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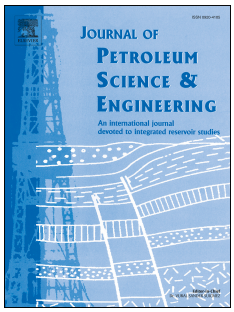

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Estimation of thermal maturity from well logs and seismic data in the Mansuri oilfield, SW Iran

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Abstract

Thermal maturity is the primary geological factor in exploration of hydrocarbon resources. Maturity index which is calculated from well-logging information and it is a useful parameter to unravel the burial history and hydrocarbon generation phases of a source rock. This study proposes a new method for estimating maturity index from well logs and seismic data using neural network and ant colony optimization (ACO) approach. The 2D seismic data and petrophysical logs of the Pabdeh Formation from three wells of the Mansuri field are employed to examine the methodology of this study. In the first step, maturity index (MI) was calculated from well logs including neutron, resistivity, sonic and density. The calculated values were used as inputs in a multi-attribute analysis to exploit logical relationships between them and seismic attributes. Seismic inversion was performed and the resulting acoustic impedance was utilized as an external attribute in maturity index estimation. A probabilistic neural network (PNN) was trained by using a set of predictor attributes derived from a multiple regression analysis. Finally, the nonlinear Ant Colony Optimization technique was utilized as an intelligent tool to generate a seismic section of maturity index. Using the Matlab programming environment for math computations and its graphical visualizations the nonlinear ACO section of the maturity index was obtained. The results show that the intelligently derived equation based on the nonlinear ant colony algorithm provides fast and more accurate solutions. The stochastic optimization outperforms the gradient optimization in maturity index estimation from well logs and seismic attributes. The calculated MI values range from 3 to 5 indicating the early stage of the oil window. The simulated MI shows a good agreement with the thermal maturity derived from Rock-Eval pyrolysis.

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