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AN OVERVIEW OF NEURAL NETWORKS STRUCTURE AND PROPERTIES

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The topic of machine learning, intelligent algorithms and artificial intelligence is extremely popular nowadays. Neural networks are interesting and useful tools for solving a wide range of engineering and research tasks.

Machine learning is a category of algorithms that allows software applications to become more accurate in predicting outcomes without being explicitly programmed. Main components to teach the machine are as follows: data, features and algorithms.

Neural network is a system that makes specific calculations based on simultaneous activities of a number of connected elements called neurons. The network structure was first observed in biological nervous systems, for example, in the human cerebellum. Neural networks are also can be built from a number of neurons, but they are artificial and more simple than biological neurons and connected in a more primitive way.

Neural networks have the following advantages over standard computer systems: self-organization and learning capability, generalization capability, fault tolerance, massively parallel processing.

A neuron is a function with a bunch of inputs and one output. Its task is to take all numbers from its input, perform a function on them and send the result to the output. Connections are like channels between neurons. Each connection has only one parameter, weight. It is like a connection strength for a signal. Weights are adjusted when training and in this way the network learns.

The neurons are linked by layers. Within a layer neurons are not connected, but they are connected to neurons of the next and previous layers. Data in the network goes in one direction – from the inputs to the outputs.

There are two major classes of neural network structures: neural networks with feedback and without it. Neural networks without feedback are often called feed-forward types. Networks in which signals can circuit for unlimited time are called recurrent neural network.

There are two ways to train a neural network: supervised and unsupervised learning. Supervised learning is based on giving a network examples of correct actions (specific set of input and output signals) that it should learn to mimic. Self-learning method includes passing only a series of test data to the input of networks, without indicating expected output signals. A self-learning network requires a learning set consisting of data provided only for input.