Geophysical Research Abstracts
Vol. 18, EGU2016-10617, 2016
EGU General Assembly 2016

Machine learning with neural networks - a case study of estimating thermal conductivity with ancient well-log data

Benjamin Harrison, Mike Sandiford, and Sandra McLaren
School of Earth Sciences, University of Melbourne, Melbourne, Australia (ben.harrison@liquidmesh.com)

Supervised machine learning algorithms attempt to build a predictive model using empirical data. Their aim is to take a known set of input data along with known responses to the data, and adaptively train a model to generate predictions for new data inputs. A key attraction to their use is the ability to perform as function approximators where the definition of an explicit relationship between variables is infeasible.

We present a novel means of estimating thermal conductivity using a supervised self-organising map algorithm, trained on about 150 thermal conductivity measurements, and using a suite of five electric logs common to 14 boreholes. A key motivation of the study was to supplement the small number of direct measurements of thermal conductivity with the decades of borehole data acquired in the Gippsland Basin to produce more confident calculations of surface heat flow. A previous attempt to generate estimates from well-log data in the Gippsland Basin using classic petrophysical log interpretation methods was able to produce reasonable synthetic thermal conductivity logs for only four boreholes. The current study has extended this to a further ten boreholes.

Interesting outcomes from the study are: the method appears stable at very low sample sizes ($< \sim 100$); the SOM permits quantitative analysis of essentially qualitative uncalibrated well-log data; and the method's moderate success at prediction with minimal effort tuning the algorithm's parameters.