Analysis of experimental data sets for local scour depth around bridge abutments using artificial neural networks

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Abstract

The performance of soft computing techniques to analyse and interpret the experimental data of local scour depth around bridge abutment, measured at different laboratory conditions and environment, is presented. The scour around bridge piers and abutments is, in the majority of cases, the main reason for bridge failures. Therefore, many experimental and theoretical studies have been conducted on this topic. This study sought to answer the following questions: Firstly, can data collected by different researchers at different times be combined in one data set? Secondly, can we determine any unquantified effects such as data differences, laboratory conditions and measurement devices? Artificial neural networks (ANN) are used and a basic ANN model is selected to observe the application problems, in order to avoid any misleading conclusion arising due to the model parameters selected and the compilation of different subsets of experimental data into one set. At the first stage, seven experimental data sets are compiled to address the first question and an ANN model is used to discovery any existing discrepancies between available data groups. The importance of selected model parameters for the model's performance was demonstrated by increasing the number of parameters. Then, each data subset was inspected to expose the importance of the homogeneity of data groups in order to obtain a best-fit ANN model. Finally, a sensitivity analysis was carried out to obtain the dominant parameters of the problem. It was concluded that the use of 'soft' computational techniques such as ANN can be beneficial, provided the user is aware of the heterogeneity of the data set and the physical context of the subject or problem being addressed. However, as with other data analysis techniques, elaborate inspection of data and results is required.

Keywords: Scour prediction methods, bridge abutment scour, soft computing techniques, ANN