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Editorial: Spatial modelling and failure analysis of natural and engineering disasters through data-based methods

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Editorial on the Research Topic
Spatial modelling and failure analysis of natural and engineering disasters through data-based methods

Numerous natural and engineering disasters are observed frequently due to the climate change and the human engineering activities. In recent years, a large number of tunnels, metros and underground spaces were constructed to reduce congestion and store potential resources with the development of infrastructure construction (Font-Capoet al., 2011; Liu and Zou 2022). A respective example in China is that the length of constructed, under constructing, and planning railway tunnels were up to 15,781 km, 8,200 km, and 12,800 km, as reported by Guo (2018). The rapid construction caused significant challenges of engineering disasters when encountering the unfavorable conditions, e.g., karst, fault, and weathered slot (Høien and Nilsen, 2014; Liu et al., 2018a, b; Golian et al., 2021). As shown in Figure 1, main engineering disasters related to the engineering construction include the water and mud inrush, soil/rock collapse, erosion, surface subsidence and crack (Liu et al., 2019, 2022; Zhang et al., 2019). These disasters may induce the serious influences on the hydraulic-geological-ecological environment (e.g., groundwater decline) and usually cause the stoppages for the projects, huge property damages, and deaths to the constructors and surface residents (Hayashi et al., 2009; Wang et al., 2019). Thus, it is necessary to establish the effective model or method to predict these disasters and their related influences on the ground and surface environment.

Considering this practical demand, a special topic, entitled "*Spatial Modelling and Failure Analysis of Natural and Engineering Disasters through Data-based Methods*" was initiated with several editors to process the timely peer-review and publication of relevant manuscript by 12 March 2021. The main objective of this Research Topic is to provide a set of peer-reviewed

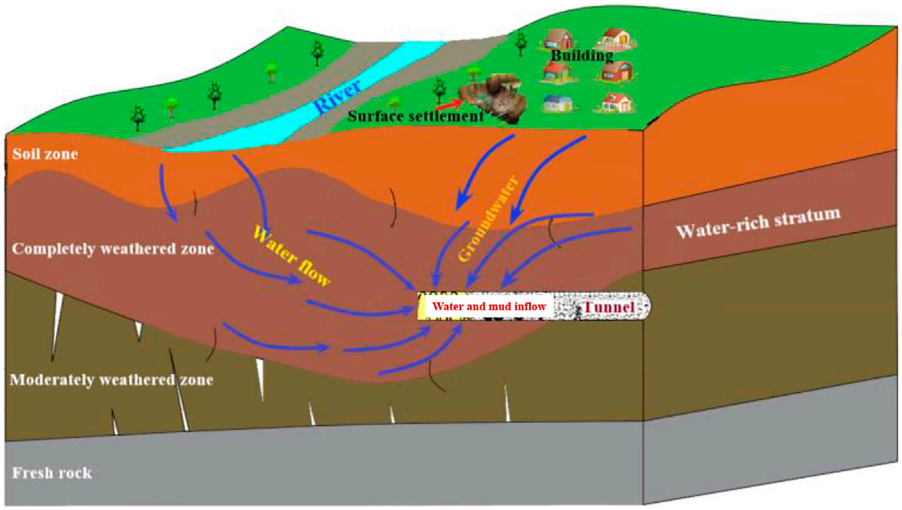

FIGURE 1
Typical unfavorable ground and the related geological disaster induced by tunnel construction.

publications that propose innovative data-based methods and techniques such as machine/deep learning and advanced numerical methods to investigate the various engineering and natural disasters. In this Research Topic, 41 manuscripts were accepted in total, indicating the acute need for the engineers and scholars to understand the aspects of engineering and natural disasters.

During the published papers, many machine learning methods were applied into the analysis of various engineering and natural disasters. For example, Wang et al. used an advanced gradient boosting algorithms to analysis the slope stability under the seismic effect. Zhu and Guan developed an improved machine model to predict the size of water-conducting region which was the key to prevent the roof water disasters during coal engineering. Liu et al. proposed an integrated model by considering the generative adversarial network and support vector machine, aiming to identify the seismic events more accurately. Also, some new numerical techniques as well as the theoretical models were proposed for many geological disasters, such as rockburst and large deformation in tunnel, deformation and stability in pile, and slope failure and rockfall (Fu et al.; Liang et al.; Zheng et al.). For example, Fan et al. analyzed the tunnel rockburst based on a field case (i.e., Jinping hydropower station) and they discussed the prediction method of rockburst based on the Hoek-Brown strength criterion and the energy release process. Zhou et al. implemented the discrete element method (DEM) to investigate the landslide failure process. Hu et al. developed a theoretical model to evaluate the large deformation of tunnel when tunnel constructed in a soft ground.

The studies in current Research Topic reflect the substantial improvements in the data-based methods and techniques in the analysis of the various engineering and natural disasters, which may provide the important references for the prediction and prevention of these disasters.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

TY, ZY, SW, GH, CoL, CnL, and RX were employed by China Construction Eighth Engineering Bureau Co., Ltd. and South Company of China Construction Eighth Engineering Bureau Co., Ltd.

The remaining author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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