PAPER ID M08

Hybridization of artificial neural network and grey relational analysis for the prediction of slope stability

ASHANIRA MAT DERIS*, BADARIAH SOLEMON

Insititute of Energy Infrastructure, Universiti Tenaga Nasional, Jln IKRAM-UNITEN, 43000 Kajang, Selangor, Malaysia
* Corresponding author email address: ashanira@uniten.edu.my

Abstract: Landslide is a common geological disaster that causes significant damage all over the world. Landslide occurrences may be triggered naturally due to the earthquake or rainfall, or human activities such as construction and deforestation. With the advent of computational intelligence technology, the prediction of slope stability using machine learning (ML) approaches has gained popularity for landslide susceptibility modeling. This study applies the ML approach, artificial neural network (ANN), to develop a slope stability prediction model. The development of the ANN prediction model consists of a feed-forward back propagation algorithm with a multi-layer perceptron network. Six slope parameters were used as the input factors with 46 slope cases. It is observed that ANN is capable of predicting complex problems such as slope stability. However, this prediction model's performance can be improved by hybridization of ANN with grey relational analysis (GRA). The proposed model is expected to enhance the performance of the prediction model by analyzing the slope data and eliminating the unnecessary data samples. During the pre-processing phase, the GRA identifies the significant factors of the slope parameters to the output parameter, a factor of safety (FOS), based on the correlation levels of input-output sequences to produce the new dataset for training and testing. Then, the new dataset will be trained using ANN to get the prediction result. The results were then analyzed based on the receiver operating characteristic (ROC) values and accuracy percentage. It shows that the hybrid prediction model of ANN and GRA gives 0.999 ROC value and 99% accuracy, compared to 0.929 and 91% for a single ANN model.

Keywords: Statistical machine learning, artificial neural networks, grey relational analysis, slope failure

Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 47, No. 1, April 2021