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Estimation of Specific Drilling in Small Tunnel by Using SVM

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Abstract

Drilling and Blasting method is the controlled use of explosives to break rocks for excavation. It is practiced most often in mining and civil engineering. Basically short tunnels are usually constructed by drilling and blasting method. The value of specific drilling in tunnel blasting processes considerably affects the efficiency of the blasting. Specific drilling affects costs of drilling and blasting, specific charge, fragmentation size, muck pile shape, over break profile shape. In this paper, we present an application of Support Vector Machine (SVM) to the calculation of the specific drilling for small size tunnel blasting. Certain small size tunnel blast tests in four case studies have been used to present the SVM-based model. Among available existing parameters in the literature, some of the most influencing parameters are selected. These models are based on seismic wave velocity (P-wave), Rock Quality Designation (RQD), coupling ratio of explosive charge, maximum depth of blast hole and tunnel area. Evaluation of the numerical measures of the goodness of the statistical fit clearly indicated that corresponding SVM model is more acceptable than multiple linear regression model for estimating specific drilling.

Keywords: *Tunnel, Drilling and Blasting, Specific Drilling, Support Vector Machine.*

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Extended Abstract:

1. Introduction

Drilling and blasting is typical method of tunnel excavation. Blast performance is ordinarily measured by specific charge and specific drilling (Alipour, Jafari, and Hossaini 2012). There are not suitable empirical or analytical models available for estimation of specific drilling. In this paper the specific drilling is modeled by SVM.

2. Materials and methods

In this paper, SVM-based model (Yu and Kim 2012) is proposed to estimate the specific drilling in small size tunnel. Polynomial based Kerenel function adopted for the modeling. The SVM model is simulated using a database including 41 datasets from four different case studies. For comparison purposes, multiple linear regression model was also used. To evaluate the performance of proposed models, the correlation between the estimated and measured values of specific drilling was determined. Standard statistical evaluation criteria were used to evaluate the performances of predictive models.

3. Results and discussion

Performance comparison of the developed model is fulfilled using value account for (VAF), Mean Absolute Percentage Error (MAPE), Median Absolute Error (MEDAE), Variance Absolute Relative Error (VARE) and determination coefficient (R^2). As such, it is observed that the SVM-based model is the most preferable model providing maximum accuracy and minimum error. Validation was also performed to show that the SVM outperformed the multiple linear regression method in evaluating relationships between specific drilling and selected rock mass and blast design parameters. Evaluation of performance comparison indicated that corresponding SVM-based models were acceptable for estimating specific drilling than multiple linear regression model. However, the specific drilling values yielded by the two methods are close together. Therefore, beside the SVM-based model multiple linear regression-based model can be applied in similar cases.

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