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Neural Network Method For The Evaluation Of Reservoir Pore Structure By Conventional Well Logging

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Abstract： After entering the high water cut stage, the remaining oil content depends on the micro pore structure of the complex, the micro pore structure research is also limited to the core laboratory stage mainly, therefore the use of logging data analysis and identification of micro pore structure is the only way for the study of residual oil.The results show that as a nonlinear method, artificial neural network can better simulate the actual strata, and can better identify the complex microstructure of the formation.. The results of network forecast and comparison with other test results show that the BP artificial neural network is feasible and effective in predicting the application of conventional and unconventional pore structures.. BP neural network method is of great value for oilfield exploration and development.

Key words： *BP neural network; log interpretation; microstructure*

I. INTRODUCTION

Pore structure characteristics of reservoir rock is defined geometric shape, size and distribution of rock have a pore throats and communicate with each other and their relationship. For carbonate reservoir，Pore structure mainly refers to the rock with a hole, the hole, slit size, shape and interconnected relationships. For tight sandstone，The most fundamental characteristic of its pore structure is characterized by small pore throats, tortuosity complex, high capillary pressure. By logging data analysis and identify the microscopic pore structure is a necessary way of remaining oil research. When entering the late stage of high water cut oilfield，How much depends on the residual oil content of complex internal microscopic pore structure，Due to the microscopic pore structure research also limited to the laboratory，Therefore, how to apply the results of this research to production practice, is the key to the residual oil exploitation。By studying the microscopic pore structure by using logging data to identify technology method，it can make the laboratory research results extend to the actual research area，Achieve a major shift from theory to practice, to identify the distribution of remaining oil, which made the appropriate enhanced oil recovery programs, and ultimately improve the economic efficiency of oilfield has an important significance.

ⅡARTIFICIAL NEURAL NETWORK MODEL

Neuron structure model is shown in figure 1，u_i make neural network, a neuron's internal state，θ_i is the threshold，x_i is the input signal，x_{ij} representatives from u_i to u_j connection weights，s_i is the external input signal。This hypothesis can be described as：

$$\sigma_i = \sum x_i w_{ij} + s_i - \theta_i$$

$$u_i = f(\sigma_i)$$

$$y_i = g(u_i) = h(\sigma_i)$$

$$h = gf$$

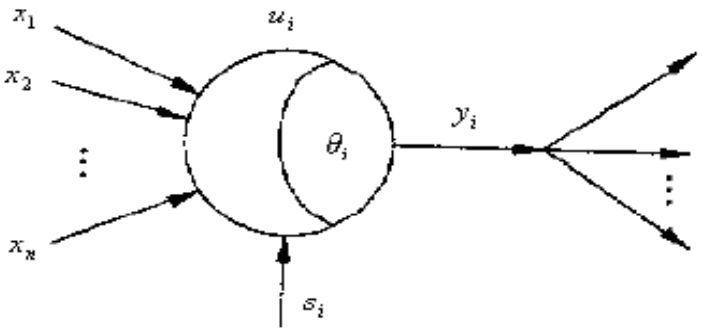

Fig1 Neuron structure model

II. THE PRINCPLE OF BP ALGORITHM

Adopt BP algorithm to train the ANN is the most widely used, research one of the most deep of multilayer feed forward neural networks, generally called the artificial neural network BP neural network [1]. BP algorithm uses the way of learning under the guidance of teachers and the generalized delta learning rule.It is based on gradient descent algorithm.In the learning process is composed of positive spread treatment and back propagation，In the process of forward travel, input mode from the input layer through processing step by step a hidden layer to output layer，If the output layer is not expected output signal from the output layer to input layer spreading, the back propagation, adjust the connection between each layer in the process of back propagation rights and offset value of each layer of neurons error decreases.Therefore the essence of the algorithm is the minimum value of error function，by multiple samples of repeated training，a weight along the fastest decline in direction of the error function to change, finally the minimum point of convergence。In order to produce a reliable output of a given input, known samples must be repeated training，rights and neurons of the connection in the offset value.Until produce expected output, the final right to connect multiple known training samples of each layer and the offset value of each layer neurons following information, such as knowledge preservation, to predict the training sample.

III. NEURAL NETWORK RECOGNITION METHOD OF PORE STRUCTURE

In the application of neural network, the network structure and algorithm are important, but the quality and quantity of samples also plays an important role.A flawed training sample column, light is time-consuming to make the sample training, or make the network training failure，but in practice no systematic theory to guide the selection of samples[2]. In this, in combination with theory and actual application, give the following principles：

1）Input and output values of normalized processing, make its value between 0～1.

2）A representative study sample, which can represent a range of various features of the sample under test.

3）Contains range wants wide, that is, as far as possible to predict the sample included within the scope of the training sample.

Based on previous research, optimizing the micro gradient (RMG), micro potential (RMN), shallow lateral (RLLS), deep lateral (RLLD), natural gamma (GR), high-resolution acoustic (HAC), spontaneous potential (SP), the curve of the seven closely associated with pore structure as neural network input. Specific applications, can according to the number of samples, quantity of log data to select any of the four, five, six, seven parameters as neural network input, the pore structure types as output. With the above study results identify prediction, satisfactory identification result. Visible, logging data combining with the neural network technology can well identify types of pore structure.

IV. CONCLUSION

Based on the BP neural network as the main method, the mathematical calculation software as the main tool, the conventional logging data and other exploration and analysis of test data as the main basis, the BP neural network in the evaluation of reservoir pore structure research，artificial neural networks for the prediction of reservoir pore structure will become more accurate, the accuracy of the prediction results will also be increased continuously. Also may be a logging data processing and interpretation of a main method is optional.

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