Predicting compressive strength of lightweight foamed concrete using extreme learning machine model

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Abstract

In this research, a machine learning model namely extreme learning machine (ELM) is proposed to predict the compressive strength of foamed concrete. The potential of the ELM model is validated in comparison with
multivariate adaptive regression spline (MARS), M5 Tree models and support vector regression (SVR). The Lightweight foamed concrete is produced via creating a cellular structure in a cementitious matrix during the mixing process, and is widely used in heat insulation, sound attenuation, roofing, tunneling and geotechnical applications. Achieving product consistency and accurate predictability of its performance is key to the success of this technology. In the present study, an experimental database encompassing pertinent data retrieved from several previous studies has been created and utilized to train and validate the ELM, MARS, M5 Tree and SVR machine learning models. The input parameters for the predictive models include the cement content, oven dry density, water-to-binder ratio and foamed volume. The predictive accuracy of the four models has been assessed via several statistical score indicators. The results showed that the proposed ELM model achieved an adequate level of prediction accuracy, improving MARS, M5 Tree and SVR models. Hence, the ELM model could be employed as a reliable and accurate data intelligent approach for predicting the compressive strength of foamed concrete, saving laborious trial batches required to attain the desired product quality.