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Application of artificial neural networks for predicting acid mine drainage characteristics in the Witwatersrand Western Basin

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2021
https://hdl.handle.net/10539/32960

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Research Topic: APPLICATION OF ARTIFICIAL NEURAL NETWORKS FOR PREDICTING ACID MINE DRAINAGE CHARACTERISTICS IN THE WITWATERSRAND WESTERN BASIN

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ABSTRACT

South Africa is amongst the countries experiencing water supply challenges, a problem partly exacerbated by pollution of both ground and surface water with Acid Mine Drainage (AMD). The now-defunct mines in the Witwatersrand Western Basin amongst other places have been identified as sources of AMD water. As a way of adding to efforts made on AMD remedial actions, this research was aimed at investigating the application of Artificial Neural Network (ANN) to predict some of AMD water properties. This would provide a tool with which unavailable data can be simulated for various use in existing processes, on-going research works as well as planning for future works around the subject. Data collected over a period of 3 year along a river within the Witwatersrand Western Basin was used to train an ANN model that would predict AMD water [SO_4^{2-}] and Total Dissolved Solids (TDS) which are in this case some of the best indicators of the level of contaminations. These were simulated using the AMD water's easy-to-measure properties, namely pH, EC and [Cl^-]. Three ANN properties, namely the number of hidden neurons, data split ratio and training algorithms were varied to work out a set of property combinations that would define the best models whilst other network variables were carefully chosen and kept constant. The analysis of different trends generated and other findings from literature have shown that the best model property combinations were determined. These are 5 hidden neurons, trainlm training algorithm and 80:10:10 data split ratio. The best model has a 10 arbitrary run average Correlation Coefficient (R) value of 0.93916 which is a good indication of the model performance. The model Mean Square Error (MSE) of 0.229 was obtained for a rescaled data. This model can reliably be used to predict Witwatersrand Western Basin AMD water properties and more.