ENHANCING ARTIFICIAL NEURAL NETWORK TRAINING PERFORMANCE FOR PREDICTION OF RESERVOIR ROCK TYPES

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Abstract

Reservoir rock type (RRT) is an integral part of the reservoir characterization process, which is among the key input parameters into three-dimensional geological and flow simulation models. Several techniques and methods are available for reservoir rock type prediction. The most direct method is based on core data analysis, which is not only time-consuming but also very expensive, while an indirect method is via the log analysis, which is cheap, fast and can be found in most of the wells in the field.

Artificial neural network (ANN) has gained popularity in recent times and is being used widely these days for reservoir characterization prediction. Generally, the most important stage in modeling reservoir rock type using ANN is the training stage where the input variables were selected to be fed to the model. To choose a set of significant inputs is a combination problem, and the selection procedure can be very time consuming.

The methodology proposed in this thesis is to provide a ranking method to select the optimum well logs to predict the RRT. Stepwise regression and rank correlation input selection methods are used to rank the log data input with the degree of influence at the desired output of the ANN. Variables ranked as important by the two methods are used as input to ANN. This helps in building a robust and reliable neural network for the analysis. The results obtained from the two methods confirm that four well logs (e.g. RHOB, NPHI, GR and Stratigraphic units) are the most significant input variables to the ANN for RRT prediction. The prediction results were excellent and the error percentage between the core RRT and predicted RRT was found to be 10 %.

This work demonstrates that by using ranking methods, high classification accuracies can be achieved in a fraction of the time required by the well-known traditional RRT prediction methods.