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Automated classification of PROMESS-1 logging data from the Gulf of Lions

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The objective of the European project PROMESS-1 (PROfiles across MEditerranean Sedimentary Systems, part 1) is to obtain comprehensive transects (from source to sink) across two Mediterranean Deltaic Margins. These are the Rhône and Catalan-Languedocian river systems and the Po and Apennine river systems. The PROMESS-1 shipboard party performed coring and in situ measurements at shelf and upper slope (50-300 m water depth) in these sedimentary environments onboard a geotechnical drilling vessel in summer 2004.

At drilling location PRGL1 in the Gulf of Lions, wireline logging, multi-sensor core logging (MSCL) and spectral X-ray (XRF) core logging data were recorded and used for a comprehensive comparative study of automated classifiers. Linear discriminant analysis, k-nearest neighbour classification, logistic regression, Parzen windows based probabilistic neural networks, support vector machines and backpropagation neural networks were applied to identify 5 stratigraphic sequences associated with 100 ka glacio-eustatic cycles. For each classification algorithm, a data set of 2800 input vectors each consisting of 17 recorded logging curves was divided into a training data set of 5 % of all data points per class and a test data set with the remaining 95 % per class. Each classifier was fed with the training data set and correct class labels (sequence 1-5), applied to the test data set and finally compared with the (known) true output.

Despite its simple mathematical background, linear discriminant analysis performs remarkably well with a performance of 69.8 % compared to backpropagation neural network (merely 61.2 %), logistic regression (64.2 %), k-nearest neighbour (69.5 %) or probabilistic neural networks (70.9 %). Best performing classifier was the support vec-

tor machine with correct classification of 74.6 % of all test data. All sequence boundaries were well detected by the algorithms with one sequence boundary being more difficult to detect by most of the classifiers. A newly developed performance cross matrix reveals that most of the misclassified data are due to sequence 1 being wrongly assigned to sequence 2.

The overall performance is good considering the small training data set (5 % of all available data). Linear discriminant analysis outperforms many of the more sophisticated classification algorithms. Support vector machines show the best classification results.

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