A Composite Open Pit Mine Wall Geodetic Deformation Prediction Model Based on Grasshopper Optimisation and Artificial Neural Network

Prosper Laari, Ziggah Yao Yevenyo and Adusei Stephen (Ghana)

Key words: Deformation measurement; GNSS/GPS; Reference systems

SUMMARY

Determining the geodetic deformations of a mine wall is an essential operation where mining companies all over the globe do not take lightly. This is because of the many damages that accompany the collapse of a mine wall. Artificial neural network (ANN) is one technique that is used as a predictive tool to determine the geodetic deformations. With the introduction of nature inspired algorithms as good optimisers, they have been used by researchers in conjunction with ANN in several fields to help produce more accurate prediction results. This work sought to develop a hybrid artificial intelligence model of Grasshopper Optimisation Algorithm and Multilayer Perceptron Neural Network (GOA-MLPNN) to predict the geodetic deformation of a mine wall. The model was evaluated by comparing it with hybrid Particle Swarm Optimisation-MLPNN (PSO-MLPNN) and MLPNN. The positional data of three monitoring prisms mounted on the mine wall was used as the inputs for the networks and the corresponding displacements as targets. The models were assessed using the statistical indicators, Root Mean Square Error (RMSE), Correlation Coefficient (r), Variance Accounted For (VAF) and Uncertainty at 95%. The results showed that for each prism station, the models were able to predict the displacements to a certain degree of accuracy. However, the proposed GOA-BPNN showed superior abilities, producing a more accurate prediction followed by the PSO-BPNN, with the standalone MLPNN producing the least accurate prediction.

A Composite Open Pit Mine Wall Geodetic Deformation Prediction Model Based on Grasshopper Optimisation and Artificial Neural Network

(12412)
Prosper Laari, Ziggah Yao Yevenyo and Adusei Stephen (Ghana)

FIG Working Week 2024
Your World, Our World: Resilient Environment and Sustainable Resource Management for all
Accra, Ghana, 19–24 May 2024