Porosity and Permeability Estimation using Neural Network Approach from Well Log Data

Akhilesh K. Verma[1,2], Burns A. Cheadle[1], Aurobinda Routray[2], William K. Mohanty[3], and Lalu Mansinha[1]
[1]*Department of Earth Sciences, Western University, London, Ontario, Canada*
[2]*Department of Electrical Engineering, Indian Institute of Technology, Kharagpur, India*
[3]*Department of Geology and Geophysics, Indian Institute of Technology, Kharagpur, India*

Abstract

In recent years, artificial intelligence techniques, and neural networks in particular, have gained popularity in solving complex nonlinear problems. Permeability, porosity and fluid saturation are three fundamental characteristics of reservoir systems that are typically distributed in a spatially non-uniform and non-linear manner. In this context, porosity and permeability prediction from well log data is well-suited to neural networks and other computer based techniques. The present study aims to estimate formation porosity and permeability from digital well log data using an artificial neural network (ANN) approach. A representative case study from the Alberta Deep Basin is presented. Five well log responses (Gamma Ray Log (GR), Deep Resistivity (RD), Formation Density (DEN), Neutron Porosity (PHIN) and Density Porosity (PHID)) are used as inputs in the ANN to predict porosity and permeability. Core porosity and permeability are used as target data in the ANN to test the prediction. The accuracy of the ANN approach is tested by regression plots of predicted values of porosity and permeability with core porosity and permeability respectively. Excellent matching of core data and predicted values reflects the accuracy of the technique. ANN is a fast and accurate method for the prediction of reservoir properties and could be applied in reservoir modeling and characterization.