

ARTIFICIAL NEURAL NETWORKS: ADVANTAGES, CHALLENGES, APPLICATIONS

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Annotation. The article discusses the implementation of artificial neural networks as one of the most promising trends in the development of artificial intelligence. The importance of artificial neural networks in different spheres of our life as well as challenges have been considered.

Keywords: artificial neural network, artificial intelligence, search systems, applications.

Introduction. Nowadays artificial neural networks have become one of the most promising trends in the development of artificial intelligence because they contribute to meeting the needs of customers at minimal cost. Being able to reproduce and model nonlinear processes artificial neural networks have found applications in such areas as system identification and control, geoscience, game playing, medical diagnosis, data mining, visualization, cybersecurity and so on.

Main part. Artificial neural networks can be defined as a generalized name for mathematical models and programs built on the principle of organization and functioning the biological neural networks – the networks of human brain neurons [1]. Artificial neural networks started as an attempt to use the architecture of the human brain in order to perform different tasks that conventional algorithms had little success with. An artificial neural network is made up of some layers, such as input, output and one or some hidden nodes. These layers contain a collection of simulated neurons that receive data from the previous layer, process it, pass the data to the next layer and finally the output layer summarizes all the calculations and offers the answer in the form of a conclusion or a prediction.

Artificial neural networks can be classified into different models in accordance with the purpose they are used for. The most basic type of artificial neural networks is a feed-forward network that can only transmit data in a single way, from the input nodes to the output nodes, for example, they can be the basis for computer vision or natural language processing; whereas recurrent neural networks can preserve and reuse the output of other processing nodes, for example, text-to-speech conversions typically use the artificial neural networks of this type. Other types of artificial neural networks that are often used today include convolutional neural networks employed in artificial intelligence applications (for example, facial recognition, text digitization, natural language processing) and deconvolutional neural networks which help to synthesize and analyze different images.

The advantages of artificial neural networks are numerous. First of all, the main characteristics of artificial neural networks are their continuous self-learning and the possibility to improve the results, which means that after training the program becomes more user-friendly immediately it is being used, as well as their ability of adapting to changes in the input data that allows to work with the same efficiency. Another advantage of artificial neural networks is their effective noise filtering in the data describing their ability to extract from a huge heterogeneous stream of data only necessary information, for example, in search for non-clinical medical research, weather forecasts, economic market analysis as well as text translation.

However, despite the efficiency and extraordinary potential of artificial neural networks they are not perfect. First of all, the final outcome depends on the choice of initial data for their training that is why the correct solution to the task is not guaranteed in some cases. Another challenge with artificial neural networks is their «black box» nature which implies the lack of explanation for the probing solutions of an artificial neural network in order to understand what kind of data is used to take a decision and what make it come to a certain conclusion.

The next disadvantage of neural networks is the fact that they usually require significantly more data to train than traditional machine learning algorithms. Moreover, if your task is more unique and complex, the more time and resources you will need to spend. That is why nowadays the new artificial neural networks are developed mostly by large companies (Google, Microsoft, IBM) which have not only a lot of money and access to high-end programmers but also to big data. Small and medium-sized businesses are not a competitor here [1]. For example, in 2020, according to the statistics, Alphabet invested in medical technologies, computer vision, data analytics and natural language processing; Apple acquired a number of technologies, in particular, Novarius for natural language processing, Perception for image recognition, Emotient for facial expression recognition, RealFace for face recognition; Facebook also made a number of important acquisitions, including Technologies for Jibbiggo oral speech translation and Zurich Eye computer vision; other notable players include Intel, Microsoft, SoftBank [2].

Having analyzed the use of artificial neural networks in different areas of our life, we have found out that among the most popular neural networks exploited in the art and entertainment industry there are such apps as «RemoveBg» that allows to remove the background from the pictures or «Colorize» and «Algorithmia» that can color old black and white photos; «Lensa» that is able to create portraits in different styles from photos, improve facial imperfections and level up photos by applying unique filters and effects or «Inpainting», the service from Nvidia, which can remove the unnecessary objects from the background, finish painting something new, retouch the face, correct the details in the picture and even prettify different things as well as «Midjourney.com» which is supposed to be one of the most useful neural networks for creating art while generating unique images for the design of any publication. What is more, The Japanese studio Qosmo has recently created a very unusual neural network «Imaginary Soundscape» that can reproduce the sound corresponding to a particular image.

Implementation of neural networks in business has seen a drastic up-rise in the development of businesses of many companies and finally benefitted the people using them [3]. For example, «Chat GPT», a revolutionary artificial intelligence technology designed by OpenAI, is exploited for a variety of applications, namely customer service, automated pre-generated responses, and natural conversations with humans. In addition, it can be used as a virtual business consultant answering questions, giving recommendations how to start any business, selecting the most cost-effective advertising channel, correcting texts for the site and so on.

In the field of journalism, the use of neural networks can be seen by the example of the news agency Bloomberg News which generates about a third of its content through «Cyborg» neural network that is able to process reports and compile news quickly, and this is not the only example.

Another big application of artificial neural networks is the voice assistants. The voice assistants in everyday life function on the trained neural networks to assist and give people the results they asked for. They are trained to detect various slangs, accents and different meanings that they mean even when they speak the same sentence [3].

Conclusion. Thus, this rapid development represents a unique improvement in many spheres of human life, offering comfort and facilitating daily work but at the same time there is a danger of job cuts and even the total elimination of an entire profession. On the other hand, despite the fact that now neural network can generate or draw something, any program still needs a person who will give input data, adjust parameters and evaluate the result based on their life experience. People will have to find new approaches to accomplishing their tasks or to obtain new tools that can open up new horizons.

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