Prediction of Piezometric Water Level Using Artificial Neural Network Optimized with Particle Swarm Optimization

Prosper Basommi Laari (Ghana)

Key words: Engineering survey; Geoinformation/GI; Positioning; KeywordPiezometric Water Level; Particle Swarm Optimisation; Artificial Neural Network ; Dam

SUMMARY

Piezometric water level is a vital measure that contribute to the safety analysis of dam when performing seepage analysis. This study adopted hybrid machine learning models and performed statistical evaluation of their performance to predicting piezometric water level. These hybrid methods include Particle Swarm Optimisation and Backpropagation Neural Network (PSO-BPNN), Particle Swarm Optimisation and Radial Basis Function Neural Network (PSO-RBFNN) and Particle Swarm Optimisation and Generalized Regression Neural Network (PSO-GRNN). The standard Multiple Linear Regression (MLR) was also applied for comparison purposes. To assess the quality of the model and its e□ciency, the study adopted Root Mean Square Error (RMSE), Mean Absolute Error (MAE) and correlation coe□cient (R). The results obtained showed that the applied hybrid machine learning models performed very well than the standalone methods of BPNN, RBFNN, GRNN and MLR. That is, PSO-BPNN, PSO- RBFNN and PSO-GRNN had the best RMSE values of 3.33E-07 m, 0.0001 m and 3.13E-04 m with corresponding MAE values of 3.47E-08 m, 0.0012 m and 3.86E-05 m. The PSO-BFNN, PSO-RBFNN and PSO-GRNN also recorded the largest R values of 0.8 m, 0.9 m and 0.8 m. The developed and tested hybrid models are a major contribution to industry players who are concerned about the safety of dams and the working environment.

Prediction of Piezometric Water Level Using Artificial Neural Network Optimized with Particle Swarm Optimization (12023)
Prosper Basommi Laari (Ghana)

FIG Working Week 2023
Protecting Our World, Conquering New Frontiers
Orlando, Florida, USA, 28 May–1 June 2023