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Research And Analysis Of Combustion Equipment Parameters Through Neural Networks

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INTRODUCTION

To increase the engine's power and economic performance, its reliability, noise, toxicity, and exhaust emissions, it is necessary to carry out complex technological processes for the design, testing, and research of thermal equipment. Neural networks give the possibility to evaluate different parameters used for better control, prediction and optimisation in diesel engines.

TRAINING THE NEURAL NETWORK

In the training stage, synaptic factors are evaluated in the process of solving the neural problem. The essence of optimization will become clear by examining the graphs of the received error data – Fig. 1. The blue line indicates Training set, green line indicates Validation set and with the red dot is marked the best network. The green line represents the output data of the neural network, and the blue line represents the real data. To achieve this result, it is necessary to create a maximum desired error that satisfies the experiment. Using the methods for minimizing the error specified in chapter two, the program trains the neural network until the desired result is achieved. Improvement of network error during the last iterations is given in Fig. 2.

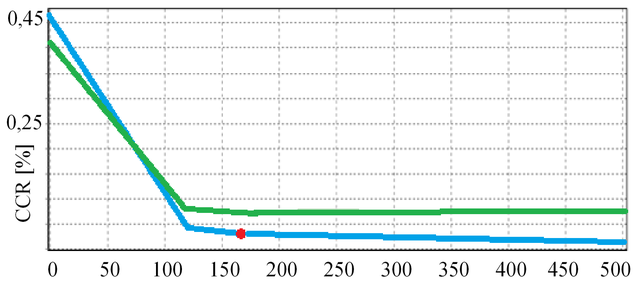

Fig. 1. Error graph

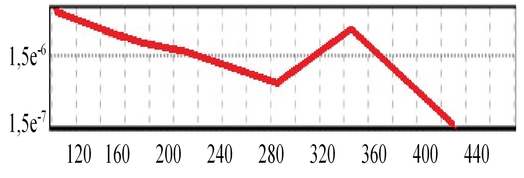

Fig. 2. Network error

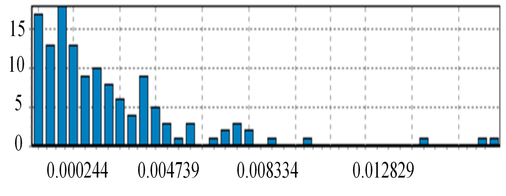

Fig. 3. Error distribution

The histogram in Fig. 3 shows how many training records have different error values. Real-time monitoring of the error allows us to understand what is happening inside the network during training.

NETWORK TESTING

The program automatically performs a network test after completing the training. Fig. 4 plots the lines of the real and network output data. The horizontal axis shows the number of rows of the input dataset, and the vertical axis shows the target values taken from the input file and the target values produced by the network. Fig. 5 shows the target values from the input file and the target values produced by the network. The horizontal axis shows the actual values. The vertical axis shows the predicted values.

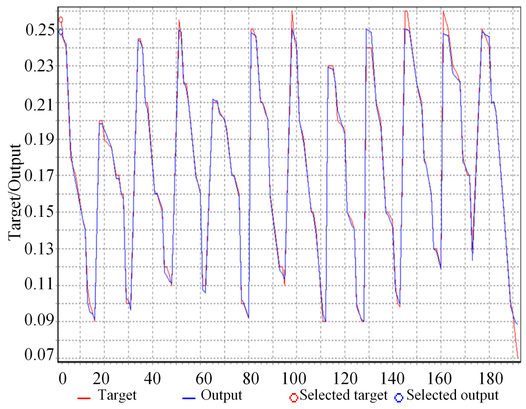

Fig. 4. Real and network output data

Fig. 6 shows the relationship between the errors and the values of the digital column inputs. The error relationship graphically allows to analyse the different variants of the selected column inputs leading to larger or smaller network errors.

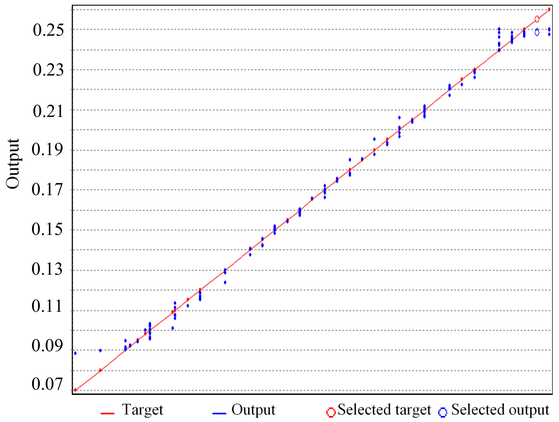

Fig. 5. Output data scatter plot

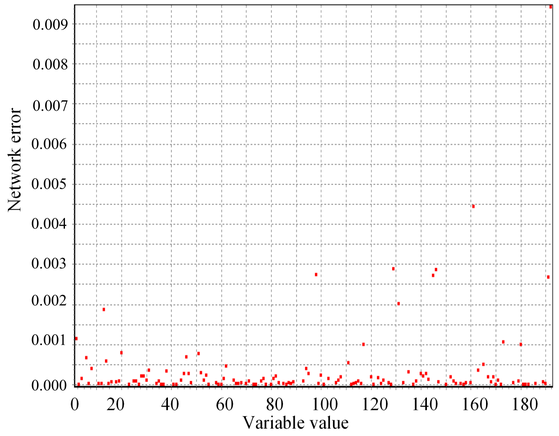

Fig. 6. Error dependence graph

CONCLUSIONS

The use of neural networks allows testing of combustion equipment. The experiment allows the discovery of input-output relationships under different parameters of the combustion equipment and under different technical conditions. The developed algorithm and program meet all requirements and limitations imposed by the available time, material resources and depth of consideration of the theory. The developed simulator proves the full functionality of the system and that the presence of such a system on board every ship is necessary. Unlike regression analysis, neural networks allow much greater flexibility in data processing, dynamism, and visual visualization of the resulting output data.

ACKNOWLEDGMENT

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