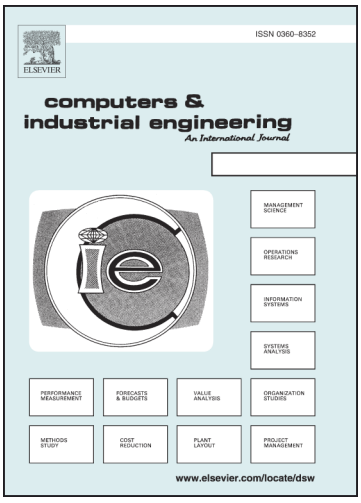
Accepted Manuscript



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PII: S0360-8352(18)30064-0
DOI: https://doi.org/10.1016/j.cie.2018.02.028
Reference: CAIE 5090

To appear in: *Computers & Industrial Engineering*

Received Date: 28 August 2017
Revised Date: 15 January 2018
Accepted Date: 18 February 2018

Please cite this article as: Qi, C., Tang, X., Slope stability prediction using integrated metaheuristic and machine learning approaches: A comparative study, *Computers & Industrial Engineering* (2018), doi: https://doi.org/10.1016/j.cie.2018.02.028

Slope stability prediction using integrated metaheuristic and machine learning approaches: A comparative study

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Abstract: Advances in dataset collection and machine learning (ML) algorithms are important contributors to the stability analysis in industrial engineering, especially to slope stability analysis. In the past decade, various ML algorithms have been used to estimate slope stability on different datasets, and yet a comprehensive comparative study of the most advanced ML algorithms is lacking. In this article, we proposed and compared six integrated artificial intelligence (AI) approaches for slope stability prediction based on metaheuristic and ML algorithms. Six ML algorithms, including logistic regression, decision tree, random forest, gradient boosting machine, support vector machine, and multilayer perceptron neural network, were used for the relationship modelling and firefly algorithm (FA) was used for the hyper-parameters tuning. Three performance measures, namely confusion matrices, the receiver operating characteristic (ROC) curve, and the area under the ROC curve (AUC), were used to evaluate the predictive performance of AI approaches. We first demonstrated that integrated AI approaches had great potential to predict slope stability and FA was efficient in the hyper-parameter tunning. The AUC values of all AI approaches on the testing set were between 0.822 and 0.967, denoting excellent performance was achieved. The optimum support vector machine model with the Youden's cutoff was recommended in terms of the AUC value, the accuracy, and the true negative rate. We also investigated the relative importance of influencing variables and found that cohesion was the most influential variable for slope stability with an importance score of 0.310. This