

Application of Machine Learning in Underground Construction and Tunneling

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Extended Abstract

The application of Machine Learning (ML) in Underground Construction and Tunneling is rapidly evolving. This is particularly true in tunnels excavated by Tunnel Boring Machines (TBM) where large amounts of real-time data are gathered through monitoring during TBM tunneling. Using monitoring data to ensure safe and optimal tunnel design and construction is difficult because the data are heterogeneous, non-linear, noisy, and involve high dimensionality. Developing predictive computational models that use the data is often challenging, if not impossible, because of the complexity of the physical processes involved in tunneling. An alternative is to let the data do the work instead. Employing ML, computers can be used to optimize performance criteria using example data or previous experience. ML can then identify hidden patterns in large datasets and evolve predictive models. The presentation will provide examples of the uses of ML in tunneling, including anticipating tunnel collapse ahead of a TBM, predicting ground settlement induced by tunneling, back-analysis of input parameters for computational models, and developing surrogate models for predicting tunnel response that replace computationally intensive numerical models. It is envisioned that the ML techniques presented in the paper can be used to improve analysis, design, and construct tunnels that are cost-effective, safe, reliable, and sustainable.