ARTIFICIAL NEURAL NETWORKS IN REDUCING THE ENERGY CONSUMPTION OF EXISTING ELECTRICAL SYSTEMS IN TEXTILE ENTERPRISES

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ABSTRACT

In this case, artificial neural networks serve as the optimal solution for reducing the energy consumption of existing electrical systems in textile enterprises. The analysis of existing electric drives in the enterprise showed that in order to implement control with speed modes, it was considered necessary to change the speed affecting the product by adjusting the rotation speed of the drive, to combine artificial neural networks based on a mathematical model and to create the effect of giving the desired speed based on the constant product volume.

Keywords: weaving machine, neural network, electric motors, reliability, textile machine, methodology, differential and algebraic equations.

First, accounting and management methodologies, corporate standards for the interrelation of modules, and then, immediately - modules for automating the work of the higher level of management were developed.

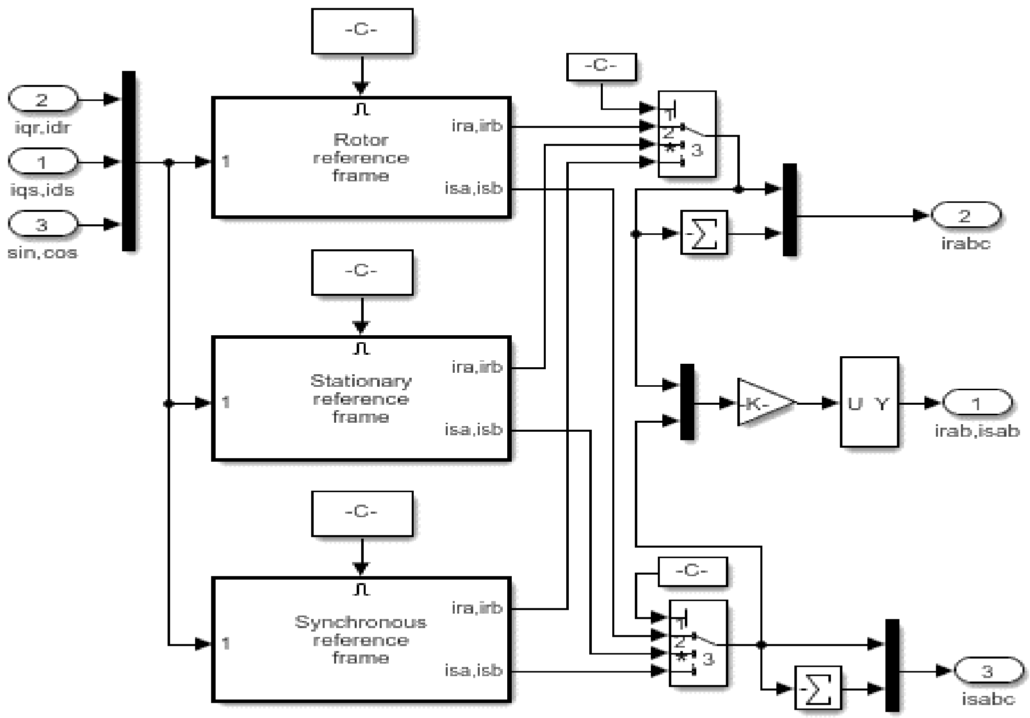

Figure 1. The structure of an artificial neuron in a model

In the first stages of the work, it will be possible to enter the generalized analytical data into the system, as well as obtain it from the existing automation programs running in the enterprise.

The main task of the artificial neural network is to extract high-level features from the analyzed signal using convolutional operations. The algorithm constructed using this network is organized on the basis of the methods of selection of parameters and the requirements for the number of convolutional layers [1.2]. The level of fault elimination can be increased with the introduction of each additional convolutional layer of the artificial neural network structure. In the study, in the diagnostic process of the artificial neural network, the first layer is presented as the main feature filter, and based on the maximum and minimum values of the factors affecting the electrical reliability, it is directed to the next layer.

Weaving machine made it possible to determine higher-order features, i.e. differences between minimum and maximum values, at the next stage of the convolutional operation based on the properties of the electrical network. In this case, depending on the structure of the network, it depends on the type of information presented, as well as the function performed by the artificial neural network.

A normalization layer was used to speed up the process and increase the stability of the induction motor [3]. This layer normalizes the output of the previous layer, subtracts the average value of the elements of the layer, and this obtained value is brought to their standard deviation. The effect of using this normalization method [4] are detailed in the sources. As in classical neural network structures, the activation function is a crucial part in artificial neural network structures. A commonly used activation function is a rectified linear unit, which is mainly used as a filler of convolutional layers and allows to increase the reliability index of the induction motor due to the representation of the nonlinearity of interactions.

Convolutional layers provide a large amount of information observed in the input matrix. In most cases, using multiple object properties will not give the desired result. Layers [5], their task is to select only the largest data for each cell (window). For this, methods of searching for high or average values from network elements are often used. The advantage of concatenating layers is that they reduce the spatial size of the algorithm data and thus avoid excessive coefficient variation.

The process of using an artificial neural network, in most cases, is carried out according to the stochastic gradient descent (SGT) algorithm. The method of using SGT allows the determination of an unweighted gradient estimate, for which the mean value of the sample gradients obtained from a small data package is used. The most important parameter of the SGT algorithm is the learning speed. This value is chosen in trial and error by analyzing the learning curve. This approach does not allow for optimization of the workflow, if the value of the parameter is high, then it causes a rapid fluctuation of the learning curve, which results in a low value when extending the working time. Unlike the SGT method, the SGT algorithm has the largest step size when several successive gradients point in the same direction [62]. The workflow, according to the SGT algorithm, begins with the determination of the initial value of the learning speed and the starting parameter of the asynchronous motor. Then the gradient p for the sample subpacket {x1, ..., xk} is evaluated according to the relation:

$$p = \frac{1}{k}\nabla_w \sum_i L(f(x_i, w), y_i)$$

where: x i is a loss function calculated for a sample of randomly selected element size m, L (f (xi, w), yi).

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