Machine Learning to Support Geological Analog Studies

A. O. Mabadeje and M. J. Pyrcz

ABSTRACT

Identification of analogous reservoirs is important during the planning and development of new fields to augment limited or missing available geological and reservoir engineering information. Conventionally, reservoir analog selections are challenged by high dimensionality making interpretation, and visualization of associated datasets difficult.

We propose a machine learning-based workflow to calculate a novel reservoir similarity score (RSA) that combines both spatial and multivariate statistics in a novel manner to determine the similarity between reservoirs and visualize the uncertainty space or space of possibilities available.

The proposed workflow: (1) key parameter selection via feature engineering, (2) multivariate and spatial analysis using multidimensional scaling and density-based clustering, (3) similarity ranking using applicable similarity functions on preprocessed data. Next, Naive Bayes classification is applied to validate the identified analogs.

The workflow integrates the geoscientist's knowledge with machine learning to go through extensive datasets of reservoir characterization, and allows visual exploration of uncertainty space, analog retrievals, estimate unknown parameters, and make better-informed decisions.

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