Machine learning methods in the analysis of production and maintenance of oil wells

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In this article, methods for determining essential features, as well as methods for predicting the corrosion process of oil wells, were considered, their advantages and disadvantages were identified. To identify the most significant features that affect pipeline corrosion processes, feature selection was carried out based on correlation analysis, as well as comparison and identification of effective methods for training neural networks. As a result, the BRANN (artificial neural network with Bayesian regularization) method was chosen, as it showed the best results with a relatively short training time. Thus, the neural network was trained to predict the effectiveness of pipeline additives to evaluate the effectiveness and corrosion rate.

Features for analysis

Features	Feature's description
x_1	Number
x_2	Date
x_3	Time
x_4	Object
x_5	Product
x_6	Environment
x_7	Fluid consumption m3/hour
x_8	Dosage ppm
x_9	Flow rate m/s
x_{10}	Frequency Hz
x_{11}	Fluid transit time
x_{12}	Residual content of reagent ppm
x_{13}	Temperature oC
x_{14}	pH
x_{15}	O2 (oxygen) ppm
x_{16}	Methodology for determining efficiency
x_{17}	Corrosion control method
x_{18}	Initial average corrosion rate mpy
x_{19}	Average corrosion rate mpy
x_{20}	Efficiency %
y_1	Initial corrosion rate mpy.
y_2	Overall corrosion rate mpy
y_3	Pitting
y_4	Current efficiency

Tab. 1. Features for analysis

The choice

Production efficiency is used as an effective indicator, and information about the state of the well obtained from the results of measurements is used as input.

Methods	Sample values			
	Training sample Y1	*Training sample Y2*	*Training sample Y3*	*Training sample Y4*
Method 1	0.84	0.81	0.87	0.84
Method 2	0.95	0.95	0.94	0.93
Method 3	0.74	0.78	0.69	0.75
Method 4	0.71	0.76	0.82	0.83
Method 5	0.87	0.79	0.81	0.78

Tab. 2. The choice of training method

Testing

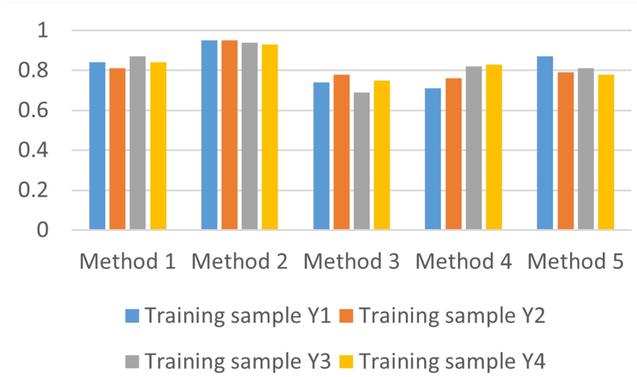

Fig. 1. The choice of training method

Value charts

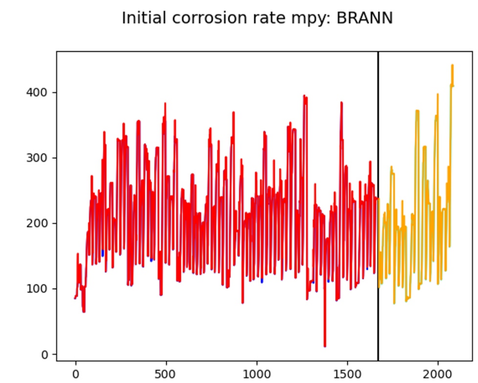

Fig. 2. Values of the y1

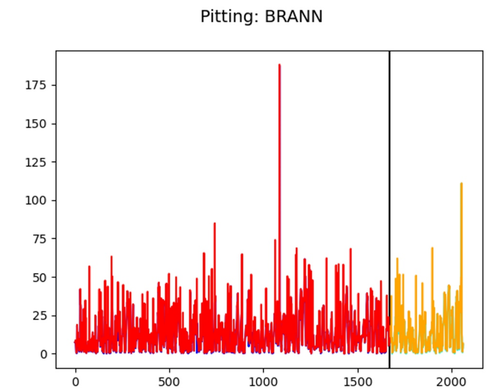

Fig. 4. Values of the y3

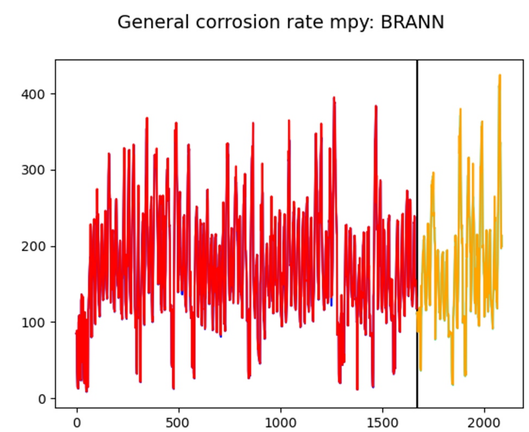

Fig. 3. Values of the y2

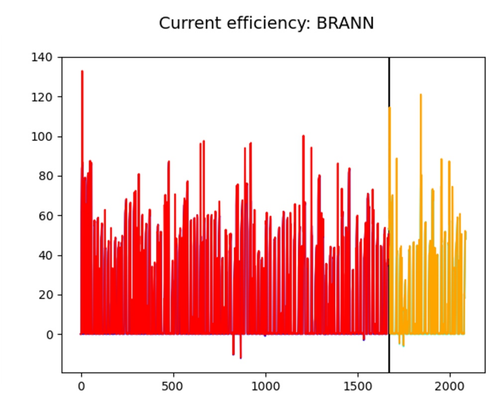

Fig. 5. Values of the y4

Conclusion

The analysis of existing methods for predicting oil production from oil wells was carried out, various machine learning methods were proposed to build a model for predicting outcome indicators (result characteristics), and the most optimal method for regularizing Bayesian backpropagation was selected. The analysis of methods for identifying significant features using the correlation method was carried out. Learning outcomes were obtained for each method.

In addition, the considered approach to the formation of a predictive model can be used for simulation models, as a result of which signs can be formed, as well as for optimizing the operation of enterprises and various technical systems.

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