A cascade-forward neural network model to determine swelling pressure of unsaturated bentonite and bentonite mixtures

Shehab, M. G. M., Taherdangkoo, R., Butscher, C.
TU Bergakademie Freiberg, Institute of Geotechnics, Freiberg, Germany

Bentonite and bentonite mixtures are used as buffer material for deep geological repositories, and backfill material to seal boreholes. Swelling is an important phenomenon influencing the long-term safety of the barrier system. Hence, proper determination of bentonite swelling pressure is vital to ensure that infrastructures remain intact. In this study, we employed a cascade-forward neural network (CFNN) model to determine the maximum swelling pressure of unsaturated bentonite and bentonite mixtures under various conditions. Bayesian regularization algorithm is employed to train the CFNN model. We collected laboratory and field data of different types of commercial and natural bentonite and bentonite mixtures from the literature to generate the dataset. The input variables of the model are montmorillonite content, specific gravity, liquid limit, plastic limit, plasticity index, initial water content, and initial dry density, while the output variable is the corresponding swelling pressure. The performance of the CFNN model is evaluated using statistical criteria including coefficient of determination and minimum squared error. The predicted swelling pressure values show an excellent agreement with the corresponding experimental values. The findings show that the developed CFNN model is an alternative approach to estimate the maximum swelling pressure of bentonite and bentonite mixtures.