Geophysical Research Abstracts
Vol. 21, EGU2019-7551, 2019
EGU General Assembly 2019


# Using Neural Networks to Predict Subsurface Reservoir Properties

David Taylor, David Hodgetts, and Ginny-Marie Bradley

University of Manchester, Earth and Environmental Science, Basin Studies and Petroleum Geoscience, Manchester, United Kingdom (david.taylor-3@manchester.ac.uk)

The application of Neural Network analysis to sub-surface reservoir properties has been used to predict reservoir qualities using inter- and intra-reservoir datasets. The two analyses presented have been produced by application of a suite of well-established Neural Network data manipulation techniques.
Neural Network analysis represents a method of data manipulation by which a great number of mathematical possibilities can be applied to discern trends in any given dataset. Through direct application, the validity of some algorithms over others for geological sub-surface prediction can be shown, further enhancing future efforts in this field, reducing hydrocarbon field development costs and increasing reserve estimates through more reliable, quicker sub-surface predictions of rock property distributions. Machine Learning applications can analyse billions of data points at a time, reducing workflow time scales from years and months, to weeks or days, removing human errors associated with lengthy analyses.
Traditional quantitative sedimentary and petrophysical data were collected from the Triassic Wolfville Formation, a Braided Fluvial System representing the initial basin fill of the Fundy Basin, Nova Scotia, and the Silurian Tumblagooda Formation, NW Australia, a tidally-influenced braided fluvial succession. High-density, classified point clouds and photogrammetric models were generated in Agisoft Photoscan Pro, before being statistically interrogated in Virtual Reality Geoscience (VRGS). This generates many more measurements, as the area from which accurate data can be extracted is increased, providing a more meaningful statistical dataset and reducing uncertainty in reservoir distribution models. Data used for prediction range from petrophysical properties, grain-size interactions, to foresets, bed geometries, geobody dimensions, facies associations and more regional basin-fill packages. Here, two methods of neural network prediction are employed: 1) Using a partial dataset to predict properties excluded, but known, as a validation of the method, and 2) using all known data to predict reservoir properties outside the dataspace, or known reservoir distribution.
The Neural Network analyses show that sub-surface rock properties can be predicted for both inter- (1) and intra-data (2) volumes, with the application of an appropriate algorithm. Care must be taken to avoid over-fitting analyses, or producing mathematically-valid disseminations, with little geologically-valid application, as Machine Learning techniques will apply any algorithm to a dataset, irrespective of any real-world validity. With wider use and testing for hydrocarbon field development, Neural Network algorithms can become further suited to sub-surface prediction.