

A Comparative Study on Visual Tools for Analogs

Emilio Vital Brazil, Vinicius Segura, Ana Fucs, Juliana Jansen

IBM Research

9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

The Oil & Gas industry has used analogy method in a wide range of problems, from complementing limited data set information (e.g., estimating unknown or missing petrophysical parameters, such as cementation and saturation coefficients, porosity, water saturation, in a geological formation) to defining exploratory strategies in new opportunities (e.g., using analogous reservoirs to compare different recovery strategies, allowing to select the optimum technique). Moreover, the use of analogs is essential in the construction of the geologic models, assisting in the determination of the volume, general features, and distribution of reservoir rocks. Using accessible reservoir information is a critical strategy in decision-making, where the identification and application of high-quality analogs reduce the exploration risk. Many researchers defend the adequacy of a reservoir to be used as an analog is directly related to the purpose of comparison. For these researchers, we should first establish the goal of using the analog - e.g., obtain technical information of EOR (enhanced oil recovery) in a specific target reservoir - and only then establish a list of necessary parameters to determine the similarity - such as the type of oil and the rock permeability. Due to an absence of consensus in the literature regarding the best parameters to be considered for the intended goal, the parameters are usually chosen by the geoscientist, which may need to consider different sets of parameters. In the same token, there is a lack of visual tools to accurately compare reservoir with multi parameters. In this work, we try to shed light on the question of how to visually compare high-dimensional objects and find similar instances. We evaluated four non-projective visualizations - parallel coordinates, radar, radial, and matrix - throughout a task of finding similar objects using a synthetic data set. During our study, we fixed an

object (target) and asked for the participant to choose what other entity is most akin to the target one, varying the visualizations and the number of dimensions in the data. The data set was created considering four different groups, each one with different mathematical formation rules to guarantee the similarity: entities within the same group are analog for themselves than when compared to ones from other groups. We performed a statistical analysis of the results taking into account the number of right answers and the time spent to find the analog reservoir.