

Automated geological interpretation of cone penetration test data to model the subsurface of the Netherlands in 3D

Peter-Paul van Maanen, TNO Geological Survey of the Netherlands;

Jeroen Schokker, TNO Geological Survey of the Netherlands;

Ronald Harting, TNO Geological Survey of the Netherlands;

Currently, visually described borehole samples are the primary input for large-scale 3D geological models of the subsurface, both when modelling architecture and composition. Cone penetration tests are rarely used and to a limited extent only. There are several reasons why it is of interest to utilize CPT data for geological and lithological modelling of the Dutch subsurface: 1) CPTs are more abundant than boreholes, 2) CPTs are cheaper and easier to gather, and 3) CPT data are more quantitative than visual estimates.

Automated lithological classification based on CPT data of the Dutch subsurface was evaluated using a large, widely distributed data set of CPT-Borehole pairs (see figure). The CPT data (cone resistance, sleeve friction, friction ratio and pore water pressure) were combined with the visually estimated lithology for each described borehole interval. Based on this data, a feed-forward neural net was trained. To investigate robustness, training and evaluation were done for both the complete data set and a smaller subset (NW-Netherlands). Results show that classification is robust for larger as well as smaller areas. This opens up the possibility to systematically incorporate classified CPT data in the 3D subsurface modelling workflow in the Netherlands and beyond.

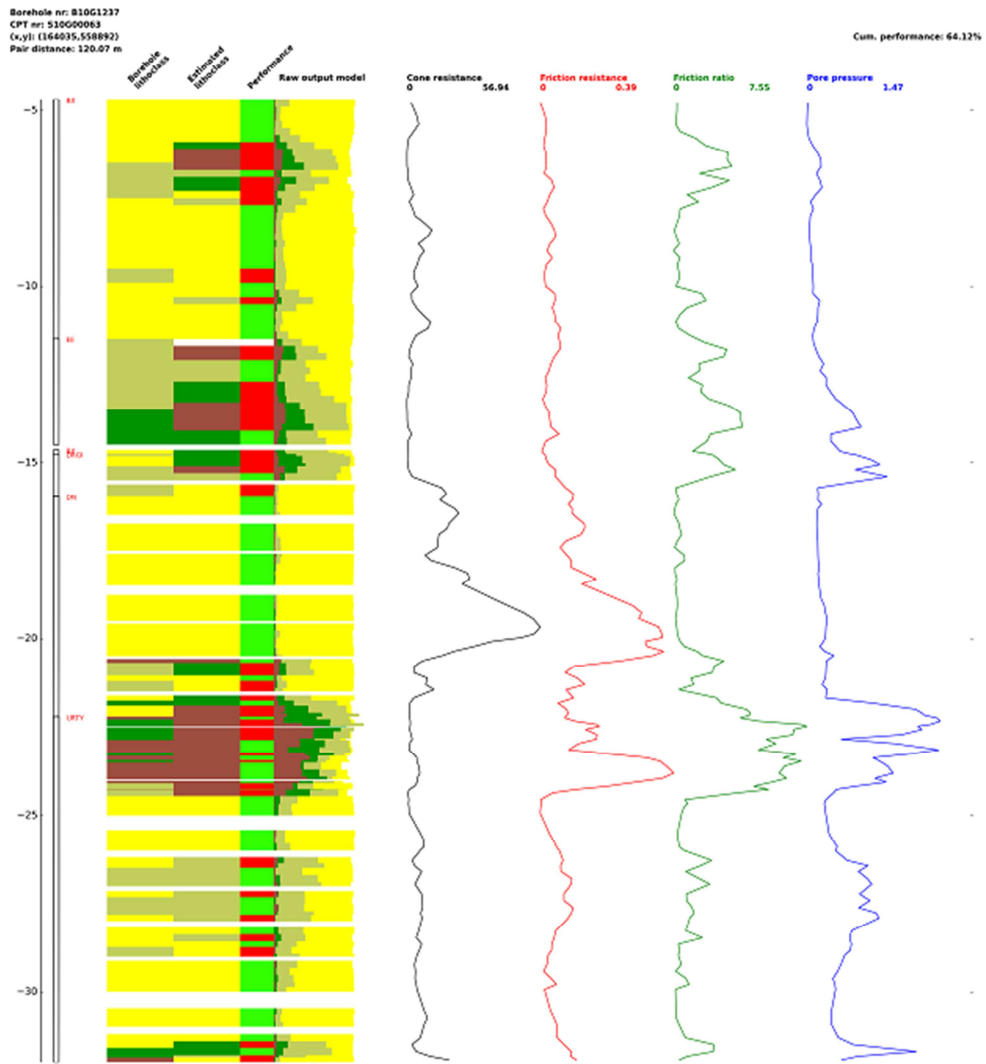


Figure 1 Classification results for one CPT-borehole pair.