

**CIEDR 2018**  
**The International Scientific and Practical Conference**  
**"Contemporary Issues of Economic Development of Russia:**  
**Challenges and Opportunities"**

**INFLUENCE OF THE DEVELOPMENT OF NEURAL NETWORK**  
**TECHNOLOGIES IN RUSSIA DIGITAL ECONOMY**

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***Abstract***

This article presents an analysis of the digitalization of the modern Russian economy, examines the principles of the operation of neural networks and their application in the economy, identifies and substantiates the advantages and disadvantages of this technology, as a result, the degree of influence of neural network technologies and the consequences of its usage in the Russian economy. The development of economic relations in a competitive environment between different countries and producers, the need to reduce the costs of goods and services and the rapid growth in using various innovative technologies has led our global economy to the post-industrial digital age. Nowadays most decisions in problem-solving processes of different spheres in our life are based on the global digitalization and the usage of the main inexhaustible resource – information. Information needs to be calculated using different techniques, one of the most advanced is neural network software. The article will be interesting for data scientists, engineers and PhD students, who are involved in software building.

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**Keywords:** Artificial intelligence, digital economy, development, machine learning, neural network, Russian economy.



## **1. Introduction**

The development of economic relations in a competitive environment between different countries and producers, the need to reduce the costs of goods and services and the rapid growth in using various innovative technologies has led our global economy to the post-industrial digital age. Nowadays most decisions in problem-solving processes of different spheres in our life are based on the global digitalization and the usage of the main inexhaustible resource – information.

The digital-informational revolution and its main result - electronic and digital economy – have drastically changed the form of the organization of socio-economic relations and institutions in the global market economy. The term “digital economy” was firstly provided in 1995 in the book “Being digital” by American computer scientist Nicholas Negroponte, who claimed that the intensive development of information and communication technologies will absolutely change all the spheres of human life (economic, social, political, cultural and others). Nowadays, actually, the process of economy digitalization affects all known to us areas of human activity - finance, trade, engineering, agriculture, construction, transport, communications, medicine, education, etc. Nevertheless, this phenomenon has both positive and negative consequences in the global economy.

One of the technologies, which has recently gained popularity in terms of digital economy is neural network. This method of implementing artificial intelligence has various scopes of application, which are discussed by specialists in almost every sphere of socio-economic relations.

## **2. Problem Statement**

The research presents an analysis of the digitalization of the modern Russian economy, examines the principles of the operation of neural networks and their application in the economy, identifies and substantiates the advantages and disadvantages of this technology, as a result, the degree of influence of neural network technologies and the consequences of its usage in the Russian economy.

## **3. Research Questions**

The main questions of the research are the next:

1. What is the influence of neural networks technologies on Russian economy?
2. Digital economy in Russia: its main role?

## **4. Purpose of the Study**

All of the above facts determine the relevance of this article, which has a purpose to examine neural network technologies and their influence in Russian digital economy.

## **5. Research Methods**

Summarizing the international experience in evaluating the level of Neural Networks influence on the digital economy of Russia, the following approaches are used:

1. A simple experiment involving the standard practice of manipulating quantitative independent variables to obtain statistically analyzed data;
2. Opinion-based research methods usually include experiment planning and collection of quantitative data. For this type of research, measurements are usually arbitrary, following an ordinal or interval type;
3. Observational studies are a group of different research methods in which researchers try to observe a phenomenon without interfering too much.

The main sources of the research are publications in the open press, press releases of major players in the field of information technology, publications of the Federal State Statistic Service, main websites and portals in the field of high-end IT technologies.

## 6. Findings

The main reason for the expansion of the digital segment of the economy is the growth of the transactional sector, which in developed countries is more than 70% of the national GDP. This sector includes: public administration, consulting and information services, finance, wholesale and retail trade, as well as various municipal, personal and social services. The greater the degree of diversification and the dynamics of the economy, the greater the volume of unique data circulating inside and outside the country. Therefore, the digital economy is most effective in markets with a large number of participants and a high level of penetration of ICT (Information and Computer Technologies) services.

Due to the above reasons of the digital economy rapid distribution, it is quite obvious that decisions in the creation and development of the digital economy were to be strictly adopted in Russian economy. The corresponding program was approved by the order of the Government of the Russian Federation dated July 28, 2017 No. 1632-r. According to the Program, the digital economy is economic activity, the key factor in the production of which is data in digital form, and which contributes to the formation of an information space, taking into account the needs of citizens and society in obtaining quality and reliable information, developing the information infrastructure of the Russian Federation, creating and using Russian information- telecommunication technologies, as well as the formation of a new technological basis for social and economic sphere (Danilov-Danil'yan & Losev, 2000; D'Alfonso, Langer, & Vandelis, 2016; Harm, Obregon, & Stubbendick, 2016).

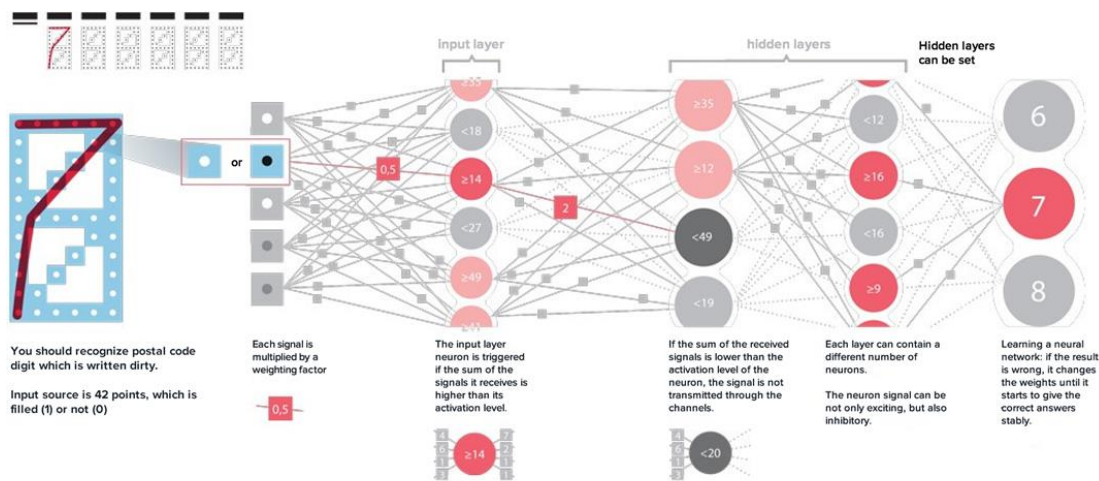
The digital economy is the result of the transformation effects of new general-purpose technologies in the field of information and communication. The digital economy now permeates countless aspects of the world economy, impacting sectors as varied as banking, retail, energy, transportation, education, publishing, media or health (Shestopalova, 2016; Demidov, 2015).

The neural network is one of the ways to implement artificial intelligence (AI). In the development of AI there is an extensive field - machine learning, which studies methods of constructing algorithms that are able to learn independently. This technology is quite necessary if there is no clear solution to any problem. In this case it's easier not to look for the right solution, but to create a mechanism that will come up with a new method to solve that problem. There is also a field in machine learning, called deep learning, which means the usage of much more computing resources for developing different algorithms.

A neural network simulates the work of the human nervous system, a feature of which is the ability to self-learn, taking into account previous experience. Thus, every time the system makes fewer and fewer mistakes.

Like our nervous system, the neural network consists of separate computational elements - neurons, located on several layers. The data arriving at the input of the neural network passes sequential processing on each layer of the network. In this case, each neuron has certain parameters that can vary depending on the results obtained - this is the training of the network.

Suppose that the task of a neural network is to distinguish wolves from bears. For configuring the neural network, a large array of signed images of wolves and bears is provided. The neural network analyzes the signs (including lines, shapes, their size and color) on these pictures and builds such a recognizing model that minimizes the percentage of errors relative to the reference results. Another task (to recognize the digit of the postal code written by hand) is detailed described in the Figure 01 below.



**Figure 01.** Recognition of postal codes using neural network

Until 2010, simply there was no database, large enough to qualitatively train the neural network for solving certain tasks, mainly related to the recognition and classification of images, that is why the probability to make a mistake was high. However, in 2010 the ImageNet database appeared, which contained 15 million images in 22 thousand categories and exceeded the amount of existing image databases, so it was available to any researcher. The neural network could be taught to make practically error-free decisions due to such volumes of data.

According to the main purpose of this article, it is necessary to identify the degree of neural networks influence on the world. In total, neural network technologies are able to both help people in one sphere and replace people in another one, this idea can be proved by following examples of implementation this kind of digital economy technology in the world.

According to the recent contract, 34 employees of the Japanese insurance company Fukoku Mutual Life will be replaced by the IBM Watson Explorer AI system. The neural network will view tens of thousands of medical certificates and take into account the number of visits to hospitals, the transferred operations and other factors to determine the terms of insurance for customers. Fukoku Mutual Life

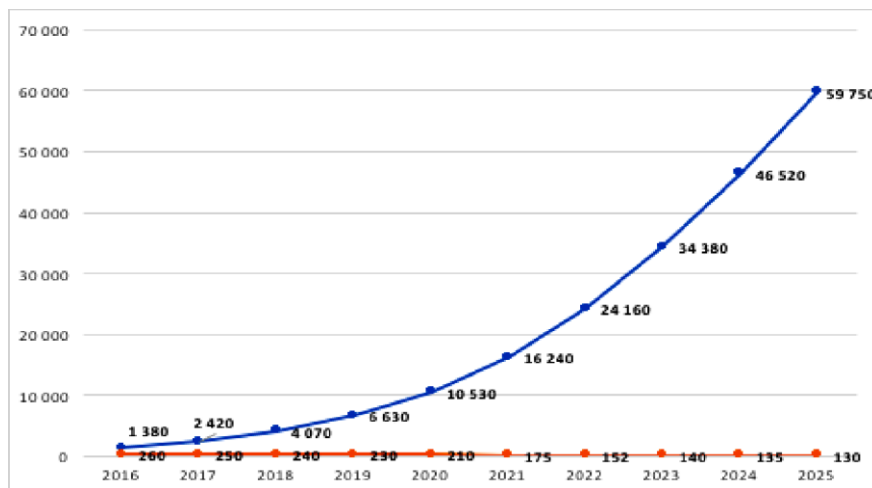
Insurance is confident that using IBM Watson will increase productivity by 30% and return investments back in two years.

Neural networks analyzing the natural language can be used to create chat-bots that allow customers to obtain the necessary information about the company's products. This will reduce the costs for teams of call centers. Such a robot already works in the reception of the Government of Moscow and handles about 5% of requests.

Herman Gref announced that the neural networks of Sberbank replaced 450 lawyers by developing claim statements much better than students with experience and legal education. The Figure 02 below shows the inverse relationship between the values of the volume of the world market of artificial intelligence and the number of Sberbank staff. With the projected growth in world investment in projects related to neural networks (the blue line), the number of employees of the Russian bank, which actively uses neural network technologies and introduces machine learning into its activities (the ginger line), is declining.

However, machine learning and neural network technologies are not able to fully replace some specialists. Despite the fact that the researchers from Nottingham University developed four algorithms of machine learning to assess the degree of risk of cardiovascular disease in patients and made trained AI determine the risk of cardiac diseases more effectively than real doctors do, the demand for professional doctors did not decrease.

Nevertheless, in terms of the modern digital economy, the labor market has changed, nowadays the demand for specialists, having skills in machine learning, programming, knowledge of algorithms has been increasing. The digitalization of modern economy with the different methods of implementing artificial intelligence is leading to the decrease in amount of costs in the form of specialists with obsolete knowledge and skills and increase in the productivity, the speed of customer satisfaction. All these positive consequences are the features of the modern digital economic age, in which there also some threats, requiring the development of the strategy for minimizing the digitalization risks (Veynberg, Timofeev, Popov, & Bortsova, 2018; Timofeev, Bayandin, & Kulikova, 2018; Popkova, Popova, Denisova, & Porollo, 2017; Przhedetskaya & Akopova, 2016; Veynberg & Popov, 2016).



**Figure 02.** Correlation between the world's investments in the development using artificial intelligence (blue line) and the staff of the largest bank of Russia: Sberbank (ginger line)

Despite the fact that Russian economy digitalization also provides new management capabilities through using large data technologies, analytics and forecasting, the control over digital services is declining, and opportunities for fraud are increasing (Veynberg & Popov, 2016; Averkin, Yarushev, Dolgy, & Sukhanov, 2016; Kovalev, Sukhanov, Averkin, & Yarushev, 2016).

Although the expansion of the range of services provides opportunities for Russian companies to enter the international market, the risks of information leaks are significantly increased, which requires an increase in the level of protection, allocation of additional investments in information security.

## 7. Conclusion

In the conclusion, the authors of the article presented the following recommendations for increasing the productivity and influence spheres of digital economy technologies, including neural network:

- make Russian government strictly responsible for supporting the market for relevant high-tech products and distribution of digitalization program;
- training of personnel for the implementation of digital projects on national economy level and the operation of information systems in public administration through the reforms in economic and technical educational programs.

## Acknowledgments

The article was supported and funded by grant project №18-310-20008 by Russian Foundation for Basic Research

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