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Supervised Machine Learning Approach for Studying the Effect of Different Joint Sets on Stability of Mine Pit Slopes Under the Presence of Different External Factors

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Abstract : Slope stability analysis is an important aspect in the field of geotechnical engineering. It is also important from safety, and economic point of view as any slope failure leads to loss of valuable lives and damage to property worth millions. This paper aims at mitigating the risk of slope failure by studying the effect of different joint sets on the stability of mine pit slopes under the influence of various external factors, namely degree of saturation, rainfall intensity, and seismic coefficients. Supervised machine learning approach has been utilized for making accurate and reliable predictions regarding the stability of slopes based on the value of Factor of Safety. Numerous cases have been studied for analyzing the stability of slopes using the popular Finite Element Method, and the data thus obtained has been used as training data for the supervised machine learning models. The input data has been trained on different supervised machine learning models, namely Random Forest, Decision Tree, Support vector Machine, and XGBoost. Distinct test data that is not present in training data has been used for measuring the performance and accuracy of different models. Although all models have performed well on the test dataset but Random Forest stands out from others due to its high accuracy of greater than 95%, thus helping us by providing a valuable tool at our disposition which is neither computationally expensive nor time consuming and in good accordance with the numerical analysis result.

Keywords : finite element method, geotechnical engineering, machine learning, slope stability
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