# Machine learning and artificial intelligence algorithms for geomechanical rock properties prediction based on laboratory measurements and well logs

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**Abstract.** Predicting and understanding the geomechanical properties of rocks is of key importance in the processes of simulating the behavior of the reservoir in geological, geophysical, geothermal or engineering issues. The main aim of the work was to test data mining and artificial intelligence algorithms like Support Vector Machines, K-Nearest Neighbours, Random Forest, Artificial Neural Networks, to find the best and most precise way to predict the elastic (P- and S-wave velocity ) and mechanical (Poisson's ratio, Young, bulk and shear modulus) parameters. P-wave and S-wave velocity measurements were made and the modulus of elasticity were determined for several dozen samples from the wells in the area selected for the location of advanced gas and carbon dioxide storage in the aquifer. The laboratory tests were performed under simulated high pressure and temperature conditions. The geomechanical and ultrasonic tests laboratory results provided a basis for building models, relationships that could be used in the absence of a specific log or response from log, setting limits or ranges of variation for the parameters concerned. The lab measurement results were used to train prediction algorithms. The results of the prediction made using machine learning and artificial intelligence methods were applied to the entire interval of Jurassic formations selected as the interval for the construction of a gas and carbon dioxide reservoir. As a result, a continuous distribution of geomechanical parameters was determined. The obtained parameters and the results of the research were applied to the construction of a comprehensive geological model for an innovative gas storage facility design. Project with the support of Norwegian Funds as part of the Polish - Norwegian Research Cooperation program, POLNOR CCS 2019, implemented by the National Centre for Research and Development (Contract NOR/POLNORCCS/AGa-Stor/0008/2019).