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Predicting rockbursts in deep tunnels based on ejection velocity and kinetic energy measurements using advanced machine learning

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Abstract

Accurately predicting rockburst in deep tunnels is paramount, as it ensures the utmost safety, minimizes costs and delays, and optimizes design and construction processes. In this paper, the efficacy of six machine learning (ML) methods was evaluated to forecast this phenomenon through the evaluation of ejection velocity (V_{max}) and kinetic energy (K_{max}) of failed rocks. The higher the values of V_{max} and K_{max}, the more favorable the conditions for rockburst. 300 datasets were generated in the Abaqus software for training and testing the ML models. Through a comprehensive analysis of the results, the potential of ML models to predict the rockburst was unequivocally affirmed. Both numerical simulations and ML models demonstrated that an elongated weak plane strategically positioned at a distance equivalent to the tunnel's radius from its perimeter and inclined at a precisely calculated angle of 45° exerted the most significant influence on the rockburst.