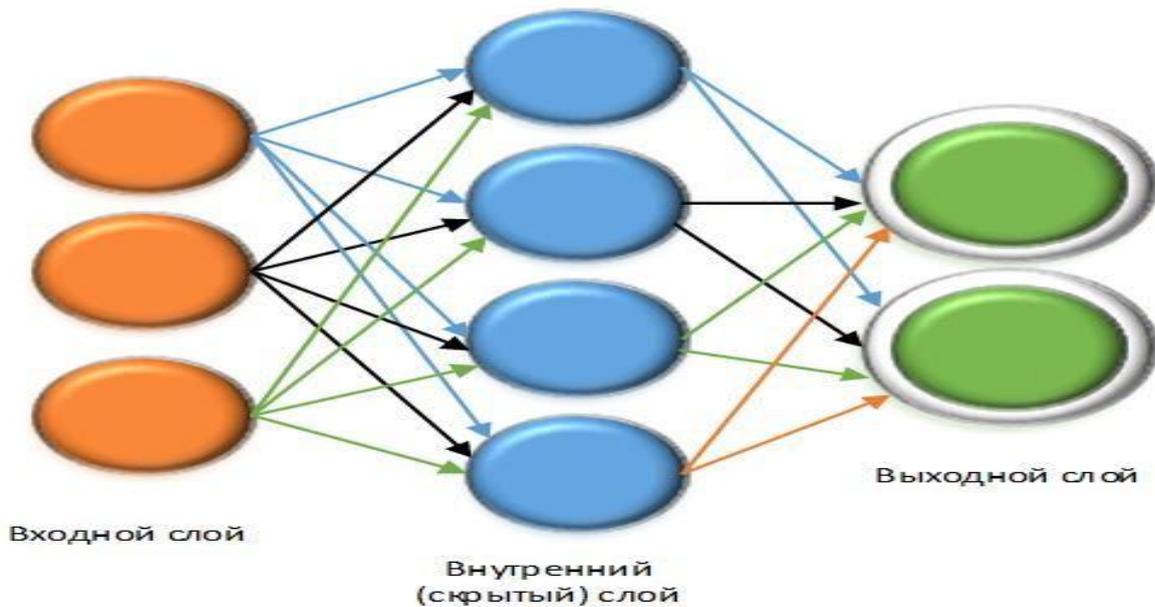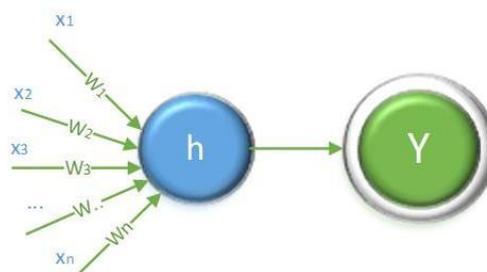
1- Figure. A simple structure of a neural network [3].

The mathematical model of an artificial neuron is usually presented in the following form, which is described by the following mathematical model:

$$Y = f\left(\sum_{i=1}^{n}(x_i \cdot W_i)\right)$$

x_i – input parameter;

w_i - weight of the parameter;

Y - output parameter.

2-Figure. artificial neuron model [4].

For a multi-layer neural network, such transformations should be performed as many levels as there are levels in the designed network.

$$F_i = f\left(\sum_{i=1}^{n}(x_i \cdot W_i)\right) \tag{10}$$

$$Y = F_n\left(F_{n-1}\left(\ldots\left(F_1(X)\right)\right)\right) \tag{11}$$

When using a neural network to solve logistics problems, the main task is to train it, which, in general, consists only of adjusting the weight coefficients. The more precisely these coefficients are chosen, the more accurately the neural network works. However, serious difficulties can arise at this stage, because the method of placing these coefficients is not known in advance. In order to eliminate uncertainty in the regulation of weighting coefficients, connections of neurons according to the "one-

to-one" principle are used. True, in this case, there will be a little excess of connections that may not be used at all in calculations, but there is no need to place them manually.

One of the more common ways to remove communication from calculations is to set the weighting factor to zero. In this case, the link remains available but does not count.

The calculation of weight coefficients is carried out during neural network training using trained and untrained learning algorithms, but at the same time, the data set must be divided into two samples: training and testing, later training tests are conducted. While studying with the teacher, the subject matter expert manually enters the appropriate values for each parameter, which are then used to make decisions. In untrained learning, a neural network learns from a training sample with responses to certain parameter combinations, and then compares the neural network's responses to actual responses to check the quality of learning on the test sample.

A fuzzy composite based on the matrix number can also be used to obtain the weighting coefficients. But for this algorithm to work, it is necessary to obtain the initial matrices, which can also be obtained by machine learning. After training, the neural network is able to process large data sets and sufficiently high speed, while maintaining high accuracy and reliability of the output results.
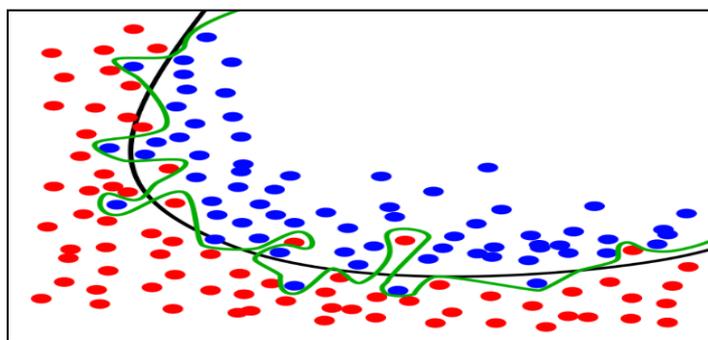
3-Figure. neural network retraining [5].

The retraining situation is clearly indicated by the green line, which accurately describes all the parameters of the model, avoiding errors in the test sample. But in real conditions, such a classification leads to many errors. To prevent such a situation, additional measures should be taken to prevent retraining. Such measures include:

• Slide management method;
• Editing - adding additional restrictions;
• Early stopping is used to stop learning when a certain parameter is reached, such as the percentage of correct answers;
• Verbalization of neural networks - description of the operating principles of the formed and trained neural network;
• A priori probability;
• Comparison of Bayesian models;
• Butch-normalization—normalize the input to get zero mathematical expectation and variance equal to unity;
• Ensemble method is used when instead of one network, several copies of it are created and some average output value is calculated on the same inputs

Conclusion

In the conditions of digitization of the economy, the following activities should be increased in logistics:

Wide use of new information technologies is necessary in the organization of logistics services. The development of information technologies within logistics services allows the customer to conduct banking operations using a telephone, modem and computer, and reduces the cost of logistics services and increases the speed of operations.

These modern types of services allow you to make bank calculations anywhere in the world, according to experts, today 25% of all banking services in European countries are carried out via the Internet.

It is expedient to introduce foreign experience of new types of services into the logistics practice of our republic and increase their volume..

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