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Comparison of two non-linear prediction techniques for estimation of some intact rock parameters

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Traditionally, some regression techniques have been used for prediction of some rock properties using their physical and index parameters. For this purpose, numerous models and empirical equations have been proposed in the literature to predict the uniaxial compressive strength (UCS) and the elasticity modules (E) of intact rocks. Two of the powerful modeling techniques for this purpose is that the non-linear multivariable regression (NLMR) and the artificial neural networks (ANN). The aim of the study is to develop some models to predict the UCS and E of rocks using predictive tools. Further, to investigate whether two-cycle or four-cycle slake durability index as an input parameter into the models demonstrates better characterization capacity for carbonate rocks, and also, to introduce two new performance ranking approaches via performance index and degree of consistency to select the best predictor among the developed models, complex and their rank cannot be solved by using a simple ranking approach introduced previously in the literature. To obtain these purposes, seven type of carbonate rocks was collected from quarries in the southwestern Turkey and their properties including the uniaxial compressive strength, the Schmidt hammer, effective porosity, dry unit weight, P-wave velocity, the modulus of elasticity, and both two and four-cycle of slake durability indices were determined for establishing a dataset used for construction of the models. As a result of this study, it is found that four-cycle slake durability index exhibits more characterization capacity for carbonate rock in the models in comparison with two-cycle slake durability index. Also, the ANN models having two outputs (UCS and E) exhibit more accurate estimation capacity than the NLMR models. In addition, newly introduced performance ranking index and degree of consistency may be accepted as useful indicators to be considered to obtain the performance ranking of complex models. Consequently, this study sets a good groundwork for further application of the computer aid models in geotechnics and geosciences.