

## NEURAL NETWORKS IN OUR LIFE

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**Abstract:** *The article is dedicated to the study of definition of neural networks and spheres of their application. Nowadays neural networks help people in lots of spheres and let people solve extremely complicated tasks. Their role in economy is high: they are used for market prediction and creating the applications for real business.*

**Keywords:** *neural network, algorithm, economics, prediction, neurons, process.*

### **Introduction**

Nowadays, information technologies are gaining more and more influence. The use of neural network is becoming more and more popular every year, especially in the field of economics and business. New models of neural networks are being developed. Despite on the fact that neural networks are used in wide variety of narrow fields, soon we will have an opportunity to implement neural networks in our everyday life.

### **The history of neural networks**

The definition of neural network firstly was described in the middle of the XX century. The scientists who managed to develop the first works in the field of neural networks were McCulloch and Pitts. The computer model of a neural network based on mathematical algorithms and the activity of human brain was created in 1943. This model laid the foundations for two different directions to neural network research. One branch was devoted to the exploration of processes in the human brain, the other - on the use of neural networks as a part of artificial intelligence to solve different tasks and problems.

The Canadian physiologist Hebb described the link of brain neurons and their interaction in 1949. Firstly, the idea that learning consists in changes in the strength of synaptic connections was suggested by him.

In 1954, Farley and Clark developed an imitation of the Hebb network with the help of computers at the Massachusetts Institute of Technology. In 1957, Rosenblatt developed mathematical and computer models of information perception by the brain based on a two-layer learning neural network. During training, this network used arithmetic operations of addition and subtraction [1].

Interest in the study of neural networks faded after the publication of the work on machine learning by Minsky in 1969. He discovered the main computational problems that arise during the computer implementation of artificial neural networks. The main disadvantage was that neural networks could not perform the operation of exclusive or [1].

Research on neural networks slowed down until the time when computers reached high computing power. Later a method of error back propagation was developed. This method effectively solved the problem with the exclusive or operation.

Modern tasks of high complexity require the use of several methods, and now neural networks are gaining more and more popularity in different areas.

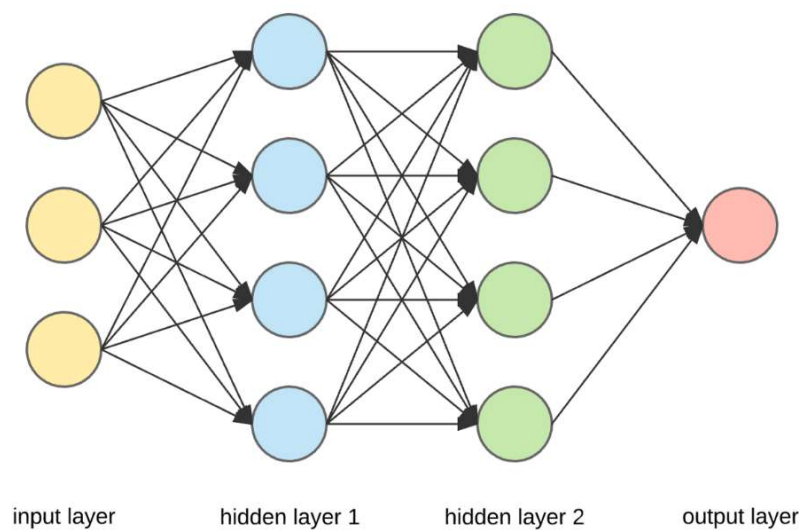
### **The concept and classification of neural networks**

An artificial neural network is a mathematical model which is built on the principle of organization and functioning of biological neural networks and which is consist of artificial neurons and nodes.

Neural networks are classified into two categories: synchronous and asynchronous. In synchronous neural networks, only one neuron changes its state once. In asynchronous networks, the states of a group of neurons or usually the entire layer change at the same time.

Two basic architectures of neurons can be distinguished - layered and fully connected networks. In layered neural networks, neurons are divided into separate classes so that information processing is carried out in layers. Layered networks are classified into single-layer and multi-layer [1].

In a multi-layer network, the first layer is an input, and the subsequent layers are internal or hidden, the last one is the output. The input layer of the multilayer network, respectively, organizes communication with the given data, and the output layer - with the output data. That is, neurons are separated into three groups: input, output and hidden. The input layer is organized from incoming neurons, which receive data for processing and distribute it to the inputs of the hidden layers of the network. A hidden neuron is a neuron located in a hidden layer of a neural network. Output neurons, from which the output layer of the network is organized, and the results of the entire neural network are output [1]. Figure 1 represents the multi-layer neural network:



**Figure 1. Multi-layer Neural Network [2]**

In fully connected networks, the organization process works as follows: each neuron sends its output signal to other neurons, including itself. After several cycles of network operation the signals of output (all or some of them) might become the output signals of neurons. All input signals are fed to all neurons.

A neural network is used when the types of connection between the input and output are unknown, if there were accurate data on the connections, it would be possible to simulate the connection. There is also some significant feature of neural networks, the very dependence between input and output can be found in the process of network training.

To train the network, an algorithm of two types is selected: controlled, that is, "learning with a teacher" and unmanaged, respectively, "learning without a teacher".

Most often, learning with a teacher is used to train neural networks. A user who wants to manage network training should prepare some training data set. That is, for the input signals, paint the corresponding output signals. The neural network begins to learn how to create a connection between input and output, looks for matches and remembers them. The training data is taken from any historical information [3].

Figure 2 represents the recurrent neural network:

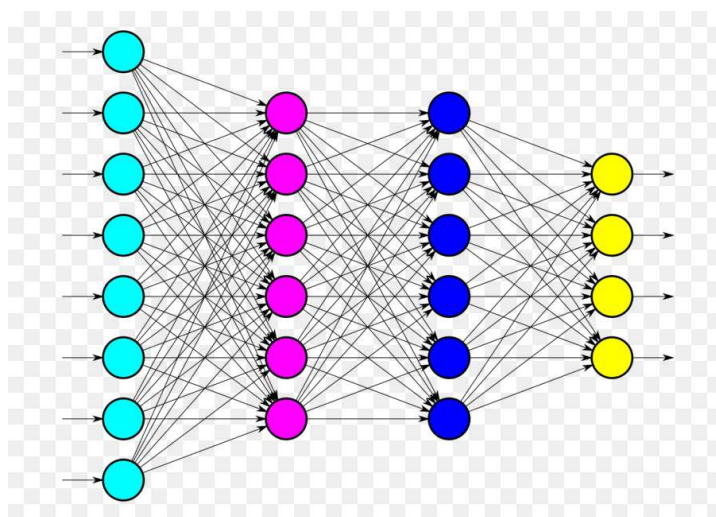


Figure 2. Recurrent Neural Network [4]

### Neural networks in Economics

The role of neural networks is increasing in the field of economics.

Now the prediction of the market, optimization of commodity and cash flows, analysis and generalization of various social surveys, prediction of the dynamics of political ratings, optimization of the production process, comprehensive diagnostics of product quality is the main purpose to use neural networks in economy [3].

Neural networks are often used in real business applications. The effectiveness of its use in forecasting systems and marketing research systems is constantly growing.

The tasks where neural networks are used are similar in many aspects to the tasks that can be solved by conventional statistical methods. However, economic systems are very complex, as they depend on the actions of different people and events. This makes the process of creating an accurate mathematical model that could fully meet all the requirements, sometimes impossible.

In such complex systems, it is advisable to use models that can directly create a complete imitation of the behavior of the economy as a whole. This can be done by using neural network technologies.

### Neural networks in other spheres

Today neural networks are used in many areas of human life:

1. Diagnosis of diseases of agricultural crops and other plants;
2. Images and videos processing is the application of artificial neural networks. Nowadays, artificial neural networks are also widely used in biometrics, like face recognition or signature verification [4];
3. Developers from Oxford University managed to train neural networks to recognize speech by lips. Studies have shown that the neural network correctly recognizes speech in 93% of cases. This achievement should significantly help people with hearing impairment [5];
4. Neural networks in Natural Language processing can be divided into two branches:  
Text Classification and Categorization: Neural networks are actively used for text classification online web searches, language identification, sentiment analysis and recognition of parts of speech.

### Language Generation and Document Summarization:

Their applications for generating text-based reports from data tables, automated reports writing, summarizing medical reports, generating stories and jokes are also created using neural networks' methods.

## **Conclusions**

Why have neural networks become so popular nowadays? Because the capacities allow even not big companies to create neural networks. Moreover, pre-trained can be used for developing your own applications. It is also possible to use the algorithm of the same neural network for similar projects.

By the way, we should not forget that neural networks have to be studied for a long time. Methods based on neural network technologies are already used in many fields today, but it is necessary to explore the possibilities of neural networks. Also we can not say that neural networks will be able to completely replace a human in problem solving process, because a lot of things should be under control of people. The combination of human source and high-level technologies is the efficient solution for modern world with its needs.

## **References**

1. История возникновения нейронных сетей. [online]. [accessed 25.03.2022] Available: <https://neuronus.com/history/5-istoriya-nejronnykh-setej.html>
2. Image classification with Convolutional Neural Networks. [online]. [accessed 25.03.2022] Available: <https://medium.com/@ksusorokina/image-classification-with-convolutional-neural-networks-496815db12a8>
3. ТРОФИМОВА Е. А., МАЗУРОВ В. Д., ГИЛЁВ Д. В. *Нейронные сети в прикладной экономике*. [online]. [accessed 25.03.2022] Available: [https://elar.urfu.ru/bitstream/10995/46988/1/978-5-7996-2018-9\\_2017.pdf](https://elar.urfu.ru/bitstream/10995/46988/1/978-5-7996-2018-9_2017.pdf)
4. *Introduction to Application of Neural Networks*. [online]. [accessed 25.03.2022] Available: <https://www.educba.com/application-of-neural-network/>
5. 17 применений машинного обучения в 5 отраслях бизнеса. [online]. [accessed 25.03.2022] Available: <https://mcs.mail.ru/blog/17-primerov-mashinnogo-obucheniya>