



TECH TO BUSINESS

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Reservoir Characterization Using Fuzzy Ranking and an Artificial Neural Network

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Background

Researchers at the University of Calgary have developed a novel algorithm to more accurately determine the physical properties of oil reservoirs than widely employed methods such as linear and non-linear regression analysis. By employing a combination of fuzzy ranking and artificial neural networks, Dr. Wang's group demonstrates that they can accurately model reservoir characteristics such as porosity, permeability, and saturation.

Accurate estimation of these attributes is critical to maximize oil recovery while minimizing economic and environmental costs associated with extraction. Currently, the most accurate method to quantify reservoir characteristics involves analysis of core samples. However, this approach is limited due to cost and because the results are limited to discrete locations from which the core samples were taken.

Well logs provide indirect measurement of reservoir properties using subterranean sensors, but encounter problems in extrapolating the results to the entirety of the reservoir when using linear or non-linear correlations between well log data and reservoir characteristics. Direct application of artificial neural networks is also not ideal, since inclusion of uncorrelated well log data in the training set decreases the reliability of the estimates.

To overcome this issue, Dr. Wang's group has developed a technique that uses a two-step fuzzy ranking algorithm to filter out uncorrelated data, and use only the most relevant measurements to train the artificial neural network. In simulations, this approach was able to accurately predict the porosity values of test samples with a correlation coefficient of 0.95. This is significantly better than linear regression models at estimating characteristics and better than other approaches to filtering well log data which have correlation coefficients of 0.93.

Competitive Advantages

Employing a two-step fuzzy ranking algorithm paired with an artificial neural network is a fast but powerful technique that accurately predicts the heterogeneous properties of large oil reservoirs without the need to perform costly core sample analysis.



Area of Application

- GIS software
- Standalone tool for well characterization

Stage of Development

The algorithm is currently working using a combination of Matlab and C++. It can be implemented as module in large GIS platforms.

Publications

[Baijie Wang, Xin Wang, Zhangxin Chen: A hybrid framework for reservoir characterization using fuzzy ranking and an artificial neural network. Computers & Geosciences 57: 1-10 \(2013\)](#)