Editorial

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It gives me great pleasure to present to you this themed issue on the application of machine learning in smart infrastructure and construction. In the past few decades, due to the pervasive and fast development of computational software and hardware, artificial intelligence (AI) and machine learning (ML) have been widely used to tackle complex engineering problems. On the other hand, due to the development and widespread deployment of affordable smart sensors, a great potential to generate and access Big Data has been devised. This has facilitated development of a new field of research and practice that aims to bring the application of ML and data analysis to design, management and analysis of our infrastructure and the built environment. In this special issue we present two papers that have explored application of ML in geotechnical engineering.

Sheil *et al.* (2020) have provided a comprehensive and critical review of the literature exploring application of ML in four key areas related to tunnelling. These are tunnel boring machine (TBM) performance prediction, tunnelling-induced settlement prediction, and geological forecasting and cutterhead design optimisation. The authors have reviewed the application of several various machine learning-based approaches, ranging from Artificial Neural Network (ANN) to Fuzzy logic and Evolutionary Computing, in tunnelling operations. The authors have also highlighted the large number of studies in the literature that reported successful application of ML in tunnelling operation in general but at the same time emphasised the need to improve/continued application in the following areas: *use of probabilistic framework to accommodate for noisy data or lack of data in general, validation against additional case histories to increase confidence in ML approaches, inclusion of other information and integration of casual modelling*. This paper depicts a

promising future for the use of ML in tunnelling and can act as a key reference review paper for future studies in this area.

Ahangar Asr and Javadi (2020) have looked at the use of ML to study partially saturated soils. Partially saturated soils are known to be notoriously complicated to model due to their multi-phase structure and the complex interactions between soil, air and water. Of particular importance in modelling unsaturated soils is the prediction of effective stress and determining the ‘effective stress parameter’. Currently, a suite of empirical equations is available from the literature that are routinely used to predict shear strength of unsaturated soils; however, they are limited to specific soil types and conditions. In this paper, the authors have proposed a ML-based approach, namely evolutionary polynomial regression to predict the effective stress parameter. The authors have used a comprehensive dataset from several articles in the literature and have demonstrated the ability of the proposed method to predict the effective stress parameter. A particular advantage of the proposed method in this paper is presenting the ML models in the form of explicit mathematical expressions which facilitate their future use and/or integration in numerical modelling analysis.

REFERENCES

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