

Smolensk Academy of Professional Education

# Neural Networks: Advantages and Applications

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## 1. Introduction

### a) Neural Networks: definition

A human brain is not capable of solving complex data and cannot extract information from compound structures. To overcome this lack of ability to resolve complex problems, Warren McCulloch and Walter Pitts came up with a mathematical model. This model is called Artificial Neural Networks (ANN) which falls under Artificial Intelligence. The ANN is a computing system designed to replicate the way humans analyze and work. The processing of multiple data inputs is done by different machine learning algorithms. These algorithms work together under a single framework called the neural network. Neural networks are inspired by the structure of biological neural networks in a human brain. There is an input neuron which acts as an interface for all the other neurons to pass the input. Also, there is an output neuron which accepts all the outputs from different neurons.



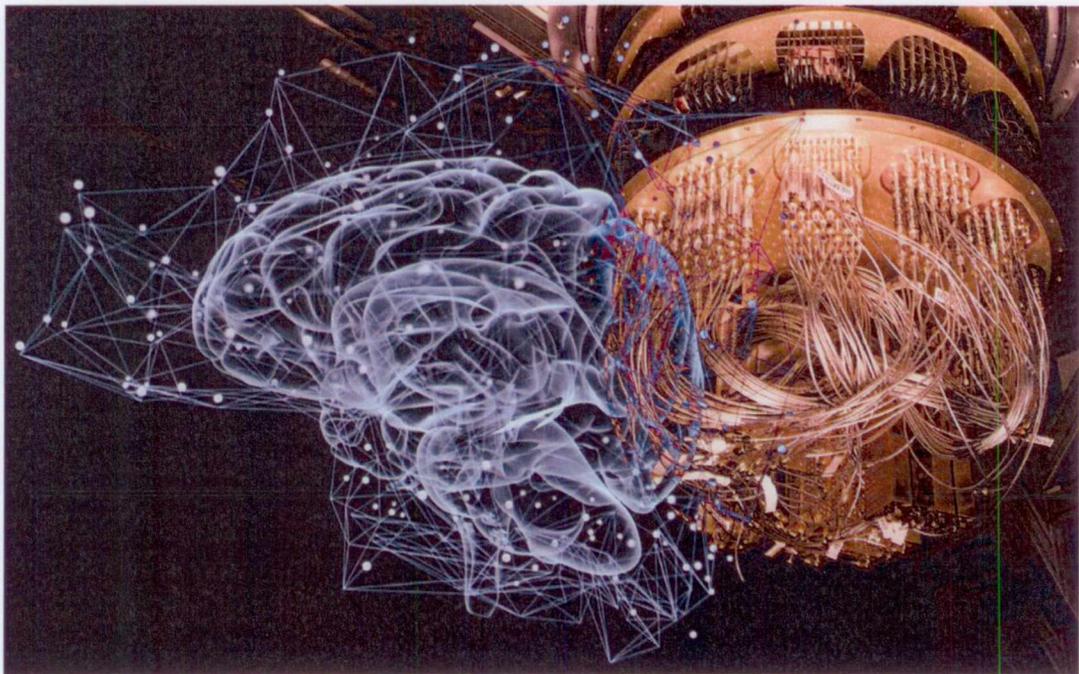
### b) The composition of neural networks

Artificial Neural Networks are composed of many nodes. These nodes are connected to each other and function together, by passing information. They consist of a number of layers called Multi-Layer Perceptron (MLP). Here, each layer performs a different function on the received data. These layers include one input layer, one output layer, and one or more hidden layers. The basic data is received by the input layer. The hidden layers extract data from one set of neurons (input layer)

and provide the output to another set of neurons (output layer), hence they remain hidden. The hidden layers, as they go deeper, capture all the minute details. This results in discovering various relationships between different inputs. Finally, the output layer provides a result which is simple and understandable.

## 2. Types of Neural Networks

The Neural Networks are divided into types based on the number of hidden layers they contain or how deep the network goes. Each type has its own levels of complexity and use cases. Few types of neural networks are Feed-forward neural network, Recurrent neural network, Convolutional neural network and Hopfield networks.



### a) Feed-forward neural networks:

Feed-forward neural networks are the basic type of neural networks. The information in this network travels in a unidirectional manner, that is, only from input to processing node to output. The hidden layers may or may not be present in this type, making it more explicable.

**b) Recurrent neural networks:**

Recurrent neural networks are much more complex and most widely used networks. The data flows in multiple directions in this network. They store the output data of the processing nodes and learn to improve their functioning.

**c) Convolutional neural networks:**

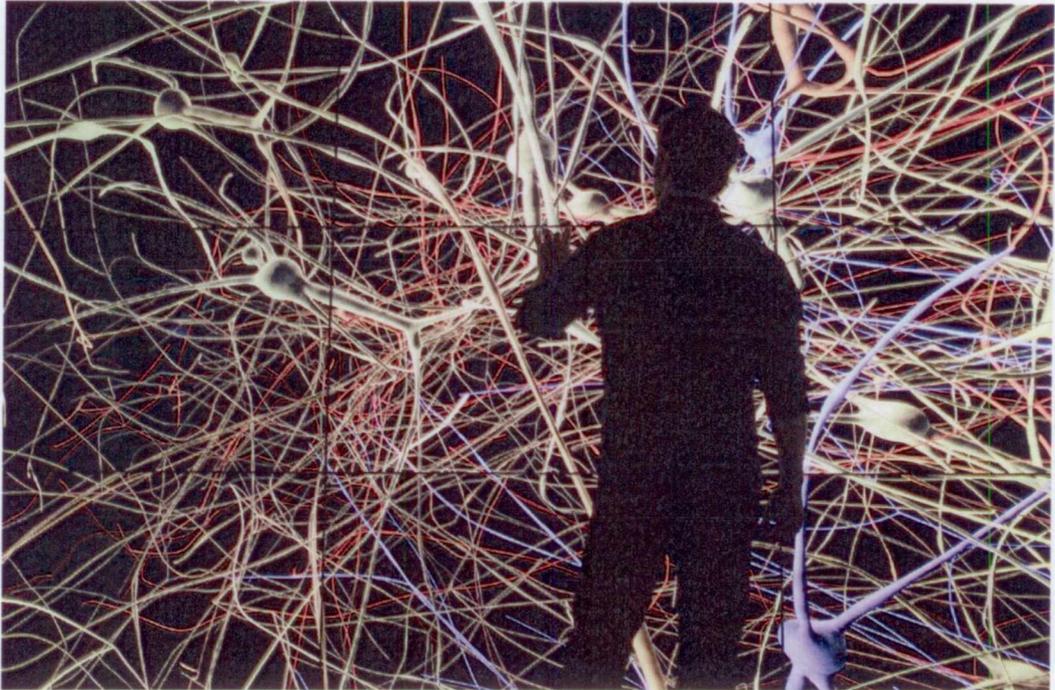
Convolutional neural networks are the ones that are popular today due to their specialty in being able to perform face recognition. They allow encoding attributes into the input, by assuming it to be an image.



### 3. Advantages of Neural Networks

- Neural Networks have the ability to learn by themselves and produce the output that is not limited to the input provided to them.
- The input is stored in its own networks instead of a database, hence the loss of data does not affect its working.
- These networks can learn from examples and apply them when a similar event arises, making them able to work through real-time events.
- Even if a neuron is not responding or a piece of information is missing, the network can detect the fault and still produce the output.

- They can perform multiple tasks in parallel without affecting the system performance.



#### **4. Applications of Neural Networks**

The Artificial Neural Network has been in existence from 1943, when it was initially designed, but has only recently come into light under Artificial Intelligence due to the applications that make it more preferable. These include:

- Image processing
- Language processing and translation
- Route detection
- Speech recognition
- Forecasting

Artificial Neural Networks are currently being used to solve many complex problems and the demand is increasing with time. The wide number of applications starting from face recognition to making decisions are being handled by neural networks.

## 5. The most popular neural network in Russia is ChatGPT

The crazy progress artificial intelligence (AI) has made lately has caused a stir in pretty much every industry you can think of. One AI superstar is ChatGPT, an AI chatbot that's so cutting-edge, it's practically doing linguistic backflips!



ChatGPT is an AI chatbot developed by OpenAI that is designed to provide human-like conversational interactions. It is built on large language models (LLMs), which are advanced machine learning models that can understand and generate natural language.

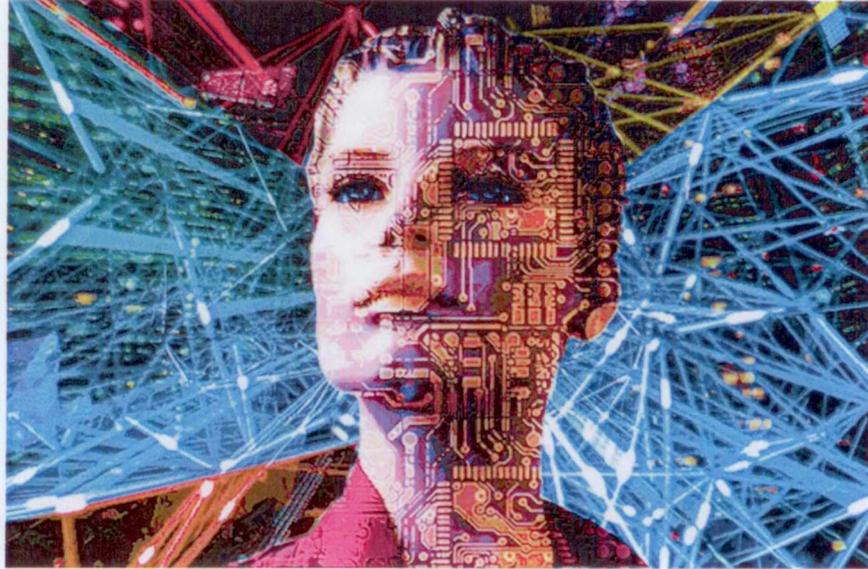
As an AI-powered natural language processing tool, ChatGPT is capable of understanding and generating text based on the prompts you give it. It has a wide range of applications, from answering your questions to helping you draft content, translate languages, and more.

Due to its advanced text-generating abilities, ChatGPT has use in various industries and fields, such as customer support, content creation, programming assistance, and more. It's an excellent example of the power AI has in transforming our daily lives and work experiences.

ChatGPT's advanced language capabilities and wide domain knowledge enable it to excel in various applications across multiple industries. While it's still a new technology, it could potentially replace human workers in a lot of sectors.

## 5 Potential Applications of ChatGPT:

- Content Generation
- Chatbots, Virtual Assistants, and Customer Support
- Language Translation
- Interactive Gaming and Storytelling
- Education and Tutoring



## 6. Conclusion

Neural networks try to emulate the human brain, combining computer science and statistics to solve common problems in the field of AI.

Neural networks will be a lot faster in the future, and neural network tools can get embedded in every design surface.

## 7. List of literature

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