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Develop a Conceptual Data Model of Geotechnical Risk Assessment in Underground Coal Mining Using a Cloud-Based Machine Learning Platform

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Abstract : The major challenges in geotechnical engineering in underground spaces arise from uncertainties and different probabilities. The collection, collation, and collaboration of existing data to incorporate them in analysis and design for given prospect evaluation would be a reliable, practical problem solving method under uncertainty. Machine learning (ML) is a subfield of artificial intelligence in statistical science which applies different techniques (e.g., Regression, neural networks, support vector machines, decision trees, random forests, genetic programming, etc.) on data to automatically learn and improve from them without being explicitly programmed and make decisions and predictions. In this paper, a conceptual database schema of geotechnical risks in underground coal mining based on a cloud system architecture has been designed. A new approach of risk assessment using a three-dimensional risk matrix supported by the level of knowledge (LoK) has been proposed in this model. Subsequently, the model workflow methodology stages have been described. In order to train data and LoK models deployment, an ML platform has been implemented. IBM Watson Studio, as a leading data science tool and data-driven cloud integration ML platform, is employed in this study. As a Use case, a data set of geotechnical hazards and risk assessment in underground coal mining were prepared to demonstrate the performance of the model, and accordingly, the results have been outlined.

Keywords : data model, geotechnical risks, machine learning, underground coal mining
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